Advancing the biodiversity agenda

A UN system-wide contribution

A report by the Environment Management Group

UNEP

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Foreword by the United Nations Secretary-General

Eight years ago, the world's leaders agreed to achieve, a significant reduction in the rate of biodiversity loss by 2010. Mounting evidence of the continuing decline in biodiversity – the variety of life on Earth – demonstrates that the 2010 target has not been met.

The current rate of loss of land, freshwater and marine biodiversity is more rapid than at any time in human history and shows no indication of slowing. The loss is part of a wider wave of environmental change driven by ever expanding human activities, touching on virtually every component of our biosphere and the global climate system.

Inadequate mainstreaming of biodiversity considerations into broader policies and strategies are one of the main reasons why the target is still to be realized. The UN system is, with its many different entities representing different sectors in society, well placed to demonstrate how mainstreaming can be improved.

The protection and enhancement of human wellbeing - as it relates to health, material needs, good social relations and security - is a common denominator for the entire UN system and the ultimate goal of sustainable development. The fact that loss of biodiversity has potentially severe consequences for human wellbeing, especially for the poor and vulnerable groups in society, is therefore of concern to many entities in the UN system. Efforts to protect biodiversity can help strengthen resilience of food production, ensure carbon storage in forests and wetlands, safeguard the supply of clean and sufficient freshwater, and maintain the opportunities for recreation and tourism.

The current report by the Environment Management Group presents why biodiversity matters to sectors, and how the different policy sectors can help maintain biodiversity and ecosystem services. The joint efforts have yielded a joint statement by the UN system, which serves to illustrate that opportunities for improved mainstreaming exist, and that public institutions, such as the UN, can help set the framework conditions for actions by the private sector, households and individuals to act. Ultimately that is what it takes to protect the diversity of life on earth – the very foundation upon which human civilization has developed and continues to depend.

Ki Moon Ban

Ban Ki-Moon
United Nations Secretary-General

Preface by the Executive Director of UNEP and Chair of the Environment Management Group

The Earth is a planet rich in diverse forms of life including a species--*Homo sapiens*--whose interactions with the environment have put the world on a path to rapid change. The future wellbeing of the individuals of this species rests on their collective ability to understand and intelligently respond to this interaction. Indeed a new and more creative compact between humanity and the Earth's life-support systems is urgently needed in 2010 - the UN's International Year of Biodiversity. This was the year by which a significant reduction on the rate of biodiversity loss was supposed to have happened. But it has not occurred.

The sheer scale and complexity of interactions between humans and the environment is a major reason why it has proved so hard for the international community and nations to halt biodiversity loss and global warming, the two over-arching phenomena of contemporary environmental change. Environmental change is often characterized by time-lags whereby a change such climate change, or loss of a species may happen a long time after the human impact which triggered the change took place. Meanwhile the Earth's natural systems, such as its ecosystems, can approach tipping points, beyond which there are abrupt, accelerating or potentially irreversible changes.

The economic and social systems driving this interaction iare also becoming increasingly complex, and run by more and more specialized sectors. It means that effective management of the environment must now a multi-sector task. The current report by the Environment Management Group (EMG) explores what the interaction between society and the life-support systems means to the different policy sectors in the UN system. How can the management of risks – such as those associated with climate change and loss of ecosystem services – and opportunities – such as those linked to the sustainable use of those nature-based services – be mainstreamed into economic and social policy sectors so as to safeguard human wellbeing?

Effective mainstreaming has proven difficult to achieve in practice due to many factors. Among them are the inherent inertia towards cooperation across the institutional silos of a sectoralised society, the fragmentation of environmental institutions, the failure of markets to reflect the real value of ecosystem services, and the demanding trade-offs between different interests and concerns in society.

A key consideration of the current work of the EMG is that new opportunities for mainstreaming are emerging. Cooperation within the biodiversity sector and across sectors is increasingly pursued. The "one UN" initiative is but one example in this respect. Improved governance of the environmental institutional landscape is also starting to be addressed. Developments in the area of biological science, monitoring, modelling and forecasting are improving the ability of society at all levels to identify risks of biodiversity loss and opportunities provided by ecosystem services. Rapid advances in information and communication technologies can potentially ease the task of managing complex information and facilitate the communication among a broad range of users.

The Intergovernmental Science Policy Platform on Ecosystems and Biodiversity (IPBES), recently given the green light, offers a unique opportunity to take many of these issues forward and build a lasting bridge between scientists at the cutting edge of knowledge and policy-makers required to respond.

Arresting the loss of biodiversity is increasingly seen as an intra- and an inter-generational aspects of human wellbeing. Economics is the currency of decision-making regarding such trade-offs. Ongoing efforts to improve the understanding of the value of biodiversity, and the services it provides, may assist society in fully appreciating the opportunities forgone by biodiversity loss.

The Economics of Ecosystems and Biodiversity (TEEB) report, hosted by UNEP, is providing that new focus and one that illuminates the narrowness of current concepts of GDP. It dovetails with growing global interest in a transition towards a Green economy where well-targeted investments and smart policy choices on the sustainable use and conservation of biodiversity can generate economic wealth, job-creation and a re-framing of sustainability in the 21st century.

The President and members of the Bureau of the Conference of the Parties to the Convention on Biological Diversity deserve credit for having challenged the UN system to contribute to the target setting process under the Convention. Members of the EMG have responded with this UN system-wide contribution to the biodiversity agenda. It goes to show that the EMG – as an interagency body – can bring a multi-sector perspective to both agenda setting and agenda implementation. Humanity is re-discovering that biodiversity is not peripheral to modern economies: it is central: - the fact is Homo sapiens need it more than ever on a planet of six billion heading to over nine billion people by 2050.

Achim Steiner
Executive Director, UNEP

Statement by the Members of the Environment Management Group

We, the Executive Heads of members of the Environment Management Group,

Conscious of the fact that the Earth is a living system, made habitable for humans entirely thanks to the activities of different organisms creating a breathable atmosphere, providing food and medicine, recycling waste products and contributing to regulating the climate, and that in this sense, biodiversity - the variety of life on Earth – is the foundation upon which human civilization has developed and continues to depend,

Mindful of the fact that the current rate of loss of terrestrial, freshwater and marine biodiversity is more rapid than at any time in human history and shows no indication of slowing, and that this loss forms part of a wider wave of environmental change driven by ever expanding human activities which touch on virtually every component of our biosphere and the global climate system and which are taking place in an increasingly globalized, industrialized and commercialized interconnected world,

Deeply concerned that loss of biodiversity leads to degradation of ecosystem services which has severe consequences for human wellbeing, especially for the poor and vulnerable groups in society, and that loss of biodiversity can reduce among other things the resilience of food production, carbon storage in forests, rangelands and wetlands, the supply of clean freshwater, opportunities for recreation and tourism, and access to nature of cultural, educational, scientific, medical, economic, aesthetic or spiritual importance,

Convinced that the protection and enhancement of human wellbeing - as it relates to health, material needs, good social relations and security - is a common denominator for the entire UN system, and that efforts to protect biodiversity significantly contribute to the safeguarding of human wellbeing,

Aware that the scale and complexity of interactions between humans and the environment are a major reason why it has proved so hard for the international community and nations to halt biodiversity loss, and that a better understanding of these interactions can result in better policies to help society in mainstreaming the management of risks, such as those relating to climate change and the degradation of ecosystem services, and opportunities, such as the use of ecosystem services, into economic and social processes,

Noting the conclusions of the Third Global Biodiversity Outlook (GBO3) from the Convention on Biological Diversity, that the target to achieve, by 2010, a significant reduction in the rate of biodiversity loss at global, regional and national scales, has not been met; that the principal direct pressures on biodiversity – namely habitat loss and degradation, overexploitation, pollution, invasive alien species and climate change – are all either constant or increasing in intensity; and that there is a high risk of dramatic further biodiversity loss, and accompanying degradation of a broad range of ecosystem services, if certain thresholds or tipping points are crossed,

Further noting the assessment of GBO3 that failure to meet the 2010 target was due in part to lack of attention given to the underlying causes of biodiversity loss, and that these could only be addressed by, amongst other things: greater efficiency in use of land and resources to meet growing demand; use of market incentives, and avoidance of perverse subsidies; strategic planning to reconcile development and poverty alleviation with the conservation and sustainable use of critical biodiversity and ecosystem services; equitable sharing of benefits from use of and access to genetic resources and associated traditional knowledge; and better education about and communication of the importance of biodiversity to human wellbeing,

Recognizing that countries have made important strides in achieving biodiversity objectives, for example by expanding protected areas systems and investing in measures to conserve and sustainably use species, showing that much can be achieved given political will and financing, although also recognizing that these efforts need to be scaled up to address the underlying causes of biodiversity loss,

Further recognizing the important contribution that the economic and production sectors can make to achieving biodiversity objectives, preventing biodiversity loss and maintaining ecosystem services,

Aware that a new 10-year strategic plan for biodiversity, including detailed time-bound targets in support of a long-term vision for biodiversity, will be considered at the Tenth meeting of the Conference of Parties to the Convention on Biological Diversity in Nagoya, Aichi Prefecture, Japan, in October 2010, and that the adoption and subsequent implementation of such a plan would present a major opportunity to address the underlying causes of biodiversity loss,

Acknowledging that biodiversity considerations need to be mainstreamed into sectoral policies and strategies, and that such efforts need to address amongst other things the institutional silos of a sectoralised society, the failure of markets to internalise the value of ecosystem services, and the demanding trade-offs between different interests and concerns in society,

Recalling the cooperative efforts of the international community to ensure the conservation and sustainable use of biodiversity through biodiversity-related conventions and other instruments and mechanisms,

Hereby commit to contribute individually and collectively to the international biodiversity agenda, in particular by identifying opportunities for cooperation on mainstreaming biodiversity into our policy sectors within the respective mandates of our organizations, for example through:

a. using advances in environmental and social sciences, monitoring, modelling and forecasting, supporting the ongoing process on the development of an intergovernmental science-policy platform on biodiversity and ecosystem services, and using new developments in information and communication technology and knowledge management to exchange information, particularly that needed to stem biodiversity loss;

b. cooperating at all levels through the “one UN” initiative in support of efforts by governments to implement their biodiversity commitments, including those under biodiversity-related conventions, for example through capacity building, education and technical support;

c. supporting nationally driven efforts to arrest biodiversity loss that are fully integrated into and advanced through national development policies,strategies and programmes;

d. capitalizing on ongoing efforts, such as the Economics of Ecosystems and Biodiversity initiative, to improve the understanding of the value of biodiversity and ecosystem services and support governments in making a shift toward more sustainable development, for example through a green economy, including investment in sustainable and equitable use and conservation of biodiversity, which may generate jobs and economic wealth;

e. recognizing and respecting the role of poor and vulnerable groups, including indigenous peoples, as custodians of biodiversity;

f. promoting awareness and enhancing capacities among different relevant stakeholder groups from each sector and identifying win-win situations across sectors;
and

g. reviewing progress in implementing the biodiversity agenda through structured, and streamlined reporting, self evaluations and use of internationally agreed indicators and targets.

We make this commitment with the view to continuing our cooperation under the auspices of the Environment Management Group and demonstrating what a multi-sectoral approach can bring to the development and implementation of the international biodiversity agenda.

The Earth is a living system, made habitable for humans entirely thanks to the activities of different organisms creating a breathable atmosphere, providing food, recycling waste products and contributing to climate regulation. In this sense, biodiversity – the variety of life on Earth – is the foundation upon which human civilization has developed and continues to depend.

HUMAN ACTIVITIES ARE DRIVING AN UNPRECEDENTED RATE OF LOSS OF BIODIVERSITY WHICH HAS POTENTIALLY SEVERE CONSEQUENCES FOR HUMAN WELLBEING, ESPECIALLY FOR THE POOR AND VULNERABLE GROUPS IN SOCIETY

The current rate of loss of terrestrial, freshwater and marine biodiversity is more rapid than at any time in human history and shows no indication of slowing. The loss is part of a wider wave of environmental change driven by ever expanding human activities, touching on virtually every component of our biosphere and the global climate system, which are taking place in an increasingly globalized, industrialized and interconnected world, fuelled by expanding flows of goods, services, capital, people, technologies, information, ideas and labour. The scale and complexity of interactions between humans and the environment are a major reason why it has proved so hard for the international community and nations to halt biodiversity loss.

Loss of biodiversity leads to degradation of ecosystem services, which has potentially severe consequences for human wellbeing. Loss of biodiversity can reduce, for instance, the resilience of food production, carbon storage in forests and wetlands, the supply of clean and sufficient freshwater, and the opportunities for recreation and tourism. Of those ecosystem services that have been assessed, about 60 per cent are already used unsustainably or degraded. A first, very coarse estimate indicates that biodiversity loss could account for around 7% of the Gross World Product (GWP) by 2050.

Despite gains in human wellbeing the world is still facing widespread poverty. Poor people bear most of the burden from environmental degradation, but are not responsible for most environmental change. Loss of biodiversity and degradation of ecosystem services compromises our ability to meet the Millennium Development Goals and to address poverty. Therefore, conservation, sustainable use and fair and equitable sharing of benefits related to the use of biodiversity are all important for the attainment of the MDGs.

OPPORTUNITIES FOR MAINSTREAMING BIODIVERSITY CAN BE BETTER MANAGED, FOR EXAMPLE THROUGH A SHIFT TOWARD A GREEN ECONOMY

Inadequate mainstreaming of biodiversity into sectoral policies and strategies has hampered progress in addressing the underlying drivers of biodiversity loss, but new opportunities for mainstreaming are emerging. Lack of mainstreaming is due to the inherent inertia towards cooperation across the institutional silos of a sectionalized society, the complexity and fragmentation of environmental institutions, the failure of markets to understand the value of ecosystem services, and the demanding trade-offs between different interests and concerns in society. Cooperation across sectors is, however, increasingly taking place. The "one UN" initiative is but one example in this respect. The fragmentation of the environmental institutional landscape is also being recognized and addressed. Furthermore, developments in the area of information and communication technologies, knowledge management, social and biological science, monitoring, modeling and forecasting are improving the ability of society at all levels to identify risks associated with biodiversity loss and opportunities provided by ecosystem services.

Efforts to address loss of biodiversity involve trade-offs between different intra- and inter-generational aspects of human wellbeing that are sustained by ecosystem services. Economics assists public and private decision-makers in making such trade-offs. Ongoing efforts to improve the understanding of the economic value of biodiversity and the services it provides can

enable society to more fully appreciate the opportunities forgone as a result of biodiversity loss and help identify win-win situations across sectors. A shift toward a green economy through investments in sustainable and equitable use and conservation of biodiversity can create jobs and economic wealth.

THE POST 2010 BIODIVERSITY AGENDA WOULD BENEFIT FROM A NEW PARADIGM FOR COOPERATION IN THE UN SYSTEM

Developing cross-cutting and sector-specific targets – such as those under consideration for biodiversity after 2010 – can be an effective way of mainstreaming biodiversity concerns into sectoral policies and plans. This is particularly so if the target-setting process actively involves the sector in question through an open, transparent and consultative process. The EMG – as an interagency body – can help inform the process of advancing the biodiversity agenda and facilitate the involvement of relevant policy sectors at the interagency level in the implementation of the agenda. A new paradigm for cooperation on the implementation of the biodiversity agenda across different policy sectors in the UN system is centered on the following key questions:

- How does each policy sector depend on biodiversity and ecosystem services?
- How does each policy sector affect biodiversity and ecosystem services?
- How could each policy sector contribute to meeting biodiversity targets individually or collectively?
- What actions by other policy sectors could complement the policy sector's efforts in addressing adverse effects on biodiversity?
- What kinds of biodiversity targets might contribute to meeting the policy sector's own objectives?

