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

Report on the technical workshop on ecosystem-based approaches for adaptation to climate change

Note by the secretariat*

Summary

This report provides a summary of the technical workshop on ecosystem-based approaches for adaptation to climate change, organized under the Nairobi work programme on impacts, vulnerability and adaptation to climate change, which was held in Dar es Salaam, United Republic of Tanzania, from 21 to 23 March 2013. The workshop considered the role of ecosystems, including forests, in adaptation; vulnerability and impacts in ecosystems; and the implementation of and benefits from ecosystem-based approaches for adaptation. Through discussions taking place in plenary and parallel breakout sessions and among members of an expert panel, Parties and expert organizations enhanced their understanding of ecosystem-based approaches for adaptation, identified areas of further work and shared best practices and lessons learned, including in the context of the Rio Conventions. Cross-cutting themes, including the importance of indigenous and traditional knowledge and the need for considering gender sensitivity in ecosystem-based approaches for adaptation, were discussed at the workshop. The report includes a summary of priority areas identified by participants for follow-up and further consideration, including under the Nairobi work programme.

* This document was submitted after the due date owing to the timing of the workshop.

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I. Introduction

A. Mandate

1. The overall objective of the Nairobi work programme on impacts, vulnerability and adaptation to climate change is to assist all Parties, in particular developing countries, including least developed countries and small island developing States, 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 socioeconomic basis, taking into account current and future climate change and variability.¹

2. The Conference of the Parties (COP), at its seventeenth session, requested the secretariat to organize, in collaboration with partner organizations of the Nairobi work programme and other relevant organizations, a technical workshop on ecosystem-based approaches for adaptation to climate change, before the thirty-eighth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), taking into account the role of ecosystems, including forests, in adaptation; vulnerability and impacts in ecosystems; and the implementation and benefits of ecosystem-based approaches for adaptation and lessons learned, including through the three Rio Conventions.²

3. The COP indicated that the workshop would be informed by the information contained in annex I to the report of the SBSTA on its thirty-fourth session,³ and subsequent views of Parties, and would include, as cross-cutting issues, indigenous and traditional knowledge and practices for adaptation, and gender-sensitive tools and approaches.

4. The COP further requested the secretariat to prepare a report on the workshop, to be made available by the thirty-eighth session of the SBSTA.⁴

B. Scope of the note

5. This document describes and summarizes the above-mentioned workshop, drawing upon the presentations and discussions that took place. It contains:

- (a) A description of the workshop proceedings (chapter II);
- (b) A summary of key issues addressed at the workshop (chapter III);
- (c) A possible way forward, which includes a summary of the recommendations and issues as identified by participants, including in the context of the Nairobi work programme (chapter IV).

C. Possible action by the Subsidiary Body for Scientific and Technological Advice

6. The SBSTA may wish to consider this workshop report at its thirty-eighth session as part of its consideration of the outputs of activities completed under the Nairobi work

¹ Decision 2/CP.11, annex, paragraph 1.

² Decision 6/CP.17, paragraph 4(b).

³ FCCC/SBSTA/2011/2.

⁴ Decision 6/CP.17, paragraph 5.

programme prior to that session. Information contained in this report may also assist Parties in their reconsideration of the work areas of the Nairobi work programme.

II. Proceedings

7. The technical workshop on ecosystem-based approaches for adaptation to climate change was held in Dar es Salaam, United Republic of Tanzania, from 21 to 23 March 2013 and was chaired by the Chair of the SBSTA.

8. The workshop was attended by 73 representatives from Parties and relevant international, intergovernmental and non-governmental organizations that are active in the fields of climate change impact and vulnerability assessment, and adaptation planning and practices, including those related to ecosystem-based approaches for adaptation.

9. The three-day workshop was organized into six sessions and included a combination of expert presentations, plenary discussion, an expert panel and parallel breakout sessions.⁵

10. The opening ceremony by the host Government was followed by a framing session, during which the chair of the workshop provided an overview of the workshop and an indication of its scope. The framing session aimed at providing the context for the workshop, including on an overview of the Nairobi work programme, the vulnerability of and risks to ecosystems under a changing climate and the genesis of ecosystem-based approaches for adaptation.

11. The second session focused on developing a shared understanding of the principles and benefits of ecosystem-based approaches for adaptation in different ecosystems and regions. The third session, on planning and practices of ecosystem-based approaches for adaptation policies and programmes, aimed at improving and developing a shared understanding of and identifying ways to enhance: (a) the integration of ecosystem-based approaches into adaptation policies and programmes, including in the context of the three Rio Conventions; and (b) the integration of gender-sensitive strategies and tools, and traditional and indigenous knowledge into ecosystem-based approaches for adaptation.

12. On the second day, the fourth session, on methodological, technical and scientific aspects of ecosystem-based approaches for adaptation, focused on: (a) different types of tools and approaches for assessing vulnerability of ecosystems, including related data and knowledge needs; (b) tools and approaches for analysing and demonstrating the economic, social and environmental effectiveness of ecosystem-based approaches for adaptation; and (c) the monitoring and evaluation of approaches, including potential indicators to demonstrate the effectiveness of ecosystem-based approaches for adaptation.

13. The third day was organized into two sessions. The fifth session focused on stakeholder engagement, and knowledge-sharing and management at different levels and scales to enhance ecosystem-based approaches for adaptation, building on the following key points: (a) opportunities and challenges in using different types of knowledge (including traditional and indigenous knowledge) to enhance the resilience of ecosystems and ecosystem-based approaches for adaptation; (b) opportunities and good practices for disseminating knowledge on ecosystem-based approaches for adaptation to target audiences (at different levels and scales); (c) ways of engaging different groups of stakeholders, including policymakers; and (d) the potential role of the Nairobi work programme in facilitating stakeholder engagement and knowledge management.

⁵ Documentation, including the agenda and summaries of the presentations and breakout group discussions, is available at <<http://unfccc.int/7379.php>>.

14. During the final session, Parties and organizations provided inputs on potential further activities that are needed on ecosystem-based approaches for adaptation, including in the context of the Nairobi work programme. The workshop concluded with a chair's summary.

III. Summary of key issues addressed

15. This chapter draws on the background document,⁶ presentations and discussions during plenary and breakout sessions, and summarizes the key issues derived from these.

A. Vulnerability of, and impacts of climate change on, ecosystems and the role of ecosystems in adaptation

16. The framing session highlighted that climate change will affect ecosystems, their functions and the many benefits and services they provide to society. These include services such as the provision of food, fuel and fibre; supporting services such as soil formation and nutrient cycling; and cultural services, including recreational and non-material benefits. The impacts of climate change, such as changing precipitation patterns, increased instances of severe weather events, including flooding and droughts, sea level rise and ocean acidification, are being felt by vulnerable ecosystems and people. There is growing evidence on the links between biodiversity loss – at the level of ecosystems, species, genetic diversity within species and ecological interactions – and climate change. Independent of climate change, biodiversity is forecast to decrease in the future as a result of multiple stresses, in particular due to increased land-use intensity and the associated destruction or conversion of natural and semi-natural habitats. Extreme climate events have and will continue to have major impacts on biodiversity.

