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Nairobi work programme on impacts, vulnerability and adaptation to climate change

Synthesis of ongoing and planned adaptation research and adaptation research needs identified in submissions by Parties and relevant organizations

Note by the secretariat[*]

Summary

This document presents a synthesis of ongoing and planned adaptation research and adaptation research needs identified by Parties and relevant organizations, drawing upon several sources of information, including information relevant to adaptation research contained in submissions under several themes of the Nairobi work programme on impacts, vulnerability and adaptation to climate change. The document also summarizes a number of cross-cutting issues relating to adaptation research including capacity-building in developing countries and concludes with issues for further consideration.

[*] This document was submitted after the due date because the compilation and analysis of information took longer than expected.

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I. Introduction

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its twenty-fifth session, requested the secretariat to prepare, before its twenty-seventh session, a synthesis report on ongoing and planned adaptation research, as well as the adaptation research needs identified in the submissions from Parties and relevant organizations included in documents FCCC/SBSTA/2006/INF.2, and FCCC/SBSTA/2006/MISC.3 and Add.1, and to take this into account in the consideration of further activities.[1]

B. Scope of the note

2. This synthesis has been prepared in response to the mandate referred to in paragraph 1 above. It is based on information contained in the above-mentioned documents in so far as it relates to ongoing and planned adaptation research and research needs, taking into account updated information provided by relevant research programmes and organizations. In addition, it was deemed useful to take into account information relevant to adaptation research contained in submissions by Parties and organizations in response to calls for submissions under the various themes of the Nairobi work programme on impacts, vulnerability and adaptation to climate change,[2] as well as from concept papers and action pledges made under that work programme. Chapter II provides further information on the sources of information used and the approach to the synthesis.

3. This synthesis is intended to provide input to the deliverables under the Nairobi work programme. It is also expected that it will contribute to the ongoing work on research and systematic observation under the Convention, such as to exchange of information between Parties and the scientific community on research needs and priorities and developments in research activities.

II. Background and approach to the synthesis

A. Background

4. The overall objective of the Nairobi work programme is to assist all Parties, in particular developing countries, including the least developed countries and small island developing States (SIDS), to improve their understanding and assessment of impacts, vulnerability and adaptation, and to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound, scientific, technical and socio-economic basis, taking into account current and future climate change and variability.[3]

5. Activities in the area of research are undertaken in line with the objective in the annex to decision 2/CP.11 to advance subtheme b (iii), "Promoting research on adaptation options and the development and diffusion of technologies, know-how, and practices for adaptation, particularly addressing identified adaptation priorities and building on lessons learned from current adaptation projects and strategies". Activities in this area can contribute to efforts by Parties and organizations, inter alia, to analyse opportunities and ways to promote research on adaptive capacities and adaptation practices that increase resilience.

B. Synthesis approach

6. The following main sources of information were used for the synthesis:

[1] FCCC/SBSTA/2006/11, paragraph 62.
[2] FCCC/SBSTA/2006/11, paragraphs 11–71.
[3] Decision 2/CP.11, annex, paragraph 1.

(a) Document FCCC/SBSTA/2006/INF.2 which contains a synthesis of views by Parties on research needs, priority areas of research, and a summary of information on research activities by the scientific community. It also contains a description of the process of research and its coordination at international, regional and national levels;

(b) Documents FCCC/SBSTA/2006/MISC.3 and Add.1, which include views by Parties on research needs and priorities relating to the Convention;

(c) Updated information on ongoing and planned adaptation research provided by relevant international research programmes and by regional organizations and networks in response to an informal request by the secretariat;[4]

(d) Information considered relevant to research on adaptation contained in concept papers, actions pledges, and submissions by Parties and organizations under the following themes of the Nairobi work programme;[5]

(i) Methods and tools: documents FCCC/SBSTA/2007/MISC.12 and FCCC/SBSTA/2007/MISC.13 (Information on methods and tools for impact, vulnerability and adaptation assessments);

(ii) Climate related risks and extreme events: documents FCCC/SBSTA/2007/MISC.4 and Add.1 and 2 and FCCC/SBSTA/2007/MISC.5 (Relevant programmes, activities and views on the issues relating to climate related risks and extreme events);

(iii) Adaptation planning and practices: documents FCCC/SBSTA/2007/MISC.10 and FCCC/SBSTA/2007/MISC.11 (Information on adaptation approaches, strategies, practices and technologies at the regional, national and local levels in different sectors, as well as on experiences, needs and concerns);

(e) The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC): Climate Change 2007;

(f) Information contained in the fourth national communications of Annex I Parties that were not available at the time of completion of FCCC/SBSTA/2006/INF.2.