MAINSTREAMING BIODIVERSITY IN KEY POLICY SECTOR PERSPECTIVES OF THE UN SYSTEM

ENVIRONMENT: CLIMATE CHANGE, LAND AND WATER

Climate change and biodiversity are interconnected, not only through the effects of climate change on biodiversity, but also through changes in biodiversity and ecosystem functioning that affect climate change. Functioning ecosystems are crucial as buffers against extreme climate events and as filters for waterborne and airborne pollutants. Protecting and enhancing ecosystem resilience, conservation, management and restoration of biodiversity and ecosystem services, are amongst the most cost-effective ways of tackling both the causes and consequences of climate change. Ecosystem-based approaches are ready for use, easily accessible, and can bring multiple benefits, including improvement of livelihoods and poverty alleviation. UN agencies such as FAO, UNDP and UNEP are working to build the capacity of developing countries and economies in transition to manage ecosystems so as to increase their resilience to climate change—thus reducing the risk of biodiversity loss. The Global Environment Facility (GEF) is a major financier of these efforts.

Land is the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system. Specific land uses or land management practices may influence particular patterns of biodiversity resulting in a complex and context-specific relationships between biodiversity and land use. Transformations in the way land is used and managed are key drivers of changes in biodiversity at global, national and local scales. Setting global benchmarks for reducing land degradation and linking these to biodiversity targets will be key to reducing future biodivesity loss and ensuring a continuing flow of ecosystem services.

Water is a vital resource, it is one of the most valuable and essential services provided by ecosystems. Practically all economic activities depend on or have an impact on water and better water management is central to the achievement of most of the Millennium Development Goals. Biodiversity underpins ecosystem functioning that sustains the water cycle. The Third World Water Development Report shows that beause of direct human intervetions, major changes are already occurring in the water cycle at local, national and regional scales. The limit of ecological sustainability of water available for human uses (4000 km^3 per annum) has already been reached. Sustaining or restoring the water related services that ecosystems provide is necessary to improve water security. Water therefore needs to be a more central focus of the biodiversity agenda for the post-2010 period. The GEF has financed measures to protect freshwater biodiversity, particularly in trans-boundary water bodies while UN agencies such as FAO, UNDP, and the World Bank are working with many countries to integrate biodiversity conservation and water management objectives through integrated water resource management.

PRIMARY PRODUCTION: - AGRICULTURE, FORESTRY AND FISHERIES

Agriculture sustains the livelihoods of nearly all human societies and all sub-sectors of agriculture depend on biodiversity, and in particular on agricultural biodiversity. This agricultural biodiversity is necessary for continuing production and adaptation to diverse and often harsh and ever changing production conditions. Agriculture has both positive and negative impacts on biodiversity. On the one hand, land use change caused by the expansion of agriculture is a major driver of biodiversity loss. On the other, agriculture landscapes also provide significant habitat for many wildlife species. The challenge is to promote production systems that are ecologically sound and sustainable and to respect the synergies and linkages between agricultural biodiversity and nutrition. The United Nations system, and FAO especially, are addressing the need to set standards for sustainable production practices in agriculture. Several UN agencies, including FAO and UNDP are implementing measures aimed at reforming farming systems on the ground so as to avoid, reduce, mitigate and offset the impacts of agriculture on biodiversity.

Forests are the most important repositories for terrestrial biodiversity, and may support more than half of the world`s species. Forest also provides extremely valuable ecological services essential to human wellbeing. More than 1.6 billion people depend on forests to varying degrees for their livelihoods, deriving from them income, food, fibre, fuel and grazing for livestock. FAO estimates that in the last decade about 13 million hectares of the world's forests were converted to other uses or lost. As forests are degraded, so too is biodiversity. Forest degradation lowers the resilience of forest ecosystems and makes it more difficult for them to cope with changing environmental conditions. The United Nations system is promoting the sustainable management of forests by coordinating Intergovernmental forums such as the United Nations Forum on Forests. The Committee on Forestry and its Regional Forestry Commissions leads and actively supports the Collaborative Partnership on Forests (CPF) and participates in specialized technical bodies that meet regularly to focus on specific areas of forestry development and management. GEF has provided significant finance for forest biodiversity conservation through UNDP, the World Bank, UNEP and FAO; this has included support to efforts to change production practices employed by the forest sector.

Oceans and seas provide about 90% of the world's fishery catch. Capture fisheries and aquaculture production supplied the world with about 110 million tonnes of food fish in 2006. Of this total, aquaculture accounted for 47 percent. Fish provided more than 2.9 billion people with at least 15 percent of their average per capita animal protein intake. Approximately half of all monitored fish stocks are now fully exploited, producing catches close to their maximum sustainable limits with no room for further expansion. Despite the social and economic importance of fisheries, attempts at sustainable management have been unsuccessful in many parts of the world and a global response is urgently needed. An ecosystem approach to fisheries is called for, to protect and conserve ecosystems while providing food, income, and livelihoods from fisheries in a sustainable manner. A combination of measures has been proposed within this framework, including banning some fishing practices, setting up marine protected areas, and regulating or

constraining access rights. FAO, intergovernmental organizations, the fishing industry and non-governmental organizations have elaborated the Code of Conduct for Responsible Fisheries describing how fisheries should be managed responsibly, and how fishing operations themselves should be conducted. GEF has invested and continues to make major investments in efforts implemented through UNDP, FAO, UNEP, UNIDO and the World Bank to reduce destructive fishery practices and improve sustainability.

Agriculture, forestry and fisheries are placed to contribute and respond to the CBD strategic plan and the post 2010 Targets. The movement towards sustainability in agriculture, fisheries and forestry sectors with support from FAO, UNDP and other organizations in the UN system, de facto includes mainstreaming biodiversity.

The ecosystem approach should be promoted and efforts made to facilitate its adoption by farmers, foresters and fishers and associated dependent communities as well as private sector interests. This can be achieved by promoting sustainable agriculture, sustainable production intensification, sustainable forest management and sustainable use of aquatic resources. Global, regional and national forums for agriculture, forestry and fisheries will ensure continued intergovernmental discussion on achieving sustainability in each sector, and expert guidance will also continue to be development and disseminated to countries. However, effective national planning and enabling policy and institutional frameworks are essential, as are significant public and private sector investments and full engagement of all relevant stakeholders, including indigenous peoples who are often important stewards of biodiversity.

SOCIAL SERVICES: HEALTH, SCIENCE AND TECHNOLOGY, EDUCATION AND CULTURE

Human health ultimately depends upon ecosystem products and services, such as availability of fresh water, food and fuel sources, needed for good human health and productive livelihoods. Biodiversity loss can have significant direct impacts on human health if ecosystem services are no longer adequate to meet social needs. Biodiversity plays a crucial role in human nutrition through its influence on world food production while the existence of functioning ecosystems such as forests and wetlands is vitally important in the regulation of infectious diseases. Availability of and access to biodiversity play an important role in the services provided by nature in education, recreation and religion, providing inspiration and a sense of place, and bearing directly on people's mental health and sense of spiritual wellbeing.

Many communities rely on natural products collected from ecosystems for medicinal and cultural purposes as well as for food. During the last 30 years, the use of traditional medicine has increased tremendously. At the request of World Health Assembly resolutions, WHO has been collaborating with other organizations in the United Nations system such as ICSP, FAO, UNESCO, UNIDO and WIPO, and nongovernmental organizations including IUCN, TRAFFIC, WWF and WSMI in various areas related to traditional medicine, including research, protection of knowledge and conservation of medicinal plants resources.

Science and Technology is recognized as a main driver of change affecting ecosystem structure and functioning and can have both positive and negative impacts on biodiversity. On one hand, when applied to specific sectors such as water management in the context of large dams and similar infrastructures, science and technology has had adverse impacts on biodiversity. On the other hand, science, technology and education can positively affect cultural and belief systems so that behaviour compatible with the conservation and sustainable and equitable use of biodiversity can be adopted and widely promoted. Many positive experiences have demonstrated that science and technology can be at the service of biodiversity conservation and the maintenance of ecosystem services on which human wellbeing and development depend.

Education is essential in promoting the sustainable use of biodiversity. Education for Sustainable Development is the educational process of achieving human development through economic growth, social development, and environmental conservation that is inclusive, equitable and secure. It is possible to learn to live full lives within the capacity of the Earth to satisfy our needs – this is one of the main objectives of the UN Decade on Education for Sustainable Development (2004-2013). Undoubtedly, biodiversity communication, education and public awareness is an area in which virtually all policy sectors can contribute to meeting biodiversity targets both individually and collectively.

Cultural and biological diversity are co-evolving, interdependent and mutually reinforcing. Each culture possesses its own set of representations, knowledge and cultural practices which depend upon specific elements of biodiversity for their continued existence and expression. Indigenous peoples in particular often live in areas rich in biodiversity and have particularly strong and direct links with it. 'Biocultural diversity' has arisen as an area of trans-disciplinary research concerned with investigating the links between the world's cultural and biological diversity, focusing on, inter alia, correlations between biodiversity and linguistic diversity in specific regions and localities. Several intergovernmental processes, policy instruments and international scientific assessments have made explicit reference to cultural drivers when dealing with biological diversity and vice versa. In this context, great expectations are placed on the proposed joint initiative of UNESCO and CBD in relation to the interlinkages between biological and cultural diversity that will be presented for adoption at the tenth meeting of the CBD COP in Nagoya in October 2010.

PRODUCTION AND SERVICE: ENERGY, INDUSTRY, TOURISM AND TRANSPORT

Energy and biodiversity are connected in many different ways; there can be positive and negative impacts on biodiversity from the different parts of the 'energy system'. Impacts are linked to the extraction, transportation, processing and use of primary fuels – both fossil and biomass – and the generation and transmission of electricity. Positive impacts can occur, for example, if countries and companies go beyond mitigation of negative impacts from operations to supporting biodiversity conservation in and around project sites and in countries and regions where they operate, particularly where capacity and resources for protecting the environment are scarce. The challenge is to reduce the drawbacks and increase the opportunities for synergies with biodiversity goals by making informed choices throughout the supply chain to end use. The UN system has a role in bringing scientific knowledge of policy relevance to decision-makers in governments and industry, and to convene industry, consumer groups and other members of civil society to make the business case for conserving and sustainably using biodiversity and to share and develop good practices.

Industries including those which extract renewable or non-renewable resources rely directly or indirectly on natural ecosystems and their resources for the supply of raw materials or ecosystem services. The harvest of biological resources, utilisation of ecosystem services, and extraction of non-biological resources by these industries can have marked impacts on ecosystems, and are a leading cause of biodiversity loss, owing to habitat conversion, overexploitation, pollution, the introduction and spread of invasive alien species and climate change. The UN Compact and the private sector programmes of UN agencies such as UNCTAD, UNDP, UNEP and UNIDO can play an important role in building capacities in government and in industry to work together to address the loss of biodiversity and ecosystem services.

Tourism and biodiversity are closely inter-connected. Biodiversity is a major resource for tourism, a sector which, if sustainably developed and well managed, can generate important economic benefits and can play a critical role in the conservation and sustainable use of biodiversity. On the other hand, unsustainable tourism can potentially reduce biodiversity and ecosystem services. Biodiversity-friendly tourism, which is included within the UNWTO's strategic objective of tourism sustainability, could contribute to maintaining the quality of ecosystems through nature-based sustainable tourism products, to generationg income for ecosystem conservation and for local populations, to the security of tourists and populations by maintaining

natural protection agains disasters (e.g. mangrove barriers), and to adaptation to climate change in vulnerable and exposed areas. The United Nations through its various bodies and agencies, including the CBD, UNCTAD, UNDP, UNEP and UNWTO are working together sharing expertise and resources to address tourism and biodiversity challenges, enhance cooperation and raise awareness on the interrelationship between tourism and biodiversity .

Transport has always been, and will continue to be, one of the main pillars of our civilization, and particularly of the modern, globalised economy. A diverse range of animal species and breeds are still important in many low income communities for transport. Without transport, most other sectors and services would not be able to operate. The most widely used mode of freight transport is by sea. Introduction of invasive aquatic species into new environments by such transport may alter entire ecosystems, with ecological, economical and health impacts as a consequence. Rail, road and air transport impact biodiversity through alteration in the type, quality and extent of habitats when building infrastructure; bird strikes when aircraft hit birds during take-off and landing; and through barrier effects, road mortality and increased human access. Several UN agencies, including FAO, ICAO, IMO and UNDP, are directly or indirectly involved in ensuring that the transport sector can provide the services humanity relies on with a minimal risk to biodiversity.

FINANCE AND TRADE

Trade policies, if designed and implemented well, can have positive impacts on biodiversity and ecosystems – by promoting specialization in production and therefore improving the efficiency of resource allocation. However, if designed or implemented poorly, trade policies can lead to overexploitation of natural resources, loss of wildlife habitats, degradation of ecosystem services, or even limit opportunities from sustainable trade initiatives. A significant amount of international trade is focused on biodiversity-based products (e.g. fisheries and forestry) or products and services derived from healthy ecosystems (e.g. agriculture, fresh water and tourism). Trade policies that actively promote trade in environmentally-friendly goods and services can be effective in contributing to the long-term sustainability of biodiversity as has been demonstrated by long-running UN initiatives such as the BioTrade Initiative of UNCTAD. The preamble establishing the World Trade Organization recognizes that trade policies may represent an economic tool to achieve, inter alia, the broader objective of sustainable development, including its three components: economic development, social justice, and environmental protection. As an example, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was adopted by governments to provide a legally-binding regulatory scheme which ensures that international trade in wild animal and plant species is legal, traceable and does not result in their overexploitation.

In terms of finance, the importance of biodiversity is also clear. With the current rate and scale of biodiversity loss weakening the ability of ecosystems to deliver key services, financial institutions are finding themselves increasingly exposed to greater biodiversity-related risks through companies they insure or in which they invest. For private financing, this calls for integrating biodiversity (and the wider environmental, social and governance, or “ESG” issues) into a wide range of products and services, including loans, equity, project finance and insurance. The linkage between finance policy and biodiversity has other dimensions, including public financing of projects for biodiversity protection and the potential for establishing financial mechanisms (whether public or private) to support biodiversity programmes. A range of national and international conservation finance instruments, such as GEF, has been created to help slow, or reverse, biodiversity loss. There is also an on-going international initiative, under the aegis of the Convention on Biological Diversity, to work towards establishing a “green development mechanism” to enhance financing of biodiversity protection on a global scale.

