

Managing risks of climate change for human well being

THE CASE FOR ADAPTION

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Impacts of climate change will inevitably influence ecosystem services and human well-being, and increase the pressure on the most vulnerable regions and communities that depend more on natural resources and ecosystems and have lower adaptive capacity. Taking appropriate adaptation measures is urgent to manage the risks and alleviate the impacts of climate change. Various mechanisms and instruments can be used, while concerted action from public and private sector and the international community is required in order to take equity and fairness into consideration.

CLIMATE CHANGE IMPACTS ON ECOSYSTEM SERVICES AND HUMAN WELL BEING

Climate change was identified by the Millennium Ecosystem Assessment as one of the five main direct drivers causing ecosystem services decline across the globe. Climate change can have significant impacts on ecosystems and their services and consequently on human well being, see Table 1.

Ecosystem services influenced by climate change encompass water, food production, provisioning

Table 1: Climate change impacts on ecosystem services and human well being.

Ecosystem services	Impact areas	Human well being
Water	Water availability, quality, regulation (resulting from precipitation pattern changes, increased groundwater salinity due to increased sea level and overexploitation, decreased river flows due to melting glaciers)	Health, material wealth and livelihoods
Food production	Drought, flood, salinisation, desertification of agricultural land	Adequate nourishment, health and security
Provisioning services, such as timber and fibre	Scarcity (due to migration caused by floods and famines)	Material wealth and livelihoods
Buffering natural disaster risks	Exposure, magnitude, recurrence, type	Security, health, material wealth and livelihoods

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services and natural disaster risk management. The availability of these ecosystem services is mainly affected by precipitation pattern changes and temperature increase. Effects of changes in these ecosystem services on human well being can have impacts on security, basic material for life, and health. Effects can be various and complex, depending on vulnerability but also on the magnitude of impact and the specific context.

Climate change impacts will vary depending on regions and sectors but will be more severe where vulnerability to climate variability and change is higher, stress factors are multiple and adaptive capacity is low. In systems already exposed to increasing resource demands, unsustainable management and pollution, exposure to climate change constitutes an important additional pressure. Poor communities tend to be more vulnerable especially when located in high risk areas, as they have lower adaptive capacity and depend more on local ecosystem services, such as water and food. Climate change has the potential for exacerbating poverty.

Historically, Africa, Asia and Latin America have been the regions most at risk and vulnerable to climate change impacts. Major climate change impacts observed in these regions include:

- ▶ Reduced length of growing season in the Sahel region in Africa with detrimental effects on crops.
- ▶ Increased frequency of intense rainfall events in many parts of Asia causing severe floods, landslides, and debris and mud flows.
- ▶ Increased occurrence of climate related disasters in Latin America increasing mortality and spread of diseases in the affected areas.

Vulnerability can be further increased by existing stress factors, such as endemic poverty, limited access to capital, ecosystem degradation, disasters and conflicts and lack of effective response from the side of the government.

INSTRUMENTS AND MECHANISMS TO COPE WITH CLIMATE CHANGE

Adaptation depends on the adaptive capacity or adaptability of a system, region or community to cope with risks or impacts of climate change. If appropriate, adaptation can reduce negative impacts and even create benefits from new opportunities provided by changing climate conditions. However, if climate changes are incorrectly perceived, adaptation may even result in increased vulnerability (maladaptation).

Adaptation is an integral part of managing the risks caused by climate change, while risk reduction activities should be embedded in an integrated approach to ensure sustainability. Among international agencies there is growing consensus that climate change adaptation and therefore also climate change risk management should be integrated into all development planning and implementation activities to address sustainable development and poverty reduction in a more appropriate and effective way.

A variety of mechanisms and instruments involving different actors can be used to manage climate change risks that affect ecosystem services and human well being, see Table 2.

Adaptation can be part of economic development that makes use of financial risk sharing and market based mechanisms to address climate change through

Table 2: Mechanisms and instruments for managing climate change risks.