7. To facilitate consideration of the information available, the information is grouped under three main headings: ongoing and planned adaptation research organized around the main focus areas under the Nairobi work programme; research needs on adaptation; and cross-cutting issues relating to adaptation research, including capacity-building in developing countries. A summary of this information is given in this document; further details can be found in the documents referred to in paragraph 6 above.

III. Synthesis of information on ongoing and planned adaptation research and identified adaptation research needs

A. Ongoing and planned adaptation research

8. Research on impacts, vulnerability and adaptation to climate change has been indicated as a priority by Parties in submissions since 2002 and, as will be seen in this chapter, much adaptation

[4] Updated information was solicited with regard to information contained in FCCC/SBSTA/2006/INF.2 relevant to adaptation, and was received from the World Climate Research Programme, the Inter-American Institute for Global Change Research and START (Global Change System for Analysis, Research and Training).

[5] Submissions on other themes of the Nairobi work programme that may also be relevant to the research theme were not available at the time of preparing this synthesis.

research is now being carried out. The release of the IPCC AR4, and in particular the contribution of Working Group II on Impacts, Adaptation and Vulnerability, provides a comprehensive assessment of the current situation and motivation to do more research in this area. It also evaluates key vulnerabilities to climate change and the risks relating to climate change. The report shows that impacts of global warming are already occurring and illustrates the potential for adaptation to reduce the vulnerabilities and risks relating to climate change.

9. Since the publication of the IPCC Third Assessment Report in 2001, much research has been carried out into the impacts of climate change on developing regions; however, further research is still required, especially in Latin America and Africa. Many new studies on adaptation have been published, bringing improved understanding of current practice, adaptive capacity, options, barriers and limits.

10. The following sections provide summarized information on adaptation research activities and priorities, structured according to the respective themes of the Nairobi work programme. Corresponding research needs are covered to a limited extent as these are addressed in chapter III.B.

1. Research relating to climate-related risks and extreme events

11. In their submissions, Parties reported on their experiences regarding the assessment and management of current and future climate-related risks and impacts, including those relating to extreme events and in specific sectors. Many Parties are involved in a wide range of assessments, research and other activities in order to understand the potential impacts of climate change and climate variability on the environment, human health, ecosystems and socio-economic systems. They also provided information on a number of research activities that are advancing understanding of climate-related risks and extreme events and strengthening the infrastructure required to address these risks at national and global levels.

12. One of the important areas of research is devoted to studying how extreme events, such as droughts, floods, wildfires, heatwaves and hurricanes, relate to climate variability and change. Research supported by the United States Climate Change Science Program has played a leading role in the scientific advances that have improved understanding of the natural processes that underlie such variability and change; it has also made available new information to help society better anticipate and prepare for the potential effects of climate variability and change. In addition, the long-term efforts on climate by the United States National Oceanic and Atmospheric Administration designed to develop a predictive understanding of variability and change in the global climate system, supports many programmes relevant to the assessment, management and prediction of climate-related risks and extreme events.

13. Many Parties have conducted their research within national climate change programmes in the sectors that are of highest priority for adaptation in their countries and where there is a correspondingly high priority for research. These sectors and areas include water resources, settlements and infrastructure, agriculture, human health, fisheries, forestry and biodiversity. A number of studies dealing with risks in these priority sectors and regions have been completed or are in progress. Examples include: a project to understand recent weather patterns in south-east Australia; projects on inland and coastal flooding, water management and socio-economic impact analysis in Belgium; and studies carried out by three institutions in Argentina on climate change impacts and associated vulnerabilities from the perspective of a developing country.

14. Another important area of research relates to the systematic and comprehensive economic analysis of the costs of the impacts of climate change, including those resulting from inaction on adaptation. The objective of the European Commission's project Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis (PESETA) is to undertake an assessment of the impacts, including monetary estimates, of climate change in Europe in the periods 2011–2040 and 2071–2100 in different sectors. This provides a valuable indication of the economic

costs of climate change in Europe, based on physical impact assessment and state-of-the-art high-resolution climate scenarios.

15. The Government of New Zealand is funding a multi-year research programme on adaptation to climate variability and change which provides information, predictions and tools to help citizens make best use of climate-dependent natural resources, adapt to natural variations and climate risks, and identify and manage expected regional impacts of global climate change. The programme also includes new social research focusing on community response to extreme events and the economic impacts of climate variability. A number of projects are already under way. Further developments are likely to include: new information on past climate variability; improved models of future variability; new tools and products tailored to climate-sensitive industry needs to facilitate their adaptation to climate variability; and improved risk assessments to reduce vulnerability to climate extremes.

16. The need to involve stakeholders in research on the impacts of climate change is recognized and put into practice by the UK Climate Impacts Programme, which provides a focus for stakeholder-led research. Alongside assessments, it has developed an approach that may help to bring together the knowledge about climate-related risks and impacts among a specialized scientific community and decision-making in vulnerable sectors.

