

III. ASSESSING THE IMPACTS OF, AND VULNERABILITY AND ADAPTATION TO, CLIMATE CHANGE

Assessing the impacts of and vulnerability to climate change and subsequently working out adaptation needs requires good quality information. This information includes climate data, such as temperature, rainfall and the frequency of extreme events, and non-climatic data, such as the current situation on the ground for different sectors including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity, and coastal zones (see CHAPTER IV).

This chapter describes what information is collected to assess climate variability and change, and the tools used for assessing the impacts and vulnerability of developing countries to climate change. If the capacity for assessing climate change is not there, countries are limited in their ability to plan adaptation measures and adapt effectively.

3.1 INFORMATION GATHERING – DATA, SYSTEMATIC OBSERVATION AND MONITORING

For countries to understand their local climate better and thus be able to predict local climate change, they must have adequate operational national systematic observing networks, and access to the data available from other global and regional networks. Systematic observations of the climate system are usually carried out by national meteorological centres and other specialised centres. They take observations at standard preset times and places, and monitor atmosphere, ocean and terrestrial systems. The major climate variables measured include temperature, rainfall, sea surface temperature, sea level rise, wind speeds, tropical cyclones (including hurricanes and typhoons), snow and ice cover.

A sure knowledge base from systematic observation and forecasting services is essential to monitor climate; detect and attribute climatic change; improve the understanding of the dynamics of the climate system and its natural variability; provide input for climate models; and thus plan adaptation options. For example, monitoring trends of sea surface temperature and sea level are essential in order

to assess their impacts on the increased intensity of tropical cyclones and storm surge; monitoring events relating to the phenomenon of El Niño Southern Oscillation (ENSO) is important in helping determining its effects on reducing or increasing precipitation in different regions leading to both floods and drought.

Article 5 of the UNFCCC refers to the need for the international community to support and further develop climate research and systematic observation systems, taking into account the concerns and needs of developing countries. As part of this recognition, the COP invited the Global Climate Observing System (GCOS)⁹ to launch a regional workshop programme in 2000 to identify the priority capacity-building needs and identify gaps in regional systematic observation (see FCCC/SBSTA/2006/MISC.13, UNFCCC 2006f). Action Plans were subsequently developed and are now being implemented for developing country regions including Eastern and Southern Africa, Western and Central Africa, East and Southeast Asia, Central Asia, South and Southwest Asia, South America, Central America and the Caribbean, and the Pacific Islands. The plans highlight the need for a better knowledge base, better forecasting and climate services and a need to improve observations at all levels to enhance countries' ability to adapt. They emphasise that effective adaptation planning requires improved observations; improved regional, national and global data, as well as denser networks; the recovery of historical data; building of support among the user communities that have a demand for climate information; and promoting greater collaboration between the providers and users of climate information.

At all the UNFCCC workshops and meeting, participants reported that observations and data availability still need to be improved in all regions. At the Africa workshop, participants agreed that systematic observation networks in Africa are inadequate because there is a lack of stations and lack of maintenance. Participants reiterated that missing and scattered observational climate data in Africa is a constraint to understanding current and future climate variability. If data exist, there are difficulties in obtaining it. Participants underlined the importance of implementing the GCOS Action Plan for Africa, the "Climate Information for Development Needs: An Action Plan for Africa", to improve the situation. Launched in 2007, the plan aims to improve the inadequate and deteriorating observing systems through an integrated programme that includes not only observations, but also climate services and climate risk management and policy.

⁹ <<http://www.wmo.ch/pages/prog/gcos/index.php>>

In most countries of Asia, the meteorological or hydro-meteorological department of the government is responsible for collecting, processing and supplying data as well as maintaining infrastructure of the systematic observation system. Participants at the Asia workshop highlighted the need to improve observations and data availability, including in islands, mountainous, and coastal ecosystems, at the national, regional and global levels. Efforts regarding the harmonization and consistency of data should be enhanced through improved coordination between data providers from different sectors. For example, China reported at the workshop on the improvements it is making to its systematic observation network under the framework of the China GCOS programme. China is monitoring atmospheric composition, energy balance, water and carbon cycles, ecosystems, land use, ice and snow, and regularly submits real-time observation data of China GCOS stations and historical data records from national stations to the World Data Center for Meteorology. The country has an operational system of short-term climatic monitoring, prediction and assessment, established in the Beijing Climate Centre, and has some regional cooperative climate programmes with other Asian developing countries such as the Islamic Republic of Iran, Nepal, Sri Lanka and Uzbekistan.

