



Position Paper and briefing on the role of ecosystems in adaptation

Climate Action Network – International is a coalition of more than 450 environmental and development non-governmental organizations worldwide committed to limiting human-induced climate change to ecologically sustainable levels.

“For increases in global average temperature exceeding 1.5-2.5°C and in concomitant atmospheric carbon dioxide concentrations, there are projected to be major changes in ecosystem structure and function, species’ ecological interactions, and species’ geographical ranges, with predominantly negative consequences for biodiversity and ecosystem goods and services e.g., water and food supply.” IPCC 4th Assessment TAR¹

Summary

This paper calls for ecosystem-based adaptation to be incorporated into the UNFCCC process and Copenhagen outcomes, providing proposals for this. It describes why this is both necessary and rational, highlighting the vital role that ecosystems, and their functions and services play in underpinning climate change adaptation, sustainable development and life on earth. The paper further describes what is meant by ecosystem-based adaptation and shows why this, along with community based adaptation should be a central part of adaptation planning and delivery. It shows that healthy ecosystems are particularly important for many of the poorest and most vulnerable people and places, who both depend on them and help maintain them.

Proposals to integrate the value and importance of ecosystems for adaptation into the UNFCCC Copenhagen outcomes:

- Under the Ad Hoc Working Group on Long term Cooperative Action (LWG-LCA):
 - The importance of healthy ecosystems should be acknowledged in ‘A Shared Vision For Long Term Cooperative Action’, drawing on Article 2 of Convention; and
 - Ecosystem based adaptation should be integrated, along with community-based adaptation and valuing traditional knowledge, into the ‘Enhanced Action on Adaptation’. Approaches that help to maintain the integrity of ecosystems, their functions and the services they provide need to be embedded within the objectives, scope and guiding principles, in implementation of adaptation action including technology transfer, linked to risk reduction and management, and institutional arrangements.
- Ecosystem-based adaptation should be incorporated into the implementation of the Nairobi Work Programme - with technical guidance and capacity developed in this area.
- Ecosystems should be viewed as a cross-cutting theme for adaptation, and should be incorporated into national adaptation strategies and action plans, including NAPAs.
- To help prevent mal-adaptation² and in support of no regret³ and multiple benefit measures, the value and importance of ecosystems should be recognised and addressed in guidelines for adaptation funding, particularly in support of developing country needs.

¹ <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>

² Adaptation that leads to perverse outcomes, for example increasing risk or vulnerability of the poorest, causing green house gas emissions from inappropriate land use change, destroying biodiversity and important ecosystem services.

- Relevant aspects of negotiations under the UNFCCC, such as adaptation, REDD and LULUCF, should be better informed by and aligned with ongoing climate change work and agreements under the Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification, the Ramsar Convention on Wetlands and other relevant international commitments.

Why integrating ecosystems into adaptation is of vital importance:

- Ecosystems and the functions and services they provide (such as water, food, soil protection, clean air, disaster risk reduction and carbon capture) underpin sustainable development, provide multiple benefits and are fundamental to our continued existence on this planet.
- Healthy bio-diverse environments play a vital role in maintaining and increasing resilience to climate change, and in reducing climate-related risk and vulnerability.
- The poorest and most vulnerable communities depend upon natural resources and ecosystem services most directly for their basic needs and livelihoods.
- Many communities and indigenous peoples hold unique indigenous knowledge linked to how they live within, interact with and manage the ecosystem, and play a vital role in sustainably managing natural resources, thereby supporting global climate resilience.
- The protection, conservation and sustainable management of ecosystems also provide employment opportunities.
- Adaptation in food production will depend on biodiversity and its integrated ecosystem and agro-ecosystem functions, to support resilient agricultural and fishing practices that are able sustain yields from land, freshwater and sea in the face of more extreme weather-related events and gradual climate variations.
- The role and value of ecosystems is often forgotten, ignored or misunderstood; this could lead to mal-adaptation, reduced resilience in local and global systems and increased vulnerability especially of the poorest people and places to present and future climate change.
- UNFCCC Article 2 recognizes these imperatives through its aim to stabilize atmospheric concentrations of greenhouse gases at levels that allow ecosystems to adapt naturally. This now needs to be appropriately translated into the Copenhagen outcomes on adaptation.

Some key benefits of integrating ecosystems into adaptation ⁴

- Supports adaptation to current and future climate conditions - increasing the health and resilience of ecosystems enables both people and nature to better cope with existing climate variability as well as future climate change.
- Ecosystem based adaptation frequently involves readily available approaches that can be implemented locally and often immediately.
- Increasing ecosystem resilience and functioning, and reducing vulnerability is a robust response to an uncertain, changing climate that provides multiple 'win-win' benefits to both society and the environment and can reduce trade offs. It lowers the risk of mal-adaptation, and is consistent with the precautionary approach.
- Many approaches to increase ecosystem resilience will also contribute to mitigation, through both maintaining and increasing carbon storage.