17. Research on decision-making under uncertainty that may benefit from climate change information is being supported by the United States National Science Foundation. It is expected to produce new insights of interest to the academic community, generate significant educational benefits and develop new tools that will benefit decision makers and a range of stakeholders.

18. A number of World Meteorological Organization (WMO) programmes, including co-sponsored activities, contribute significantly to the issue of climate risks:

(a) The IPCC AR4 includes updated information on the observed and predicted evolution of climate-related extreme events (see also para. 8 above);

(b) The World Climate Programme deals with the general issue of climate data. It has developed the mechanism of ‘climate watches’ for observing and recording climate extremes, the Climate Information and Prediction Services (CLIPS) project for the provision of climate information, products, predictions and services adapted to the needs of users, and is dealing with climate risk management and impacts in a number of domains, in particular agriculture and, more recently, health issues;

(c) The Hydrology and Water Resources Programme develops a range of actions relating to climate-related risks in hydrology;

(d) The Disaster Risk Reduction Programme strengthens international collaboration in disaster risk management;

(e) The WMO Space Programme contributes more specifically to the coordination of space-based observations;

(f) The World Climate Research Programme (WCRP), whose strategic aim for 2005–2015 is to facilitate analysis and prediction of Earth systems and variability, is developing a specific research strategy on climate extremes. One of the WCRP core projects focuses on climate variability and predictability;

(g) The Global Climate Observing System (GCOS) works towards strengthening climate monitoring and relevant observing systems, which are essential for understanding the frequency and significance of extreme events, and for providing data for research and projections and for underpinning climate models.

2. Research relating to adaptation planning and practices[6]

19. Research on adaptation planning and practices can be found in research programmes and activities at the regional, national and local/community levels in all regions and encompassing many sectors, in particular water resources, agriculture and health. In the member States of the European Union (EU) settlements in coastal zones and biodiversity and environment are also a priority; coastal hazards and the risk of drought and floods were mentioned by New Zealand among others. Japan's official development assistance provides funding for studies and projects at the national level and in forest and nature conservation as well as in the sectors mentioned above. The United States is providing practical scientific information and tools to improve the design and implementation of adaptation measures in a variety of sector- and region-specific adaptation projects.

20. Improved ecosystem models have become available in the past four years, offering a better tool for testing adaptation options as well as the possibility of more accurate predictions and more relevant regional projections.

21. In addition to general impact studies, a number of research programmes provide specific information on impacts and adaptation in specific sectors that would facilitate adaptation planning and practices. For example, in the area of agriculture in New Zealand, such programmes include investigating the adaptive breeding of new cultivars. In other examples from the United States, the impact of climate variability and change on transportation are being studied, and work has started on compiling best practices and lessons learned in incorporating climate change issues into the planning process.

22. In Australia, adaptation research is focusing on building capacity and developing technical solutions to manage the effects of climate change on agriculture and natural resource management. Work being done with rural industry groups includes overcoming knowledge gaps on adaptation strategies through research. This will prepare the agricultural community for the unavoidable impacts of climate change, for example through developing adaptation options for vulnerable rural industry sectors.

23. In addition to research activities that are undertaken at the national or sectoral level, there are some transnational research activities including the first joint calls for research under the European Research Area Networking (ERA-Net) Climate Impact Research Coordination for a Larger Europe (CIRCLE). The extended country reports prepared under CIRCLE provide further information on research activities at the national level in individual EU member States.

24. It is also recognized that research into climate change response options including adaptation must be tackled from an interdisciplinary perspective. Pioneering work using this approach has been carried out by the United Kingdom’s Tyndall Centre for Climate Change Research in a number of areas, including energy-economic modelling, adaptation in the water sector and decision-support tools for coastal zone management, flooding and public health, linking air quality and climate change mitigation, and perceptions of dangerous climate change. Similarly, in Germany the Klimazwei research programme, which addresses protection against the impacts of climate change, explores options for adaptation to climate trends using a multidimensional and integration-oriented policy approach that links economic, ecological and social aspects of climate change.

25. The Food and Agriculture Organization of the United Nations reported on observing and support networks at the global, regional and national levels and on its promotion of research, testing, validation and introduction of adaptation options (including indigenous and new technologies) in the agriculture sector. The WCRP is coordinating research aimed at reducing the uncertainty in projections of sea level rise.

[6] A separate synthesis covering information and views on adaptation planning and practices is available in document FCCC/SBSTA/2007/9.

