



Mobilizing Solutions for Adaptation: Enhancing Resilience

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U.S. Environmental Protection
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Workshop Summary

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1. Introduction

The Government of the United States hosted the workshop “Mobilizing Solutions for Adaptation: Enhancing Resilience” on October 28-30, 2003, in New Orleans, Louisiana. Participating U.S. government agencies included the Agency for International Development (AID), the Department of Energy (DOE), the Department of State, the Environmental Protection Agency (EPA), and the National Oceanographic and Atmospheric Administration (NOAA).

The purpose of the workshop was to explore means and opportunities for enhancing the incorporation of adaptation to climate variability and change into relevant U.S.-supported programs and initiatives in developing countries. The long-term vision of this effort is to use these programs and initiatives to assist in the development of resilient, robust societies, economies, and ecosystems that have the capacity to address the challenges and opportunities of both current climate and potential climate change conditions.

The workshop sessions were structured around six major themes. The first three sessions focused on adaptation and sustainable development in three critical sectors:

- ▶ agriculture
- ▶ coastal zones
- ▶ water resources.

Although other sectors (e.g., health) are also sensitive to climate change and need to consider adaptation, these three are particularly important in terms of both development assistance and vulnerability to potential climate variability and change.

The second set of sessions concerned three cross-sectoral, or integrating, themes:

- ▶ climate information
- ▶ climate risk management
- ▶ the role of technology in adaptation.

Each session began with a set of presentations to provide background information and a context for discussion. Discussions following these presentations generally focused on several questions:

- ▶ How have considerations of resilience to current and future climate uncertainty been incorporated into various development programs and initiatives?
- ▶ What barriers did the implementation of these programs and initiatives face?

- ▶ Were these barriers overcome? If so, how?
- ▶ Did unanticipated problems arise? If so, how were they resolved?
- ▶ Did the adaptations effectively reduce vulnerability to current climatic variability or potential impacts of climate change?
- ▶ What gaps exist among these programs and initiatives?
- ▶ Are there potential “targets of opportunity” for additional activities?

Section 2 of this report presents general workshop findings on approaches to adaptation, methods and mechanisms for implementation, and some of the barriers that countries face in their efforts to incorporate consideration of climatic variability and change into decision-making processes. Section 3 presents additional findings that are particularly relevant to one of the cross-cutting themes. Because the major points raised during the discussions of adaptation and sustainable development in agriculture, water, and coastal resources sectors were considered to be relevant across sectors, findings specific to these sectoral themes are not included in this report. However, summaries of all workshop sessions on both the cross-cutting and sector-specific themes are contained in Appendix A. The workshop agenda and a list of participants are included in Appendices B and C, respectively.

2. General Findings

A number of the workshop findings can be considered to be applicable to all of the topics discussed at the workshop. These findings include an approach to adapting to climatic variability and potential climate change, means and mechanisms for doing so, and barriers to planning and implementing these efforts.

2.1 A General Approach to Adaptation

Throughout the workshop, participants highlighted four key issues regarding a general approach for adapting to climatic variability and potential climate change:

- ▶ Adaptation entails the consideration of climatic variability and change in ongoing decision-making processes, development plans, projects, and initiatives.
- ▶ Adaptation requires being proactive regarding the full range of future stresses (e.g., socioeconomic, environmental, and climatic changes).

- ▶ The goal of adaptation is to enhance resilience and develop flexible management approaches that facilitate adjustments in response to changing climate conditions.
- ▶ Opportunities exist for integrating greenhouse gas reduction (mitigation) and adaptation concerns, such as efficiency improvements in the agriculture and water sectors.

The following is an elaboration of these points.

Adaptation entails the consideration of climatic variability and changes in climate in ongoing decision-making processes, development plans, projects, and initiatives.

Adaptation is the process of improving society's ability to cope with changes in climatic conditions across time scales, from the short term (e.g., seasonal to annual) to the long term (e.g., decades to centuries). Virtually all human activities are affected by climate, either directly or indirectly. Decision makers in climate-dependent sectors such as agriculture and water incorporate climate considerations into decision-making processes, development plans, projects, and initiatives associated with many of these activities. Many of these decision-making and planning processes also consider historical patterns of climate variability and extreme events, particularly those that occur on relatively short time scales (e.g., seasonal and annual variations). However, few decision-makers in these sectors consider variations in climate that occur on longer time scales (e.g., decadal to centurial). Nor do they consider how potential future climate change could cause the patterns of climate variability to differ from historical trends.

This perspective on adaptation recognizes the need to adapt to both natural and anthropogenic changes in climate. Workshop participants described a range of efforts now under way in many countries to assist farmers, water resource managers, disaster management officials, and others in adapting to natural climatic variations brought about by the El Niño/Southern Oscillation (ENSO) phenomenon. Ultimately, those who are affected daily by climatic conditions may not be able to distinguish between the effects of natural variations in climate that are consistent with current or historical patterns of climate variability and the effects of changes in these patterns attributable to anthropogenic climate change.

Adaptation requires being proactive regarding the full range of future stresses (e.g., socioeconomic, environmental, and climatic changes).

Work in helping vulnerable populations adapt to current climate variability has shown that socioeconomic, environmental, and climatic stresses are all connected. The full range of potential future stresses must be considered in adapting to the potential impacts of climate change, because future changes in socioeconomic and environmental conditions could substantially alter the environment in which adaptation must take place. To be sustainable,

adaptation efforts must anticipate these socioeconomic and environmental changes and pursue options that build resilience to the stresses these changes present.

The goal of adaptation is to develop flexibility and resilience.

The ultimate goal of adaptation is to develop flexible and resilient societies and economies that have the capacity to address both the challenges and the opportunities presented by changing climatic conditions. Because climate change could alter historical patterns of both climate variability and extreme events in unknown ways, societies need to become more flexible and resilient to a wider range of impacts if they are to adapt to these potential changes. In this context, resilience is not just returning to a fixed level of vulnerability, but reducing vulnerability and enhancing the capacity to minimize risks so that vulnerability to future climate events is reduced.

Opportunities exist for integrating mitigation and adaptation concerns.