HUMANITARIAN AFFAIRS AND PEACE-KEEPING

The impact of war on biodiversity is high and may include habitat destruction, pollution and overexploitation, all of which may take place not only during the conflict, but also during the post conflict phase. Impacts may be long lasting and sometimes irreversible. Despite difficult conditions and alongside efforts to help relieve human suffering, some organizations such as UNHCR strive to undertake measures for environmental conservation. Primary attention is given to factors such as water pollution, soil erosion and deforestation, but there is increasing awarness of the impact of loss of biodiversity and ecosystem services and of the benefits that conservation, restoration and sustainable use of biodiversity can offer. A need for close cooperation between military and civilian actors has been identified as has the importance of fostering different types of network. To address the need of peacekeeping field missions, the United Nations Department of Peacekeeping Operations (UN DPKO) has with the technical assistance of UNEP successfully developed specific Environmental Policy and Guidelines.

IDENTIFYING OPPORTUNITIES FOR COHERENT AND COLLABORATIVE IMPLEMENTATION OF THE POST 2010 BIODIVERSITY AGENDA

Cooperation in the UN system regarding mainstreaming biodiversity can benefit from a structured approach along key institutional functions with a clear understanding of the contributions and expectations from each institution. The process for strengthening international environmental governance has identified several key functions of which the following four are of particular relevance for cooperation on mainstreaming:

STRENGTHENING THE SCIENCE-POLICY INTERFACE

Understanding the interactions between society and biodiversity requires data, expertise and knowledge from many walks of life, something the UN system with its broad technical expertise base and its network of collaborating partners is well placed to contribute to. Further cooperation within the UN system would probably be most valuable if it is linked to particular intergovernmental assessment processes such as the potential marine assessment or the proposed intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES), both of which are currently under discussion. There is also a potential UN role in ensuring mechanisms in place for building links between different assessment processes.

The world has over the last decades witnessed developments in information and communication technologies which have revolutionised information access and the exchange of information. Web-based information platforms and knowledge management tools can increase access to up-to-date, coherent and quality-assured priority data and information, indicators, early warning and alert services draw information from information networks, research, monitoring and observations. The area of biodiversity information exchange is potentially an area where the UN system could join hands, whether through internal coordination or through the facilitation of coordination across organizations and networks both within and outside the UN. Such effort could be geared towards intergovernmental scientific and technical advisory bodies or processes of the three Rio conventions and the biodiversity related conventions.

INTERLINKAGES AND SYNERGIES IN THE IMPLEMENTATION OF THE BIODIVERSITY-RELATED CONVENTIONS

A range of cooperation bodies and mechanisms has been established between the biodiversity-related and Rio Conventions, but also other conventions and UN and intergovernmental agencies that address biodiversity issues. Recommendations have surfaced over the years calling for a formal context in which to attempt greater cooperation amongst their operations and synergies at national levels. The elaboration of the post-2010 targets offers ample opportunities for creative, effective and efficient synergy among agencies and countries, aided by the emerging “one UN” approach.

Strengthening coherence among the conventions requires national level cooperation and coherence, but these are hampered in many countries by a serious lack of coordination mechanisms. Various initiatives have tested approaches to improved coordination, for example for a streamlined approach to national reporting to various MEAs. In addition, a number of issues offer the opportunity for enhanced cooperation between national focal points, ministries and agencies in charge of MEAs. This includes, among others, implementation of the Millennium Development Goals, Reducing Emissions from Deforestation in Developing Countries, sustainable use of water, and conservation and sustainable use of dryland biodiversity. Global efforts between the MEAs on those issues might provide guidance for cooperation at the national level.

The elaboration of the post-2010 targets offers the opportunity to streamline approaches to implementation of the biodiversity agenda at global, regional and national levels. The biodiversity-related conventions, other conventions and UN agencies have sought to consider post-2010 targets through the EMG and all countries are expected to commit themselves to contributing to the achievement of those post-2010 targets that are agreed. UN leadership through the Environment Management Group should mandate joint implementation of the targets and offer follow-up support. Current work on the UN system's contribution to the 2010 biodiversity target, on biodiversity indicators, an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, a potential ad hoc joint working group of governments to guide the biodiversity synergies process will – not least aided by the "one UN" approach - significantly strengthen interlinkages and synergies among biodiversity-related conventions, other conventions and UN agencies.

OPPORTUNITIES FOR INTEGRATING BIODIVERSITY TARGETS INTO NATIONAL DEVELOPMENT COOPERATION

The key to meeting biodiversity targets is implementation of pertinent actions at both local and national levels. The loss of biodiversity and ecosystem services is a global problem, yet responsibility for actions to prevent biodiversity loss lies with sovereign nation states. At the country level, there is a need for biodiversity management to become more firmly nested into national development policies. Instruments developed through multilateral processes, such as the National Biodiversity Strategies and Action Plans (NBSAPs), serve as critical entry points for focussed development cooperation support. However, NBSAPs need to be better integrated into national development plans such as the Poverty Reduction Strategy Papers and different economic sector plans. There also needs to be greater involvement of all stakeholders in the development and implementation of national plans of all kinds, including NBSAPs, and in particular an enhanced role for indigenous peoples, who often important stewards of biodiversity. The UN Development Assistance Framework is an important cooperation instrument, negotiated between country representatives and the UN which can be one support mechanism to attain integrated priorities of the NBSAP or the post 2010 targets, prioritised in country development planning.

The key collaboration needs identified by countries during the review of the 2010 target implementation are a potential opportunity for the "one UN" system to identify where various instruments and expert organizations are best placed to provide a concerted support:

- **Capacity support and institutional strengthening for national action** where the UN has a pivotal role to play in building the capacity of developing countries to combat biodiversity loss.
- **Tools for monitoring & evaluation, research and assessments:** The UN system can offer science-based input to countries as they pursue biodiversity targets and integrate them into the global context.
- **Tools for calculating biodiversity value-budgeting assets and trade-offs at the national levels:** Sound development policies can offer positive outcomes on multiple social, economic and environmental fronts, although invariably involving some degree of trade-off. Identifying and addressing trade-offs requires systematic application of decision-support tools such as Strategic Environmental Assessment.

REVIEWING EFFECTIVENESS IN THE ACHIEVEMENT OF THE TARGETS

UN entities have played an important role in tracking progress towards the 2010 Biodiversity Target as partners in the Biodiversity Indicator Partnership. Several of the global biodiversity indicators have been developed and delivered by UN entities. In a post-2010 world, with a broader suite of targets under a revised strategic plan for biodiversity, it is possible that a broader range of UN entities can play a role in the review process through structured, reporting, self evaluations and indicators. A UN system wide partnership in support of strengthened review efforts could possibly serve as a foundation for a system, whereby a broader range of UN entities could take responsibility for or contribute to measurement of indicators in particular as they relate to indirect and direct drivers of biodiversity loss and degradation of ecosystem services.

The United Nations System can play an important role in facilitating the flow of knowledge. Many countries have taken important steps to conserve biodiversity – for instance by expanding their protected area systems, ensuring that protected areas are managed effectively, and regulating the production practices employed major economic sectors to reduce their impact on biodiversity. Although while efforts on the whole fall short of addressing the underlying causes of biodiversity loss, it will be important to take stock of lessons and good practices, determine what is working and why, and provide information-sharing platforms to distill and disseminate this information so as to guide future investments. Of particular importance is the need to distill information on what is working at the local level, so as to inform broader conservation efforts.

SUPPORTING THE BIODIVERSITY AGENDA BY "DELIVERING AS ONE"

The foundation for a new and multi-sector paradigm of cooperation is sketched out on the basis of a multi-sectoral policy perspective to the biodiversity challenge in this report. It confirms that opportunities for improved mainstreaming exist, and serves to demonstrate what a multi-sectoral approach can bring to the development and implementation of the biodiversity agenda. The report therefore is not the end of the process. Rather, it signifies a milestone in a unique effort by the UN system to join hands in the supporting the implementation of the biodiversity agenda by 'delivering as one' – the multi-sectoral one.

INTRODUCTION

2010, the year proclaimed by the United Nations General Assembly as the International Year of Biodiversity, has seen a review by the Convention on Biological Diversity (CBD) of progress made towards the achievement of the strategic plan and the 2010 biodiversity targets under the Convention. Based on this review parties under the Convention embarked on an inclusive process to revise the strategic plan and the biodiversity targets.

In late 2008 the President of the Conference of the Parties to the Convention together with the Convention's Executive Secretary and the Executive Director of UNEP in his capacity as Chair of the Environment Management Group (EMG)[1] invited the Group to contribute to this review process (UNEP 2008). Following a dialogue with the members of the EMG it was agreed to initiate a forward looking process to solicit inputs to the post 2010 biodiversity agenda from the UN system.

An Issue Management Group with representatives from 27 UN entities developed the process for preparing the input in the form of a report. The process included the development of a questionnaire and the establishment of a writing team consisting of members of the group.

The report has been informed by document UNEP/CBD/SP/PREP/1/REV1: Revision and Updating of the CBD Strategic Plan: Synthesis and Analysis of Views and document UNEP/CBD/SP/PREP/2: Revision and Updating of the CBD Strategic Plan: Possible Outline and Elements of the new Strategic Plan.

The initiative under EMG is designed to interface with the intergovernmental strategic and target setting process under the Convention. The aim of the report is firstly to inform those participating in that process how different policy sectors of the UN system interact with biodiversity. Secondly, the initiative aims to create awareness in the UN system of the Convention process and identify how collaboration in the UN system can be furthered in support of the implementation of the biodiversity agenda.

The first section of the report sets out why biodiversity matters to development, why mainstreaming of biodiversity into social and economic sectors is important for halting the loss of biodiversity, and how the UN system can help to do this.

The second section presents the perspectives of selected policy sector areas on the following key questions:

- How does each policy sector depend on biodiversity and ecosystem services?
- How does each policy sector affect biodiversity and ecosystem services?
- How could each policy sector contribute to meeting biodiversity targets individually or collectively?
- What actions by other policy sectors could complement the policy sector's efforts in addressing adverse effects on biodiversity?
- What kinds of biodiversity targets might contribute to meeting the policy sector's own objectives?

The third section presents opportunities for synergies and collaboration among agencies, funds and programmes for helping halt the loss of biodiversity. Areas considered include the provision of knowledge, implementation of biodiversity related agreements, integration of biodiversity concerns into the development framework at international and national level and review of effectiveness in implementation. The report finally presents some conclusions and outlook for further work.

[1] The EMG is an interagency cooperation body on environment in the UN system that includes members from the specialized agencies, funds and programmes of the UN, the secretariats of the multilateral environmental agreement, the Bretton Woods institutions and the World Trade Organization. The group is chaired by the Executive Director of UNEP and UNEP provides the secretariat to the group (see also www.unemg.org).

SECTION I. BIODIVERSITY FOR HUMAN WELLBEING AND DEVELOPMENT

CHAPTER 1
MAINSTREAMING BIODIVERSITY FOR SUSTAINABLE DEVELOPMENT

A. HUMAN CIVILIZATION AND LIFE ON EARTH

The Earth is a living system, made habitable for humans entirely thanks to the activities of different organisms creating a breathable atmosphere, providing food, recycling waste products and helping to regulate climate. In this sense, biodiversity - the variety of life on Earth – is the foundation upon which human civilization has developed and continues to depend.

Biodiversity contributes directly to many aspects of people's livelihoods and wellbeing, providing products, such as food, medicines, fuel and fibers, whose values are widely recognized. It also underpins a much wider range of services, many of which are currently undervalued. The bacteria and microbes that transform waste into usable products, insects that pollinate crops and flowers, coral reefs and mangroves that protect coastlines, and the biologically-rich landscapes and seascapes that provide enjoyment are only a few. Functioning ecosystems are also crucial as buffers against extreme climate events, as carbon sinks, and as filters for waterborne and airborne pollutants.

The richer the diversity of life, the greater the opportunity for coping with unexpected changes: medical discoveries, economic development, and adaptive responses to challenges such as climate change. Although much more remains to be understood about the relationships between biodiversity, ecosystem services, national economies and human wellbeing (see box 1), it is well established that if the products and services that are provided by biodiversity are not managed effectively, future options will become ever more restricted, for rich and poor people alike (UNEP 2007).

BOX 1 HUMAN WELLBEING, ECOSYSTEM SERVICES, NATIONAL ECONOMIES AND BIODIVERSITY

Human wellbeing is broadly defined as people's freedoms of choice and actions, or capabilities, to achieve security, basic material needs, good health, and good social relations. The capabilities are determined by demographic, social (including institutional), material, and environmental factors. The expansion of such capabilities equals development, while their deprivation leads to vulnerability and poverty.

Ecosystem services are the benefits that people derive from ecosystems, often categorized as provisioning (such as food, fuel, or fibre), regulating (such as pollination, and regulation of climate and water levels), cultural (such as aesthetic and spiritual benefits) and supporting (such as soil formation and nutrient-cycling by microorganisms). Environmental factors determining human wellbeing include ecosystem services indispensable to all people in all places.

The contributions of ecosystem services to human wellbeing and to national economies are substantial. Examples include:

- Annual world fish catch – USD 58 billion (provisioning service);
- Anti-cancer agents from marine organisms – up to USD I billion per year (provisioning service);
- Global herbal market – roughly USD 43 billion in 2001 (provisioning service);
- Honeybees as pollinators for agriculture crops – USD 2 – 8 billion/year (regulating service); and
- Coral reefs for fisheries and tourism – USD 30 billion a year (provisioning and cultural service).

Biological diversity - or biodiversity - is the term given to the variety of life on Earth and the natural patterns it forms. Biodiversity includes diversity at the genetic level, such as that between individuals in a population or between plant varieties, the diversity of species, and the diversity of ecosystems and habitats. Biodiversity encompasses more than just variation in appearance and composition. It includes diversity in abundance (such as number of genes, individuals, populations or habitats in a particular location), distribution (across locations and through time) and in behavior, including interactions, such as between predators or prey. Biodiversity is not in itself an ecosystem services but underpins the supply of services.

Sources: CBD, MA 2005, UNEP 2007

B. GLOBAL CHANGE AND BIODIVERSITY LOSS

Humans, like every other species, have evolved in interaction with their environment. This interaction, which has continuously shaped human history has now grown to global proportions (see figure 1). The interaction is driven by ever expanding human activities, touching on virtually every component of our biosphere and the global climate system. These activities are taking place in an increasingly globalized, industrialized and interconnected world, fuelled by expanding flows of goods, services, capital, people, technologies, information, ideas and labour. Consequently, the planet is witnessing levels of environmental change at all scales which are unprecedented in human history (UNEP 2007).

The current rate of loss of land, freshwater and marine biodiversity is more rapid than at any time in human history and if anything is projected to increase. Ecosystems may be approaching tipping points, beyond which there are abrupt, accelerating or potentially irreversible changes. Ecosystem change is also often characterized by time-lags whereby the effect of an action may not be manifested until some time after the action itself.

Species extinction rates are as high as in the five "mass extinctions" of Earth history. This loss, together with loss of genetic diversity and degradation of ecosystems, is one of a series of unprecedented current and projected mutually reinforcing environmental changes which include global warming, reduction in air quality (in many locations of high population density) and in the stratospheric ozone layer (although the latter is projected to recover between 2060 and 2075 if current efforts to reduce ozone depleting substances are maintained), land degradation and declining availability of freshwater.