3. Research relating to methods and tools for impact, vulnerability and adaptation assessments[7]

26. Several Parties in a variety of ways reported research on assessment methodologies and tools.[8] In general, a growing demand for methods and tools to make assessments of climate change impacts all over the world is anticipated. In the EU, a number of research projects to develop methods and tools are planned or being undertaken, such as observations and modelling of the effects of climate change on various ecosystems and regions, including the Arctic and the subarctic regions, the Alps and oceans, lakes and rivers. Assessments are also being undertaken for various sectors, for example the health and socio-economic sectors.

27. Another important branch of research is the development of existing and new adaptation methods and technologies. For example, the FINADAPT programme (Study of Adaptation to Climate Change in Finland) (2004–2005) contributed to estimating the adaptability of people and the environment in Finland to the impacts of climate change. The methods included a combination of literature review, expert judgement, modelling and scenario analysis, stakeholder dialogue and survey responses. A new, more comprehensive set of scenarios for Finland's future climate and its impacts was developed in the FINSKEN (Developing consistent global change scenarios for Finland) project; future research is expected to focus on updating the current set of scenarios as well as extending it to include other socio-economic and environmental characteristics (e.g. non-forest land uses, social preferences, infrastructure and adaptation capacity). With regard to water resources, different research programmes in Finland have studied projected future changes in runoff.

28. The CLIMPACTS programme (New Zealand) has recently developed methods and tools for assessing the human dimensions of climate change. These developments include the capacity to generate scenarios of land-use changes, to examine adaptation options and to evaluate benefits and costs. These tools are part of a wider methodology (called Climate Change Adaptation through Integrated Risk Reduction) which promotes the mainstreaming of adaptation into decision-making. These integrated methods and tools, developed and applied initially in New Zealand, have also been applied in, for example, Australia, Sri Lanka and various Pacific Island countries.

29. Also, further developments of New Zealand's research programme on adaptation to climate variability and change (see para. 15) are likely to include development of climate-related decision support tools to enable local government to bring adaptation to climate change into policy and strategic planning.

30. In the United States, a range of research and other activities to develop methods and tools to enhance adaptation options is under way under the United States Climate Change Science Program strategic plan. Attention is also being focused at the local and state levels. Research partnerships have been initiated with a view to involving decision makers in the process of identifying the knowledge gaps that are most relevant to their decision-making processes. These partnerships have also explored mechanisms for improving the utility and flow of knowledge from the research community to those who can use and benefit from it.

31. In response to interest from the regions, WMO embarked on work to assist SIDS in all regions to access the GCOS network. In the Pacific region, for example, the Pacific Island GCOS (PI-GCOS) is intended to be a long-term, user driven operational system capable of providing the comprehensive observations required for monitoring the climate system, for detecting and attributing climate change, for assessing the impacts of climate variability and change, and for supporting research towards improved understanding, modelling and prediction of the climate system. The Implementation Plan for the

[7] A separate synthesis covering information and views on methods and tools is available in document FCCC/SBSTA/2007/8.

[8] Where information relevant to methods and tools has already been described under a different heading of this synthesis (in particular, climate risk assessment), this has not been repeated here.

PI-GCOS includes research projects on assessment methodologies and tools. It is recognized that research on local level modification of technologies is needed. This would allow practitioners in different sectors to use technologies to plan for and implement adaptation in their communities.

32. THORPEX, a part of the WMO World Weather Research Programme, is an international research and development programme that aims, in response to the weather-related challenges of the twenty-first century, to accelerate improving in the accuracy of one-day to two-week high impact weather forecasts for the benefit of society, the economy and the environment.

B. Adaptation research needs

33. The submissions from Parties summarized in document FCCC/SBSTA/2006/INF.2 generally confirmed the priorities for research relating to the Convention that had already been identified in 2002 (see FCCC/SBSTA/2002/INF.17). The submissions under the Nairobi work programme (see para. 6) underlined the interest in adaptation research, emphasizing some directions for future research without adding entirely new priorities.

34. The state of the science presented in the IPCC AR4 provided policymakers with information about climate change impacts and adaptation potential, and included a summary of remaining priorities for further research. Several Parties in their submissions on the Nairobi work programme urged that the research community should do its best to address the gaps in contemporary research identified in the AR4.

35. The GCOS, WCRP and International Geosphere-Biosphere Programme (IGBP) have started to consider research gaps and uncertainties addressed in the AR4, including on impacts, adaptation and risk. To this end, a workshop titled "Future climate change research and observations: GCOS, WCRP and IGBP learning from the IPCC Fourth Assessment Report" was held (4–6 October 2007 in Sydney, Australia), with the aim of establishing research requirements, based on the gaps identified in the AR4, that would lead to better climate change risk analyses and adaptation measures.