³ "No-regrets" options are adaptive measures whose socio-economic benefits exceed their costs whatever the extent of future climate change.

⁴ Adapted from IUCN EbA Policy briefing, March 2009 - based on UKCIP: Principles of Good Adaptation. (www.ukcip.org).

- In food production, agricultural and marine biodiversity deliver high and dependable yields in the face of environmental change, whilst preserving the ability of ecosystems to sustain food production for future generations.⁵ The knowledge, experience and culture of local and indigenous communities shape and conserve agricultural and marine biodiversity.⁶
- Gender-sensitive community engagement can be supported– taking an ecosystem approach is already part of many local community initiatives, building on existing community knowledge and adaptation practices.
- Integrated solutions and multi-agency, multi-sector cooperation in adaptation planning and practice can be promoted; for example integrating adaptation measures into land use planning and using economic tools, such as tax deductions, provides incentives for landowners to conserve biodiversity and ecosystem services.
- Ecosystem based adaptation can help manage and reduce climate related risk, including through adaptive management options, facilitating and accelerating learning, and increasing social and economic resilience to climate change.
- Ecosystem based adaptation can be cost-effective and closely aligned with development goals and poverty alleviation, including through good governance, participatory approaches and achieving multiple benefits.

Integrating ecosystems into adaptation planning and practice

Research shows that optimal adaptation strategies take integrated approaches that incorporate adaptation measures based on ecosystems and biodiversity into wider adaptation planning, complementing rather than being an alternative to other approaches.⁷ Community-based adaptation (including traditional knowledge and practice based on free, prior and informed consent⁸) is intimately connected with the health of and functions provided by ecosystems. Community and ecosystem adaptation collectively help underpin good adaptation policy, planning and delivery, and are especially significant to communities and peoples directly dependent on natural resources for their livelihoods.

This paper specifically addresses the role of ecosystems in adaptation as this is often forgotten, overlooked or misunderstood. Incorporating and valuing ecosystems in adaptation policy and planning can help deliver no regret and multiple benefit measures that include avoiding mal-adaptation, can help protect the natural resource base of vulnerable communities, and can help maintain resilience to future climate change. It is a proactive and enduring way to help maintain the natural systems, functions and services that underpin life.

⁵ For example, see: Pimentel, D., Hepperly, P., Hanson, J., Douds, D., and Seidel, R. (2005) Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems, *Bioscience*, 55(7) 573-582; and: Miguel A. Altieri, (2002) Agroecology: the science of natural resource management for poor farmers in marginal environments, *Agriculture, Ecosystems and Environment* 1971 1–24

⁶ Agricultural biodiversity is defined by the Food and Agriculture Organisation of the UN (FAO) as the ‘variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agro-ecosystem in support of food production and food security.’

⁷ <http://www.cbd.int/doc/meetings/cc/ahteg-bdcc-02-02/other/ahteg-bdcc-02-02-unep-wcmc-en.pdf>

⁸ For Indigenous Peoples, the Right of Free, Prior and Informed Consent (FPIC) is a requirement, prerequisite and manifestation of the exercise of the fundamental, inherent right to Self-determination as defined in international law. http://www.treatycouncil.org/PDFs/FPIC_ENG_110908WEB.pdf

A. BACKGROUND AND EXPLANATION

1. What is adaptation?

Adaptation is defined as any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC 2007). This may happen autonomously, or may be through planned intervention. Adaptation strategies generally aim to reduce the impact and cost of climate change by decreasing vulnerability and increasing resilience of society, economy and environment to climate change impacts.

2. Why is it needed? The interconnected impacts of climate change on people and ecosystems

Climate change is already happening; people, societies, biodiversity and ecosystems are already experiencing its impacts. Climate change adds a further pressure on many natural systems already negatively impacted by unsustainable practices. Biodiversity (including plants, animals and micro-organisms) is already being eroded at a rapid rate by factors such as habitat loss and over exploitation. Species loss can reduce the overall resilience of ecosystems to further impacts of climate change, both direct (e.g. weather events) and indirect (e.g. insect infestations or fires), with significant impacts on people and livelihoods.

Adaptation needs to address climate impacts, and build resilience to future impacts. Impacts will include more frequent and severe floods and droughts, increasing summer heat, warming ocean temperatures, sea level rise, changing ocean currents, disruptions to food and water supplies, increasing frequency of natural disasters, reduction in ecosystem services, and associated extinction of many species critical for ecosystems to function and for supporting human well being.