Fundamental social and economic processes in society are the key underlying drivers of environmental change. Demographics, consumption and production patterns, scientific and technological innovation, economic demand, markets and trade, distribution patterns, institutional and social-political frameworks and value systems all play a part in determining the impact that humans have on the rest of the natural world. This impact is expressed through a number of direct drivers of biodiversity loss, the most important of which are habitat degradation and land use change, overexploitation, pollution, invasive alien species and climate change.

The relative importance of each of these varies greatly from place to place and in its impact on different components of biodiversity. Activities which act as drivers of biodiversity loss often also enhance human prosperity and people's capacity to cope with environmental stress such as droughts and floods. Moreover, different drivers often act together, multiplying each other's impacts and making it even harder to find simple solutions to biodiversity loss.

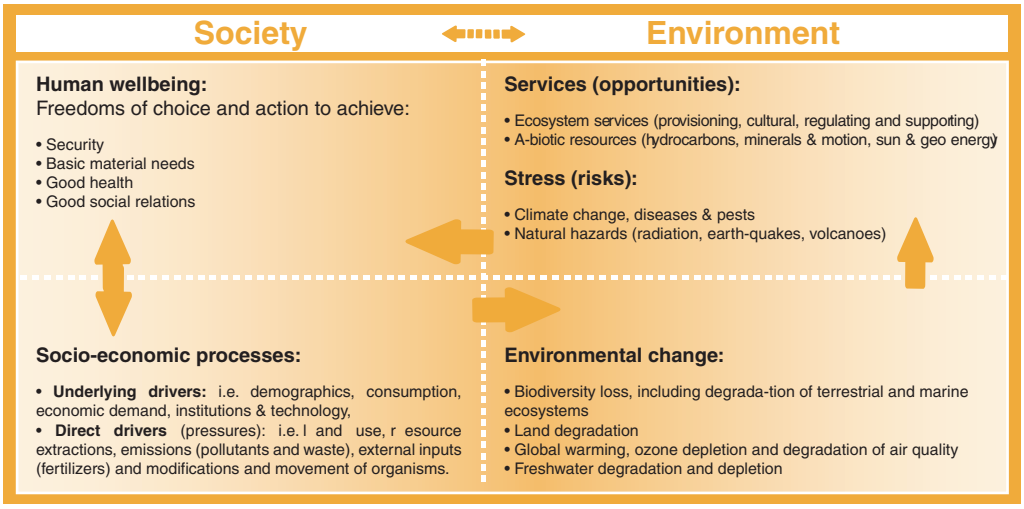


Figure 1 The interaction between society and environment: A look at the Earth will reveal a planet with diverse forms of life including one species, Homo sapiens, whose interactions with the environment has put it on a path to rapid change. The future wellbeing of the individuals of this species rests on their collective ability to understand this interaction and manage the risks and opportunities therein. The elements presented in this figure are drawn from the conceptual framework of the fourth Global Environmental Outlook, GEO4 (UNEP 2007).

C. BIODIVERSITY AND THE MILLENNIUM DEVELOPMENT GOALS

Despite the positive trend shows by a number of indicators of human wellbeing, the world is still facing widespread poverty. The degradation of ecosystem services and exacerbation of environmental stress has potentially severe consequences for human wellbeing, especially for the poor and vulnerable groups in society. Furthermore, the consequences of loss of biodiversity and of ecosystem services are not shared equally. The areas of highest dependence on ecosystem services are in developing countries which are also those richest in biodiversity and it is always in developing countries where countless poor people rely on biodiversity for their basic needs.

Loss of biodiversity has a direct impact on those goods and services provided by the natural world that humanity benefits from. Loss of biodiversity reduces, for instance, access to food and medicines, carbon storage in forests and wetlands, the supply of clean and sufficient freshwater, and the opportunities for recreation and tourism. Of those ecosystem services that have been assessed, about 60 per cent are already degraded or used unsustainably (MA 2005).

Projecting future losses of biodiversity and ecosystem services and placing a monetary value on them is extremely difficult, particularly in view of the great uncertainties, environmental, economic and political, that face us in the coming decades. A first, very coarse estimate indicates that biodiversity loss could account for around 7% of the Gross World Product (GWP) by 2050. (TEEB 2009). The burden of this is likely to be disproportionately met by the world's poor (UNEP 2007). Indeed, the connection between biodiversity and the fight against rural poverty is clearer than ever. Poor rural people account for about 75 per cent of the one billion living below the poverty line and are often entirely dependent on the environment for food security. The more natural resources are available, the easier it is for them to find products which meet their livelihood necessities. Furthermore, biodiversity is important to manage risk. In this respect, because rural people are often among the world's poorest and vulnerable groups, conserving biodiversity, particularly agricultural biodiversity, is necessary for sustainable rural development, food security, and poverty alleviation. Conservation, sustainable use and fair and equitable sharing of benefits related to the use of biodiversity is therefore important for the attainment of the Millennium Development Goals (see Box2).

BOX 2 MILLENNIUM DEVELOPMENT GOALS (MDGS) AND BIODIVERSITY LINKAGES

1. Eradicate extreme poverty and hunger

Target for 2015: Halve the proportion of people living on less than a dollar a day and those who suffer from hunger. - More than a billion people still live on less than USD1 a day: sub-Saharan Africa, Latin America and the Caribbean, and parts of Europe and Central Asia are falling short of the poverty target.

- As 40% of the global economy is based on biodiversity, a reduction of its components will directly affect the world economy, increasing poverty levels.

- Currently only 30 crop species dominate the worldwide food production and 90% of animal food supply comes from 14 mammal and bird species which themselves rely on biodiversity for their productivity and survival.

- 900 million extremely poor men, women and children who live in rural areas are the most vulnerable to the negative impacts of biodiversity loss.

2. Achieve universal primary education

Target for 2015: Ensure that all boys and girls complete primary school. - As many as 113 million children do not attend school, but the target is within reach. India, for example, should have 95 percent of its children in school by 2005.

- Shortage of wood fuel imposes time and financial costs on poor households, putting a particular burden on those that are short of labour and making it harder for children to attend school.

3. Promote gender equality and empower women

Targets for 2005 and 2015: Eliminate gender disparities in primary and secondary education preferably by 2005, and at all levels by 2015. - Two-thirds of illiterates are women, and the rate of employment among women is two-thirds that of men. The proportion of seats in parliaments held by women is increasing, reaching about one third in Argentina, Mozambique and South Africa.

- The marginalization of women leads to the marginalization of the traditional knowledge (TK) that they preserve, which is indispensable for maintaining livelihood security and conserving biological diversity.

4. Reduce child mortality

Target for 2015: Reduce by two thirds the mortality rate among children under five - Every year nearly 11 million young children die before their fifth birthday, mainly from preventable illnesses, but that number is down from 15 million in 1980.

- The WHO suggests that 80% of the worlds people rely on traditional medicines and traditional systems of medicine for day-to-day health care.

- Environmental-related diseases such as diarrhoea and acute respiratory infections are primary causes of child mortality.

5. Improve maternal health

Target for 2015: Reduce by three-quarters the ratio of women dying in childbirth. - In the developing world, the risk of dying in childbirth is one in 48, but virtually all countries now have safe motherhood programmes.

6. Combat HIV/AIDS, malaria and other diseases

Target for 2015: Halt and begin to reverse the spread of HIV/AIDS and the incidence of malaria and other major diseases. - Forty million people are living with HIV, including five million newly infected in 2001. Countries such as Brazil, Senegal, Thailand and Uganda have shown that the spread of HIV can be stemmed.

7. Ensure environmental sustainability Targets:

• Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources.

• Achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth.

• By 2015, reduce by half the proportion of people without access to safe drinking water.

• By 2020 achieve significant improvement in the lives of at least 100 million slum dwellers.

- More than one billion people lack access to safe drinking water and more than two billion lack sanitation. During the 1990s, however, nearly one billion people gained access to safe water and the same number to sanitation.

- Biodiversity loss will directly affect the quality and quantity of ecosystem services provided such as catchment protection, carbon storage, soil fertility, recycling of nutrients, control of erosion and pollinating crops and trees.

8. Develop a global partnership for development Targets:

• Develop further an open trading and financial system that includes a commitment to good governance, development and poverty reduction – nationally and internationally

• Address the least developed countries' special needs, and the special needs of landlocked and small island developing States

• Deal comprehensively with developing countries' debt problems

• Develop decent and productive work for youth

• In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries

• In cooperation with the private sector, make available the benefits of new technologies .

- Many developing countries spend more on debt service than on social services. New aid commitments made in the first half of 2002 could mean an additional $12 billion per year by 2006.

- Payments for ecosystem services, restoration of ecosystems and development and application of new approaches to conservation and sustainable use may contribute to job creation and economic growth.

Source: UNU-IAS 2008, MDG on Reducing Biodiversity Loss and the CBD's 2010 Target

Efforts to achieve a significant reduction in the rate of loss of biodiversity need to address both the underlying drivers and the direct drivers. The sheer scale and complexity of interactions between humans and the environment is a major reason why it has proved so hard for the international community and nations to halt biodiversity loss and global warming, arguably the two main dimensions of environmental change.

The solution for society is in principle to understand the dynamics of its interplay with the environment and internalise – or mainstream – the management of the risks and opportunities that arises out of this interplay into social and economic processes. It is the latter that has proven to be a stumbling block for efforts to date.

The 2010 biodiversity target

Over the past few decades, the global community – of which the UN system is an important part – has grown increasingly aware of how human wellbeing in the long term depends on biodiversity and ecosystem services.

A suite of global legal instruments was adopted during the 1970s to address international concerns about wetlands, natural heritage sites, wild animals and plants in international trade and migratory species (see Box 3).

In November 1988, almost two decades after the first of these instruments was adopted, the United Nations Environment Programme (UNEP) convened the Ad Hoc Working Group of Experts on Biological Diversity to explore the need for an international convention on biological diversity. By 1991, the Ad Hoc Working Group had become known as the Intergovernmental Negotiating Committee. Its work culminated on 1992 with the Nairobi Conference for the Adoption of the Agreed Text of the Convention on Biological Diversity (CBD).

The Convention was opened for signature on 1992 at the United Nations Conference on Environment and Development, the Rio «Earth Summit», and entered into force on 1993. The CBD agreed on 3 main objectives:

- The conservation of biological diversity
- The sustainable use of the components of biological diversity
- The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

In 2002 the member States of the Convention agreed on an ambitious target, namely to " achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth."

This target - often referred to as the 2010 target - was subsequently endorsed by the World Summit on Sustainable Development and the United Nations General Assembly and, in 2007, was incorporated as a new target under the Millennium Development Goals.

CHAPTER 2
TOWARDS A NEW PARADIGM FOR COOPERATION IN THE UN SYSTEM

A. BUILDING ON THE 2010 LESSONS LEARNED

Mounting evidence of the continuing decline in biodiversity demonstrates that the 2010 target has not been met. 2010 – The International Year of Biodiversity – represents however an opportunity to take stock of progress made towards meeting the target and renews the efforts for halting biodiversity loss based on the lessons learned. The very existence of the target seems to have helped stimulate important action, including the development of national biodiversity plans, establishment of protected areas, and enhancement of efforts to address direct drivers such as pollution, overexploitation and invasive species. However, analysis of the first generation of national plans has shown that there is a huge unmet need to address the underlying causes of biodiversity loss and that in general only limited progress has been made in mainstreaming biodiversity into national development policies and strategies.

Effective mainstreaming has proven hard to achieve for a number of reasons. Among them are the inherent inertia against cooperation across the institutional silos of a sectoralised society, the complexity and fragmentation of environmental institutions, the failure of markets to reflect the value of ecosystem services, and the difficult trade-offs between different interests and concerns in society.

BOX 3. BIODIVERSITY COMMITMENTS IN THE UN SYSTEM

The legal regime on biodiversity

Many global treaties have been established to safeguard the diversity of life on the planet starting with the Ramsar Convention on Wetlands in 1971, the Convention Concerning the Protection of World Cultural and Natural Heritage (the World Heritage Convention) in 1972, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1973 and the Convention on the Conservation of Migratory Species of Wild Animals (CMS) in 1979. These were followed by the Convention on Biological Diversity (CBD) in 1992. A supplementary agreement to the CBD, the Cartagena Protocol on Biosafety, which seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology, entered into force in 2003. Negotiations for an international regime on access to genetic resources and benefit-sharing have been in progress for some years. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) approved by the FAO Conference in 2001 and administered by FAO is harmonized with the CBD. In addition, the United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention to Combat Desertification in those countries experiencing serious drought and/or desertification, particularly in Africa (UNCCD) and the United Nations Convention on the Law of the Sea (UNCLOS) are all relevant to biodiversity. Under the auspices of the World Intellectual Property Organization (WIPO), negotations are taking place for an international rgime on traditional knowledge, traditional cultural expressions and genetic resources. A number of regional treaties contribute to safeguarding biodiversity, especially in the marine environment.

Financing the implementation of national commitments in the legal regime

The rapid development of international norms and commitments weigh heavy on countries and in particular developing ones. The Environment Fund established under UNEP to finance environmental activities in the UN system was the first multilateral source set up to fund environmental implementation in the UN. Its role was largely surpassed by that of the Global Environment Facility (GEF), initiated in 1991 as a partnership between the UN and the Breton Woods institutions, and entrusted with being the financial mechanism for the CBD and other Rio Conventions . Since 1991, GEF has as part of its biodiversity portfolio provided USD2.7billion in grants and leveraging USD7.4 billion in co-financing for over 965 projects. Marked aggregated aid to biodiversity was in 2007 over USD3 billion, provided by 21 developed countries and the European Community. In that year it is estimated that environmental non-governmental organizations raised more than USD3 billion for their activities, mostly directly related to biodiversity.

BOX 4. A GREEN ECONOMY

A green economy is an economy responding to the need for society to mitigate and adapt to environmental change including loss of biodiversity. The concept is consistent with other economic characteristics and stages like: 1) an agrarian economy (an economy which relies on farming); 2) an industrial economy (an economy dominated by manufactured goods); 3) a service econ-omy (an economy dominated by services rather than products); and 4) a knowledge economy (an economy based on the produc-tion, distribution, and use of knowledge). Similarly, a green economy is one driven by the demand for, and supply of, environmen-tally sound products and services, which generates economic wealth and job-creation and safeguard and enhance human well-being.

UNEP launched the Green Economy Initiative (GEI) in 2008 to put forward strong and convincing evidence that would support a global plan for a transition to a green economy. The Green Economy Initiative (GEI) is designed to assist govern-ments in "greening" their economies by reshaping and refocusing policies, investments and spending towards a range of sectors, such as clean technologies, renewable energies, water services, green transportation, waste management, green buildings and sustainable agriculture and forests (See webpage: http://www.unep.org/greeneconomy).

B. MANAGING OPPORTUNITIES

Environmental institutions can become more effective in facilitating the mainstreaming of biodiversity considerations into the social and economic pillars of sustainable development. The UN's first environmental institution, UNEP, established in 1972, was actually designed with this function in mind. It was mandated to guide, partly finance and co-ordinate environmental programmes across the entire UN system. The programmes were to keep the environment under review, set norms, support and finance implementation of national commitments and review the effectiveness of measures. These key functions are today integrated quite far into many parts of the UN system. However, the international environmental institutional architecture has become so complex and fragmented, that the coordination of these functions, which are so critical for effective mainstreaming, has become weakened (UNEP 2009b).