17. Some ecosystems have already been affected by observed changes in climate and are considered to be particularly sensitive to changes in regional climate. Climate change exacerbates the pressure on ecosystems and people that are already negatively affected by unsustainable practices such as deforestation, land degradation and conversion. Participants provided examples of climate change impacts on different types of ecosystems, including the following:⁷

(a) Coastal zones and coastal marine ecosystems (including coral reefs): changes in marine systems, particularly fish populations, are linked to large-scale climate shifts and affect socioeconomic systems;

(b) Forests, drylands, croplands and grasslands: increased summer aridity over most mid-latitude continental interiors and the associated risk of drought could lead to decreased water availability, resulting in increased stresses on animals through changes in forage quality, decreased rangeland productivity in drought- and flood-prone regions and the increased risk of forest and rangeland fires with associated impacts on infrastructure (e.g. roads and built-up areas);

(c) Mountain ecosystems and inland waters: changes in stream flow, floods and droughts are having an impact on the goods and services that such ecosystems deliver (e.g. freshwater fisheries, wetland flows) and socioeconomic systems (e.g. declining commercial

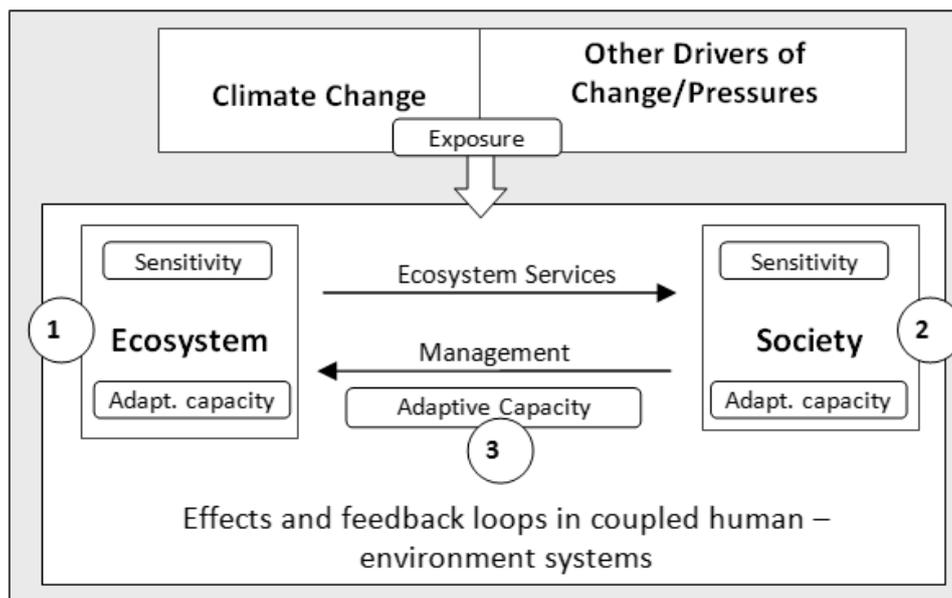
⁶ Document FCCC/SBSTA/2011/INF.8, "Ecosystem-based approaches to adaptation: compilation of information".

⁷ These three groups of ecosystems were considered as a basis of breakout group discussion during the workshop.

pelagic fishery in Lake Kariba in Zambia/Zimbabwe, decreasing fish yields in Lake Tanganyika, United Republic of Tanzania).

18. There was recognition among participants of the role that healthy ecosystems play in increasing the resilience of communities and helping people to adapt to climate change through the delivery of a wide variety of services that help to maintain human well-being. The figure below shows a close link between the health of ecosystems and the adaptive capacities of people within the coupled human–environment systems: healthy ecosystems have the capacity to accommodate pressures and maintain resilience,⁸ while the adaptive capacities of human society are linked to the provision of ecosystem services.

Effects and feedback loops in coupled human–environment systems



Source: Adapted from Locatelli B, Kanninen M, Brockhaus M, Colfer CJP, Murdiyarsro D and Santoso H. 2008. *Facing an Uncertain Future: How Forests and People Can Adapt to Climate Change*. Bogor: Center for International Forestry Research. Available at <<http://www.cifor.org/online-library/browse/view-publication/publication/2600.html>>.

B. Principles and benefits of ecosystem-based approaches for adaptation to climate change

19. Ecosystem-based approaches for adaptation have been defined in several ways and there is still no common and agreed definition (see the box below for a definition by the Convention on Biological Diversity (CBD)). When defining ecosystem-based approaches for adaptation, participants pointed out the need to move away from a purely anthropogenic perspective to one that embraces both ecosystems and people. A conceptual separation between ecosystem-based approaches for adaptation and adaptation of ecosystems is needed, while recognizing the broader role that ecosystems could play in actions to combat climate change.

⁸ Resilience is understood as the disturbance an ecosystem can tolerate before it shifts into a different state (Fourth Assessment Report of the Intergovernmental Panel on Climate Change) or an ability to adapt naturally to climate change (the critical ecosystem property that is defined in Article 2 of the Convention).

Definition of ecosystem-based adaptation

Ecosystem-based adaptation, which integrates the use of biodiversity and ecosystem services into an overall adaptation strategy, can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity. Ecosystem-based adaptation uses biodiversity and ecosystem services in an overall adaptation strategy. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change.

Source: Convention on Biological Diversity. 2009. Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. Montreal: Convention on Biological Diversity.

20. Operational guidelines on ecosystem-based approaches developed by the Global Environment Facility (GEF) aim to facilitate access to the Least Developed Countries Fund and the Special Climate Change Fund for projects oriented to ecosystem-based approaches for adaptation and clarify criteria for projects that intend to employ ecosystem-based approaches for adaptation.⁹

21. A broad set of principles underlying ecosystem-based approaches for adaptation include:

- (a) Understanding that maintenance of ecosystem services can be achieved by conserving ecosystem structure and function;
- (b) Recognizing that ecosystems are complex, have limits and are interconnected;
- (c) Understanding that ecosystems evolve and change over time and that, until recently, the major drivers of long-term ecosystem change was from climate shifts. As a result, ecosystems are naturally resilient and adaptable to some rates of change;
- (d) Ensuring participatory decision-making that is decentralized to the lowest accountable level, and is flexible and adaptive;
- (e) Managing ecosystems at the appropriate spatial and temporal scales;
- (f) Using information and knowledge from all sources, including traditional, local and contemporary scientific sources, and recognizing that such information needs to be gathered and validated.