Although the process of adapting to climate change is fundamentally different from that of mitigating greenhouse gas emissions, opportunities exist for integrating adaptation and mitigation concerns, particularly in the agricultural and water sectors. For example, more efficient water use in the agricultural sector and in urban areas can both reduce energy demand and foster resilience to potential water shortfalls in the future. Similarly, protecting mangroves in coastal regions can both maintain an important carbon sink and provide protection against the impacts of storm surges. However, potential trade-offs between adaptation and mitigation measures should also be recognized. For example, some efforts to increase carbon sequestration through plantations could preclude the future use of less-vulnerable crop varieties by altering the soil chemistry.

2.2 Methods and Mechanisms for Adaptation

Much of the workshop discussion focused on the implementation of adaptation measures. Experience with efforts to adapt to current climate variability suggests the following methods and mechanisms for adaptation:

- ▶ Consider the context in which adaptation must take place.
- ▶ Balance bottom-up and top-down approaches.
- ▶ Use a wide range of networks and partnerships.
- ▶ Find opportunities to foster cross-sectoral integration.
- ▶ Work at multiple levels of governance.
- ▶ Work “end-to-end.”
- ▶ Work in multiple time scales.

The following is an elaboration of each of these points.

Consider the context in which adaptation must take place.

Adaptation is context-specific. Changing climatic conditions will affect different populations and sectors in different ways, and adaptations to climatic changes must be appropriate to the needs and capabilities of those affected. Considering the context in which adaptation takes place includes the following elements:

- ▶ **Working with stakeholders to define problem-specific solutions.** Adaptation must be demand-driven, because those affected by climate are in the best position to understand their needs and priorities. For example, many adaptation efforts in the agricultural sector should involve local farmers: they decide which crops to plant, how much to plant, and when to plant.
- ▶ **Understanding the decision-making processes.** It is important to understand the decision-making frameworks being used if consideration of changing climate conditions is to be integrated into these frameworks. Most decision-makers are more concerned about short-term concerns rather than longer-term issues such as climate change. For adaptation to be effective, it should take into account short-term objectives in addition to long-term goals.
- ▶ **Identifying appropriate intervention points.** Efforts to facilitate adaptation must be appropriate for the sector and population to which they are being directed. Some interventions will be more effective than others. The most appropriate are likely to be identified by stakeholders who would be directly involved in implementing adaptation actions.
- ▶ **Emphasizing adaptive management.** Adaptation is a social learning process. Those involved in making the adaptations (including the scientific community) must learn what works through experimentation, information exchange, and adjustment, i.e., through “adaptive management.” Many efforts to facilitate adaptation involve providing information about future climatic conditions and changes in these conditions to decision-makers. For these efforts to be credible, they must be incremental, iterative, and sustained.
- ▶ **Supporting and integrating indigenous adaptations.** Historical adaptations undertaken by indigenous cultures can be a strong basis for promoting adaptation to future change. It should be recognized, however, that long-term climate change could cause patterns of climate variability to change in unpredictable ways from those experienced in the past, which may decrease the reliability of historical adaptations.

Balance bottom-up and top-down approaches.

Adaptation requires finding a balance between bottom-up (i.e., “letting a thousand flowers bloom”) and top-down approaches (i.e., the imposition of a management structure). In some situations where natural resources are managed at the local level, bottom-up approaches may be more appropriate, whereas in other situations in which natural resources are managed at the national level, top-down approaches may be more appropriate.

Use a wide range of networks and partnerships.

Efforts to facilitate adaptation should employ a wide range of social, scientific, and private sector networks. For example, in many countries, water resources are managed by departments of agriculture rather than specialized water agencies. Efforts to promote more efficient water use, even in urban areas, should therefore involve stakeholders in the agricultural sector as well as other areas. At the same time, almost 70 percent of all water investment resources are derived from local tax revenues and water tariffs. The private sector is also heavily engaged in water projects.

Efforts to facilitate adaptation should also employ multiple brokers of information. Much of adaptation depends on the provision of credible information on climatic conditions. Decision-makers in different sectors have different sources of information, and adaptation programs appear to be most effective when trusted information brokers are identified and engaged early in the process.

Find opportunities to foster cross-sectoral integration.

Adaptation often requires integrating efforts across sectors. Areas such as coastal zones and watersheds provide important opportunities for fostering this cross-sectoral integration. An important element of National Adaptation Plans of Action (NAPAs) is to promote integrated risk management across sectors to provide an integrated approach to adaptation.

Work at multiple levels of governance.

Efforts to promote adaptation should target multiple levels of governance, including local, national, and international governing structures. Because many adaptation activities must be carried out at the local level, it is important that local institutions be involved in the decision-making process. At the same time, integrating adaptation across sectors often requires coordination and cooperation at the state or province and national levels. These higher levels of government may have laws and institutions that affect management of climate sensitive resources. Since many important resources cross national boundaries, a subregional or regional approach may also be required.

Work “end-to-end.”

Adaptation requires working “end-to-end,” from the planning stage through implementation, monitoring, evaluation, and adjustment. Important aspects of this “end-to end” approach include:

- ▶ starting with existing planning efforts, projects, initiatives, and technologies
- ▶ setting priorities to maximize the use of limited resources
- ▶ monitoring and assessing progress at the project, program, and societal levels
- ▶ developing indicators of outcomes to demonstrate and evaluate results.

Work in multiple time scales.

Adaptation requires working in multiple time scales, from the very short term (e.g., seasonal) to the very long term (e.g., century). It was frequently noted that those affected most by climatic conditions, such as farmers, might not be able to distinguish between the impacts of climate variability and those of climate change. Predictions of conditions created by an existing El Niño or La Niña are more important to them than predictions of the longer-term changes in ENSO or other patterns caused by climate change. At the same time, however, these longer-term predictions are important for infrastructure planning purposes and other long-term decisions such as coastal development. Working across time scales will help decision-makers identify appropriate intervention points and integrate consideration of climate into both daily decisions and long-term policy formulation and development planning.

2.3 Barriers

Workshop participants identified a number of important barriers to the implementation of adaptation measures and the integration of climate considerations into decision-making processes. In particular, they noted the following:

- ▶ Efforts to integrate adaptation measures across sectors face systemic and perceptual barriers.
- ▶ Vulnerable countries have limited adaptive capacity and in-country expertise.
- ▶ Approaches for integrating short- and long-term planning efforts are not well established.

Efforts to integrate adaptation measures across sectors face systemic and perceptual barriers.