A key consideration by the EMG is that new opportunities for mainstreaming are emerging. Cooperation within the biodiversity sector (e.g. the Liaison Group of Biodiversity-related Conventions) and across sectors is increasingly being pursued. The "one UN" initiative is one example in this respect. The fragmentation of the environmental institutional landscape is being addressed; this will potentially enhance the complementarity and coherence among a diverse set of expertise and competencies. Recent efforts in this regard include the process for strengthening international environmental governance under UNEP (UNEP 2010) and the preparation of the UN Conference on Sustainable Development in Rio de Janeiro in 2012 which amongst others is scheduled to address the institutional architecture for sustainable development. Furthermore, developments in the area of biological science, monitoring, modelling and forecasting are improving the ability of society at all levels to identify risks of biodiversity loss and opportunities provided by ecosystem services. Rapid advances in information and communication technologies can potentially ease the task of managing complex information, including that concerning biodiversity, and facilitate the communication of such information to a broad range of users.

Finally, rather than being seen as question of a trade-off between environment and development arresting the loss of biodiversity is increasingly seen as a trade-off between different intra- and inter-generational aspects of human wellbeing which are supported by ecosystem services. Economics is the currency of decision-making regarding trade-offs between these different aspects of human wellbeing. Ongoing efforts to improve the understanding of the value of biodiversity and the services it provides may assist society in fully appreciating the opportunities forgone by biodiversity loss and identifying new win-win situations across sectors. The Economics of Ecosystems and Biodiversity (TEEB) report, for example, seeks to show that economics can be a powerful instrument in biodiversity policy (TEEB 2009). A shift toward a green economy (see box 4) through investments in sustainable use and conservation of biodiversity can generate economic wealth and job-creation which safeguard and enhance human wellbeing. Environmental institutions can play their part in this by mainstreaming economic and social considerations into their own policies and programmes.

C. ANCHORING THE POST-2010 BIODIVERSITY AGENDA IN THE UN SYSTEM

The development of cross-cutting and sector specific targets – such as those under consideration in the post-2010 biodiversity target-setting process – can be an effective way of mainstreaming biodiversity concerns into sectoral policies and plans. This is particularly so if the target-setting process involves the sector in question through an open, transparent and consultative process and takes into account that sector's mandate. The UN system is comprised of many different entities representing different sectors in society (see figure 2) and is therefore well placed to contribute.

A complex governance structure has an impact on what the UN system can deliver at interagency level.

Generally, each entity in the UN is governed by an intergovernmental body which can either have independent legal standing, such as that of a treaty and a specialised agency, or can be a subsidiary body of the General Assembly, such as those of the UN programmes, funds and commissions. The bodies are served by secretariats some of which are supported by a fund or organized around the management of a fund. Many issues addressed by the UN system require cooperation across different entities and for this reason different coordination arrangement have been established. These arrangements vary in shape and form. Some of them, like the EMG, are coordination bodies at interagency secretariat level.

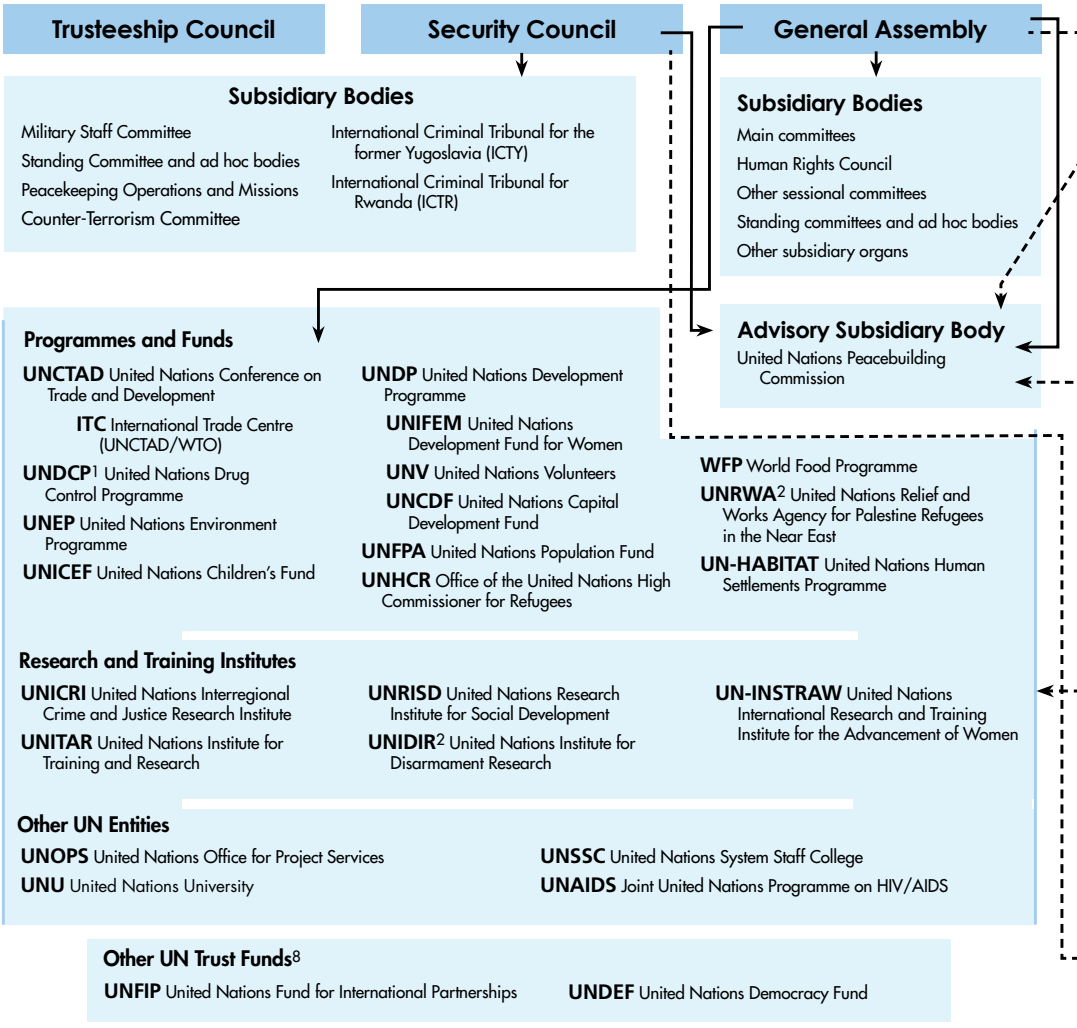
Sectoral institutions such as those of the UN system relate to biodiversity in different ways. Some sectors are more directly dependent on ecosystem services than others but all ultimately depend on well functioning ecosystems and all can play a role in safeguarding biodiversity through measures such as addressing the drivers of biodiversity loss (see box 6).

Section two of the report presents the perspectives of selected policy sectors on the following key questions:

- How does each policy sector depend on biodiversity and ecosystem services?
- How does each policy sector affect biodiversity and ecosystem services?
- How could each policy sector contribute to meeting biodiversity targets individually or collectively?
- What actions by other policy sectors could complement the policy sectors efforts in addressing adverse effects on biodiversity?
- What kinds of biodiversity targets might contribute to meeting the policy sector's own objectives?

The United Nations System

Principal Organs



NOTES: Solid lines from a Principal Organ indicate a direct reporting relationship; dashes indicate a non-subsidiary relationship.

1 The UN Drug Control Programme is part of the UN Office on Drugs and Crime.

2 UNRWA and UNIDIR report only to the GA.

3 The United Nations Ethics Office, the United Nations Ombudsman's Office, and the Chief Information Technology Officer report directly to the Secretary-General.

4 In an exceptional arrangement, the Under-Secretary-General for Field Support reports directly to the Under-Secretary-General for Peacekeeping Operations.

5 IAEA reports to the Security Council and the General Assembly (GA).

6 The CTBTO Prep.Com and OPCW report to the GA.

7 Specialized agencies are autonomous organizations working with the UN and each other through the coordinating machinery of the ECOSOC at the intergovernmental level, and through the Chief Executives Board for coordination (CEB) at the inter-secretariat level.

8 UNFIP is an autonomous trust fund operating under the leadership of the United Nations Deputy Secretary-General. UNDEF's advisory board recommends funding proposals for approval by the Secretary-General.

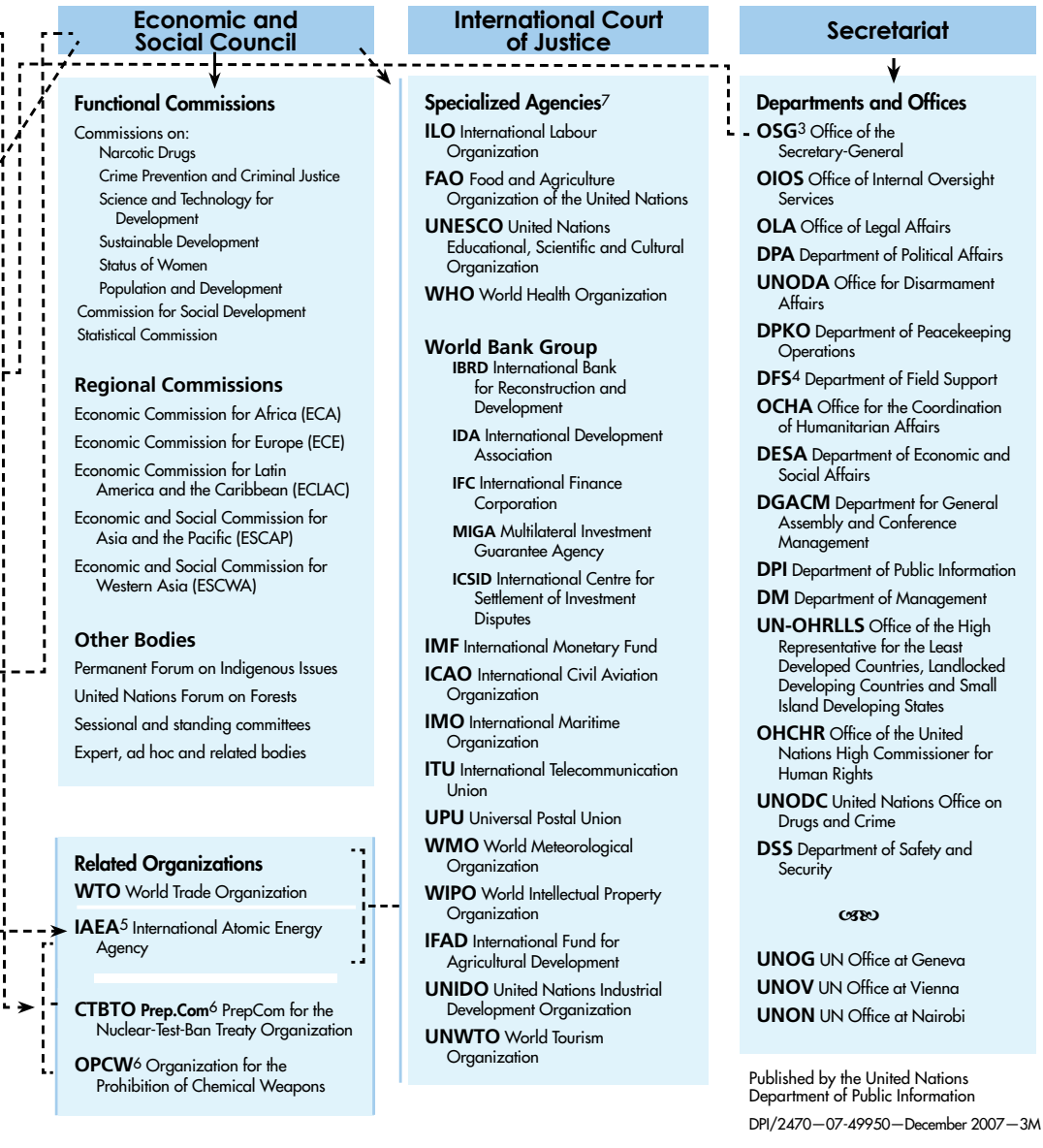


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Figure 2 The UN System

D. STRENGTHENING THE INSTITUTIONAL FUNCTIONS THAT UNDERPIN MAINSTREAMING

Cooperation in the UN system on mainstreaming biodiversity can benefit from a structured approach along key institutional functions with a clear understanding of the contributions and expectations from each institution. The process for strengthening international environmental governance (UNEP, 2010) has identified several key functions out of which the following four functions are of particular relevance for cooperation on mainstreaming:

- Cooperation on **facilitating the interface between science and policy** consists of several subelements including acquisition of data and information, information networking, assessments, and provision of scientific advice. All sectors will have a role in contributing to the pool of knowledge, at least on the indirect and direct drivers if not on biodiversity as such. A core contribution for biodiversity institutions is to synthesise this knowledge and make it available in a usable format. The non-biodiversity sectors on the other hand need to clearly express their expectations and detail their information needs.

- **Development of norms**, such as legally binding obligations and commitments and non-binding targets and guidelines, has been carried out through a number of UN agencies. Increasingly, efforts to maintain ecosystem services are seen as a step in pursuit of other societal objectives such as food security, climate adaptation and mitigation, access to safe drinking water, and poverty eradication (see box 2). Cooperation is needed to avoid situations where norms in one policy sector are countered by those of another.

- Cooperation on support to implementation of the post 2010 biodiversity targets in developing countries needs to be anchored at the national level. The UN development assistance framework (UNDAF) and the poverty reduction strategies and plans (PRSPs) provide vehicles for spearheading cooperation. There is a critical need to better integrate biodiversity management and broader national development policies, strategies and programmes and climate change risk management. UN agencies surveyed by the EMG indicated that most agencies have biodiversity related targets (see box 5) at a global scale, underlining the need for an improved system for implementation and monitoring at the country level. Cooperation is needed in the area of investment, technological support and capacity building. This can be achieved by building on the comparative advantage of each institution under a "delivering as one" approach.

- Development of targets and indicators for their achievement can provide a sound basis for reviewing the effectiveness of measures. This is a key function of a target- and results-based approach to mainstreaming and can be achieved through a mix of structured, and streamlined reporting, self-evaluation and independent evaluation. Such structured reviews allow institutions to improve institutional performance incrementally.

BOX 5. EMG MEMBERS WORKING DIRECTLY AND INDIRECTLY ON BIODIVERSITY TARGETS

Specific biodiversity targets	Biodiversity-related targets	Biodiversity relevant targets
CBD	ESCAP	UNWTO
CITES	IMO	UNITAR
FAO	UNFCCC	UNIDO
Ramsar	UNDESA	
UNCTAD	UNESCO	
UNEP	UNIDO	
	WIPO	

Source: EMG Survey 2009

BOX 6. THE RELATIONSHIP BETWEEN POLICY SECTOR INSTITUTIONS AND BIODIVERSITY

Biodiversity institutions are the custodian of the values biodiversity represents and the knowledge, norms, measures for implementation and review of effectiveness of measures needed to safeguard these values.