1. Impacts, vulnerability and adaptation

36. Research on impacts, vulnerability and adaptation was indicated as a priority by many Parties in their submissions (FCCC/SBSTA/2006/MISC.3 and Add.1). Parties recommended that the assessment of global and regional impacts and risks associated with various greenhouse gas (GHG) stabilization levels and emission pathways should take adaptation into account. Enhanced research is needed on improvements in modelling regional and sub-regional climate change for the integrated assessment of impacts, vulnerability and adaptation, including the size and frequency of extreme events. Research is also needed for specific regions, especially for developing regions, and for specific phenomena and impacts (such as ice coverage, ocean acidity and related impacts on ecosystems).

37. Parties also pointed out the importance of taking the human dimension into account in climate change research in the area of impacts, vulnerability and adaptation, especially when assessing adaptation, adaptive capacity, sensitivity and vulnerability. Some Parties highlighted the need for improved tools for integrated assessment to assess policy options, and the importance of incorporating economic, social and biophysical data into decision support tools for the prioritization of adaptive responses.

38. Important research topics for impacts, vulnerability and adaptation include:

(a) Integrated analysis of climate change impacts and vulnerabilities, including impacts of extreme events and climate variability on regional scales and lower; analysis of the additional stress induced by non-climatic factors; and migration responses to climate change;

(b) Economic assessment of the adverse effects of climate change on global and regional scales;

(c) Regional and global climate change impacts associated with different GHG stabilization levels and pathways and their likelihood by region, system and sector, taking adaptation into account;

(d) Likelihood, magnitude and time scale of significant impacts and abrupt or irreversible events;

(e) Methodologies, technologies, timing and costs of adaptation;

(f) Adaptation strategies and their link to sustainable development and equity issues with specific focus on developing countries. This should incorporate local strategies aimed at enhancing adaptive capacities to withstand impacts and strengthening resilience to potential adverse effects of climate change.

39. The demand for systematic approaches, strategies, practices and technologies for adaptation is growing all over the world. Research on adaptation options and the dissemination of its findings is a high priority. This calls for intensifying existing cooperation and initiating new cooperation with developing countries.

40. Better understanding of the relative costs of climate change impacts and adaptation allows policymakers to consider optimal strategies for implementing adaptation policies, especially regarding the extent of adaptation required and the timing. Only a small amount of literature on the costs of climate change impacts could be found for assessment in the IPCC AR4. Debate still surrounds the topic of how to measure impacts, and which metrics should be used to ensure comparability. The literature on adaptation costs and benefits is limited and fragmented; it focuses on sea level rise and agriculture, with more limited assessments for energy demand, water resources and transport. Moreover, the coverage of countries and regions is uneven.

41. Scenarios are required that describe the future evolution of the world under different and wide-ranging assumptions about how societies, governance, technology and economies will develop in future; they are also required on the regional and local scales appropriate for impacts analysis which then allow adaptation to be incorporated into climate change impact estimates. Furthermore, scenarios for abrupt climate change, for large sea level rises due to ice sheet melting and for the time period beyond 2100 are needed.

42. Parties from the Alliance of Small Island States (AOSIS) have experienced limitations with integrated assessment models, which tend to assess impacts on a sectoral basis, but do not take into account certain complex ecosystems and relevant economic sectors. As a result, while these studies have been useful, there are significant information gaps that lead to an incomplete portrayal of climate change impacts in many countries. This in turn creates challenges for identifying and disseminating risk management options for adaptation. There is a need for impact models that are suitable for small island States, and for improvements in the technologies and resolution used for climate modelling and for the mapping of vulnerable areas and communities, as well as for technological improvements in the resilience of physical infrastructure and improved early warning and monitoring systems for extreme weather events.

43. In connection with the assessment and management of extreme events, in many SIDS, and across some SIDS regions, it is extremely difficult to locate or access historical information on the physical, environmental, financial, social and economic effects of extreme weather events. Mechanisms to support the gathering, storing and sharing of data on the impacts of these events, at both the country and regional levels, would greatly facilitate risk management planning in anticipation of future climate and climate

change related events. This could be facilitated, for example, through the creation of easily accessible databases on historical climate variability, extreme events and their impacts.

44. The United States notes that there still remain many unresolved questions about key aspects of the climate system, including some that have enormous societal and environmental implications. For example, understanding how climate variability and change influence local and regional occurrence and severity of extreme events such as hurricanes, floods, droughts and wildfires. One of the highest priorities for decision makers is to determine how climate variations, whether natural or human-induced, alter the frequencies, intensities and locations of extreme events.

45. The EU noted that the management of current and future climate-related risks and impacts is still at a preliminary stage, which may result in considerable damages. The demand for data and underlying observations for climate risk management is, however, considerable.