Ecosystem services include provision of food, water, timber, fuel and fibre; regulating services that help control climate, floods, disease, waste and water quality; supporting services such as soil formation, photosynthesis and nutrient cycling, and cultural services which include non-material benefits such as heritage and spiritual, religious and inspirational benefits (see Annex 1). (Millennium Ecosystem Assessment, 2005)

Whilst climate change impacts us all, developing countries and poor people are disproportionately vulnerable as they are most directly dependent on ecosystems for their livelihoods and security⁹. They have limited choices, resources and capacity to cope with climate change impacts. They are located in some of the most vulnerable environments and geographical regions (such as drought prone sub-Saharan Africa and small island states) and marginal areas (such as floodplains or high mountains). The poor are also most reliant on climate sensitive sectors (agriculture, freshwater, fisheries, forests, coral reefs, mangroves, etc) and on natural resources¹⁰ that underpin their livelihoods and development prospects.

Climate change plays out first through the natural environment, and is felt first by the poorest people. Whilst we all ultimately depend on natural resources, ecosystem functions and biodiversity for our health, prosperity and wellbeing, the poorest are most directly reliant on them on - particularly when faced with external shocks, such as natural disasters or the impacts of global recession. A healthy natural environment with functioning ecosystems

⁹ <http://www.unep-wcmc.org/latenews/Biodiversity%20and%20Poverty%20Reduction%20UNEP-WCMC.pdf>

¹⁰ IPCC 4th Assessment Report <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter17.pdf> (page 734)

provides services, resilience, reduces vulnerability to climatic impacts and supports adaptation. This is vital for all of us, but particularly for the world's poor and we need take responsibility for it.

Article 2 of the UNFCCC¹¹ includes the aim to stabilise atmospheric concentrations of greenhouse gases at levels that allow ecosystems to adapt naturally. Climate change must be limited to less than 2°C above pre-industrial temperatures. Scientists confidently predict that average global warming of 2°C will result in dangerous and irreversible effects on nature, humans and the economy, and that these will rapidly worsen above 2°C.¹² However, the Convention on Biological Diversity's Ad Hoc Technical Expert Group on Biodiversity and Climate Change (CBD AHTEG), reported to the UNFCCC in Poznan 2008, that the rate of climate change has already exceeded the capacity of some species and ecosystems to adapt naturally, and is close to exceeding that of many others. It highlighted that these impacts will have significant economic, societal and ecological costs.¹³

Planned adaptation is already necessary and may be achieved in many different ways. It is vital that the close links between climate change, people, poverty reduction, biodiversity and ecosystems are realised and integrated, using approaches with mutually supportive outcomes. Failing to do this will undermine actions in all these areas – and negatively impact the poorest. Including ecosystem-based adaptation can help deliver “no regret” choices that reduce mal-adaptation and deliver multiple benefits for local communities and the environment.

3. What does ecosystem-based adaptation mean?

An ecosystem can be practically defined as a dynamic complex of plant, animal and micro-organism communities, and the non-living (physical and chemical) environment, interacting as a functional unit. Ecosystems cover a hierarchy of spatial scales and can comprise the entire globe, biomes at the continental scale or small, well-circumscribed systems such as a small pond. (Millennium Ecosystem Assessment, 2005)

Ecosystem based approaches are based on the integrated management of land, ocean, fresh water and living resources, promoting sustainable use and conservation of natural resources in an equitable way. The ecosystem-based approach is the primary framework for action under the Convention on Biological Diversity (CBD). Specific principles and operational guidance have been agreed under the CBD for the Ecosystem Approach.¹⁴ These could be used to implement or help inform ecosystem-based adaptation.

¹¹ UNFCCC Article 2: The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

¹² IPCC 4th Assessment TAR, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf>.

¹³ The CBD has 191 country signatories and promotes three objectives: 1) conservation of biodiversity; 2) sustainable use of resources; and 3) equitable sharing of the benefits of biodiversity. It affirms the role of national governments by agreeing that countries are sovereign, have control over use of their own genetic resources, and that they need to act to protect their interests in the growing market for biological resources.

¹⁴ Under the CBD, the Ecosystem Approach has 12 complementary and interlinked principles – see the following link for the principles: <http://www.cbd.int/ecosystem/principles.shtml>.

Ecosystem based adaptation should involve collective action at the local and landscape scale among governments, local communities, indigenous peoples, development and conservation organizations, and other stakeholders to plan and empower local action that increases community and environmental resilience to the changing climate. Whether working at a large scale, transboundary or a small scale, it should be inclusive, support empowerment and decentralization down to the lowest appropriate level and be based on sound science.