In Latin America, workshop participants reported that climate information is either unavailable or sparse, and it is difficult to use it for modelling and scenario development. According to the GCOS February 2005 report, another reason for large gaps in observational coverage lies in the fact that the network of national correspondents works only on a voluntary basis. Retirements, political instability, economic problems and over-tasking of staff are a few of the issues that endanger the continuity of climate data series (GCOS 2005). The workshop reported a significant gap in observational coverage and that the problem is more acute for some regions, mainly the higher elevations along the Andean Mountain Range. This range constitutes a major determinant of the climate systems of the continent and high-elevation data is important for the detection and assessment of climate change and its impacts on glaciers, snow cover, and run-off. It was reported that the websites of national meteorological services, in general, do not make datasets available to allow studies of detection and attribution of climate change and there are just a few countries in Latin America which, at present, have active climate change programs. It was emphasised as urgent to implement plans for investments in meteorological information and to improve Latin American countries' capabilities and knowledge to undertake and maintain systematic, long-term, climate observational programs, along with the capacity to undertake analyses of climatic information.

In small island developing States the national meteorological and hydrological services are the responsible agency for climate observations. However, it was reported at the expert meeting that many networks are not working efficiently due to: limited assigned satellite windows for data transmission; low frequency of recordings; delays in maintenance and replacement and incorrect calibration of equipment; and limited access to products and services. Following 10 GCOS regional workshops between 2000 – 2006, elements of the regional action plans are now being implemented. The Pacific Islands Global Climate Observing System is addressing capacity-building needs, improving observing stations, climate prediction, telecommunication and data rescue. The Regional Action Plan for Central America and the Caribbean is partly being implemented through the Mainstreaming Adaptation to Climate Change project. This includes upgrades of observation networks, data rescue, and assessment of surface and groundwater monitoring networks.

In summary, the UNFCCC-organized workshops and meeting in 2006 – 2007 highlighted that there is still a need to take stock of available climate information in developing countries so that it is clear where the systematic observation needs are most pressing. Follow-up actions include improving and sustaining operational observing networks, such as the GCOS observational networks. Collaboration between national and international providers of climate information and the users, in all sectors, of such information for adaptation to climate change is vital as well as generating awareness among different user communities of the usefulness of climate information and services and improving national and regional coordination. Data needs to be carefully packaged so that it can be used effectively. Rescuing historical meteorological data is important. Education and training and improved national planning and reporting would also help build capacity.

At the workshops and meeting, it was highlighted that it is not just climate data that is needed for effective vulnerability and adaptation assessments to climate change in developing countries. Equally as important, and very much lacking at present, is the need for accurate socio-economic data. This data needs to come from across sectors and is an important complement to existing assessments, particularly given that poverty has been recognized as a major factor in vulnerability.

3.2 INFORMATION ANALYSIS – REPORTING OF IMPACTS, VULNERABILITY AND ADAPTATION

Reliable, systematic climate data helps countries determine their current climate variabilities, and model future changes. Countries use a number of assessment models, tools and methodologies as well as various scenarios, including those provided by the IPCC (IPCC 2000), to help provide an assessment of the future impacts of climate change. Climate change impacts, vulnerability and adaptation assessments need to generate outputs that are policy relevant. To do this, climate change data including future impacts and vulnerabilities needs to be integrated with socioeconomic data and analyses across a range of sectors, and the results must be tailored for policymakers and stakeholders.

All Parties to the UNFCCC are committed to submit national communications in which they outline the implementation of the UNFCCC and the impacts from climate change that they are facing. In their national communications, countries provide an assessment of vulnerabilities and adaptation options. Water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity, and coastal zones are common sectors for which impacts and vulnerability assessment have been carried out by developing countries.

At the workshops and expert meeting, vulnerability and adaptation assessments were identified as vital tools for developing countries to evaluate and implement responses to climate change. A major problem in all regions was the limited capacity at regional and national level due to deficiencies in data collection and the lack of technical expertise. It was highlighted as important to make the models, tools and methodologies that are appropriate for assessments in developing countries more widely available. Exchanging information on tools used for vulnerability and adaptation assessments, together with the outcomes of these assessments, would help countries improve capacity in this area. This could be done through workshops and symposia, regional science journals, websites to facilitate information exchange and by making better use of existing channels of information.

The resolution of models used to determine climate change in developing countries is too coarse and often relies on data from sources in other countries. Along with the disparity in outputs from different models, this makes the use of results as a basis for adaptation action very difficult. A major problem encountered when using models to get national results is the need for readjustment and downscaling to suit a country's individual needs. Participants highlighted the need for enabling training on

the use of models and tools in all regions and providing technical support, such as through the training of trainers on modelling tools, and follow-up through regional centres of excellence, to address gaps in expertise in the application of methods and tools and in using climate information and geographical information systems. At the SIDS meeting special mechanisms for vulnerability and adaptation assessment training, including short courses and longer-term professional training incorporating capacity-building for participatory approaches, were mentioned as a follow-up action.