46. The positive or negative effects of climate change concern different groups of citizens. For example, based on present knowledge, it is believed that the nature of northern Finland and its inhabitants will be particularly sensitive to the effects of climate change. Initiation of adaptation measures will allow more detailed determination of how the impacts of climate change concern different groups and what kind of adaptation measures can be used to promote equal social development. However, this will require further research as well as the development of assessment methods.

47. Taking transportation as one example of an affected sector, the complexity of transportation and climate change issues and the lack of related expertise pose major challenges for transportation decision makers and planners. Decision makers (who are often unfamiliar with how transportation will be affected by climate change) are faced with making choices with significant long-term implications for climate change. In its fourth national communication, Germany noted that to date there has been little research into the infrastructure and transport sectors, particularly for changes in traffic streams. Knowledge about adaptation measures is therefore limited.

48. The European Commission recognized the need to undertake further research and to develop adaptation strategies. Most of the policy action in this area is currently being undertaken by individual member States. New work on adaptation is planned under the next phase of the European Climate Change Programme, which aims to ensure that adaptation aspects are fully integrated into European climate policy. One of the expected results is to identify knowledge gaps and suitable opportunities for additional research programmes.

2. Integrated approaches to adaptation and mitigation and their integration to sustainable development

49. In their submissions summarized in document FCCC/SBSTA/2006/INF.2, Parties addressed the cross-cutting issue of integrated approaches to adaptation and mitigation in the framework of strategies for sustainable development, noting the need to assess the technological and adaptation scenarios associated with different stabilization levels and emission pathways for GHGs. In this regard, the EU suggested the initiation of an international programme or framework that would assess (a) the global and regional impacts and risks, (b) the economic, environmental and social costs and benefits associated with various GHG stabilization levels and emission pathways, and (c) the technological and adaptation scenarios associated with each.

50. Japan considered that it is important to coordinate activities in climate change monitoring, advanced climate modelling, and impact and adaptation studies, so that information from different research areas can be made mutually supportive. Such improved information aids decision-making and is critical to support planning, adaptive management and mitigation policymaking.

51. The EU and Mexico suggested that more research is needed on the costs and benefits of mitigation and adaptation under various scenarios, in order to assess how regional and national

sustainable development strategies can simultaneously meet development priorities and address climate change. China highlighted the need for research and methods for assessing impacts of mitigation on sustainable development.

52. The IPCC AR4 recognizes that synergies exist between adaptive capacity and sustainable development, and that societies that are pursuing a path of sustainable development are likely to be more resilient to the impacts of climate change. Further research is required to determine the factors which contribute to these synergies, and how policies to enhance adaptive capacity can reinforce sustainable development and vice versa. Further understanding of adaptation is likely to require learning-by-doing approaches, where the knowledge base is enhanced through accumulation of practical experience. It is important to understand what characteristics strengthen the adaptive capacity of some people and places, and what characteristics predispose physical, biological and human systems to irreversible changes as a result of exposure to climate and other stresses.

53. The Earth System Science Partnership (ESSP)[9] noted that the assessment of impacts, vulnerabilities and adaptation to climate change is so complex that it is difficult to prioritize research needs. However, the ESSP identified the following as being of great importance: multi-scale analysis of climate change impacts and mitigation responses, including economic costing of climate change; assessment of climate impacts at different GHG stabilization levels; and the assessment of impacts from abrupt and/or irreversible climate changes. Also important are the study and analysis of adaptation strategies and their links to sustainable development, that is, climate proofing, and the assessment of the various impacts that adaptation strategies may have.

C. Cross-cutting issues

1. Promoting understanding of the impacts of, and vulnerability to, climate change and implications for sustainable development

54. A number of activities are being carried out by international organizations, research programmes and by national governments that promote the understanding of the impacts of, and vulnerability to, climate change in various ways, including through capacity-building, taking into account the implications for sustainable development in developing countries. Some examples are given below.

55. Research results presented in the contribution of Working Group II to the IPCC AR4 underscore the extreme vulnerability of SIDS to the negative impacts of climate change, including sea level rise and climate-related extreme events, and highlight a range of present and future climate change impacts, as noted by Parties from AOSIS. The combination of processes triggered by climate change, such as sea level rise, extreme weather events and coral bleaching, and the resulting loss of biodiversity can be expected to cause increasing damage to already fragile island economies, reversing years of development efforts and posing an enormous risk to the sustainable development of SIDS.

56. In 2004, based on a proposal by Spain, the Ibero-American Network of Climate Change Offices (RIOCC) was created, comprising climate change offices in 21 countries in the Ibero-American region. One of its aims is to deal with climate change matters in a wide-ranging approach; the working programme encompasses activities in, inter alia, impacts and adaptation, capacity-building, climate change and development aid.