Efforts to integrate adaptation measures across sectors face numerous systemic and perceptual barriers. These barriers include the following:

- ▶ **Difficulties in communicating information across sectors and between different levels of governance.** Few countries have the necessary institutional structures in place to enable stakeholders in different sectors and levels of governance to communicate with each other, making integrated approaches to adaptation difficult. Facilitating communication between the scientific community and decision makers (i.e., between the providers of information on climate variability and change and the users of that information in government, communities, and businesses) also presents challenges.
- ▶ **Short-term planning horizons on the part of policy-makers and other important decision-makers.** Most policy-makers have short-term planning horizons, often dictated by election cycles. These short-term horizons are often inadequate for the longer-term decisions required for effective adaptation measures. As a result, policy-makers often lack incentives to undertake sustained adaptation efforts.
- ▶ **Mechanisms for using market forces to facilitate adaptation are not well understood.** The benefits of effective adaptation are often manifested as a public good, while the costs of undertaking adaptation measures are generally absorbed by individuals. Climate information, for example, is often perceived as a public good, and few individuals are willing to pay for the customized information needed for effective adaptation. Similarly, water resources are often heavily subsidized, hampering conservation efforts.

Vulnerable countries have limited adaptive capacity and in-country expertise.

Many of the populations that are the most vulnerable to the impacts of climate variability and change have limited adaptive capacity and expertise to adapt to these impacts. For example, many countries lack the tools, models, and even the data necessary to assess vulnerabilities and adaptations. General circulation models estimate changes in subcontinental-scale climate, but have more limited capability for estimating regional or local climate changes — even with the application of downscaling techniques.

Approaches for integrating short- and long-term planning efforts are not well established.

Approaches for integrating climate issues into short- and long-term planning efforts are not always well established. Most approaches to planning and decision-making rely on historical data and are not designed to accommodate the uncertainties inherent in adapting to future climate change.

In addition, a well-accepted framework for setting and communicating priorities does not exist. Because adaptation involves incorporating climate concerns into a broad range of planning and development activities across multiple sectors and institutions, means for setting priorities among

these activities are not well developed and are difficult to undertake. Furthermore, it becomes difficult to distinguish between priorities for adaptation and priorities for sustainable development.

3. Findings Related to Specific Workshop Themes

Most of the points raised during the discussions cut across the sectors and themes and are reported in the previous sections. However, numerous points were also raised that were particularly relevant to the cross-sectoral themes of climate information, climate risk management, and the role of technology in adaptation. Because the issues raised concerning climate information and climate risk management overlapped significantly, they are considered together in the following discussion. As noted in Section 1, findings specific to the sectoral themes of adaptation and sustainable development in the agriculture, water, and coastal resources sectors are not included in this report.

3.1 Climate Information and Risk Management

Three major points emerged during the workshop regarding climate information and climate risk management:

- ▶ Improvements in climate information and prediction, although important elements of adaptation, should not be regarded as a panacea for adaptation.
- ▶ Climate information should be tailored to the needs of the user.
- ▶ Adaptation can be enhanced by coordination and cooperation among the climate, development, and risk management communities.

Improvements in climate information and prediction should not be regarded as a panacea for adaptation.

Much of the scientific community focusing on climate variability, climate change, and adaptation are developing tools for climate information, prediction, and assessment, and recognize that improvements must still be made to these tools. Considerable work is needed, for example, in refining GCM predictions and downscaling these predictions to the national, subnational, and, ultimately, local levels. However, these improvements may not be sufficient for adaptation, because of the inherent uncertainty in predictions and the broad range of physical, biophysical, and socioeconomic systems involved.

Climate information should be tailored to the needs of the user.

Building and sustaining trust and credibility with the user is an essential element in communicating climate information. It is essential, therefore, that climate information be tailored to the needs of each user, and that users are provided with updated information during a climate event as well as before and after it. Providers of climate information should also give estimates of their confidence in the accuracy of the information so that users can incorporate this information appropriately in their decision-making processes. Finally, decision support tools can play an important role in providing context-specific information. Considerable work is needed in understanding the political and institutional issues associated with communicating this information effectively.

Adaptation can be enhanced by coordination and cooperation among the climate, development, and risk management communities.

A substantial gulf currently exists among the climate, development, and risk management communities. There is an expectation among those engaged in climate risk management and disaster relief that the development community should be responsible for efforts to build resilience, while those in the development community view this as the responsibility of the disaster relief community. Adaptation presents an opportunity to bridge the gaps between these communities as well as with the climate community.

3.2 The Role of Technology in Adaptation

Two major points emerged during the workshop regarding the role of technology in adaptation:

- ▶ Technologies used for adaptation are the same as those used for development.
- ▶ Technology needs assessments should consider national priorities and be driven by the host country.

Technologies used for adaptation are the same as those used for development.

If adaptation involves considering climate and changes in climate in decision-making processes, development plans, projects, and initiatives, then the technologies used for adaptation are the same as those used for development. Adaptation technologies are those that enable societies to become more flexible and resilient to the full range of future stressors. Technologies in this sense include both “hard” technologies such as computer hardware, improved climate prediction models, drought-resistant phenotypes, and infrastructure, and “soft” technologies such as information, networks, training, and research. It is important, however, that the selection of technology consider the context in which it is to be used.

Technology needs assessments should consider national priorities and be driven by the host country.

Because adaptation is context-specific, technology needs assessments must be aware of national priorities and must be driven by the host country. Sustainable development involves struggling with multiple objectives and achieving a balance among them. Host country decision-makers are in the best position to balance these multiple objectives in technology decisions.

Appendix A: Session Summaries

Session 1: Climate and Development: Agriculture

Facilitator: Bill Easterling, Pennsylvania State University

Presenters: Ko Barrett, USAID: *Role of Climate in U.S. Agricultural Development Programs*

Ramasamy Selvaraju, Tamil Nadu Agricultural University, India: *Implementation of Climate and Agricultural Programs*

Ko Barrett of USAID stated that USAID efforts to promote adaptation generally emphasize decision support mechanisms and systems. These include preliminary reviews of adaptation options and analyses of climate variability. An example of such a program is the Famine Early Warning System (FEWS). USAID is also helping countries expand trade, improve sustainability, and increase their adaptive capacity. Many of these efforts use science and technology to promote innovation, and include broadening agricultural training, outreach, education, and adaptive research. Interagency collaboration is also involved. For example, USAID and USDA worked together to develop a decision support system for agriculture that was based on USDA research into crop selection, livestock management, and agricultural production together with NOAA regional climate forecasts. There is strong support within USAID to link adaptation, sustainable development, and agriculture, because there is an advantage in mainstreaming adaptation across activities.