The IPCC 4th Assessment Report highlights evidence, for example, that the loss of local knowledge about thresholds in ecological systems is a limit to the effectiveness of adaptation. Community and ecosystem-based adaptation, including using traditional knowledge and practise (with free, prior and informed consent), are not alternative pathways but mutually supportive. There is a need to learn from indigenous and local communities. They often hold unique knowledge about the way people live within, interact with and manage their ecosystem, for example, Aboriginal fire management. Local and indigenous engagement can also have additional benefits such as recovering and revaluing languages on the brink of extinction and helping elders and women regain status within communities.

Community-based adaptation is intimately connected with the health of and functions provided by ecosystems. Collectively, they are core principles for good adaptation planning and practice. The IPCC 4th Assessment Report also highlights a series of studies that have shown that successful community-based resource management can enhance the resilience of communities as well as maintain ecosystem services and ecosystem resilience and functioning and that this constitutes a major priority for the management of ecosystems under stress (such as coral reefs).¹⁵

An example of ecosystem-based adaptation is maintaining and restoring “natural” or “green” infrastructure such as mangroves, coral reefs and watershed vegetation. This is a cost-effective and locally appropriate means for reducing vulnerability to storm surge, rising sea levels and changing precipitation patterns, while reducing biodiversity loss, and maintaining or enhancing ecosystem function including in support livelihoods (e.g. fish spawning and nurseries in mangroves). See Annex 2 for further examples.

Effectively valuing the role of ecosystems (both carrying out economic valuation studies and implementing policy that reflects broad ecosystem values) requires coordinated efforts within and between local, national, and international institutions, including governments and key government departments (Treasury, finance etc), public and private sectors and civil society. The health and productivity of ecosystems also depends on policy choices, including for example linked to investment, trade, taxation, subsidies, market-based instruments and regulation.

4. Why is including and valuing ecosystems in adaptation important to creating a climate resilient society?

Human activity is putting such strain on the natural functions of the Earth that the ability of the planet’s ecosystems to sustain future generations is rapidly declining. Unsustainable provision of food, fresh water, energy, and materials to a growing population is undermining the complex systems of plants, animals, and biological and non-biological processes that make the planet habitable.

¹⁵ <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter17.pdf> (page 729)

These systems will face even greater pressures as climate change and human demands increase, further weakening the natural infrastructure on which all societies and economies depend, and specifically reducing the climate-resilience that these systems provide. Protecting our future well-being requires reducing human-caused emissions of greenhouse gases to levels that do not cause dangerous changes to the climate system, and ensuring wiser and less destructive use of natural assets. This necessitates major changes in the way we make and implement decisions. Ecosystem-based adaptation provides a huge opportunity to help create climate resilient societies and to move towards a more sustainable and equitable future.

It is essential to manage unavoidable change as the global community attempts to halt progressive changes in climate. Where possible, current adaptation should not undermine future resilience or adaptive needs, and should help build adaptive capacity and resilience in communities and the systems people depend on. The effects of climate change will almost certainly persist for centuries, and depending on the level of mitigation achieved, will be of increasing severity. Including and valuing ecosystems in adaptation policies and practices now can help ensure no regret and multiple benefit measures that help avoid mal-adaptation and maintain maximum resilience to future climate change.

Humans fundamentally and absolutely depend on functioning ecosystems - on the flow of ecosystem services we use or value (see Annex 1). Ecosystems and biodiversity underpin productivity and socio-economic development, as well as life on Earth. The loss of ecosystem services is a significant barrier to the achievement of the Millennium Development Goals¹⁶, and in an interconnected world will impact us all. Many people in many different countries all over the world also believe we have a moral responsibility to look after biodiversity, a key functional component of ecosystems, for its intrinsic value as well as for its cultural, spiritual and aesthetic services.

Scientific evidence clearly identifies the critical role that ecosystems play in securing human health and well-being, and the damage to ecosystems from human activities, including through climate change. For example, the Millennium Ecosystem Assessment, the TEEB¹⁷, CBD AHTEG, the IAASTD¹⁸, IPCC 4th Assessment and more recent peer reviewed science, Poznan side events¹⁹, the Tällberg Foundation²⁰, amongst others.

“The security value of biodiversity can be compared with financial markets. A diverse portfolio of species stocks, as with business stocks, can provide a buffer against fluctuations in the environment (or market) that cause declines in individual stocks. This stabilizing effect of a “biodiverse” portfolio is likely to be especially important as environmental change accelerates with global warming and other human impacts.” TEEB Phase 1 page 17

The IPCC has suggested that ecosystem resilience is usefully equivalent to the critical ecosystem property highlighted in Article 2 of the UNFCCC, i.e. an “ability to adapt naturally”. Ecosystem resilience is understood as the disturbance an ecosystem can tolerate

¹⁶ Millennium Ecosystem Assessment, 2005

¹⁷ The Economics of Ecosystems and Biodiversity (G8+5 endorsed initiative). Phase 1 published in June 2008.