57. Recognizing that a robust and diverse economy is less vulnerable to climate risks and that resilience to the impacts of climate change contributes to the success of development efforts, the United States Agency for International Development works to incorporate climate change adaptation planning into mainstream development assistance activities. It works with development partners to reduce the vulnerability of individual projects to the impacts of climate change.

[9] Partnership of the WCRP, the IGBP, the International Human Dimensions Programme and DIVERSITAS.

58. The practical application of research deliverables such as climate models and seasonal climate forecasts is important for strategic disaster response planning internationally. The United States reported on help provided to build expert capacity and institutions as well as community preparedness by supporting the development and dissemination of specific research applications (e.g. malaria forecasts to enhance public health and disaster response, and models for predicting food security scenarios and for water resources management). The United States International Research Institute for Climate and Society[10] concentrates its applied research for the sustainable development of society through its three regional programmes in the Africa, Asia-Pacific, and Latin America and the Caribbean regions. These programmes focus on improving the operational management of agriculture and river basins and developing early warning systems for floods, droughts, food security crises, epidemics of human diseases, livestock diseases and agricultural pests. The work is carried out in such a way as to enable better understanding of problems and the development of practical, proactive strategies for managing climate risks.

59. On the issue of improving the communication of research findings to policymakers at different levels, Japan suggested that improved information on climate observations, projections and climate change impacts might help decision-making and that it is critical to support adaptation planning, adaptive management and mitigation policymaking. Mexico stressed the importance of research on the development of efficient methods and tools for climate change communication strategies to be used for stakeholders at different levels. In this regard Mexico suggested that the development of research projects that involve synergy with other conventions for adopting mitigation and adaptation actions to climate change would be very useful. The United States stressed that the development of improved science-based resources to aid in decision-making is critical to support planning, adaptive management and policymaking.

60. One of the aims of the ESSP is to delivering research outputs of value to users seeking information regarding likely future climate change and its interactions with bio-geochemical and socio-economic systems. ESSP believes that disseminating climate information on regional scales underpins all efforts in understanding the impacts of, and vulnerability to, climate change and developing adaptational strategies. In this regard, the ESSP highlights the ESSP Integrated Regional Study approach, and particularly the success of the Global Environmental Change and Food Security (GECAFS) regional case study approach.

2. Capacity of developing countries and enhancement of their capacity to contribute to and participate in adaptation research

61. In their submissions summarized in FCCC/SBSTA/2006/INF.2, Parties highlighted the importance of the enhancement of the capacity of developing countries to contribute to, and participate in, global climate change research efforts, including participation in studies undertaken under global and regional programmes. Many Parties regard capacity-building as essential for climate monitoring and analysing climate observations. Parties reported on their participation in, and support for, a number of global and regional initiatives on enhancing capacity of developing countries, such as activities of START, the Asia-Pacific Network for Global Change Research (APN), the Inter-American Institute for Global Change Research (IAI), the International Research Institute for Climate Prediction and the Consultative Group on International Agricultural Research. The programmes of these organizations include substantial components directed at enhancing the capabilities of scientists from developing countries to participate in such regional research and contribute to global-scale studies. Some examples are given below.

62. In their submissions contained in document FCCC/SBSTA/2006/MISC.3, Japan and Mexico pointed out the need for better coordination of activities in impact and adaptation studies and the

[10] <http://portal.iri.colombia.edu>.

strengthening of regional cooperative networks to facilitate adaptation, including increased use of existing ones, such as APN and IAI.

63. As noted by several Parties (EU and AOSIS), traditional knowledge can bring with it experience and understanding of the social and cultural environment that are fundamental to understanding and evaluating impacts, vulnerabilities and adaptation, and may be able to fill gaps where scientific data collection is sparse and global model resolution is too coarse. It can also provide valid input into vulnerability and adaptation assessments, and assist in identification of resilient ecosystem components based on generations of experience. The development of methodologies or guidance for incorporating this knowledge into national assessments and eventually into adaptation on the ground was considered to be potentially extremely beneficial. The Arctic Climate Impact Assessment report attempted to combine such knowledge and insights from indigenous people with data from scientific research. The report shows that with regard to water management such traditional management approaches, for example with regard to water management, worked quite well but have often not been taken into account. Furthermore, cultural barriers may have to be overcome in order to link traditional knowledge with the most up-to-date information on climate change.

64. A number of Parties provided information on their efforts to enhance research capacity in developing countries. For example, the United Kingdom has continued to support research and capacity-building on adaptation at an international level; bilateral collaborative research projects on the impacts of climate change in China and India have been completed, and further research is under way or planned. Work on cross-cutting issues by the United States Climate Diagnostics Center will focus on outreach to support capacity-building in the policy and decision-making communities, facilitating the use of information products and services for predicting extreme events. Australia reported on practical assistance it is providing to Pacific Island countries to monitor sea levels, improve climate prediction services, assess vulnerability and enhance adaptation capacity.