22. Wide-ranging examples of ecosystem-based approaches for adaptation were shared at the workshop and the details are summarized in the annex (table 1). The wide variety of approaches include:

- (a) Coastal defences through the maintenance and/or restoration of mangroves and other coastal wetlands to reduce the impacts of coastal flooding and coastal erosion;
- (b) Sustainable management of upland wetlands, forests and flood plains for the maintenance of water flow and water quality;
- (c) Conservation and restoration of forests to stabilize land slopes and regulate water flows;
- (d) Establishment of diverse agroforestry systems to cope with increased risk from changes in climatic conditions;

⁹ <http://www.thegef.org/gef/council_document/guidelines-ecosystem-based-adaptation>.

- (e) Management of invasive alien species that are linked to land degradation and which threaten food security and water supplies;
- (f) Management of ecosystems so as to complement, protect and extend the longevity of investments in hard infrastructure;
- (g) Conservation of agrobiodiversity to provide important gene pools to facilitate crop and livestock adaptation to climate change;
- (h) Establishment and effective management of systems to ensure the continued delivery of ecosystem services to support resilience to climate change, for example through protected areas, diverse land use and agricultural systems.

23. Participants discussed the need to recognize the distinctions and synergies between ecosystem-based approaches for adaptation and other adaptation approaches. In relation to other approaches for adaptation, ecosystem-based approaches for adaptation have synergies with disaster risk reduction, community-based natural resource management, climate change integrated conservation strategies and community-based adaptation. Well-managed and resilient ecosystems and their services contribute to the reduction of people's vulnerability to climate change impacts before, during and after their occurrence. Ecosystems also reduce exposure to some hazards by functioning as natural buffers and reducing vulnerability by supporting livelihoods.

24. Participants shared views on various benefits and co-benefits of the ecosystem-based approaches for adaptation implemented in various ecosystem and regional contexts, including the following (also see annex):

- (a) Simultaneous achievement of socioeconomic and adaptation benefits;
- (b) Climate-resilient outcomes, in terms of both ecosystems and the adaptive capacity of people;
- (c) Sustainable local livelihood co-benefits;
- (d) Ecosystem conservation;
- (e) Promotion of integrated (e.g. ecosystem-based approaches for adaptation integrated with other adaptation measures, including hard infrastructural) and cross-sectoral adaptation.

25. Participants emphasized that some trade-offs will need to be made following the implementation of ecosystem-based approaches for adaptation, such as the possibility that stabilizing slopes with grass and vegetation would exacerbate the fire hazard. These trade-offs should be identified with stakeholders and addressed as far as possible using adaptive management to record changing priorities. This is part of societal choice on how best to reduce the effects of climate change and adapt to them.

C. Integration of ecosystem-based approaches into adaptation policies and programmes

1. Integration of ecosystem-based approaches into adaptation policies and programmes in the context of the Rio Conventions

26. The discussion of ecosystem-based approaches for adaptation in policy process has evolved since the Millennium Ecosystem Assessment report, which was published

in 2005.¹⁰ Various policy discussions proliferated, leading to the consideration of ecosystem-based approaches for adaptation being included in COP decisions and in decisions of the Conference of the Parties of another Rio Convention, the CBD. Ecosystem-based adaptation was discussed at the second meeting of the CBD Ad Hoc Technical Expert Group on Biodiversity and Climate Change, which was convened in 2009 to provide scientific and technical advice on and an assessment of the integration of the conservation and sustainable use of biodiversity into climate change mitigation and adaptation activities.

27. The Cancun Agreements recognize the need to consider ecosystems for enhanced action on adaptation. In this context, the Cancun Adaptation Framework affirms that enhanced action on adaptation should take into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional and indigenous knowledge, with a view to integrating adaptation into relevant social, economic and environmental policies and actions, where appropriate.¹¹

28. Participants shared examples where ecosystem-based approaches for adaptation and/or ecosystem considerations have been integrated into adaptation policies and programmes at the regional and national levels. At the regional level, the LIFE programme, the financial instrument of the European Union (EU) supporting environmental and nature conservation projects throughout the EU, as well as in some candidate, acceding and neighbouring countries, has co-financed some 3708 projects, contributing approximately EUR 2.8 billion to the protection of the environment.¹² The Common Agricultural Policy of the EU contributes to the sustainable development of rural areas, in particular through helping the agricultural sector to adapt to new challenges. The Biodiversity Information System for Europe, which serves as the EU Biodiversity Clearing House Mechanism to CBD, brings together facts and figures on biodiversity and ecosystem services, relevant policies, environmental data centres, assessments and research findings from various sources.¹³

29. Examples of integration at the national level include the following:

(a) The National Framework Strategy on Climate Change (2010) and the National Climate Change Action Plan (2011) in the Philippines serve as a road map for enhancing the country's social and economic adaptive capacity, the resilience of ecosystems and the best use of mitigation and finance opportunities. The Action Plan provides guidance for local government units to formulate and implement local climate change action plans. The local governments develop and regularly update approaches tailored to the needs, challenges, opportunities and emerging issues facing local communities;

(b) Tanzanian national strategies, such as Development Vision 2025, the National Strategy for Growth and Reduction of Poverty (2010–2015), the National Strategy for Urgent Actions on Land Degradation and Water Catchments (2006), the National Biodiversity Strategy and Action Plan and the National Climate Change Strategy (2012), all integrate ecosystem-based approaches for adaptation;

(c) In the United States of America, one of the guiding principles of the Interagency Climate Change Adaptation Task Force notes the need for adaptation to take into account strategies to increase ecosystem resilience and protect the critical ecosystem

¹⁰ Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: Synthesis*. Washington, D.C.: World Resources Institute. Available at <<http://www.millenniumassessment.org/documents/document.356.aspx.pdf>>.

¹¹ Decision 1/CP.16.

¹² <<http://ec.europa.eu/environment/life/>>.

¹³ <<http://biodiversity.europa.eu/>>.

services on which humans depend in order to reduce the vulnerability of human and natural systems to climate change. United States federal agencies integrate ecosystem-based approaches for adaptation into their work (e.g. forest ecosystem restoration by the United States Forest Service and wildfire management by the National Oceanic and Atmospheric Administration; and the Climate Ready Estuaries programme¹⁴ of the United States Environmental Protection Agency);

(d) In South Africa, the Expanded Public Works Programme,¹⁵ which aims to bridge the gap between the growing economy and the large number of unskilled and unemployed people, has led to job creation through ecosystem rehabilitation and restoration. The National Water Resources Strategy and a water pricing strategy currently being developed in South Africa provides a major opportunity for mainstreaming ecosystem-based approaches in a key national policy process. The Disaster Management Act 57 of 2002 currently under review provides an opportunity to make links to ecosystem-based approaches.

30. Participants also discussed the integration of biodiversity conservation and sustainable use, ecosystem restoration and sustainable land management in ecosystem-based approaches in the context of the Rio Conventions. The CBD process includes the following relevant areas of work:

(a) The Programme of Work on Protected Areas requires the development of protected area action plans which include the adaptation of protected areas and the use of protected areas for ecosystem-based approaches for adaptation;

(b) The Strategic Plan for Biodiversity 2011–2020 highlights the importance of integrating biodiversity conservation and ecosystem restoration into ecosystem-based approaches for adaptation;

(c) National biodiversity strategies and action plans also support the ecosystem-based approaches for adaptation that provide the ecosystem services for helping people to adapt.