Ramasamy Selvaraju of Tamil Nadu Agricultural University discussed his work in the agriculture sector in India, which focuses on the use of climate predictions to enhance climate risk management, particularly at the farm scale. He noted that although there is a broad range of activities at different levels (i.e., farm to national), institutional issues are often not addressed. He also noted that adaptation requires linkages among physical systems, biophysical systems, and socioeconomic systems. Finally, he has found that effective learning and outcome require participatory decision-making. Adaptation is very much an experiential learning process. The use of climate information is not always successful in avoiding adverse impacts, but does help in reducing risk.

The session discussion was initiated with a question regarding whether or not GCMs are robust enough to support climate predictions at the farm scale. In Kenya, GCMs have provided useful information in some areas and seasons. However, regional institutions are best placed to use this information. It was also pointed out that the current level of understanding does not support any improvements in predictions. The major question is how GCMs can be downscaled sufficiently to support specific applications in the field. The START program is undertaking pilot projects

that are attempting to use climate prediction for decision making, but it is not clear how these pilot activities can be expanded to a more broad-based system. One of the difficulties is that local users such as farmers distrust these predictions if they do not match their personal observations. Efforts in India have met with some success when extension services are used to transmit information.

A question was also raised regarding the use of climate information and prediction in decision support systems. With multiple levels of decision-making, it is not clear if a common methodology is needed or if a broad range of approaches can be developed to fit particular situations. There are also questions regarding technological change. Most assessments do not take technology changes into account. It was pointed out that there is not necessarily a “right” or “wrong” methodology, because there are appropriate approaches to doing both dynamic and statistical forecasting. Both have their uses, and a combination of each is often best. However, it is important that models be validated and calibrated.

Many participants felt that decision support systems should be used with caution, because the decision-maker’s information needs and the decision-making context must be understood if the systems are to be useful. Most decision-makers are not focusing on climate change, but have shorter-term goals. They are usually thinking about adapting to multiple changes. For example, farmers in Tamil Nadu are concerned with adapting to falling groundwater tables, while those in Southern Africa are concerned with adapting to AIDS. Credibility is essential in this regard, and those promoting these systems need to build credibility and trust. This raises the question of how the human and physical capital needed to maintain credibility and trust can be sustained over the long term.

Session 2: Climate and Development: Coastal Zones

Facilitator: Eileen Shea, East-West Center, University of Hawaii

Presenters: Ralph Cantral, NOAA: *Role of Climate in Coastal Zone Programs*
Andrea Volentras, SPREP: *Implementation of Coastal Zone and Climate Program*

Ralph Cantral of NOAA outlined the coastal management approach taken in the United States. Coastal management is the responsibility of the states, and each state has its own priorities. The role of the federal government is to identify emerging issues and provide assistance to the states in their management efforts, such as providing decision support systems. The states themselves use a range of management approaches, including planning, permitting, enforcement, and coordination. The states must also confront difficult issues regarding conflicts between private property and public goods. For example, the North Carolina Coastal Resources Commission banned the construction of sea walls to protect public access. These sorts of issues make it

difficult to address adaptation through local implementation, so a top-down approach is needed at times.

Andrea Volentras of SPREP addressed adaptation from an SPREP perspective. Pacific islands are witnessing a broad range of climate-related changes, including coral bleaching, larger storm surges, and seasonal crops that are growing throughout the year. Most island countries are taking both top-down and bottom-up approaches to adaptation. At the national level, SPREP is working to build enabling environment by holding high level meetings to promote the mainstreaming of adaptation issues. However, 80 percent of the land in most Pacific island countries is customarily managed at the community level, limiting the ability of national governments to impose management controls. SPREP environment ministers are trying to bring different sectors together within local communities in order to promote integrated coastal management. In collaboration with the Canadian International Development Agency (CIDA), SPREP recently completed the Pacific Island Climate Change Assistance Programme (PICCAP), which helped Pacific island countries develop adaptation measures. The program helped build awareness of and develop strategies for adaptation by helping local communities conduct vulnerability analyses, identify options, and set priorities among these options. The project also allocated funds for implementing certain high-priority projects. SPREP has encountered some barriers in these efforts, including poor coordination among departments at the national level, weak meteorological services, and a general bias toward development. However, it did have some success stories, including an end to sand mining, the promotion of tree regrowth, and a heightened awareness of coastal and climate issues.

Much of the discussion during the session focused on the setting of priorities among adaptation options. In PICCAP, SPREP worked with local villagers to identify the changes they were witnessing and which of these changes were most affecting them. It was recognized, however, that there was a financial constraint on what could be done. The difference in approaches to coastal management between the United States and the Pacific islands was also noted. The U.S. approach emphasizes planning at the state and local level. However, it may be easier to implement national programs in the Pacific because the coastal zone belongs to the community rather than to individuals. It was pointed out that much of coastal management is people management. For example, the primary issue regarding climate change and the coasts in South Africa is the potential impact on fishing industry brought about by changes in ocean currents and freshwater runoff. In the United States, estuaries could be endangered by sea level rise as communities choose to protect private property rather than to allow wetlands to migrate inland. Finally, it was pointed out that adaptation in the coastal zones provides an opportunity for integrating efforts across sectors. In the Pacific, climate change provided a hook to address problems that needed to be remedied anyway. Elsewhere, such as in the Everglades of the United States, most actions are taken for reasons other than adaptation to climate change, but could help with adaptation as well.

Session 3: Climate and Development: Water resources

Facilitator: Roberto Lenton, Columbia University

Presenters: Dan Deely, USAID: *Water Resources Management Strengthens Adaptation Capacity*
Ali Agoumi, Hassani School of Public Works, Morocco: *Implementation of Water Resources and Climate Programs*

Dan Deely of USAID outlined USAID activities related to adaptation and water resources. With a significant amount of all freshwater resources currently being used for irrigation, population growth is putting increased demands on limited water resources. This could exacerbate water shortages in such countries as South Africa and Morocco, where almost all water resources are already allocated. Further stress could be caused by urbanization: a majority of the world's population is expected to be living in cities by 2005. Because water is a cross-sectoral issue, USAID's Water Team pulls together various interests within USAID to address water-related issues. USAID has wide array of programs related to the legal, institutional, regulatory, and policy aspects of water resources management, as well as water-related activities in the agriculture, urban, industrial, and energy sectors. These activities include water management, water policy reform, privatization, decentralization, the development of data systems and analytical tools for resource assessment, frameworks for monitoring and enforcement, and conflict management. USAID currently spends \$460 million on water-related activities.