65. The purpose of the Climate Change Adaptation in Africa Research and Capacity Development Program (CCAA), which commenced in 2006, is to significantly improve the capacity of African countries to adapt to climate change in ways that benefit the most vulnerable. The CCAA funds research that reduces uncertainty, enhances adaptive capacity and supports capacity-building programmes in Africa. The CCAA approach will promote the incorporation of indigenous knowledge on coping with climate variability into research projects, lead to better-defined research questions, and facilitate the process of transferring or devolving results and skills to those who will use them.

66. START has been working since 1990 to promote and enable research on regional aspects of global environmental change in the developing world. This is done through capacity-building programmes, collaborative research and assessment projects, scientific networks and forums to share and disseminate information, and mobilization of financial, institutional and human resources. A network of START research centres and collaborating scientists and institutions throughout Africa, Asia, the Caribbean, Europe, Latin America, North America and the Pacific carries out the work of START. Since 2000, the management of risks from environmental change has been an increasingly important part of START's research. The ACCCA project (Advancing capacity to support climate change adaptation) aims to bring together stakeholders and scientific communities of the developing world to enable and support effective adaptation decisions that will reduce vulnerability to climate and environmental changes while promoting sustainable development. This project draws on lessons learned from the UNEP/GEF-funded project: assessment of impacts and adaptations to climate change (AIACC).

67. The Water Center for the Humid Tropics of Latin America and the Caribbean, together with other partners, supports the countries in the Mesoamerican Region in the areas of numerical weather forecasting, climate scenario development, Earth Observation Systems (in the context of GCOS and GEOSS), forest fire monitoring, land-use change, disaster management and adaptation to climate change.

68. The International Water Management Institute (IWMI) carries out significant research in the field of drought assessment and mitigation in Africa. Current drought research activities at IWMI include quantification of drought risks and low flows in Iran, climate change induced impacts on irrigation schemes in Morocco, global mapping of drought-related indicators. Attempts are being made to initiate drought research projects in East and West Africa.

69. The Sahara and Sahel Observatory, an independent international organization based in Tunisia, is composed of African and European countries, regional and international organizations and representatives of civil society, and contributes to adaptation research through data collection and observation.

70. In a survey circulated by the IAI among its member countries in late 2004, adaptation to climate change was identified as a priority for global change research. In the IAI new cooperative five-year science programme, the Second Round of Collaborative Research Network (CRN II), a number of research projects are under way that address impacts, vulnerability and adaptation, and are expected to contribute to the development and strengthening of regional capacity. Examples include a multinational project that studies land-use change patterns and their implications, such as the effects on agriculture and socio-economic systems. Another project is looking at effective strategies to reduce risks and increase adaptation capacity of the farmer groups most vulnerable to economic and climatic impacts in four coffee-producing countries. In the Caribbean, studies of past hurricane activities will be used to develop an interactive model that links hurricane activity to post-hurricane hazards and damages. The results are expected to contribute to an accurate assessment of hurricane risks and to reducing vulnerability of the region. Another project, dealing with tropical cyclones, will look at rural and urban vulnerabilities to climate extremes in the context of adaptive water resource management that takes into account climatic uncertainty. The research strategy in many of those projects is multidisciplinary, with the participation of researchers from a broad range of disciplines such as anthropology, sociology, ecology and environmental economy, and from scientists across 17 countries in the Americas.[11]

IV. Issues for further consideration

71. Parties may wish to consider the following questions when discussing ways to promote further research on adaptation in the context of the Nairobi work programme:

(a) What actions could be taken to facilitate the use of the findings resulting from research activities on adaptation so that existing information is taken into account in considering adaptation options and related decision-making processes?

(b) How could the cooperation of the existing international and regional programmes, networks and organizations be enhanced even further, and new partners be involved, in particular at regional level?

(c) What role could the ongoing dialogue under the SBSTA between Parties and the research community play in contributing to the objectives of the Nairobi work programme, in particular as regards promoting research on adaptation?

(d) Given the essential role that data observations play for supporting research and climate change models, including for adaptation, how could data coverage from observations and networks be enhanced and the necessary quality of climate observing systems be ensured, in particular in developing countries or in regions where such coverage is still weak, in order to develop a sound basis for adaptation research in those regions?

[11] A brief description of the CRN II projects can be found in document FCCC/SBSTA/2006/MISC.15.

(e) The IPCC AR4 identifies key gaps and uncertainties, including those relating to research on adaptation. What actions could be done to address these in the future?

(f) How could the contribution of traditional knowledge to research on adaptation be enhanced and better use made of the synergies between adaptive capacity and sustainable development?

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