31. Similarly, the United Nations Convention to Combat Desertification (UNCCD) process includes the following areas that facilitate the integration of ecosystem-based approaches into adaptation policies and programmes:

(a) The objectives of the 10-year strategic plan and framework to enhance the implementation of the Convention include improving the conditions of affected ecosystems and improving the livelihoods of affected populations;

(b) Sustainable land management is a key element in the implementation of UNCCD strategic objectives (e.g. improving affected populations by enhancing food security and improving conditions of affected ecosystems by preventing land degradation and desertification).

32. However, it was recognized that barriers to the integration of ecosystem-based approaches into adaptation policies and programmes and in the context of the Rio Conventions do exist. They include the following:

(a) Poor understanding among policymakers and other relevant stakeholders of ecosystem-based approaches for adaptation and their distinctiveness vis-à-vis other adaptation measures with regard to, for example, the costs and benefits of such approaches;

(b) Poor coordination and alignment between sectors prevent the integration of ecosystem-based approaches for adaptation into sectoral policies. Participants mentioned

¹⁴ <<http://water.epa.gov/type/oceb/cre/index.cfm>>.

¹⁵ <<http://www.epwp.gov.za/>>.

the need to establish strong communication channels among the focal points of the three Rio Conventions in order to foster synergy;

(c) Lack of case studies that demonstrate the benefits of investment in ecosystem-based approaches for adaptation, in terms of benefits to adaptation and ecosystems, co-benefits to livelihoods and comparison with other adaptation options;

(d) Climate change vulnerability assessments do not always integrate ecosystem considerations;

(e) Lack of SMART indicators to measure the effectiveness of ecosystem-based approaches for adaptation and to measure climate-resilient outcomes;¹⁶

(f) Lack of detailed guidelines and follow-up actions to ensure synergies between relevant programmes across the Rio Conventions;

(g) Lack of financial and human resources in environment ministries, coupled with lack of understanding of the costs and benefits of these approaches, present a barrier to the integration of ecosystem-based approaches into national climate change strategies;

(h) With respect to the challenges associated with the fragmentation of funding among United Nations agencies and donor and international agencies, participants noted the need for stronger coordination among donor and international agencies (e.g. building experience of developing indicators that are relevant for biodiversity, desertification and climate change) and the need for a strong political will in national governments to direct the funds to real needs and priorities (e.g. the allocation of funds within a country needs to be based on evidence).

2. Integration of gender-sensitive strategies and tools and indigenous and traditional knowledge into ecosystem-based approaches for adaptation

33. Participants agreed that women's empowerment and equity is a priority in adaptation, and particularly in ecosystem-based approaches for adaptation. However, women tend to have limited access to resources to enhance their adaptive capacity in terms of limited land rights, representation in decision-making bodies and access to technology and training. In this regard, participants identified the need to integrate gender-sensitive strategies and tools into the planning and implementation of ecosystem-based approaches for adaptation.

34. Participants discussed some examples and associated benefits of integrating gender-sensitive strategies and tools into ecosystem-based approaches for adaptation. Women possess important repertoires of coping strategies that have been traditionally used to manage the effects of climate variability and diversify livelihoods. National adaptation programmes of action provide useful lessons on gender consideration in national adaptation planning and implementation.

35. Some examples and associated benefits of integrating community and local knowledge into ecosystem-based approaches for adaptation were discussed. Consideration of local knowledge contributes to ownership, equity, empowerment and scaling up, and helps to build joint solutions to address both climate change and developmental challenges. For example, ecosystem-based adaptation (EbA) demonstration sites in Costa Rica, Mexico, El Salvador and Panama led by the International Union for Conservation of Nature (IUCN) provide examples of developing adaptation practices based on local knowledge and building local capacity for improving transboundary water governance frameworks. Communities that plan, own and understand ecosystem-based approaches for adaptation can benefit their livelihoods and the environment.

¹⁶ SMART stands for Specific, Measurable, Attainable, Relevant and Time-bound.

36. Participants also recognized local knowledge, including both indigenous and traditional knowledge, as a cross-cutting aspect of ecosystem-based approaches for adaptation. Local knowledge offers rich and relevant knowledge and solutions for successful ecosystem-based approaches for adaptation, for example: traditional knowledge of risk management and resilience enhancement in drylands; pastoralists' knowledge of diversifying and managing livelihood options to manage risk and improve resilience; cases in Rwanda and Kenya involving the use of traditional seeds to improve livelihoods; improved slope stabilization through indigenous grass plantation in Nepal to increase fodder and fuelwood availability; use of donkeys rather than oxen for farming in Kenya as a more drought-resilient and gender-sensitive strategy (donkeys are generally easier for women to handle compared with oxen).

37. Local knowledge coupled with scientific knowledge enhances the outcomes of ecosystem-based approaches for adaptation, particularly in areas related to, for example, conservation farming, soil management, ecosystem goods used by people, sustainable food production, water harvesting, health and sanitation.

38. Although it is mutually beneficial to include both gender and local dimensions in any framework for implementing ecosystem-based approaches for adaptation, and although there are synergies between ecosystem-based approaches for adaptation and community-based approaches, participants also identified the following as barriers to their effective integration:

(a) It is often challenging to bring local knowledge and experience to national and regional policies and strategies;

(b) Contentious territorial and land ownership often presents challenges with regard to engaging indigenous groups;

(c) Ecosystem-based approaches for adaptation are often too top-down and do not integrate lessons learned from community-based adaptation;

(d) Guidelines on how to support the integration of gender considerations and local knowledge into adaptation actions have not been synthesized or integrated into the current principles of and/or guidelines for ecosystem-based approaches for adaptation.

D. Methodological, technical and scientific aspects of ecosystem-based approaches for adaptation

39. In order to enhance the understanding of methodological, technical and scientific aspects of ecosystem-based approaches for adaptation, participants discussed lessons learned and good practices on relevant tools and approaches (annex, table 2).

40. With respect to tools and approaches for vulnerability assessments, the following examples were shared by participants:

(a) Three country climate change adaptation studies in South Africa, Brazil and Philippines were undertaken by Conservation International (CI) to test the effectiveness and cost-effectiveness of ecosystem-based approaches as an adaptation strategy. The study involved three steps, namely, a large-scale background assessment (e.g. identifying local scientific capacity, determining information needs), the development and use of vulnerability scenarios (incorporating ecological, institutional and economic vulnerability) and the detailed analysis of priority areas for ecosystem-based approaches for adaptation;¹⁷

¹⁷ CI is currently working on a series of guidance documents in this regard (e.g. CI. 2013. *Constructing Theories of Change Models for Ecosystem-based Adaptation Projects: a Guidance Document*).