Environmental institutions include those dealing with climate change, land management, human settlements and water. They depend on ecosystem services such as those related to carbon storage, water regulation, soil formation and protection, and production of fuel and fibre. They have a role in facilitating a coherent and balanced approach to mainstreaming of environmental concerns into other sectors.

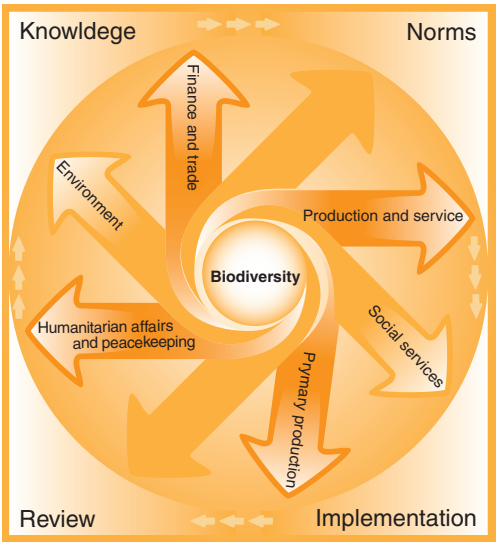
Primary production institutions include sectors such as agriculture, forestry and fisheries. They depend on ecosystem services related to provision of food, fuel and fibre and have a long term interest in protecting services related to regulating (such as pollination, and regulation of climate and water levels), cultural (such as aesthetic and spiritual benefits) and supporting (such as soil formation and microorganisms cycling nutrients) functions. The sector influences drivers, such as land use, pollution, invasive species, trade in agricultural commodities, and poverty and also has tools to support mainstreaming of biodiversity concerns into other sectors.

Social services institutions such as health, knowledge and culture depend on ecosystem services such as those related to provision of food and medicines, regulation of air and water quality and recreational, cultural and spiritual values. The health sector influence drivers such as poverty, and population growth through health policies and standards. The knowledge sector influences important drivers such as science and technology and cultural change through research, education and cultural programmes.

Production and service institutions include the energy, industry, transport and tourism sectors. This is a non-homogenous group in its dependence on biodiversity. Some sectors such as biotechnology, draw their raw material from genetic resources, ecotourism depends on biological and cultural diversity, and biofuels relate to agriculture and forestry. The sector influences drivers, such as land use, overexploitation, pollution, invasive species, and trade in commodities.

Finance and trade institutions are based on production in society which ultimately rests on well-functioning ecosystems. Measures related to trade and investments can be highly effective in altering multiple drivers. The challenge is to ensure that they are well focussed and, in the case of trade measures, that they are applied in a non-discriminatory manner.

Humanitarian affairs and peace keeping institutions are to some extent dependent on ecosystem services although their primary efforts are often focused on immediate crises. In the longer term, cooperation on maintenance of ecosystem services can reduce tensions and prevent conflicts.



The following section elaborates further on opportunities for coherent and collaborative implementation of the post-2010 biodiversity agenda. The exploration of these opportunities may help the UN move towards a new paradigm for cooperation on mainstreaming biodiversity concerns into social and economic sectors. Work in the UN could be organized more effectively, for example through the use of information and communication technologies to achieve economies of scale and improve institutional resilience, innovation and adaptability. Ultimately, public institutions such as the UN need to be more effective in setting the framework conditions for actions by the private sector, individuals and households that can help halt the loss of biodiversity.

REFERENCES SECTION I

MA (2005) Millennium Ecosystem Assessment. Biodiversity Synthesis. World Resources Institute, Washington. D.C.
http://www.millenniumassessment.org/documents/document.354.aspx.pdf

TEEB (2009) The Economics of Ecosystems and Biodiversity for national and international policy makers – Summary: Responding to the value of Nature.
http://www.teebweb.org/LinkClick.aspx?fileticket=I4Y2nqqIiCg%3d&tabid=924&language=en-US

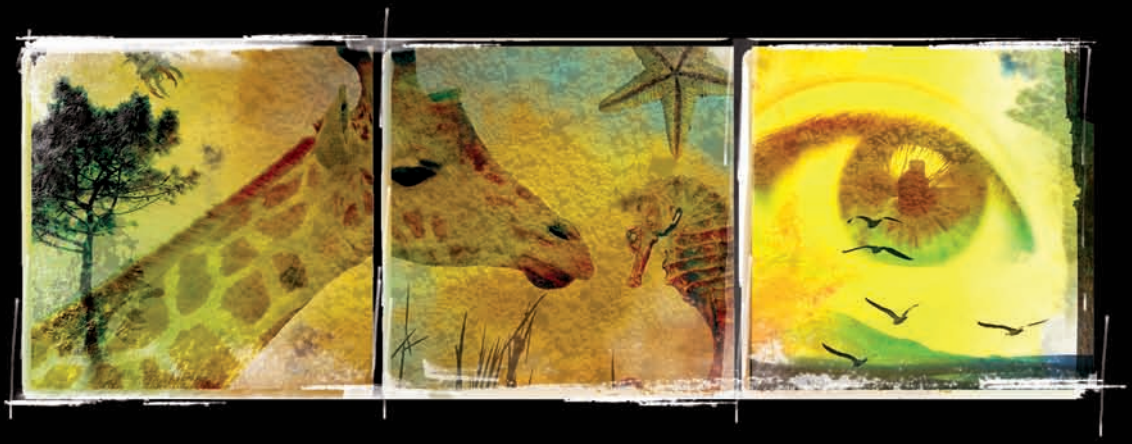
UNEP (2007) Global Environment Outlook GEO 4, United Nations Environment Programme, Nairobi.
http://www.unep.org/geo/geo4/media/

UNEP (2009a) Issue Management Group 8 April 2009, Report of the meeting, United Nations Environment Programme, Geneva.
http://www.unemg.org/LinkClick.aspx?fileticket=zVC-Pw6TyjQ%3d&tabid=1225&language=en-US

UNEP (2009b) Information note on Environment in the UN system, United Nations Environment Programme, Geneva.
http://www.unep.org/environmentalgovernance/LinkClick.aspx?fileticket=K3qKmxG3JPA%3d&tabid=2227&language=en-US

UNEP (2010) International Environmental Governance: outcome of the work of the consultative group of ministers or high-level representatives, Note by the Executive Director to the eleventh special session of the Governing Council/Global Ministe-rial Forum, United Nations Environment Programme, Nairobi.
http://www.unep.org/gc/gcss-xi/working_docs.asp

UNU-IAS (2008) MDG on Reducing Biodiversity Loss and the CBD‘s 2010 Target.
http://www.ias.unu.edu/resource_centre/Reducing_Biodiversity_Loss_user%20friendly.pdf



SECTION II. POLICY SECTOR PERSPECTIVES OF THE UN SYSTEM

CHAPTER 3
ENVIRONMENT: - CLIMATE CHANGE, LAND AND WATER

A. CLIMATE CHANGE

THE IMPORTANCE OF BIODIVERSITY TO CLIMATE CHANGE

It is now widely recognized that climate change and biodiversity are interconnected, not only through the effects of climate change on biodiversity, more extensively elaborated on in the next section, but also through changes in biodiversity and ecosystem functioning that affect climate change. The carbon cycle and the water cycle, arguably the two most important large-scale processes for life on Earth, both depend on biodiversity—at genetic, species and ecosystem levels.

Functioning ecosystems are crucial as buffers against extreme weather events and provide important resources to support natural-resource based livelihoods and food security. Protecting and enhancing ecosystem resilience through conservation, sustainable management and restoration of biodiversity and ecosystem services is one of the most cost effective ways of tackling both the causes and consequences of climate change. Healthy ecosystems store carbon and if degraded or destroyed release this as carbon dioxide, one of the principal causes of climate change. Reducing greenhouse gas emissions originating from the degradation and destruction of ecosystems will thus contribute to better encountering the challenges posed by climate change. Such ecosystem-based approaches are ready for use, easily accessible, and can bring multiple benefits, including improvement of livelihoods and poverty alleviation.

THE IMPACTS OF CLIMATE CHANGE ON BIODIVERSITY AND ECOSYSTEM SERVICES

There is significant scientific consensus that increasing global average temperature by 2°C or more will likely result in dangerous climate change with greater likelihood of irreversible changes in terrestrial, freshwater and marine ecosystems and serious implications for the provision of key ecosystem services, including climate regulation, water flows and carbon sequestration. It is possible that this 2°C warming threshold could be crossed as early as 2040 unless significant mitigation measures are taken urgently (Allison et al., 2009). Significant impacts would likely be felt in highly vulnerable areas, many located in least developed countries, as mean global temperature change approaches 1.5 °C resulting in increased magnitude and frequency of storms, drought and floods and deleterious changes to the functioning of ecosystems (UN World Economic and Social Survey, 2009).

Climate change will increase rates of biodiversity loss, affecting both individual species and their ecosystems. Most of the 80% of the world's coral reef may die within decades due to climate change (UNEP, 2008a). The IPCC Fourth Assessment Report (IPCC AR4, 2007) states that the most vulnerable ecosystems include coral reefs, the sea-ice biome, other high-latitude ecosystems such as boreal forests, mountain ecosystems, and mediterranean-climate ecosystems. Also if greenhouse gas emissions continue at or above current rates, during the next 100 years the ability of many ecosystems to adapt naturally is likely to be exceeded by an unprecedented combination of climate change, associated disturbances such as flooding, drought, wildfire, and other global change issues, especially land-use change, pollution and over-exploitation of resources. The report also notes that approximately 20 to 30% of plant and animal species assessed to date are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5 to 2.5°C. The report stresses that since global losses in biodiversity are irreversible, projected impacts on biodiversity are significant and relevant. With this level of warming, many species are at far greater risk of extinction than in the recent geological past.

Climate change is impacting ecosystems and their services and functioning in ways that are difficult to model and predict, but yet have severe repercussions. The Second Ad hoc Technical Expert Group on Biodiversity and climate change convened by the Convention on Biological Diversity concluded that continued climate change will have predominantly adverse and often irreversible impacts on many ecosystems and their services; however, there is still uncertainty about the extent and speed of such impacts, and the thresholds of climate change above which ecosystems are irreversibly changed and no longer function in their current form.

Climate change also impacts the species and genetic diversity underlying these ecosystems. The effect will be a dramatic increase in biodiversity loss across genes, species and ecosystems. The impacts of climate change are exacerbated by land use change, some

of which are directly related to climate change itself (e.g. changes in agricultural areas induced by changes in temperature, precipitation and growing season, and change in distribution of biofuel crops caused by efforts to reduce consumption of fossil fuels).

The primary areas of climate change impacts on biodiversity that have already been experienced or are projected include:

- Changes in the spatial and temporal distributions of species and assemblages
- Migration and dispersal potentials of species and assemblages
- Genetic diversity and viability of populations of species
- Physiological tolerance of species
- Disturbance of functional interactions between species
- Disruption of ecosystem processes and functioning
- Increases in the number and distribution of invasive species
- Changes in rates of photosynthesis, carbon uptake and productivity

RESPONDING TO CHALLENGES AND OPPORTUNITIES

The prospect of irreversible adverse effects of climate change adds to the urgency of achieving the objectives of the Rio Conventions, the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD) in that, when furthering the implementation of these, they all contribute, within their respective mandates, to tackling climate change in a more integrated and effective manner. The additional challenge climate change poses to the achievement of the Millennium Development Goals (MDGs) is also important to note.

The growing threats from climate change will mainly affect populations that are already challenged by multiple vulnerabilities associated with low levels of economic and human development, for example, by multiplying livelihood risks and further weakening adaptive capacities. Developing countries will increasingly be seeking to apply the broadest range of options to deal with climate change – for both mitigation and adaptation.

There are several scientific questions that need answering, including the following:

- What are the physical changes to species and various ecosystems driven by climate change such as submersion of ecosystems by sea level rise and melting of permafrost? The various ecosystems include polar, agricultural, dry and sub-humid lands, forest, inland waters, island, marine and coastal, and mountain ecosystems. Can these changes be quantified and/or modelled?
- What changes can be accommodated through natural adaptation? Does migration and dispersal allow for the movement of ecosystems and/or the evolution of new ecosystems?
- Is there ecosystem and species resilience to extreme climate change and weather events such as high temperature and extended drought?
- How will land-use patterns affect the re-organization of ecosystems in the landscape, for example by impeding migration and seed dissemination?
- How can models of natural responses to climate change better integrate human responses in order to account for multiple drivers of loss or change?
- How can bioclimatic models be improved? This could include reflecting observations in the refinement of models, better considering species interactions in ecosystem-level models and improving access to basic species and climate data.
- Is species migration limited by soil and elevation?

The UNFCCC provides an intergovernmental forum to deal with climate change-related issues, touching on all aspects of sustainable development, and has developed the necessary basis to deal with related questions, based on long-standing cooperation with and input from competent partners such as the Intergovernmental Panel on Climate Change (IPCC). Cooperation among international organizations, UN entities, other Conventions and their secretariats and other intergovernmental organizations is very important for an effective international response to climate change, ensuring that the Convention process has the best scientific and other relevant information available. One example of the need for such cooperation in this context is found in the UNFCC Nairobi Work Programme on impacts, vulnerability and adaptation to climate change. Under the thematic work area «modelling, scenarios and downscaling» in the work programme is a call for partners and organizations to improve bioclimatic modelling, which has led to a number of pledges for action, including one by the CBD's AHTEG on biodiversity and climate change.

The Conference of the Parties (COP) and its subsidiary bodies also seek to ensure that the climate change related activities of other international organizations are coherent with the convention process and respond to the needs of the Parties, taking into account the potential linkages and synergies which may exist. Standing items on the agendas of convention bodies such as the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) relating to cooperation with relevant international organizations, reducing emissions from deforestation in developing countries and adaptation, also deal with biodiversity-related issues.

A number of organizations, including the CBD, have made important contributions to reports, fora and meetings. Relevant work has been carried out under the CBD's first and second Ad Hoc Technical Expert Groups on biodiversity and climate change which have assessed the links between biodiversity and climate change mitigation and adaptation as well as the role of tools such as economic valuation in promoting enhanced synergies in implementation. Information brochures on forestry and adaptation-related issues have been produced on the initiative of the Joint Liaison Group of the Rio Conventions, and information and experience exchanged in the context of UNFCCC's web platform.

Other past and current cooperative activities with the CBD include: joint outreach activities, joint papers on cross-cutting issues, a joint workshop on forests, an IPCC report on biodiversity, exchange and joint work on cross-cutting issues such as on the CBD's CEPA/ UNFCCC's Article 6, technology, research and systematic observation.

The UNFCCC Nairobi Work Programme, which will be evaluated at the end of this year in Cancun, will if extended by Parties continue to play a crucial role in assisting all Parties to improve their understanding and assessment of impacts, vulnerability and adaptation to climate change and to make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability. The programme may also serve as a central knowledge sharing and learning platform, as an interface between partner organizations and the UNFCCC process, and as a channel for catalyzing action by Parties and organizations, including the private sector, for example, in enhancing or strengthening education, training and awareness-raising, regional centres and networks, and in enhancing the focus on community-based adaptation. Due to its unique positioning and expertise, the NWP may well be placed to address issues of relevance dealt with in this report.