Ali Agoumi of the Hassani School of Public Works, Morocco, focused on efforts to address adaptation in the Maghreb region of Africa, which includes Morocco, Algeria, and Tunisia. The region's climate has been warming, and it has experienced an increase in droughts and floods. The region is also experiencing high population growth and urbanization, which are stressing existing water supplies. Climate change is likely to exacerbate these stresses. For example, an analysis of the potential impacts of climate change on the Al Wahda Dam suggests that there could be a 10 to 20 percent reduction of water in the reservoir behind the dam because of global warming. The region is already implementing adaptive policies, including pollution control, usage charges, and the development of nonconventional water sources. With GEF support, Morocco, Algeria, and Tunisia are cooperating in a regional effort to incorporate climate change adaptation into integrated watershed management for three watersheds in the Maghreb region. The project will include an assessment of an existing vulnerability study, the development of regional integrated watershed planning, and the development of an institutional action plan.

Much of the discussion following the presentations focused on the role of finance and the private sector in water management. It was pointed out that some of biggest water projects in developing countries are finance projects, and many of these projects are driven by the private sector. For example, a \$1 million loan guarantee in Egypt by USAID for a water project generated over \$56 million in loans from the private sector. Similarly, a loan guarantee of \$20 million in India

generated \$500 million in loans from the private sector for water projects. The pricing of water is a significant issue, because it is heavily subsidized in many countries. Often those who benefit most from these subsidies are those with greatest ability to pay.

Institutional issues also need to be addressed. For example, water resources fall under the purview of ministries of agriculture in most countries. This can make it difficult to integrate efforts across different agencies and ministries. Although countries participating in the Second World Conference on Environment and Development in Johannesburg committed to have integrated water management by 2005, few countries have mechanisms set up for this. South Africa and Morocco are two of the countries that have redone their water laws. With 95 percent of its current water resources committed, South Africa is particularly concerned with preserving instream flow. It now prohibits the use of more than 50 percent of instream flow for purposes other than ecosystem protection. In 1985, Morocco created a high-level Water National Council, and all watershed management plans have been adopted in consultation with the council. Although this body became the National Council of Water and Climate, nothing has been done to link the water and climate issues. Much of this is the result of cultural differences among the different organizations involved.

Session 4: Climate Information

Facilitator: Roger Pulwarty, University of Colorado

Presenters: Candyce Clark, NOAA: *Role of Climate Information in Development Programs*
Steven Zebiak, International Research Institute (IRI) for Climate Prediction *Climate Information: International Research Institute (IRI) for Climate Prediction*
Laban Ogallo, Drought Monitoring Centre Nairobi (DMCN), Kenya: *Climate Information and Program Implementation*

Macol Stewart Cerda of NOAA, speaking on behalf of Candyce Clark, presented an overview of NOAA programs related to climate information. NOAA's Office of Global Programs (OGP) conducts and sponsors research activities that help increase the understanding of linkages between climate and society's well-being in a variety of socioeconomic sectors. It emphasizes climate variability, but is expanding its activities to cut across time scales. Most of these activities focus on the interface between scientific information and environmental and societal decision-making. The Office is working to catalyze interactions between scientists and decision-makers to stimulate new ways of using climate information and to feed this information back into the research agenda. A number of gaps remain, however. In particular, the gap between the development and disaster management communities needs to be filled. Climate falls in gap between development and humanitarian concerns, with each community expecting the other to address it.

Steve Zebiak of the International Research Institute (IRI) for Climate Prediction reviewed the IRI's progress in the development and use of climate information. The IRI engages in a range of climate-related activities, including climate prediction; climate and environmental monitoring; impacts analysis, decision support and the development of decision-support tools; institutional and policy development; and capacity building, outreach, and education. The IRI's approach to the application of climate information comprises several elements: (1) focusing on the problem and engaging with people dealing with problem; (2) engaging in bidirectional capacity building, which entails both communicating knowledge about climate and learning about actual needs and potential interventions; (3) tailoring information to the context of intervention tools; and, (4) demonstrating the potential value of the information. He also pointed out that a strong relationship exists between climate variability and climate change. The mechanisms for coping with climate variability and climate change overlap greatly with regard to the sources of climate information, the nature of this information, the networks of organizations and institutions dealing with the issues, the tools that they use to do so, and the policies that they adopt. Furthermore, climate change will ultimately be played out in the form of year-to-year "events," and efforts to building resilience to these "events" will build resilience more generally.

Laban Ogallo of the Drought Monitoring Centre Nairobi (DMCN) summarized the activities of the DMCN in the greater Horn of Africa. Drought Monitoring Centers for eastern and southern Africa were established in 1989 as a WMO/UNDP project, with Nairobi as the main center. DMCN is currently funded by USAID and coordinated under the auspices of WMO. The centers were established in the belief that monitoring, prediction, and timely early warning of extreme climate events is one of the best strategies for mitigating the negative impacts of such events. The DMCN generates a number of products, including climatological summaries, drought severity warnings, climate outlook summaries, summaries of socioeconomic conditions and their impacts, and pre-season consensus outlooks. Providing this information to the agriculture sector presents a challenge, because many farmers cannot read or write and do not have access to the Internet. The DMCN, in collaboration with NOAA/OGP, IRI, and other partners, is implementing a series of pilot application projects in the region to demonstrate the value of climate information and prediction services. The specific objectives of pilot application projects are to assess and communicate examples of successful use of seasonal climate prediction products; to assess and communicate examples of impediments to successful use of seasonal climate prediction products; and to develop new methodologies for better production, dissemination, interpretation, use, and evaluation of climate information and seasonal prediction products. The DMCN is also carrying out research activities aimed at developing new applications tools that could enable decision-makers to take advantage of seasonal forecast information.