(b) A representative of the United Nations Development Programme (UNDP) gave a presentation on the development of a methodology for vulnerability and impact assessment and its application at Mount Elgon, Uganda, as part of the EbA programme for mountains, a joint project of UNDP, IUCN and the United Nations Environment Programme (UNEP), which is supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The work has involved exploring appropriate ways to take account of ecosystems in climate change vulnerability assessment, and how to generate maps, using a geographic information system, to support vulnerability assessments and decisions on locations that are suitable for interventions using ecosystem-based approaches for adaptation;¹⁸

(c) The secretariat of the Pacific Regional Environment Programme (SPREP) has considered the community as a central focus of vulnerability and adaptation assessments, where participatory approaches in Choiseul Province (Solomon Islands) involved respected community leaders, specific women's, youth and men's engagement groups and church leaders. The participatory approaches included respecting and following community protocols, communicating messages visually and in the correct cultural context, and using local examples and focused on community 'champions';¹⁹

41. Participants provided the following examples of tools and approaches for demonstrating the economic, social, environmental and political effectiveness of ecosystem-based approaches for adaptation:

(a) Economic analysis by SPREP of EbA options and alternative adaptation approaches in Lami, Fiji, involved participatory mapping with a focus on vulnerable communities;²⁰

(b) The UNEP-led Ecosystem-based Adaptation Decision Support Framework is a useful planning tool that provides advice to help planners and decision makers to compare, select, design and track context-specific ecosystem-based approaches versus other adaptation measures, including by directing users to existing tools;²¹

(c) The EbA programme for mountain ecosystems in Nepal, Peru and Uganda, a joint project of UNDP, IUCN and UNEP being implemented by national authorities in partnership with civil society organizations and local communities, seeks to establish the economic benefits and financial costs of ecosystem-based approaches for adaptation in order to guide national policies. The programme, among other activities, seeks to compare options for ecosystem-based approaches for adaptation based on economic assessment and to develop the business case for ecosystem-based approaches for adaptation;

(d) A climate risk screening tool and resilience enhancement measures developed by the Scientific and Technical Advisory Panel of the GEF aims to ensure the mainstreaming and targeting of adaptation and resilience and to reduce the risks from climate change in GEF focal areas;

(e) A learning framework that IUCN is evolving for its work on ecosystem-based approaches for adaptation.

42. With respect to monitoring and evaluation approaches, participants proposed different types of indicators to monitor and demonstrate the effectiveness of ecosystem-based approaches for adaptation (see annex, table 2). Participants shared the following examples of indicators and guidelines in this regard:

Arlington: CI).

¹⁸ <<http://www.EBAflagship.org>>.

¹⁹ <<http://www.sprep.org/attachments/Publications/ChoiseulCCAssmntreport.pdf>>.

²⁰ <http://www.sprep.org/attachments/Publications/Lami_Town_EbA_Technical.pdf>.

²¹ <<http://ebaflagship.org/resources/methodologies-and-tools>>.

(a) River base flow and changes in groundwater and surface water quality were mentioned as indicators in monitoring and evaluating changes in ecosystem services;

(b) Changes in adaptive capacities are monitored by, for example, measuring any improvement in water use efficiency to maintain ecosystem integrity (e.g. amount of surface water extracted for irrigation in project sites, number of monitored wells increasing groundwater efficiency in project sites) and measuring improvement in land-use practices and climate change resilience (e.g. total hectares of riparian and wetland habitat restored with native vegetation within project sites, total number of hectares with ecosystem-based approaches);

(c) Measuring the decrease in average rural poverty rate within the targeted watersheds, community support for ecosystem-based approaches for adaptation, monitoring ongoing governance, and legal provisions allocating environmental flows were mentioned as additional but indirect parameters to measure changes in adaptive capacity and ecosystem resilience.

43. Participants identified several gaps in tools and approaches with respect to enhancing understanding of methodological, scientific and technical aspects of ecosystem-based approaches for adaptation. The following gaps correspond with the knowledge needs with regard to ecosystem-based approaches for adaptation identified by participants:²²

(a) Lack of an evidence base to demonstrate the effectiveness of ecosystem-based approaches for adaptation, including consideration of the thresholds (i.e. limit of climate change impacts to which the approach can provide adaptation benefits) and boundary conditions (i.e. minimum size or the state of ecosystem necessary to provide adaptation benefits), and the socioeconomic, environmental and political costs and benefits;

(b) Lack of knowledge tools, including case studies of best practices demonstrating the effectiveness of ecosystem-based approaches, decision-making at the local level, cost-benefit analysis tools to map different costs and benefits associated with ecosystem-based approaches for adaptation and best practice guidelines and guidance documents;

(c) Challenges in monitoring and evaluating ecosystem-based approaches for adaptation with respect to: attribution, time frame, cost, calibration, impact and evidence base. Participants identified a lack of robust and SMART indicators for ecosystem-based approaches for adaptation. In this regard, several challenges were identified, including the long time frame required to demonstrate real benefits associated with these approaches, the often high cost associated with monitoring and evaluation, an absence of long-term monitoring impeding the effective measurement of adaptive capacity and ecosystem resilience, and challenges in including multiple sectors and stakeholders. Participants recognized that to design and use simple monitoring and indicator systems (local to national levels) will be challenging if simplicity and causality are to be achieved. Participants also recognized that many of these challenges are not unique to the monitoring and evaluation of ecosystem-based approaches for adaptation but are consistent with challenges in monitoring and evaluation for other adaptation options.

E. Knowledge management and stakeholder engagement

44. Several case studies on knowledge management, capacity-building and stakeholder engagement to promote ecosystem-based approaches for adaptation and to facilitate the

²² Aspects related to knowledge needs with regard to ecosystem-based approaches are discussed in chapter III.E and the annex, table 3.

integration of ecosystem-based approaches into adaptation planning and programmes at different levels and scales were shared by participants, as follows:

(a) Partners for Resilience, a partnership between the Netherlands Red Cross, CARE Netherlands, Cordaid, the Red Cross/Red Crescent Climate Centre and Wetlands International, contributed to the increase in resilience of 450,000 people in nine countries. The Partners for Resilience initiative contributed to the increase in resilience of communities by integrating climate change adaptation and ecosystem management and restoration into disaster risk reduction. With this integrated approach, communities strengthen their capacities to reduce the impact of disasters. This innovative partnership, implemented in Ethiopia, Guatemala, India, Indonesia, Kenya, Mali, Nicaragua, Philippines and Uganda, involved developing individual village-level risk reduction plans and joint land-use plans for clusters within a similar risk context. These were then integrated into regional government adaptation plans and overarching policies for the sustainable use of land and resources (e.g. restoring eroding hill slopes on the upper delta plain, cleaning up clogged rivers on the middle delta plain and rehabilitating coastal forests on the lower delta plain);²³

(b) Wetlands International, in partnership with CI, the World Wide Fund for Nature (WWF) and the Co-operative Programme on Water and Climate, developed and delivered training to policymakers and practitioners in several parts of the world on ecosystem-based approaches for adaptation and community-based adaptation to climate change. International trainers worked together with local trainers to ensure that the course is locally and regionally relevant;²⁴