Mechanism	Sector	Instruments (examples)
Financial risk sharing	Insurance and reinsurance	<ul style="list-style-type: none"> ▶ Alternative insurance schemes ▶ Risk transfer mechanisms ▶ Assistance for risk management (expertise, procedures, databases, tools) ▶ Practical risk handling measures
Market	Finance and investment, private sector, public-private partnerships, public sector and policy making institutions	<p>Regulation</p> <ul style="list-style-type: none"> ▶ User fees and taxes ▶ Investor friendly policies to promote climate friendly, resilient facilities ▶ Increasing regulation of access to ecosystem services for improved operating efficiencies of companies using land, energy and water resources <p>Business</p> <ul style="list-style-type: none"> ▶ Compensation payment for ecosystem services, eg through governmental incentive programmes that compensate landowners for protecting ecosystem services ▶ Carbon emissions trading markets with cap and trade systems for pollutant reduction, eg voluntary non-regulated schemes (Chicago Climate Exchange in US) that impose caps on emissions and allow companies to trade their pollutant rights to meet defined targets, 'compliance' market (EU's emissions trading scheme that is based on the Kyoto protocol)

Continued overleaf

Mechanism	Sector	Instruments (examples)
		<ul style="list-style-type: none"> ▶ Ecolabeling/environmental certification ▶ Flexible business strategies and practices to address risks and uncertainties by taking environmental aspects into account to improve cost of capital and investor risk, business tools and methods to anticipate impacts of own activities on ecosystems ▶ Technologies that are environmentally friendly and improve availability of ecosystem services ▶ Precautionary environmentally sound approaches ▶ Tradable development rights (marketable rights given to landowners in areas reserved for conservation) ▶ Credits for diverse commodities (e.g. aquifer recharge, renewable energy, wasteload allocation, wetlands mitigation, water exchanges) ▶ Low input systems, eg organic farming to improve sustainability of production systems and agricultural biodiversity ▶ Industry clusters (closed loop) where waste of one industry becomes resource of another ▶ Eco-/Agro-/Cultural tourism
Technology transfer	Science and research, experts, private sector	<p>Agriculture/food production</p> <ul style="list-style-type: none"> ▶ Drought resistant high yielding (crop) species ▶ Improved cropping calendar, crop rotation ▶ Sustainable technological applications <p>Ecosystems/natural resources management</p> <ul style="list-style-type: none"> ▶ Integrated ecosystem management ▶ Habitat fragmentation reduction through migration corridors and buffer zones ▶ Mixed use strategies ▶ Conservation of forests and natural habitats in climatic transition zones with genetic biodiversity for ecosystem restoration ▶ Soil and water conservation ▶ Wetlands/coastal and marine resources protection ▶ Land use planning <p>Natural disaster risks management</p> <ul style="list-style-type: none"> ▶ Early warning systems ▶ Risk assessment and monitoring tools ▶ Flood and drought control management systems ▶ Contingency plan for response to emergencies <p>Human health</p> <ul style="list-style-type: none"> ▶ Health care systems, eg public infrastructure ▶ Financial and public health resources, eg public health training programmes, research for effective surveillance and emergency response, monitoring and information dissemination, sustainable prevention and control programmes ▶ Technological/engineering solutions to prevent vector borne diseases and epidemics ▶ Waste disposal infrastructure ▶ Water supply and sanitation facilities
Capacity building	Various sectors including science and research, experts, development agencies, meteorological institutes, etc	<ul style="list-style-type: none"> ▶ Improving adaptive and coping capacity ▶ Knowledge sharing/training ▶ Interlinking with research centres and experts, eg through monitoring and climate risk information platforms
Humanitarian and development aid	International, national, non-governmental and governmental agencies	<ul style="list-style-type: none"> ▶ Integrated climate change risk management in development programmes, covering land use planning, settlement development, infrastructure planning, building codes and related policies, or diversification of income generation in high-risk areas to reduce vulnerability towards disasters ▶ Response and relief

various approaches in the private and public sector. Businesses traditionally dealing with risk management, such as insurance and reinsurance, are leveraging their capacities in order to integrate climate change issues. Business sectors, such as finance and investment

are beginning to develop innovative approaches to tackle these new challenges and opportunities arising from the increasing awareness of the importance of environmental, social and corporate governance for businesses and markets.

The public sector and policy making institutions provide the necessary pillars for market regulation, while public-private partnerships can facilitate governmental institutions the access to capital and resources. Interlinkages and dependencies of businesses on ecosystem services and environment factors can be important triggers in the pursuit of innovative market based and financial risk sharing approaches; see for example the consideration of the high economic value of biodiversity for potential new business opportunities.