Much of the discussion following these presentations focused on means for providing appropriate information to those who need it. Approaches that were suggested include delivering information to specialists in information delivery and using trusted information brokers. For

example, extension services and the private sector are important sources of information for crop diversification decisions, and local religious leaders may be helpful in ensuring the credibility of new information from sources unfamiliar to the general population. Downscaling information to a useful scale also presents difficulties. The DMCN brings experts from the agriculture and other sectors into centers to help with the necessary downscaling. Much of this depends on the needs of the users and their capacity to use the information being provided. The Horn of Africa program has focal points for many sectors. It provides sector-specific information to these focal points, while general information is provided to media. It was also pointed out that climate predictions do not work in all situations, and other strategies may be needed to promote resilience, such as information about sensitivities of systems and opportunities for crop diversification. In addition, participants stressed the need to focus on all aspects of the project life cycle, from project design through implementation and evaluation. Much of the success of PICCAP, for example, hinged on this “end-to-end” approach, which included vulnerability assessments at the local community level, the setting of priorities among identified options, the allocation of funds to specific projects, and the monitoring and evaluation of these projects. Questions were raised regarding indicators of success for adaptation. It was pointed out, however, that if resilience is the effective incorporation of climate concerns into development activities, then measures of success for adaptation and the development activity should be one and the same.

Session 5: Climate Risk Management

Facilitator: Eileen Shea, East-West Center, University of Hawaii

Presenters: Maxx Dille, IRI: *Role of Climate Risk Management in Development Programs*
Nathaniel Cruz, PAGASA, Philippines: *Implementation of Climate Risk Management*

Maxx Dille of the International Research Institute for Climate Prediction provided an overview of the role of climate risk management in development programs. He outlined a number of assertions about climate change adaptation and risk management that can guide the process of incorporating climate risk management into development programs, including the following:

- ▶ Risk management provides a framework for organizing ideas and actions related to climate change adaptation.
- ▶ Risk management and climate change adaptation are not ends in themselves but rather means for achieving development goals.
- ▶ Practicing risk management forces specificity as to one’s goals, adverse outcomes that could interfere with achieving those goals, who or what is at risk of realizing those outcomes, the risk factors that could lead to those outcomes, and risk assessment.

- ▶ Climate change adaptation and risk management should be problem-driven.
- ▶ Bottom-up problem identification and collaborative solutions determine what climate-related information, products, and services are needed.
- ▶ Regional organizations and networks are key intermediaries for promoting climate change adaptation and risk management at the national and local level.
- ▶ Adaptation is an incremental process of learning by doing.
- ▶ Looking backward at how climate affects development is key for using predictions to move forward.

Finally, he suggested that the practice of integrated climate risk management could result in reduced risks of losses through targeted vulnerability reductions, an improved understanding of climate-impact relationships, and a better definition of data requirements and better data. It would also result in stronger institutions and networks, more appropriate policies and decisions, and a greater capacity to manage climate variability and change.

Nathaniel Cruz of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) summarized the implementation of climate risk management in the Philippines. Philippines experiences more tropical cyclones than any other country in the world, averaging 20 cyclones per year. It also experiences significant variability in rainfall amounts and onset of rainy season as the result of ENSO. To reduce risks associated with this variability, PAGASA issues monthly climate assessment bulletins, and created the Drought Early Warning and Monitoring System (DEEWMS). The Philippines established a series of interagency committees to deal with 1986-1987 and 1997-1998 El Niños and the 1998-2000 La Niña, culminating in the El Niño National Action Team for the 2002-2003 El Niño. This Action Team comprises all of the cabinet secretaries, and is co-chaired by the national Departments of Agriculture and National Defense. PAGASA has also created a National ENSO Early Warning and Monitoring System, and in 2003 created the Climate Outlook Forum. Finally, it has created the Climate Monitoring, Prediction & Services Center (CLIMPSC), which provides monthly weather situation and outlook summaries, seasonal climate outlook summaries, El Niño/La Niña advisories, press releases, specialized climate forecasts, and vulnerability maps.

Initial discussion following these presentations focused on the relationships among evaluations, assessments, and the communication of climate information. It was pointed out that drawing analogues to past events can be helpful to decision-makers. It is important that researchers do not attempt to define how decision-makers should use the information they provide, but instead provide estimates of their confidence in the information they are providing. Building credibility can be difficult, particularly with longer-term events such as ENSOs and climate change. The

Greater Horn of Africa Project worked to build credibility by providing pre-season outlooks as well as fortnightly updates. Difficulties in quantifying risk, particularly in economic terms, also make communication with decision-makers difficult. Participants stated that local governments and professional planners typically do not do risk assessments, because many of them do not know what to do. Finally, there is the problem of interpretation of forecasts. Intermediaries often interpret the climate information being provided in different ways. This points to the need to tailor information to the needs of the user as well as for awareness and outreach.

The discussion pointed out that it is important to take stock of indigenous adaptive resources; many indigenous cultures, particularly those in the agriculture sector, have developed sophisticated and appropriate means for coping with climate variability. Lessons learned from these experiences may prove useful to other populations experiencing similar conditions. For example, indigenous cultures in Central America developed ways to adapt to the periodic droughts brought on by the ENSO that have proved to be useful under current conditions.

Session 6: Role of Technology

Facilitator: William Agyemang-Bonsu, EPA, Ghana

Presenters: Elmer Holt, U.S. DOE: *Role of Technology in Development Assistance*
Aurelia Micko, NOAA: *Rural Communities, National Institutions, and the Role of Technologies in Development*
Kishan Kumarsingh, Trinidad and Tobago: *Climate, Technology and Program Implementation*

Elmer Holt of the U.S. Department of Energy provided a brief overview of the U.S. government's approach to technology in development assistance. An important element of the U.S.'s development assistance strategy is to facilitate technology transfer through partnerships with developing countries and by creating incentives for investment in climate-friendly technologies and practices. Among the U.S. government's development assistance priorities are supporting the economic growth and social development that protect the resources of host country, supporting design and implementation of policy and institutional frameworks for sustainable development, and strengthening in-country institutions and capacity that involve and empower the citizens. An important program in this effort is the Climate Technology Initiative (CTI), an international initiative created in 1995 to facilitate the more rapid development and diffusion of climate-friendly technologies and practices. Among the lessons of CTI are (1) technology has a major role in development assistance, (2) bilateral and multilateral approaches can be effective, (3) donors must be aware of the development priorities of the host country and how these interact with the sectors identified during vulnerability assessment, and (4) feasibility and affordability when considering a set of technology options for development projects.