(c) Climate and Development Knowledge Network shared its experiences in facilitating climate science and resilience knowledge-sharing and knowledge brokering. These experiences include the application of innovative dialogue tools to facilitate national- and community-level exchanges, with a view to encouraging the sharing of community-based and scientific sources of climate information and helping to inform community-level decision-making and national disaster risk reduction planning in Kenya and Senegal.²⁵ The Africa Climate Change Resilience Alliance (ACCRA)²⁶ includes a consortium of organizations working to increase the use of evidence in designing interventions to increase the adaptive capacity of vulnerable communities (applying the ACCRA Local Adaptive Capacity Framework in 11 rural communities with the aim of brokering discussions between policymakers, researchers and local officials) and developing a framework for decision-making on ecosystem-based approaches for adaptation to build resilience in urban areas;

(d) The Philippines provided an example of how local governments are synergized in implementing a multi-sector Framework Strategy and Action Plan in a way that allows developers to tailor approaches and activities to local needs;

(e) The EbA programme for mountain ecosystems in Uganda, referred to in paragraph 40(b) above, provided a good example of bringing together the disaster risk reduction and climate change communities.²⁷

²³ <<http://www.partnersforresilience.nl>>.

²⁴ For more information on the training kit, see <www.wetlands.org/WatchRead/Currentpublications/tabid/56/mod/1570/ArticleView/article/3084/Default.aspx>. Wetlands International is currently seeking funds to peer review, update and roll out the future training.

²⁵ <<http://cdkn.org/project/dialogue-on-humanitarian-climate-change-policy-and-disasters/>>.

²⁶ <<http://cdkn.org/organisations/accra/>>.

²⁷ <<http://ebaflagship.org/ecosystems/mountains/uganda>>.

45. Participants discussed the need to identify stakeholders who are relevant for the ecosystem-based approaches for adaptation and recognized the role of policymakers/decision makers at the national, subnational and local levels, as well as across different sectors, communities (including vulnerable groups), the private sector, donor communities and practitioners in facilitating the implementation and integration of ecosystem-based approaches into adaptation policies and programmes.

46. Participants noted that there are different knowledge needs with regard to ecosystem-based approaches for adaptation for different groups of stakeholders. They identified the following knowledge needs, which are mainly targeted at decision-makers at different levels and across different ministries and departments: present benefits associated with ecosystem-based approaches for adaptation (e.g. long- and short-term tangible benefits, including socioeconomic benefits and co-benefits); better understanding of uncertainty and risks associated with loss of ecosystems/ecosystem services; uncertainty associated with climate change; how these approaches connect with activities relating to REDD-plus;²⁸ and better understanding of the benefits of and opportunities for a combination of ‘green’ and ‘grey’ (or hybrid engineering) options for adaptation. Participants also identified specific knowledge and information needs with regard to a better understanding of climate change and ecosystem interaction, future risk assessment and planning tools.²⁹

IV. Way forward

A. Summary of recommendations

47. Based on the presentations and discussions on barriers, best practices and lessons learned, participants recommended a range of priority areas for further action in order to understand the vulnerability of ecosystems to climate change and to advance the work on ecosystem-based approaches for adaptation.

48. With respect to the integration of ecosystem-based approaches into adaptation policies and programmes, participants discussed and identified the following opportunities and ideas for further work, drawing upon the lessons learned in implementing ecosystem-based approaches for adaptation at the national and local levels:

(a) Funding considerations: ecosystem principles could be established as one of the criteria for adaptation-specific funding. This would ensure the provision of funding for these approaches;

(b) Vulnerability assessment considerations: it is important to consider the functions of ecosystems when conducting climate change vulnerability or risk assessments;

(c) Integration of traditional and indigenous knowledge: participants recognized that ecosystem-based approaches for adaptation provide opportunities to incorporate traditional and indigenous knowledge into adaptation policies and strategies;

(d) Provision of information and knowledge: several participants highlighted the need for enhanced provision of and access to information and knowledge, including on

²⁸ REDD-plus is understood as policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

²⁹ The knowledge needs with regard to ecosystem-based approaches for adaptation identified by participants for different ecosystem contexts are set out in the annex (table 3).

lessons learned from implementation and the demonstrated benefits and co-benefits of ecosystem-based approaches for adaptation. There was also a recommendation that champions be established who could be focuses of shared learning on ecosystem-based approaches for adaptation. The affordability and availability of relevant tools and information to local people was identified as a key to successful implementation. There were also recommendations that a global mapping study be undertaken where these approaches would be implemented and integrated into climate change adaptation strategies at the national level. Participants highlighted the need for enhancing education, capacity-building and awareness-raising at multiple levels;

(e) Synergies and coherence: it is important to explore synergies (i) across various sectors and cross-cutting areas (e.g. water, energy, agriculture, health, forestry); (ii) between top-down and bottom-up approaches (e.g. linking local learning with national policy and strategies); and (iii) among donors and non-governmental organizations that are involved with ecosystem-based approaches for adaptation.

49. Participants also identified the following possible ways to enhance synergies across the three Rio Conventions in integrating ecosystem-based approaches for adaptation:

(a) Multilevel indicators (i.e. local, national, regional and global), more holistic and programmatic planning, and a process for harmonizing goals and indicators across the three Rio Conventions need to be developed to achieve synergies between biodiversity conservation, sustainable land management and adaptation;

(b) Supporting and building communication among the focal points of the three Rio Conventions should be encouraged;

(c) Global studies should be carried out to evaluate the efforts of multilateral/bilateral projects and national adaptation policies and programmes to build synergies across the work of enhancing adaptation, conserving biodiversity and combating desertification.

50. Participants made the following recommendations with regard to enhancing the integration of gender-sensitive strategies and tools and local knowledge into ecosystem-based approaches for adaptation:

(a) Use gender-sensitive tools and strategies in vulnerability and impact assessments and learn how gender is included in existing practices (e.g. community-based forest management);

(b) Use culturally appropriate tools and strategies to fully engage women, vulnerable groups and local communities;

(c) Support the production of new knowledge sets, based on collaborative efforts involving community-based knowledge holders and natural and social scientists, and develop guidelines for integrating local knowledge, which define the relationship with other forms of knowledge and the processes for validating them;

(d) Build the capacity to institutionalize ecosystem-based approaches for adaptation at different levels (e.g. involving key stakeholders at the local and district levels in planning and developing scenarios and vulnerability assessments; and supporting local-level learning and actions by using participatory tools such as videos and 3D basin models and training local authorities);

(e) Demonstrate the tangible and diverse benefits associated with such approaches, through case studies and sharing of lessons learned.