The UN Chief Executive Board, by a recent decision, has appointed the UNFCCC secretariat as convenor of the UN-wide adaptation theme under its umbrella. A UN-wide adaptation side event in Cancun and a synthesis of the possible role that different UN agencies can play in the future adaptation regime, based on the current elements included in the negotiating text prepared by the Ad-Hoc Working Group on Long-term Cooperative Action will generate a meaningful synthesis based on a concerted input by all UN agencies.

A Rio Conventions' Ecosystems and Climate Change Pavilion, a collaborative activity of the CBD, the UNCCD and UNFCCC Secretariats,

will contribute to enhanced awareness-raising, information sharing and outreach in the framework of the Rio Conventions (CBD COP Decision IX/16), and to enhancing collaboration and coordination between the Rio Conventions (UNFCCC COP Decision 8/CP.13, UN General Assembly Resolution 64/203 of 14 December 2009).

The CBD has held workshops to strengthen the integration of climate change related-issues within National Biodiversity Strategy and Action Plans and has considered how climate change should be reflected in the programmes of work and cross-cutting issues of the Convention through the in-depth reviews of implementation.

CLIMATE CHANGE IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

The increased risk to biodiversity imposed by continuing and unavoidable climate change highlights the need for enhanced knowledge about the cumulative effects of climate change and other stressors that result in biodiversity and ecosystem services loss.

The IPCC AR4 report and the report of the Second Ad hoc Technical Expert Group on Biodiversity and Climate Change (published as CBD Technical Series No. 41) stresses the need for better observations on climate (temperature and precipitation) and on the impacts of climate change on biodiversity (Magrin et al 2007). While there are some tools for estimating gradual change for most impacts of climate change, there are very few for assessing the conditions that lead to circumstances where a system changes or deteriorates rapidly (so called tipping points). Most of the past research has addressed impacts on a single sector and there have been very few studies that address the interacting responses of diverse sectors impacted by climate change, making it very difficult to evaluate the extent to which multi-sector responses limit options or create completely new outcomes (Field et al 2007). The issues of improving climate data and observations along with the development of various climate applications (products and forecasts) for various user sectors (i.e. agriculture, biodiversity and energy) could be effectively addressed in the future by the Global Framework for Climate Services (WCC3, 2009).

Also, further assessments of implications for biodiversity and associated ecosystem services as temperature rises in the next 10, 20, 50 years are needed, noting that the effects of climate change are already evident, including identifying 'points of no return' for biodiversity and ecosystem services. These assessments would be particularly important to undertake in regions of the world which are highly vulnerable to climate change, are highly reliant on services provided by biodiversity and ecosystems for their livelihoods and do not have the economic means to adapt quickly or comprehensively. These assessments would also be of relevance in the context of climate change adaptation planning, disaster risk reduction and development planning.

Climate change and biodiversity are interconnected. Therefore, meeting biodiversity targets can contribute to alleviating greenhouse gas emissions and to reducing the threat of climate change and corresponding negative impacts on biodiversity and many other related sectors. At the same time, the efficient implementation of the UNFCCC can bring considerable benefits for biodiversity. It is important to better understand and integrate possible direct and indirect, positive and negative linkages between climate change and biodiversity and to take them appropriately into account so to be able to harness synergies leading to win-win-situations. In the light of the findings of the IPCC and the AHTEG, an agreement on climate change could play a significant role in protecting biodiversity and preventing the worst projections of the IPCC becoming a reality.

B. LAND

Land is the terrestrial bio-productive system comprising soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system. Specific land uses or land management practices may influence particular patterns of biodiversity resulting in a complex and context specific relationships between biodiversity and land use. Understanding this complexity is essential to establishing the links between biodiversity and human wellbeing.

"Land Cover" refers to the physical surface characteristics of land (for example, the vegetation found there or the presence of built structures), while 'land use' describes the economic and social functions of that land. Haines-Young, R (2009)

THE IMPACTS OF LAND USE ON BIODIVERSITY AND ECOSYSTEM SERVICES

Human activities affect terrestrial ecosystems worldwide. Because the type and intensity of land management regimes directly affect biodiversity and the flow of ecosystem services, land-use change and transformations in the way land is managed are key drivers of change in biodiversity and ecosystem services at global, national and local scales.

Land degradation can be defined as the reduction or loss of biological or economic productivity and complexity of cropland, irrigated cropland, rangeland, pasture, forest and woodland. It can have multiple causes, but is often the result of inappropriate land use or land management regimes. Land degradation can result in widespread changes to land resources, mainly soils, water and vegetation, as well as to changes in the provision of ecosystem services. Desertification (land degradation in drylands) contributes significantly to climate change and biodiversity loss.

Spatial connectivity between different areas means that changes in land use can have impacts on biodiversity and ecosystem services elsehwere, through modifications of biological interactions, fluxes of water and nutrients, or changes to disturbance regimes such as fire.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

There is a need to improve the scientific understanding of the impacts of different land management practices on biodiversity and ecosystem services. There is also a need for a broader perspective on the value of biodiversity and ecosystem services as the basis for developing adaptive and flexible approaches to policy and management (Haines-Young, R, 2009). A start has been made, for example in an OECD study based on the Integrated Model to Assess the Global Environment (IMAGE), developed to understand the relative importance of major processes and interactions in the society–biosphere–climate system (Bakkes and Bosch, 2008). This study established a link between change in land cover, land use and biodiversity, most recently explored in the 'Cost of Policy Inaction' analysis undertaken as part of the TEEB initiative. A system-wide set of studies of the effects of land use on ecosystem dynamics, including comparative studies across gradients of land use intensities, could complement regional and global analyses and help in the development of appropriate policies.

Different forms of natural or human-induced change interact in their impact on land, highlighting the need for policy coherence and synergy across all sectors that deal directly or indirectly with land use and land management. Coordination and spatial planning efforts across the different multilateral environmental agreements and other UN agencies is already creating a fruitful interface within the land, agriculture and forestry communities. A number of UN system-wide actions (see box 6) address the indirect drivers of biodiversity loss through provision of policy advice, communication, education and public awareness, including the implementation of the ecosystem approach, the realignment of economic incentives and mainstreaming of biodiversity across sectors in government and society. Strengthening the UN system to harmonize and foster action on issues related to land governance including empowerment of local populations and the use of rights-based approaches remains a priority in sectors dealing with land administration, the rural-urban dichotomy and human settlements.

The Ecosystem Approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Application of the ecosystem approach will help to reach a balance of the three objectives of the Convention on Biological Diversity. (see Chapter 1)

LAND USE IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

Setting global benchmarks for reducing land degradation and linking these to biodiversity targets is one potentially effective mechanism for focusing attention within the land sector on biodiversity and ecosystem services. 'Zero-net' land degradation by an agreed timeframe, for example the end of the UN Decade for Deserts and the Fight against Desertification 2010-2020, could be translated into concrete land degradation reduction targets that converge with biodiversity targets for 2020 and beyond. These targets could help bring together efforts to address desertification, land degradation and issues related to drought across various international initiatives and networks such as the Millennium Development Goals, UN Land, the CBD Programme of Work on Dry and Sub-humid lands, the UNDP Drylands Programme.

An integrated approach to policymaking on sustainable land management is needed. Such an approach would entail broad-based participation by all UN and associated entities that have a role in addressing the "vicious cycle" of land degradation, including FAO, GEF, UNCCD, UNEP, UNDP and The World Bank. Effective action through policy coherence and synergy is already being undertaken by UN agencies and includes a range of ecosystem service-oriented strategies that contribute to:

- A UN system-wide Land Initiative;
- Increased science-policy dialogues and policy interactions on sustainable land management;
- Increased monitoring and assessment of desertification, land degradation and drought;
- Promotion of responsible investments in ecosystem services, drought risk management, carbon markets and dryland agriculture systems.

If a robust evidence base for policy is to be constructed, biodiversity indicators also have to be better integrated with empirical information on the various drivers of change, and in particular the factors shaping land use, so that better modelling and scenario tools can be developed.

C. WATER

Water is a vital resource. It is recyclable but not replaceable. Useable freshwater is finite and its distribution very uneven both across countries and within them. Practically all economic activities depend on or have an impact on water and better water management is central to the achievement of most of the Millennium Development Goals. Water security is a primary natural resource challenge and therefore of direct relevance to a broad range of stakeholders in addition to those interested in biodiversity. Water is very high on political, public, economic and financial agendas. It is not surprising, then, that water and the management of changes occurring in the water cycle are central and cross-cutting themes in relation to biodiversity and sustainable development across the multi-lateral environment agreements and much of the rest of the UN.

In 2030, 47% of the world population will be living in areas of high water stress and more than 5 billion people, 67% of the world population, may still be without improved access to sanitation. Increasing water insecurity is the key natural resource factor undermining sustainable development

Water is central to ecosystem functioning: all life-forms depend upon it. Water supply is also one of the most valuable and essential services provided by ecosystems; for example, the estimated value of water-related services provided by tropical forests exceeds their combined values for climate regulation, timber and non-timber products and tourism and recreation. Water moves through the biosphere through precipitation (rain and snow fall), surface waters and soil and groundwater. Biodiversity underpins ecosystem functioning that supports this cycle: for example, in most areas about 60% of local precipitation arises through transpiration of plants (particularly forests). Sustaining the water cycle therefore involves not only improved wetland management but better management

of practically all land-use activities. Changing water availability and quality is a major driver of changes in inland water and wetland ecosystems as well as terrestrial ecosystems.

THE IMPACTS OF WATER USE ON BIODIVERSITY AND ECOSYSTEM SERVICES

The Third World Water Development Report (UNESCO, 2009a) shows that major changes are already occurring in the water cycle at local, national and regional scales due to direct human interventions. The groundwater portion of the water cycle has been subjected to massive changes. Problems are emerging on continental scales and are impacting not only people but also both terrestrial and aquatic ecosystems; groundwater depletion, for example, is exerting major influences on terrestrial vegetation and agriculture. Nearly a third (31%) of freshwater species assessed for the 2009 IUCN Red List are already threatened or extinct. Competition for water exists at all levels, and is forecast to increase in almost all countries. Conflicts between agricultural and urban uses are a paramount concern; 80% of humanity is projected to be living in towns and cities by 2030 and water is the primary natural resource upon which cities depend (44% of cities already rely on forested protected areas for their water supplies). Sustaining or restoring the water-related services that ecosystems provide is necessary to improve water security and has demonstrable economic cost-savings (UNESCO, 2009a).

The limit of ecological sustainability of water available for human uses (4000 km3 per annum) has already been reached, but use and availability are not evenly distributed. «Nature» is still the most important player in the water cycle and evapo-transpirates an estimated 70,000 km3/year from forests, natural vegetation and wetlands. It is inevitable that as water becomes scarcer human activities will take an increasing share of it; this needs to be managed if it is not to stimulate further negative feedbacks whereby further water abstraction and degradation undermines the ability of nature to continue to supply water for us to use.

The impacts of climate change are occurring mainly through changes in the water cycle. The findings of the IPCC third and fourth assessment reports confirm that the changing, and generally accelerating, water cycle is central to most of the climate change related shifts in ecosystems and human wellbeing.

The IPCC technical report on climate change and water (IPPCC,2008) concludes, inter alia, that: the relationship between climate change and freshwater resources is of primary concern and interest; so far, water resource issues have not been adequately addressed in climate change analyses and climate policy formulations; likewise, in most cases climate change problems have not been adequately dealt with in water resource analysis, management and policy formulation; and, according to many experts, water and its availability and quality will be the main pressures, and issues, on societies and the environment under climate change.

The carbon cycle and the water cycle are perhaps the two most important large-scale bio-geological processes for life on Earth and interactions between various stages of the carbon and water cycles can yield feedbacks to climate change. For example, the sustainability of carbon storage by forest ecosystems can be threatened unless water cycles are sustained. Mitigation efforts must pay more attention to the role of both the water and carbon cycles.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Sustaining or restoring the water-related services provided by ecosystems is at the heart of managing water security for both people and nature. There is already solid evidence that ecosystem-based solutions to water related problems are not only viable but can be very attractive in terms of investment returns. Water related economic interests are already driving major shifts towards improved attention to the wiser use of nature and biodiversity on the business, public and national policy agendas in many countries, including major developing nations.

WATER USE IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

Water forges the strongest links between biodiversity and development and therefore between the Multilateral Environmental Agreements (MEAs) and the broader development community. Amongst the MEAs, water is central to, and explicit in, the Ramsar Convention. Amongst the other MEAs, and in particular the CBD, there is a need for elevated attention to relationships between biodiversity, ecosystem functioning, the water cycle and development across most areas of work. Water should be a more central focus of the biodiversity agenda for the post-2010 period. It is essential to capitalise on the prominent ways in which water makes biodiversity more relevant to a broader constituency and provides one of the clearest and relevant frameworks for UN system wide efforts.

PROTECTED AREAS AS A MEANS OF MAINTAINING BIODIVERSITY: OPPORTUNITIES AND NEW CHALLENGES

Most biodiversity exists on production lands outside Protected Areas used by different economic sectors. While Protected areas cannot address the root causes of biodiversity loss nor protect biodiversity outside their boundaries, they can if effectively designed and managed nevertheless make a major contribution to biodiversity conservation in terrestrial, aquatic and marine environments. Some 12.9% of the world's land areas outside Antarctica and 6.3% of the world's territorial seas (i.e. up to 12 nautical miles) are protected– the largest deliberate decision of land use allocation in history. Protected areas contribute to the conservation of biodiversity by securing critical natural habitats, provide refugia and by helping to maintain ecosystem processes. Protected areas also secure the wellbeing of humanity itself. Protected areas provide livelihoods for nearly 1.1 billion people (UN Millennium Project 2005), are the primary source of drinking water for over a third of the world's largest cities (UNEP,2009), are a major factor in ensuring global food security through the protection of fisheries, wild crop relatives and ecosystem services (Dudley et al, 2008).

If protected areas are to be effective at conserving biodiversity, while at the same time providing an array of societal goods and services, they must be embedded in comprehensive and ecologically representative networks, and be supported by an enabling environment of effective management, appropriate policies and sustainable funding. These same preconditions form the basis of the Convention on Biological Diversity's Programme of Work on Protected Areas, which was approved in 2004. Despite progress, many of the challenges that led to the adoption of the CBD Programme of Work on Protected Areas in 2004 remain in 2010. There continue to be major gaps in the coverage and representation of the global protected area network, including, for example, marine, freshwater and temperate grassland biomes (UNEP-WCMC, 2008). These ecological gaps are highlighted even further in national-level gap assessments, where many species, ecosystems and ecoregions lack protection altogether. There continue to be major gaps in funding the world's protected areas – the current gap is estimated to be between $40 and $50 billion per year (TEEB, 2009), and continues to grow. A recent study of Peru's protected area finance, for example, found that funding was less than half of what was needed to plan and manage the protected area system (Flores, M. and G. Chan. 2008). There continue to be major gaps in management effectiveness; a recent study of nearly 7,000 assessments of protected areas from more than 100 countries found that less than a quarter were considered effectively managed (Leverington, F., M., 2008).