Aurelia Micko of NOAA then summarized NOAA's experience with RANET (New Radio and Internet Technology for Communication of Weather and Climate Information to Rural Communities for Sustainable Development). Funded by USAID, RANET was started by the African Center for the Meteorological Applications for Development (ACMAD) in 1999 to bring climate and weather-related information to rural producers to help them prevent and prepare for disasters, and to reduce their vulnerability by increasing agricultural production and food security. The project is now operating in 20 different African countries, and pilot activities have begun in Asia and the Pacific. The goals of the RANET program are to improve access by rural communities to weather, climate, and other environmental information and to improve the ability of national meteorological services to disseminate information. It is also intended to help develop an awareness within the meteorological and development communities of the difficulties and challenges facing dissemination of information to rural communities. It uses a number of different radio or internet based strategies to provide meteorological and extension agencies with improved access to information to climate and weather information, and also provides various information dissemination technologies through which these agencies can distribute their own information. It also provides training related to these technologies, and is collaborating with various NGOs and international agencies whose own networks (e.g., recruiting or training information brokers and extension officers) can be used to pass along data and products.

In the final presentation of the session, Kishan Kumarsingh of Trinidad and Tobago discussed technology issues and concerns with regard to adaptation. The UNFCCC Conference of the Parties has approved framework for technology transfer, and a Technology Needs Assessment (TNA) handbook has been prepared. However, this handbook focuses primarily on mitigation, and does not adequately address adaptation issues. This is a problem, particularly for the Small Island Developing States (SIDS), whose adaptation concerns are paramount. He also pointed out that mitigation technologies are relatively straightforward. However, no clear definition of adaptation technologies exists. Issues are further complicated by the uncertainties of GCMs. Adapting to the long-term impacts of climate change is particularly challenging, because most development plans have relatively short time horizons. A useful starting point for assessing vulnerability and preparing TNAs is to base these assessments on available knowledge and to focus on exploring practical options. Though this process is challenging, stakeholders should also be involved, and barriers and policy needs should also be identified.

Initial discussion following the presentation focused on the nature of an adaptation technology and the difficulties associated with the definition of an adaptation technology. Just as indicators of vulnerability may be the same as those used in sectoral programs, adaptation technologies may be same ones that are used in these sectors. The technologies themselves may not change as part of the adaptation process, but their use might change. It was observed that the technologies used RANET are not completely new, and some communities use simple, wind-up radios. Many existing technologies can be adaptation technologies. If models suggest that climate change will result in less precipitation, adaptation technologies are those that conserve water or make more

available for potable uses. However, donor organizations interested in funding “adaptation projects” frequently ask for this distinction to be made, however, because they are reluctant to invest financial resources reserved for the support of adaptation efforts in an activity that could be supported through general development assistance funds.

The discussion also focused on issues of technology transfer. It was suggested that it is important to look at how the system as a whole can be made more sustainable. However, the price of maintaining this approach is high, and financing is big problem. The Global Environment Facility was established to fund projects that produce global environmental benefits, but it is difficult to establish the global environmental benefits associated with adaptation. In addition, means for assessing the cost-effectiveness of adaptation investments are not well developed, making donors unwilling to dedicate the financial resources necessary for these investments. Also, a number of barriers must be faced, including intellectual property rights, institutional arrangements, and tariffs or import duties. Because resources are scarce, it is important that efforts be made to fold technology into development assistance. Finally, it was pointed out that pilot projects can also be useful in demonstrating the utility of a particular technology to stakeholders, although it is not always clear how these projects can be expanded to a more general level.

Session 7: Other Presentations

Facilitator: Dan Reifsnyder, U.S. Department of State

Presenters: Mariko Hara, Embassy of Japan in Germany
Mariko Fujimori, Pacific Consultants Co., Ltd.
Neale Macmillan, Canadian International Development Agency (CIDA)
Ashley Fuller, Australian Greenhouse Office (AGO)
Bo Lim, United Nations Development Programme (UNDP)

Mariko Hara of Japan’s Ministry of Foreign Affairs discussed addressing adaptation through Japanese Official Development Assistance (ODA). Japan provides development assistance through both bilateral and multilateral cooperation. Bilateral assistance is provided through technical cooperation administered by the Japan International Cooperation Agency (JICA) and by loans, which are administered by the Japan Bank for International Cooperation (JBIC). Multilateral cooperation is provided through Human Security Funds and contributions to international organizations. Among the ODA activities related to climate change are technical cooperation grants and annual climate change technical training seminars, both of which are implemented by JICA. Local Japanese embassies also operate a small-scale grant assistance program for grassroots human security projects. Finally, she suggested that although Japan attaches significant importance to climate change, several issues must be addressed before more adaptation projects are included in ODA portfolios. Adaptation projects have generally received

less attention by recipient countries, and are not given high priority. At the same time, there are no indicators by which to measure the effectiveness of adaptation projects, and these projects tend not to appeal to the private sector. This lack of appeal to the private sector makes it incumbent upon the public sector to promote adaptation.

Mariko Fujimori of Pacific Consultants Co., Ltd., introduced the “Resource Book for Policy and Decision Makers, Educators and other Stakeholders,” prepared by SPREP under the sponsorship of Japan’s Ministry of Environment. The purpose of the resource book is to provide decision-makers with a coherent, authoritative, and readily accessible body of knowledge and resource materials regarding the Pacific region’s vulnerability and potential response strategies. It is also intended to provide educators and related practitioners with an integrated and functional resource portfolio for formal education and professional development programs as well as political and public awareness programs. Among the conclusions of the book are that the combination of current and future impacts of climate variability and change is of particular concern to Pacific island countries, and that they will have no choice but to adapt to future changes. The most desirable adaptive responses are those that address the adverse impacts of present-day climate variability, actions that would be taken in the absence of climate change, and adaptation policies that should be incorporated in the mainstream policies and disaster reduction, environmental management, and national development plans.