The development of higher resolution regional models for developing countries is important as well as analysing the disparity between the model outcomes. This would help enhance capacity for reaching informed decision making. For example, at the Africa workshop, participants emphasised the need to develop regional climate models to provide fine-scale climate information for long-term impact studies and forecasting, as well as facilitate information exchange between African institutions. Some efforts are being undertaken in this regard in developing countries, and regional models are being developed that are capable of providing more useful information needed by planners and policy makers. For example, the Hadley Centre's model PRECIS (Providing REgional Climates for Impacts Studies)¹⁰ has been designed for use by local meteorological offices or research institutes. Training on this model has been undertaken in several developing countries, including Cuba, Brazil, Argentina, South Africa and India, and Jamaica, Cuba and Barbados mentioned at the expert meeting that results from the model have been used in vulnerability assessments.

At the SIDS meeting it was further highlighted that establishing a group of experts to facilitate assessments for specific circumstances of SIDS would be useful. Establishing a roster of experts with specialized skills, in all regions at centres of excellence, would help to maintain experts working in the regions. This would also help continuity in impact and vulnerability assessment, a problem highlighted at the Africa meeting where participants emphasized that the impact and vulnerability assessment undertaken in the initial national communication process was disjointed from that of the second national communication.

Participants at all workshops and at the expert meeting emphasised the lack of socio-economic data, or indeed development indicators and relevant tools for enhancing

¹⁰ <<http://precis.metoffice.com>>

the use of socio-economic assessment in a way that would be relevant to policy makers and other stakeholders, including ministries of finance and economy. It is important to link climate vulnerability to socio-economic studies and long-term periodic and socio-economic assessments. Preserving indigenous knowledge that is relevant to community level responses, studies on coping strategies, and gender specific vulnerability assessments were all highlighted as important elements to determining adaptation options.

Useful methodologies for assessing adaptation options include both top-down and bottom-up approaches. Both methodologies need to be linked to promote integrated adaptation assessments. Top-down methodologies include the use of modelling and scenario analysis. This can provide useful background to decision making and is strong in terms of the biophysical aspects of impacts. However the models do not perform well in representing human interactions and local abilities to adapt. This is highlighted by an example from the Cook Islands (Box III- 2).

As a complement to the top-down approach is a vulnerability-based, bottom-up, approach, which recognizes and builds upon local coping strategies and indigenous knowledge and technologies, and the capacity and coping range of communities, local institutions and sectors in

responding to current climate variability. This approach helps to incorporate human and economic dimensions of the local communities, particularly livelihood aspects and inter-sectoral relationships. It is useful in developing specific strategies and policy implementation. However, it exhibits a weaker attribution to future climate change.

An example of this approach is the UNFCCC's National Adaptation Programmes of Action (NAPAs) for use by least developed countries to prioritize their urgent adaptation needs.¹² The rationale for NAPAs rests on the limited ability of least developed countries to assess their vulnerability and adapt to climate change. A new approach was needed that would focus on enhancing adaptive capacity to climate variability and thus help these countries directly address their urgent needs arising from the adverse effects of climate change. The NAPAs use and build upon existing coping strategies at the grassroots level, rather than focusing on scenario-based modelling, to assess future vulnerability and adaptive responses at local and state level. Involvement of different stakeholders (national, sectoral, local) and including existing coping strategies are an integral part in the assessment process.

¹¹ Adapted from a presentation given by Ms. Pasha Carruthers on this topic at the UNFCCC CGE Regional Hands-on Training Workshop on Vulnerability and Adaptation Assessments for the Asia and the Pacific Region, held in Jakarta, Indonesia on 20 to 24 March 2006.

¹² <<http://unfccc.int/2719.php>>

Box III-2. Experience of the Cook Islands in applying impacts assessments methodologies¹¹

As part of the Pacific Island Climate Change Assistance Programme which aims to help Pacific islands meet their reporting obligations to the UNFCCC, the Cook Islands applied the prototype integrated assessment model PACCLIM (PACific CLimate Impacts Model). This model was developed by the International Global Change Institute in New Zealand and involved the integration of a global climate model with climate data and a regional climate scenario generator. Economic activity in the Cook Islands includes tourism, pearls, commercial and subsistence fisheries and coastal floodplain agriculture. The Cook Islands faced numerous challenges when

carrying out the assessment, including gaining trust for the project, the limited time to carry out the project, the presentation of complex material, gathering the relevant input, recording feedback, verifying anecdotal evidence and quantifying observations and uncertainties. The conclusion was that the tool had limited applicability for the Cook Islands and was rather complicated, and that it would be better to focus on refining data collection and on improving results by using simpler methods. The tool could be better used for training in identifying cross-sectoral considerations.