¹⁸ International Assessment of Agricultural Knowledge, Science and Technology for Development. Global and Sub-global assessments peer-reviewed by governments and experts, and approved by the Panel of participating governments.

¹⁹ For example, side event presentation in Poznan http://ec.europa.eu/environment/climat/pdf/poznan/pres_zauberger.pdf

²⁰ Grasping the Climate Crisis - A Provocation from the Tällberg Foundation (2008) Bo Ekmam, Johan Rockstrom, Anders Wijkman

before it shifts into a different state.²¹ Research is demonstrating that functionally diverse systems (i.e. rich in biodiversity) are better able to adapt and are more resilient to climate change than functionally impoverished systems.²² A larger gene pool facilitates the emergence of genotypes that are better adapted to changed climatic conditions. In agriculture, for example, selecting and breeding relies on agricultural biodiversity and is essential for providing locally-adapted plant and animal varieties for resistance to disease, pests and emerging climate conditions. As biodiversity is lost, options for change are diminished and people become increasingly vulnerable. The maintenance of ecosystem integrity and the conservation of biodiversity is central to improving our ability to cope with climate change, particularly for the poorest and most vulnerable.

Understanding and working with natural systems, their functions, and processes and working with local communities and stakeholders should be a mainstream part of adaptation and structural planning processes. This supports good sustainable development practice, it ensures solutions are locally appropriate and don't undermine the functioning of ecosystems.

Ecosystem-based approaches are particularly important for sustainable water management, coastal protection against storms and sea level rise, soil management, disaster risk reduction, sustainable agricultural production, the conservation and sustainable use of biodiversity and the sustainable development of natural-resource dependent communities. In soil management, practices such as crop rotation, composting, green manures and cover cropping enhance biodiversity to build soil organic matter for better yields, drought-resistance, and absorption of excessive rainfall.

Cyclone-prone coastal communities in Vietnam have been experiencing the risk reduction benefits of mangrove forests firsthand. Since 1994 the Vietnam National Chapter of the Red Cross has been working with local communities to plant and protect mangrove forests in northern parts of the country. They have planted nearly 12,000 hectares and the benefits have been clear. An initial investment of US\$1.1 million saved an estimated \$7.3 million a year in sea dyke maintenance. During the devastating typhoon Wukong in 2000, project areas remained unharmed while neighbouring provinces suffered huge losses of lives, property and livelihoods (<http://www.ifrc.org/publicat/wdr2001/>).

Such approaches, as part of adaptation planning and where aligned with local needs, capabilities and governance arrangements, can serve multiple purposes and provide multiple benefits (e.g. tropical forests support a range of products critical for poor communities, protect against erosion, filter the air, sequester carbon, increase water holding capacity, are biodiversity rich and offer renewable raw materials). They are often cost-effective and more enduring as they provide local benefits and can be locally managed and maintained. "Green" or "nature-based" infrastructure and technology approaches, such as mangrove restoration and natural forest conservation and restoration, should be proactively considered and wherever possible integrated into hard-engineering approaches.

As many of the world's most climate-vulnerable communities are also some of the poorest, and those most directly dependent on local ecosystems and natural resources for their well-being and livelihoods, community and ecosystem based adaptation will often be their first line of defense against the impacts of climate change.

²¹ <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter4.pdf> (p.215)

²² See for example the Resilience Alliance and their work at <http://www.resalliance.org/576.php>

5. Integrating ecosystems within approaches into adaptation – the role of the UNFCCC and its Parties

This section responds to the emerging negotiation process up to Copenhagen, to agreed outcomes, and to knowledge sharing and learning by doing. With a focus on implementation, it suggests where and how ecosystem based adaptation could be usefully incorporated into adaptation policy, processes and planning to help create effective climate resilient societies, particularly addressing the needs of the most vulnerable people and places.