51. Participants identified the following areas for further work with respect to enhancing understanding of methodological, technical and scientific aspects related to ecosystem-based approaches for adaptation:

- (a) Review and synthesize information on existing vulnerability assessment tools and the experience of developing the tools that consider ecosystems;
- (b) Establish a better understanding of the impacts of climate change on ecosystem services;
- (c) Develop the evidence base for ecosystem-based approaches for adaptation, through a systematic review methodology to describe and synthesize both successful and unsuccessful cases, and through reviews of published literature;³⁰
- (d) Develop guidance on developing robust indicators to monitor and evaluate ecosystem-based approaches for adaptation.

52. With respect to knowledge management and stakeholder engagement, participants identified the following possible set of actions based on knowledge needs with regard to ecosystem-based approaches for adaptation:

- (a) Undertake capacity-building activities (e.g. training of trainers) and develop more training courses on ecosystem-based approaches for adaptation;
- (b) Ensure that materials developed on ecosystem-based approaches for adaptation are disseminated to a wide audience (e.g. decision makers in different ministries, local people and the private sector);
- (c) Communicate knowledge on the effectiveness of these approaches to relevant communities in their language;
- (d) Capture clearly the barriers to these approaches, divergent interests, and losers and winners from implementation of these approaches;
- (e) Support and fund pilot initiatives on ecosystem-based approaches for adaptation within different socioecological situations;
- (f) Establish and promote champions to lead the work on such initiatives, by facilitating South–South cooperation on the exchange of best practices, including on institutional arrangements, donor coordination, a results framework and indicators;
- (g) Engage regional platforms and networks in the regional dissemination of best practices and enhance the dialogue between policymakers and the private sector;
- (h) Develop and support a consistent terminology for defining ecosystem-based approaches for adaptation so as to reduce the confusion with regard to terms and definitions.

B. Issues for further consideration in the context of the Nairobi work programme

53. The workshop identified a set of activities that can be undertaken by Parties, relevant organizations and other stakeholders engaged in the Nairobi work programme to

³⁰ Participants noted that a great deal of literature is available on ecosystem-based approaches for adaptation, although they do not necessary include consistent terminologies. Examples include: Munroe R, Roe D, Doswald N, Spencer T, Moller I, Vira B, Reid H, Kontoleon A, Giuliani A, Castelli I and Stephens J. 2012. Review of the evidence base for ecosystem-based approaches for adaptation to climate change. *Environmental Evidence*. 1(13).

address and support areas of further work and build on the lessons learned during the workshop.

54. Participants at the workshop shared their thinking on ways to further advance the discourse on ecosystem-based approaches for adaptation in the context of the Nairobi work programme and proposed a set of activities to be undertaken under the programme, as described in paragraphs 55–58 below.

55. With regard to the provision and dissemination of knowledge and information on ecosystem-based approaches for adaptation, participants proposed that the Nairobi work programme could serve as a global knowledge platform and function in close coordination with regional and other knowledge platforms and networks on ecosystem-based approaches for adaptation. Work under the Nairobi work programme could include the following:

(a) Developing and exchanging a synthesis of best practices in, and an evidence-base for, ecosystem-based approaches for adaptation (including lessons learned and benefits) by capturing learning from pilot initiatives with respect to the institutional frameworks, knowledge needs, donor coordination and results frameworks, and collate inputs from Parties, relevant Nairobi work programme partner organizations, experts and champions;

(b) Documenting information and best practices in indigenous and traditional knowledge linked with biodiversity, sustainable land management and adaptation (the underlying objectives of the Rio Conventions) and synthesizing this information to feed into national and regional planning and programmes to undertake enhanced action on adaptation in a gender-sensitive manner;

(c) Compiling and synthesizing existing guidelines on ecosystem-based approaches for adaptation;

(d) Compiling and synthesizing existing guidelines on integrating ecosystems into climate change vulnerability assessment;

(e) Undertaking an assessment of how ecosystem-based approaches for adaptation are integrated into climate change adaptation strategies.

56. In terms of stakeholder engagement, participants highlighted the potential role of the Nairobi work programme in facilitating:

(a) A dialogue between policymakers and expert organizations on knowledge production and dissemination;

(b) Development of guidance on ecosystem-based approaches for adaptation, engaging Parties and relevant expert organizations;

(c) South–South cooperation in promoting best practices in these approaches;

(d) The organization of training of trainers.

57. Monitoring and evaluation was seen as another cross-cutting issue that the Nairobi work programme could help to address, in particular in enhancing synergy across the three Rio Conventions. In this regard, suggestions made by participants included:

(a) A mapping exercise at the country level to evaluate outcomes of different projects, programmes and policies linked to the three Rio Conventions, and to identify the conditions under which synergies have been achieved (and their effects across levels). The resulting knowledge could be consolidated under the Nairobi work programme;

(b) Monitoring and evaluating the effectiveness of ecosystem-based approaches for adaptation in promoting synergies between the Rio Conventions and consolidating the resulting outcomes and further needs for decision makers;

(c) Facilitating greater integration across the goals and indicators for major funds, through the provision of further information and opportunities for such integration, drawing on information included in submissions from Parties and relevant organizations.

58. Participants also noted the need for the work to be undertaken under the Nairobi work programme to be relevant for the Cancun Adaptation Framework under the Convention. For example, lessons learned on monitoring and evaluation from this workshop could feed into the technical workshop on monitoring and evaluation mandated under the Adaptation Committee, which is planned to take place in 2013. The Nairobi work programme could facilitate collaboration between Parties and relevant experts to identify and address knowledge gaps within the context of the national adaptation planning process.

Annex

[English only]

Ecosystem-based approaches for adaptation: examples and benefits, tools and approaches for assessments, and knowledge needs

Table 1
Examples of ecosystem-based approaches for adaptation and their potential benefits^a

<i>Adaptation measure</i>	<i>Benefits</i>	<i>Co-benefits</i>			
		<i>Social and cultural</i>	<i>Economic</i>	<i>Biodiversity</i>	<i>Mitigation</i>
Restoration of mangroves for protecting coastal settlements against storm surges in the United Republic of Tanzania	Protection against storm surges and coastal inundation	Provision of employment options Contribution to food security	Generation of income to local communities through marketing of mangrove products	Conservation of species that live or breed in mangroves	Conservation of carbon stocks, both above ground and below ground
Restoration of mangroves in Pakistan	Improved crab and shrimp catch Shoreline protection Villages could be saved from wave surges	Provision of employment options	Generation of income to local communities through marketing of mangrove products	Conservation of species that live or breed in mangroves	Conservation of carbon stocks, both above ground and below ground
Making use of indigenous knowledge for forest management in Bolivia (Plurinational State of)	Protection of forest	Communities are empowered Indigenous knowledge recognized and protected	Potential sources of income for local people		Reduced emissions from deforestation and forest degradation
Conservation of upstream forests to regulate water flow and control erosion for the benefit of vulnerable communities in the United	Protection against erosion	Opportunities for recreational and cultural activities		Conservation of habitat for forest plants and animal species	Conservation of carbon stocks Reduction in emissions from deforestation and forest degradation