Neale Macmillan provided selected highlights of Climate Change Programming at the Canadian International Development Agency (CIDA). CIDA administers the Canada Climate Change Development Fund (CCCDF), which is a five-year, \$100-million initiative within Canada’s Official Development Assistance (ODA) Program. CCCDF projects fall under four program areas: emissions reduction, carbon sequestration, adaptation, and core capacity building. The goal of the adaptation program area is to build capacity for adaptation to protect health, livelihoods, and property. CCCDF adaptation projects are currently under way in the Caribbean, El Salvador, South Pacific, Bangladesh, Vietnam, India, and the Sahel. CIDA also supports adaptation activities through contributions to the UNFCCC’s LDC Fund, and a CIDA representative currently sits on LDC Experts Group (LEG).

Ashley Fuller of the Australian Greenhouse Office (AGO) discussed efforts in Australia to address adaptation. The AGO was established in 1998 as a specialized agency to deal with the climate change issue. Although availability of water is an ongoing problem throughout the country, Australia had no policy basis for addressing adaptation until a year ago. Australia’s Commonwealth Scientific & Industrial Research Organisation (CSIRO) has conducted a national impacts assessment, but most other vulnerability studies have been ad hoc and isolated. The Council of Australian Governments (COAG) has now identified adaptation as an immediate priority and has established a Working Group on Adaptation. The Working Group has developed a national work plan on climate change impacts and adaptation, which includes priority projects, case studies, and communication of information to regional stakeholders to improve knowledge

underpinning regional and national adaptation strategies. The AGO has also commissioned an overview of adaptation options for the agriculture sector in light of the forecast impacts of climate change, and a scoping study is currently under way to examine options for the Great Barrier Reef. The general approach being taken by the AGO in these efforts is to build on existing data, maximize stakeholder involvement, and work to satisfy multiple objectives.

Bo Lim of the United Nations Development Programme (UNDP) discussed the Global Environment Facility (GEF) strategy on adaptation. The UNDP is one of the three implementing agencies of the GEF. Although the GEF was established to be the global financial mechanism for multilateral environmental agreements, it is beginning to move toward a policy change that considers how activities that enable developing countries to comply with these agreements can also foster sustainable development. She also pointed out that there is a distinction between capacity building and capacity development. Capacity building simply involves training individuals. Capacity development is broader, however, and includes planning, implementation, stakeholder engagement, monitoring and evaluation, and technical assessment. By taking this broader perspective of capacity development, one can identify weaknesses in the process and design effective and efficient interventions. One tool that the UNDP developed to assist in this process is the Adaptation Policy Framework (APF), which was released at COP 9 this past year.

Appendix B: Workshop Agenda

Mobilizing Solutions for Adaptation: Enhancing Resilience

October 28-30, 2003
Le Pavillon Hotel
New Orleans, Louisiana

Tuesday, October 28

Morning

- Welcome and Introduction (Avis Robinson, U.S. EPA) 9:00-9:05
 - Objectives of Workshop (Dan Reifsnnyder, U.S. Department of State) 9:05-9:10
 - Introduction of Themes (Joel Smith, Stratus Consulting Inc.) 9:10-9:20
- Climate and development: Agriculture
(Facilitator: Bill Easterling, Pennsylvania State University)
 - Role of Climate in U.S. Agricultural Development Programs
(Ko Barrett, USAID) 9:20-9:40
 - Implementation of Climate and Agricultural Programs
(Ramasamy Selvaraju, Tamil Nadu Agricultural University, India) 9:40-9:55
 - Discussion, Q&A 9:55-11:00
- Climate and development: Coastal Zones
(Facilitator: Eileen Shea, East-West Center)
 - Role of Climate in Coastal Zone Programs (Ralph Cantral, NOAA) 11:15-11:35
 - Implementation of Coastal Zone and Climate Program
(Andrea Volentras, SPREP) 11:35-11:50
 - Discussion, Q&A 11:50-1:00

Afternoon

- Climate and development: Water resources
(Facilitator: Roberto Lenton, Columbia University)
 - Role of Climate in Water Resource Development Programs
(Dan Deely, AID) 2:00-2:20

- Implementation of Water Resources and Climate Programs (Ali Agoumi, Hassani School of Public Works, Morocco) 2:20-2:35
- Discussion, Q&A 2:35-3:45
- Climate Information (Facilitator: Roger Pulwarty, University of Colorado)
 - Overview: Role of Climate Information in Development Programs (Candyce Clark, NOAA) 4:00-4:10
 - Climate Information: *International Research Institute (IRI) for Climate Prediction* (Steven Zebiak, IRI) 4:10-4:25
 - Climate Information and Program Implementation (Laban Ogallo, Drought Monitoring Centre, Kenya) 4:25-4:40
 - Discussion, Q&A 4:40-5:45
 - First day wrap-up (Avis Robinson) 5:45-5:55

Wednesday, October 29

Morning

- Climate Risk Management (Facilitator: Eileen Shea, East-West Center)
 - Role of Climate Risk Management in Development Programs (Maxx Dilley, IRI) 8:30-8:50
 - Implementation of Climate Risk Management (Nathaniel Cruz, PAGASA, Philippines) 8:50-9:05
 - Discussion, Q&A 9:05-10:15
- Role of Technology (Facilitator: William Agyemang-Bonsu, EPA, Ghana)
 - Overview: Role of Technology in Development Assistance (Elmer Holt, U.S. DOE) 10:30-10:40
 - Rural Communities, National Institutions, and the Role of Technologies in Development (Kelly Sponberg, NOAA) 10:40-10:50
 - Climate, Technology and Program Implementation (Kishan Kumarsingh, Trinidad and Tobago) 10:50-11:05
 - Discussion, Q&A 11:05-11:55
- Second day wrap-up (Avis Robinson) 11:55-12:00

Thursday, October 30*Morning*

- Other Presentations (Facilitator: Dan Reifsnyder)
 - Japan (Mariko Hara, Embassy of Japan in Germany) 8:30-8:45
 - Japan (Mariko Fujimori, Pacific Consultants Co., Ltd.) 8:45-9:00
 - Australia (Ashley Fuller, Australian Greenhouse Office) 9:00-9:15
 - Canada (Neale Macmillan, CIDA) 9:15-9:30
 - UNDP (Bo Lim) 9:30-9:45
- General discussion (Facilitator: Joel Smith) 9:30-12:30
- Synthesis, Wrap-up and Next Steps (Dan Reifsnyder) 12:30-12:55
- Adjournment (Avis Robinson) 12:55-1:00

Appendix C: Participant List

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