(N.B. these suggestions are neither exhaustive nor prescriptive, and are numbered but not ranked)

What UNFCCC Parties can do in the Copenhagen process:

1) Under the AWG-LCA, Parties should:

- Call for the importance of healthy ecosystems to be acknowledged in A Shared Vision For Long Term Cooperative Action, drawing on Article 2 of the UNFCCC.
 - Intervene to ensure that ecosystem based adaptation should be integrated, along with community-based adaptation and valuing traditional knowledge, into the 'Enhanced Action on Adaptation'. Approaches that help to maintain the integrity of ecosystems, their functions and the services they provide need to be embedded within the objectives, scope and guiding principles, in implementation of adaptation action including technology transfer, linked to risk reduction and management, and institutional arrangements.
- 2) In the Nairobi Work Programme, Parties should call for support to increase understanding and use of ecosystem-based adaptation, including through the development and availability of technical guidance and capacity.
- 3) Parties should call for relevant aspects of negotiations under the UNFCCC, such as adaptation, REDD and LULUCF to be better informed by and aligned with ongoing climate change work and agreements under the Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification, the Ramsar Convention on Wetlands and other relevant international commitments.
- 4) Within guidelines for adaptation funding, Parties should ensure that the value and importance of ecosystems is effectively recognised and addressed to safeguard the fundamental earth processes upon which we all depend, and to help prevent mal-adaptation and deliver no regret and multiple benefit measures, particularly in support of developing country needs.
- 5) Developed and Annex 1 countries must meet their current commitments and provide the resources necessary for immediate implementation of the NAPAs, and with this support 'learning by doing', including on the role of ecosystems in adaptation.
- 6) Encourage the Adaptation Fund Board and governments to allocate funds to community-level projects that strengthen local ecosystem resilience and reduce local peoples vulnerability to climate change.

What Parties can do at home:

- 1) Recognise ecosystems as cross-cutting and underpinning for adaptation, and incorporate ecosystem-based adaptation within national adaptation frameworks, strategies and action plans, including into NAPAs and national land use plans and processes.
- 2) Integrate national adaptation plans with national sustainable development and poverty reduction strategies, mainstreaming the value and significance of ecosystems and their services.

- 3) Effectively use environmental mainstreaming tools such as strategic environmental assessments (SEA), environmental impacts assessments (EIA) and technology impact assessments in planning and policy and in project and programmes delivery.
- 4) Fully involve local communities and resource users, including using traditional knowledge and practices (through informed prior consent), in developing climate change strategies and action plans;
- 5) Help develop shared learning and capacity within all relevant government departments, and at sectoral and community levels, of the value and role of ecosystems, including their fundamental underpinning of adaptation.
- 6) Provide learning and knowledge linked to implementation and delivery back into appropriate work stream of the UNFCCC in support of learning by doing.
- 7) Support coordinated efforts within and between local, national, and international institutions and sectors, including within government, public and private sectors and civil society, to enable sustainable management of natural assets and effective inclusive engagement of local communities.

What communities can do

- 1) Document and communicate local experience and knowledge of dealing with climate-induced changes, including through working with local NGOs;
- 2) Undertake participatory appraisal of resources, needs and options;
- 3) Become actively involved in local and national government planning for adaptation;
- 4) Advocate where possible for sub-national, national, regional and international adaptation policy that is locally focused and community based, taking account of traditional knowledge and the importance of ecosystems and their services, and that addresses the needs of the most vulnerable countries, communities, ecosystems and livelihoods. This needs to be supported by scaled up new, additional, stable and flexible funding.
- 5) Share community, traditional and indigenous knowledge (based on free, prior and informed consent) to help ensure effective and locally appropriate adaptation.

What sectors can do

- 1) Develop and apply sector and develop cross-sector focused learning and knowledge of the value and role of ecosystems within their sector, e.g. water, agriculture, forestry, fisheries, for adaptation and more broadly.
- 2) Undertake cost benefit analysis and long term evaluations of including ecosystem-based approaches to adaptation.
- 3) Pilot and demonstrate practical approaches for ecosystem-based adaptation involving local communities, and ensure integration with 'hard' engineering and technological adaptation measures.
- 4) Improve the design and governance of protected areas systems, including by recognising and supporting governance by communities and indigenous peoples in resource conservation, and through collectively understanding the role of the private sector.
- 5) Shift current policy and research focus in agriculture from industrial agriculture, which is focused on short-term efficiency and profit and which undermines local knowledge and diversity, to agricultural systems that promote crop and breed diversity and the long-term health of soil, water and (agro) ecosystems.
- 6) Offer capacity building and training for ecosystem-based adaptation targeted at policy makers and practitioners at different levels, working with local communities where appropriate.

To create a climate resilient society, adaptation priorities need to be agreed in-country, through nationally-led processes, working with other nations to address trans-boundary interests such as shared water resources and biodiversity populations. Such processes should work with local communities, use scientific and traditional knowledge, and listen to and effectively use important ecological data and messages from inside and outside government. UNFCCC Parties need to reflect this in the adaptation outcomes from Copenhagen and in national strategies for delivery.

Annex 1

The Millennium Ecosystem Assessment classification of Ecosystem Services

Ecosystems are functional units made up of assemblages of living organisms that interact with each other and with the chemical and physical environment. Some of the interactions result in ecological processes that work at varying spatial and temporal scales to deliver ‘ecosystem services’ that benefit people. This link, from ecosystem function to human well-being, defines an ecosystem service.