<i>Adaptation measure</i>	<i>Benefits</i>	<i>Co-benefits</i>			
		<i>Social and cultural</i>	<i>Economic</i>	<i>Biodiversity</i>	<i>Mitigation</i>
Republic of Tanzania					
Sustainable non-timber forest product management in the Lao People's Democratic Republic	Enhanced local livelihoods	Opportunities for recreational and cultural activities Protection of indigenous peoples and local communities		Conservation of habitat for forest plants and animal species	Conservation of carbon stocks Reduced emissions from deforestation and forest degradation
Protection of forests in Austria	Protecting settlement areas from avalanches	Raising awareness about forests and forestry	Strengthening the forest sector Increased livelihood generation and potential revenue from recreational activities	Protecting soil from erosion	Reduced emissions from deforestation and forest degradation
Sustainable forest management to safeguard livelihoods in the United Republic of Tanzania	Conserving land and biodiversity	Opportunities for recreational and cultural activities Protection of indigenous peoples and local communities		Conservation of habitat for forest plants and animal species	Conservation of carbon stocks Reduction in emissions from deforestation and forest degradation
Making use of traditional farming methods such as the Matengo pit system (the Ngoro system) in Mbinga District, southern United Republic of Tanzania	Conserving land and biodiversity	Enhanced food security Diversification of food products Conservation of traditional knowledge	Possibility of agricultural income in difficult environments	Conservation of genetic diversity of crop varieties and livestock breeds	
Restoration of the Shinyanga region of the United Republic of Tanzania through ngitilis (woodland enclosures)	Increase in production of fodder, fuelwood, and other products				

<i>Adaptation measure</i>	<i>Benefits</i>	<i>Co-benefits</i>			
		<i>Social and cultural</i>	<i>Economic</i>	<i>Biodiversity</i>	<i>Mitigation</i>
	such as fish and non-timber products such as honey				
Slope stabilization through indigenous grass plantation in Nepal	Increased fodder and fuel availability Improved disaster risk reduction				
Restoration of wetlands in Thailand	Improved water availability and local biodiversity Enhanced grazing potential	Sustained provision of livelihoods, recreation and employment opportunities	Potential revenue from recreational activities	Conservation of wetland flora and fauna through maintenance of breeding grounds and stopover sites for migratory species	Reduced emissions from soil carbon mineralization
Using local traditional seeds in Rwanda and Kenya		Enhanced food security Diversification of food products	Possibility of new income in difficult environments	Conservation of genetic diversity of crop varieties and livestock breeds	
Maintaining water security in critical water catchments in Mongolia	Mean annual in-stream summer 30-day base flow maintained in two project sites Groundwater and surface water quality improved or maintained in two project sites Number of monitored wells increasing ground-water consumption		Water use efficiency improved to maintain ecosystem integrity as measured by the amount of surface water extracted for irrigation in project sites		

<i>Adaptation measure</i>	<i>Benefits</i>	<i>Co-benefits</i>			
		<i>Social and cultural</i>	<i>Economic</i>	<i>Biodiversity</i>	<i>Mitigation</i>
	efficiency in project sites				
Protection of wetlands and ponds in the Czech Republic	Slow water run-off from the watershed Ensuring the protection and creation of habitats for aquatic and water-bound ecosystems Increasing self-cleaning water flow Interaction between groundwater and surface water Creation of space for recreation of local population	Good cooperation of local and national authorities Positive impacts on local population, fauna and flora	Increased livelihood generation and potential revenue from recreational activities	Positive impacts on local population, fauna and flora	Reduced emissions from soil carbon mineralization
Establishing climate ready estuaries in the United States of America	Sustained provision of livelihoods and recreation	Protecting people living in coastal areas	Reduction of long-term costs of climate change impacts	Conservation of biodiversity along the estuaries	Reduced emissions from soil

^a Derived from examples presented and discussed during plenary, panel and breakout group meetings at the technical workshop on ecosystem-based approaches for adaptation to climate change and the framework taken from the Convention on Biological Diversity (*Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*. Technical Series No. 41. Montreal: Convention on Biological Diversity).

Table 2

Tools and approaches for assessments of ecosystem vulnerabilities and effectiveness of ecosystem-based approaches for adaptation^a

<i>Tools and approaches</i>	<i>Examples</i>
Tools and approaches for assessing vulnerabilities of ecosystems due to changing climate	
Risk assessment and planning tools	Scenario mapping; Risk maps on floods and landslides (e.g. using geographic information system); Updating reservoir design in response to changing climate; Water flow modelling to allocate water use; Participatory hazard mapping (linking hazards to locations in the project site); Triangulation of methods (e.g. comparison of model projections with expert opinion)
Ecosystem and land-use interaction	Ecosystem and land-use maps; Assessing degree of community dependency on natural systems
Databases	Knowledge platforms on case studies, assessment tools/toolkits and best practice documents, including on existing management approaches
Tools and approaches for demonstrating effectiveness of ecosystem-based approaches for adaptation	
Economic	Economic effectiveness methodology; Social return of investment approach; Natural capital accounting; Cost-benefit analysis; Building on existing cost-effectiveness tools; Trade-off analysis; Valuing ecosystem services
Social	Incorporate value for tourism; Participatory monitoring techniques; Participatory Monitoring, Evaluation, Reflection and Learning for Community-based Adaptation (e.g. CARE tool with focus on community-based approaches ^b)
Environment	Strategic environmental assessment; World Risk Index; Management Effectiveness Tracking Tool for Protected Areas
Political	Inclusion of gender considerations
Cross-cutting/ other considerations	Approach needed to capture multiple benefits over different time scales; Use of proxy sites

^a Inputs based on breakout groups, plenary discussion and presentations during the workshop.

^b Information on the CARE tool is available at

<http://www.careclimatechange.org/files/adaptation/CARE_PMERL_Manual_2012.pdf>.

Table 3
Knowledge needs for ecosystem-based approaches for adaptation^a

<i>Elements</i>	<i>Knowledge needs</i>
Information on ecosystem services	Baseline information for each ecosystem service; Changes in structure, function and dynamics of the environment (e.g. vegetation and crop changes, species shift, water use changes); Social and economic aspects; Linkages between social and ecological systems; Historical changes in climate and future projections; Information on ecosystem services and benefits
Information on land use and interactions with climate and ecosystems	Impact on land degradation, impact on people; Localized information on water flow and land use (e.g. impact on land degradation, landslides and avalanches)
Mapping of stakeholders	Recognition of different information needs for different stakeholder groups; Identifying winners and losers
Future use and planning for integration in policies and programmes and getting 'buy-in' by policymakers and local communities	Desired future state, scenario planning for short, medium and long term, including trade-offs; Inform local people and decision makers about costs of damage and value of ecosystem services; Co-benefits of ecosystem-based approaches for adaptation; Understanding of developmental objective; Understanding of difference between ecosystem-based approaches for adaptation and other alternative approaches to adaptation.

^a Inputs based on breakout groups, plenary discussion and presentations during the workshop on ecosystem-based approaches for adaptation.