CHALLENGES AND OPPORTUNITIES

The mechanisms described offer a variety of opportunities to cope with climate change risks. Since uncertainty is a major characteristic feature of climate change and clarifications are needed on how to put values on ecosystem services with public good characteristics that cannot be allocated to clear property rights, many of these opportunities still require research and support to become viable.

Further, the realisation of these opportunities requires large amounts of new and additional investment and financial flows. National policies could be supportive by promoting optimised resources use, providing incentives for private investors, and integrating climate change adaptation in key ministries and institutions as well as policies. Also, the insurance sector could attract private sector investment through alternative insurance schemes and risk transfer mechanisms, while an international fund could be established to backstop reinsurance schemes, support public-private partnerships or backstop national disaster funds. Despite of all these possibilities, further funding will be needed which could come through international cooperation from the developed countries, but most appropriately from polluting agencies based on the principle that the party responsible is liable for damages.

Another handicap is the urgency of taking appropriate actions in the fields of adaptation and mitigation in time to avoid increasing costs in the future. Economic losses due to climate change could reach US\$1 trillion in a single year by 2040. Effective action requires a multistakeholder approach with the active involvement of governmental and non-governmental institutions at different levels. This must be based on the integration of climate change adaptation as a priority topic into all levels of decision making and operations, and on joint and coordinated efforts, together with other involved agencies and partners, at different levels to facilitate the use of synergy effects and improve cost effectiveness.

Governments should provide policy frameworks to facilitate adaptation and provide stability for business operations including subsidies and regulations to encourage appropriate actions, while providing accurate information on climate change. Inputs from the private sector could be in form of knowledge and resources as well as innovative products and services for new markets. The international community could undertake a concerted effort and provide a coordinated approach towards integrating climate change risk management into development and addressing underlying vulnerabilities, based on the integration of development, climate change and disaster risk management expertise.

While markets may be effective in determining efficient allocation of scarce resources, they do not take into

INVESTING IN BIODIVERSITY FOR THE FUTURE

Climate change is projected to have the second largest global impact on biodiversity by the year 2100. Biodiversity loss can have far reaching implications causing increased water loss and altered ecosystems and a loss to ecosystem services.

Biodiversity is of high economic value as a reservoir of potential active pharmaceutical ingredients and of genes for growing crop species, for biotechnological processes or for bionic developments.

Examples of market based mechanisms that apply to biodiversity as an ecosystem service include tradable quota systems and bioprospecting. The former addresses the over exploitation by allocating quotas to extractive companies so that the sum of all quotas does not exceed the carrying capacity of the extracted resources, while quotas can be traded between producers, for example in fisheries management. Bioprospecting is the process of scientific research for the useful application of genetic resources in various commercial markets, while also providing incentives for biodiversity conservation.

Financial institutions that lack information about companies depending on biodiversity issues run the risk of getting exposed to significant reputational and other risks if loans, investments or other products are provided to companies with negative impact on ecosystems or that depend on ecosystems for their services. Goldman Sachs for example adopted a biodiversity benchmark that was developed by Fauna and Flora International and Insight Investment. This allows for a performance assessment of extractive companies in terms of biodiversity. Such instruments will become increasingly important as stricter biodiversity laws are passed. Still, awareness of the financial sector towards the economic relevance of biodiversity conservation needs to be further increased. In this regard a review on costs of biodiversity loss and benefits of biodiversity protection, and linking biodiversity business concerns to tangible financial metrics such as risks, shareholder value, or market capitalisation, could be useful.

Sources: Conservation Biology 2006, Nature 2000, Business.2010, 2007, UNEP 2005.

account issues relating to equity and fairness. In developing countries, the poor depend heavily on ecosystem services for their well being, and the transfer and use of these resources is usually done through non-market channels. Therefore, bringing these ecosystem services into the formal market may cause some groups of individuals to be pushed into destitution. Moreover, by placing a price on a service which, previously, had been free and which people believe should always be free, such as clean water for personal consumption, clean air and flood regulation, may raise issues of ethics and rights.

The views expressed in this article do not necessarily reflect those of UNEP or the editors, nor are they an official record. A full version of the article with the references is available on: www.climateactionprogramme.org

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