The Millennium Ecosystem Assessment (MA) developed a functional classification of ecosystem services. The MA found that approximately 60% (15 out of 24) of the ecosystem services it evaluated, at a global scale, were being degraded or used unsustainably.

| Provisioning Services | Regulating Services | Cultural Services |
|---|--|--|
| <i>Products obtained from ecosystems</i> <i>e.g.</i> Food Fresh water Fuelwood Fibre Biochemicals Genetic Resources | <i>Benefits from regulation of ecosystem processes</i> <i>e.g.</i> Climate regulation Disease regulation Water regulation Water purification Pollination | <i>Non-material benefits obtained from ecosystems</i> <i>e.g.</i> Spiritual and religious Recreation and ecotourism Aesthetic Inspirational Educational Sense of place Cultural heritage |
| <p>Supporting Services <i>Services necessary for the production of all other ecosystem services</i> <i>e.g.</i> Soil Formation, Nutrient cycling, Primary Production</p> | | |

Underpinning this is the dynamic complex of plant, animal and micro-organism communities (biodiversity), and the non-living (physical and chemical) environment, that interact as a functional unit. Ecosystems cover a hierarchy of spatial scales and can comprise the entire globe, biomes at the continental scale or small, well-circumscribed systems such as a small pond.

Annex 2

Examples of ecosystem-based adaptation providing multiple benefits to people, the economy, and nature.

- ❖ Maintaining and restoring “natural” or “green” infrastructure such as mangroves, coral reefs and watershed vegetation as a cost-effective and locally appropriate means for reducing vulnerability to storm surge, rising sea levels and changing precipitation and river discharge patterns, while reducing biodiversity loss, and maintaining or enhancing ecosystem function. E.g. Wetlands International’s Green Coast approach in Asia - climate change adaptation through restoration of coastal ecosystems²³; and restoring the water regulating capacity of Wular lake (India) - millions of people that live downstream in the Kashmir valley will gain relief from future floods and benefit from enhanced access to water in times of extreme droughts.²⁴ Also see Van Beukering, Brander et al. 2007
- ❖ Enhancing the availability and sustainable management of natural resources (food, medicines and other products) to support local livelihoods and as safety net when times are hard.
- ❖ “The environmental shortcomings of agricultural practice associated with poor socioeconomic conditions create a vicious cycle in which poor smallholder farmers have to deforest and use new often marginal lands, so increasing deforestation and overall degradation. Loss of soil fertility, soil erosion, breakdown in agroecological functions have resulted in poor crop yields, land abandonment, deforestation and ever-increasing movement into marginal land, including steep hillsides. Existing multifunctional systems that minimize these problems have not been sufficiently prioritized for research. There is little recognition of the ecosystem functions that mitigate the environmental impacts.” International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) Summary for DecisionMakers of the Global Report – finding no.4. This summary was approved in detail by Governments attending the IAASTD Intergovernmental Plenary in Johannesburg, South Africa (7-11 April 2008). (http://www.iaastd.net/docs/IAASTD_GLOBAL_SDM_JAN_2008.pdf)
- ❖ Supporting indigenous peoples and local communities to adapt and enhance traditional knowledge systems and management practices to changing climatic conditions, including protecting and restoring natural areas of cultural or religious significance, and areas critical for the cultural survival of indigenous groups as well as providing a legal framework that allows these peoples to adapt - and move - as the environment changes;
- ❖ Prioritising ecosystem health in sectoral maritime management, e.g. in fisheries, is a vital insurance policy in terms of maintaining and strengthening the resilience of ocean ecosystems to climate change impacts, such as ocean acidification, storm surges, etc. Moreover, preventing destructive fishing and avoiding an excessive fishing fleet size also helps to prevent emission, as generally speaking, the most destructive and least selective fishing methods are also the most fuel-intensive.
- ❖ Maintaining connectivity of ecosystems including through protected areas and corridors in production landscapes involving a full range of stakeholders and governance

²³ http://www.wetlands.org/Portals/0/publications/Brochure/wetlands_adaptation_press19aug.pdf

²⁴ http://www.wetlands.org/Portals/0/publications/Brochure/wetlands_adaptation_press19aug.pdf

arrangements that will ensure the continued supply of ecosystem services and local community benefit. The South Africa Climate Action Partnership's project to develop stewardship tools and corridors for climate change adaptation in Kwazulu Natal, South Africa.²⁵

- ❖ Promoting the cooling capacity of trees and other biomass, in particular for densely populated urban areas. E.g. the greening programmes of the Wildlands Conservation Trust in South Africa.²⁶
- ❖ Preserving an abundance of organisms (plants, animals, micro-organisms) and multiple groups performing similar functions for restoring and maintaining resilience (Hooper, Chapin III et al. 2005). For example, integrated agricultural systems with a diversity of crops and surrounding ecological zones can provide strong defences in the face of weather extremes, pest infestations and invasive species. Un-even, mixed species forests are more resistant to storms and pests and have a lower fire risk, compared to monocultures.
- ❖ Wetlands management, enabling plants and animals to survive and helping wetland-dependent communities to adapt to climate change, while at the same time providing through wetlands and salt marshes for natural barriers that allow managing increasing water flow, floods and storms over large areas. (Turner, van den Bergh et al. 2000)
- ❖ Improving infiltration and retention of water into the soil and progressing towards soil saturation helping the restoration of groundwater and surface water resources and therefore the development of permanent vegetation accompanied by cooler temperatures, contributing *inter alia* to mitigating climate change risks such as floods, droughts and heat waves.
- ❖ Conserving and developing genetic resources in-situ, in farmers' fields, in collaboration with farmers and other stakeholders. Mobilizing farmers through, for example, farmer field schools and building their capacities in conservation farming and participatory plant breeding, utilizing traditional knowledge in improving farmers seeds varieties to adapt to future environmental changes, where by drought resistant, flood and salt tolerant seeds are developed by farmers. This participatory conservation oriented breeding adds value to the local plant varieties by further developing traits with economic or socio-cultural value and conserving the genes of these varieties in the process.

General References

- Balmford, A., A. Bruner, et al. (2002). "Economic reasons for conserving wild nature." Science **297**: 950-953.
- Berkes, F., J. Colding, et al. (2003). Navigating social-ecological systems: Building resilience for complexity and change. Cambridge, Cambridge University Press.
- Daily, G. C. and P. A. Matson (2008). "Ecosystem services: From theory to implementation." Proceedings of National Academy of Sciences **105**(28): 2455-2456.
- Daily, G. C., S. Polasky, et al. (2009). "Ecosystem services in decision-making: Time to deliver." Frontiers in Ecology and the Environment **7**(1): 21-28.

²⁵ <http://www.cap.org.za/view.asp?ItemID=21&tname=tblComponent1&oname=News%20/%20Projects&flt=proj&pg=front>

²⁶ see www.wildlands.co.za/Programmes.aspx and <http://www.greeningyourfuture.co.za/>

- Emerton, L. (2008). Ecosystems, infrastructure and the use of economics to influence decisionmaking. Economics and Conservation in the Tropics: A Strategic Dialogue, Resources for the Future.
- Hooper, D. U., F. S. Chapin III, et al. (2005). "Effects of Biodiversity on Ecosystem Functioning: A Consensus of Current Knowledge." Ecological Monographs 75(1): 3-35.
- Irwin, F. and J. Ranganathan (2007). Restoring nature's capital. Washington DC, World Resources Institute.
- Lobell, D. B., M. B. Burke, C. Tebaldi, M. D. Mastrandrea, W. P. Falcon, and R. L. Naylor. 2008. Prioritizing climate change adaptation needs for food security in 2030. *Science* 319:607-610.
- Millennium Ecosystem Assessment (2005b). Ecosystems and human well-being: Synthesis. Washington DC, Island Press.
- Metzger, M. J., D. Schröter, R. Leemans, and W. Cramer. 2008. A spatially explicit and quantitative vulnerability assessment of ecosystem service change in Europe. *Regional Environmental Change* 8:91-107.
- NRC (2004). Valuing ecosystem services: Toward better environmental decision-making. Washington DC, National Academies Press.
- Pearce, D. W. (2005). Investing in environmental wealth for poverty reduction: Environment for the MDGs. New York, United Nations Development Programme, United Nations Environment Programme, International Institute for Environment and Development, IUCN, World Resources Institute.
- Ranganathan, J., C. Raudsepp-Hearne, et al. (2008). Ecosystem services: A guide for decision makers. Washington DC, World Resources Institute.
- Turner, R. K., J. C. J. M. van den Bergh, et al. (2000). "Ecological-economic analysis of wetlands: Scientific integration for management and policy." Ecological Economics 35: 7-23.
- Van Beukering, P., L. Brander, et al. (2007). Valuing the environment in small islands: An environmental economics toolkit. Peterborough, UK, Joint Nature Conservation Committee.
- WRI (2005). The wealth of the poor - Managing ecosystems to fight poverty. World Resources. Washington DC, World Resources Institute.
- WRI (2008). Roots of resilience - growing the wealth of the poor. Washington DC, World Resources Institute.