In addition to these challenges, protected areas are now facing a whole new set. Global and national economic crises continue to unfold, straining already tight budgets for protected areas. In a world of diminishing natural resources, poverty alleviation, not nature conservation, is the top priority for most developing countries, and protected areas are increasingly expected to provide benefits and services to offset their costs. At the turn of the century, the global climate crisis barely registered as a mainstream issue; today it is one of the drivers in economic and resource decisions, eclipsing protected areas as a global and national concern. These new pressures necessitate a whole new set of responses and approaches in planning, establishing and managing protected areas, including:

New approaches to old and emerging challenges – There is an urgent need to incorporate climate change, ecosystem services and poverty alleviation into traditional protected areas assessments and practices. For example, planners can incorporate areas important for fisheries, storm surge protection, and wild crop relatives into their ecological gap assessments, thereby increasing the transparency with which tradeoffs can be made. They can look beyond strained government budgets and identify innovative and sustainable finance mechanisms that capitalize on protected areas services, such as water, tourism, agriculture and carbon storage. They can assess not only how well biodiversity is managed within protected areas, but also how well other values are managed, such as areas important for water supplies, tourism, livelihoods and adaptation to climate change.

New economic accounting – Policy makers must increasingly consider protected areas as a strategic investment in their national economies. A recent report that summarized over 1,000 studies worldwide, for example, estimated that investments in creating and managing protected areas would yield a return on societal benefits on the order of between 25:1 and 100:1 (TEEB, 2009). Therefore, policy makers must systematically assess the full range of values and services afforded by their protected area systems.

New questions and perspectives – Protected areas are increasingly recognized as a key strategy for climate change adaptation and mitigation (Dudley, N. and S. Stolton, 2009). However, planners must consider not only how protected areas enable biodiversity to adapt to climate change; they must also consider how they enable human communities to weather the changes likely to occur under different climate change scenarios.

New scales – Traditionally, policy makers and managers have focused on individual protected area sites. However, because national and regional interconnected networks are necessary for adapting to climate change adaptation and providing ecosystem services, because sustainable finance mechanisms such as tourism typically apply to multiple protected areas, and because threats and management weaknesses are often systemic, planners will increasingly need to think at the level of protected area systems, not sites.

New partners – Managing for societal values beyond biodiversity, managing at larger scales, and integrating protected areas into national economies and sectors will require involving a whole new set of partners. These may come from sectors that have previously been wholly absent in protected area planning, finance and management. Examples include involving insurance companies to identify areas at risk from severe flooding, involving companies interested in financial investments in protected area management, involving cities in the planning, management and finance of water catchment areas within protected areas, and involving indigenous and local communities in processes that would include their lands as part of an integrated land-use planning process.

The challenges facing protected areas have not only increased, but they are now compounded by the new challenges of the coming decades. However, these challenges may also present new opportunities. If policy makers can embrace the changes required to make protected areas relevant to these new challenges, they will be able to position protected areas as an investment that will pay long-term dividends in alleviating poverty, securing food and water, sustaining local livelihoods, bolstering national economies and buffering humanity against the coming climate crisis.

CHAPTER 4
AGRICULTURE, FORESTRY AND FISHERIES

A. AGRICULTURE

THE IMPORTANCE OF BIODIVERSITY FOR AGRICULTURE

Nearly all human societies depend on some form of agriculture to sustain their livelihoods, and agriculture is one of the world`s most economically important sectors. According to the second State of the World`s Plant Genetic Resources for Food and Agriculture, (to be published in 2010 - FAO, 2009a), while there is significant regional variation, overall, agricultural production is the main source of income for half of the world`s human population and is particularly important for the poor. It is estimated that about 75% of the world's poor live in rural areas and depend to a greater or lesser extent on some form of agriculture. Livestock production alone contributes 40 percent of the global value of agricultural output and supports the livelihoods and food security of almost a billion people (FAO, 2009b).

All sub-sectors of agriculture depend on biodiversity. Many generations of selection by farmers and breeders combined with natural selection have resulted in the development and use of thousands of varieties of crops and animal breeds. There is growing recognition of the essential role this agricultural biodiversity, and biodiversity more generally, plays in meeting basic human food security and nutritional needs, and in maintaining ecosystem functions such as decomposition of organic matters, soil development and moisture retention, water infiltration, erosion control, carbon sequestration, pollination, and dispersal of seeds. Pollination alone is a globally significant ecosystem service estimated to produce several billion dollars in benefits each year.

Agricultural biodiversity will even be more important in future to provide the crop varieties and breeding stock to enable farmers and pastoralists to adapt under ever changing production conditions, and in particular, rapidly changing climatic conditions. Now for the first time since 1970, more than one billion people – about one-sixth of all of humanity – are hungry and undernourished worldwide. Enhanced investment in conserving, using and developing agricultural biodiversity is now more crucial than ever. The interrelationships among biodiversity, agriculture and food production, nutrition, human health, environmental health, social stability, culture and economic production are inextricable. Healthy and dynamic relations between wild biodiversity and managed agricultural biodiversity are necessary to ensure that this overall system continues to work, secures the necessary high levels of genetic diversity, is resilient and maintains its ability to cope with the challenges of climate change, extreme weather events, emerging diseases, shifts in population patterns and economic stresses.

THE IMPACT OF AGRICULTURE ON BIODIVERSITY AND ECOSYSTEM SERVICES

Agriculture has both positive and negative impacts on biodiversity. As noted in Chapter 1, some of the main direct drivers of biodiversity loss are land use change, invasive alien species and pollution. These are often particularly prevalent in agricultural landscapes: native grasses and shrubs and forests have been cleared and drained for agriculture production with resulting significant loss of wildlife habitat; the products of soil erosion and pesticide, fuel and other forms of chemical runoff have polluted rivers, streams, ponds and lakes, and adversely impacted aquatic species; some species used in agriculture have become invasive in some places, while agriculture itself is may be adversely impacted by other invasive species.

Conversely, agriculture landscapes may provide significant habitat for many wildlife species. Ponds established for livestock, rice paddies, irrigation and other farm water storage systems, provide aquatic habitat and water for both aquatic and terrestrial wildlife; such habitats may be very important during drought and for migratory birds. Grasslands, rangelands, crop land, and crop residues provide wildlife habitat, including refuges for endangered species. Livestock grazing of grasslands is essential in many areas in maintaining native grasslands and their associated species, and grazing prevents encroachment of shrubs and other woody plants, thereby reducing fire hazard. Appropriate agricultural practices can also mitigate climate change.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Much is already being done to try to reduce adverse impacts of agriculture on biodiversity and promote practices that benefit biodiversity and ecosystem services. Farmers are increasingly adopting techniques such as integrated pest management and using methods to prevent or reduce soil erosion and contamination of aquatic systems from chemical and livestock wastes. Efforts to reduce and prevent wildlife conflicts with farming communities are being implemented as is management of agricultural lands to contribute to wider ecosystem functions, such as the maintenance of water quality, soil moisture retention, carbon sequestration, recycling of organic matter and dispersal of seeds of threatened wild plant species.

However, there still remain serious challenges, brought about by the need to feed a growing world population, coupled with the still widespread use of unsustainable production practices and the increased scarcity of natural resources worsened by climate change. The latest estimates show that an increase of about 70% in world agricultural production will be required to meet food and nutrition demands by 2050 (FAO, 2009c). This challenge must be met through promoting production systems that are ecologically sound and sustainable and respecting the synergies and linkages between agricultural biodiversity and nutrition. Although technological progress, input use and high yielding varieties have helped to enhance agricultural production, the increasing number of undernourished people in the world shows that much is still to be done.

With land scarcity, intensification of sustainable production rather than expansion of area under production becomes the primary option to increase food production in light of global-level food crises. As the world is faced with the need to increase crop production in the context of an increasingly degraded environment, the challenge is to increase the ability to use and manage agricultural biodiversity sustainably, moving away from non-renewable inputs and intensification based on chemicals towards farming practices relying on natural biological processes and biodiversity. Intensification of sustainable crop production addresses this, through identification and use of mechanisms for valuing agricultural biodiversity and ecosystem services, in addition to sound agronomic practices (integrated crop, soil, nutrient and water-efficient management). Practices such as combining crop and livestock production can add an additional benefit and have less impact on biodiversity. For example, ruminants can consume crop residues, while animal products can provide a source of income at times outside of the harvest season, including manure which can be returned to the system as fertilizer. Alternatively, carefully managed grazing with livestock can yield a source of livelihood in areas that are unsuitable for cultivated crop production.

The linkages between agricultural biodiversity and nutrition are illustrated in a recent study prepared by the Center for Indigenous Peoples' Nutrition and Environment (CINE) and FAO (FAO and Center of Indigenous People, 2009). This study shows that, in many cases from different parts of the world, an increase in commercial food items over time results in a decrease in the quality of the diet. The study also shows the crucial role of a diversified diet based on local biodiversity and traditional food for food security, nutrition and health.

The global changes the world is facing will inevitably require attention to be paid to appropriate management of agricultural biodiversity. Initiatives will have to follow two different and balanced approaches: on the one hand the need to improve our production capacity, and on the other hand the need to conserve and manage biodiversity – at the genetic, species and ecosystem levels - so as to maintain the world's natural capital and cope with future threats.

The Global Environment Facility (GEF) is a major financier of efforts to reduce the impacts of agricultural practices on biodiversity, working through agencies such as the World Bank, UNDP, FAO, IFAD and the Regional Development Banks. This work is focused on adapting land use practices employed by agriculture at the landscape level, as well as creating market incentives for sustainable agriculture. This work is generating a body of knowledge of what is working and why, that will be instrumental in scaling up efforts to mainstream biodiversity management into the agricultural sector.

FAO, through its Commission on Genetic Resources for Food and Agriculture, provides an intergovernmental platform for sharing the best available knowledge on genetic resources for food and agriculture and undertaking global initiatives in this area. The Commission`s Multi-Year-Programme of Work includes a set of country-driven assessments leading to the publication of the first Report on the State of the World's Biodiversity for Food and Agriculture. Under the guidance of the Commission, Global Plans of Action for both plant and animal genetic resources for food and agriculture have been adopted and are being implemented at all levels to contribute to efforts to achieve food security and poverty alleviation.

At the request of countries, FAO leads and advances major global initiatives on pollinators, on soil biodiversity, and on biodiversity and nutrition, as established under the CBD. FAO has established an initiative called Globally Important Agricultural Heritage Systems (GIAHS) to provide adequate recognition to, and conservation of, traditional agriculture heritage systems - characterised by a combination of outstanding landscapes, ingenious management of land, water and biological resources, important biodiversity within- and between- species and at ecosystem level, in regions with a high level of unique agricultural biodiversity. To date, over 100 systems world-wide have been identified and the initiative supports the efforts of a growing number of countries in Africa, Asia and Latin America to protect and promote their agricultural heritage systems.

B. FORESTRY

THE IMPORTANCE OF BIODIVERSITY FOR FORESTRY

The world`s forested area is around 40 million km² or just over 30% percent of the total land area (FAO, 2010). Forests are the most important repositories for terrestrial biodiversity, and may support more than half of the world`s species. Forest also provides extremely valuable ecological services essential to human wellbeing, including regulation of local and global climate, amelioration of weather events, regulation of hydrological cycles and protection of water catchments. Forests are warehouses for a vast array of genetic resources, much of which has yet to be uncovered let alone used and developed.

At least 350 million people live inside or near forested areas[2] and more than 1.6 billion people depend on forests to varying degrees for their livelihoods in the form of income, food, fibre, fuel and grazing for livestock. Forestry is a globally important economic sector, with more than 10 million people being employed in the formal forest sector, with a growing portion employed in management of protected areas (FAO, 2010).

Access to forest biodiversity is often essential to the survival of local communities and may be of considerable economic importance. Natural resources other than timber collected from forests include foodstuffs such as nuts, fruits, mushrooms, vegetables, honey and spices, as well as a range of other products including medicines, oils, saps, resin, waxes and fibres. Bush meat provides an important source of protein and income as do aquatic resources found within forest aquatic ecosystems.

HOW FORESTRY AND RELATED ACTIVITIES AFFECT BIODIVERSITY AND ECOSYSTEM SERVICES

FAO estimates that about 13 million hectares of the world's forests have been converted to other uses or lost in the last decade (FAO, 2010). The causes of forest loss and conversion are varied. The most important factors associated with the decline of forest biological diversity are of human origin and include the conversion of forests to agricultural land, overgrazing, unmitigated shifting cultivation, unsustainable forest management practices, introduction of invasive alien plant and animal species, infrastructure development (e.g. road building, hydro-electrical development, urban sprawl), mining and oil exploitation, anthropogenic forest fires, pollution, and climate change.

As forests are degraded, so too is biodiversity. Forest degradation lowers the resilience of forest ecosystems and makes it more difficult for them to cope with changing environmental conditions. Deforestation accounts for up to 20 percent of the global greenhouse gas emissions that contribute to global warming, adversely impacts water and soil resources, contributes to species extinction and reduces food security in at least some regions of the world.

[2] Vital Forest Graphics UNEP, FAO and the United Nations Forum on Forests 2009

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Intergovernmental forums such as the United Nations Forum on Forest promote sustainable forest management by facilitating implementation of forest-related agreements and fostering a common understanding of sustainable forest management. FAO provides forums for intergovernmental discussions through its Committee on Forestry and its Regional Forestry Commissions and convenes a number of specialized technical bodies that meet regularly to focus on specific areas of forestry development and management. The Collaborative Partnership on Forests (CPF), is a voluntary arrangement among 14 international organizations and secretariats with programmes on forests, to promote the management, conservation and sustainable development of all types of forest, and to strengthen long-term political commitment to this end. To address the need to assess the state of forest resources, FAO created the Global Forest Resources Assessments (FRA), an instrument based on country reports, for the monitoring of the world's forests. A number of programmes and actions have also been started to address the need to protect forests and their biological resources. Three UN Agencies, FAO, UNDP and UNEP, have joined forces to create the UN REDD Programme, aimed at assisting countries to reduce greenhouse gas emissions from deforestation and forest degradation. Although a climate change initiative, the programme will secure major tropical and sub-tropical forest habitats. The Global Environment Facility remains the largest investor in forest biodiversity conservation initiatives and is scaling up investments in this area through GEF agencies such as the World Bank, UNDP, UNEP, FAO and the Regional Development Banks.

The United Nations system, and FAO especially, are developing the necessary knowledge base to promote and achieve sustainable forest management while agencies such as UNDP are active in building capacity for sustainable forest management and strengthening governance systems in the sector.

The contribution of agroforestry to biodiversity conservation is not properly recognized. Agroforestry systems, combining agriculture with tree conservation and cultivation, and sometimes livestock, provide high quality habitats for biodiversity conservation, avoiding fragmentation and monocultures. Agroforestry also contributes to soil conservation and fertility, and has several co-benefits, ranging from economic diversification to better pollination.

The Non-Legally Binding Instrument on all types of forests (NLBI) was adopted by the UN General Assembly at the end of 2007 and promotes sustainable forest management as a dynamic and evolving approach to maintain and enhance the biological, ecological, social and economic value of forests. In this way, it offers an integrated framework to address the interrelated challenges of forest loss and degradation, desertification and climate change, contributing actively to the conservation and sustainable use of forest biodiversity. As a complement to this, CITES provides a legally-binding regulatory scheme for international trade in listed timber species and non-timber forest products, for example bigleaf mahogany, ramin, agarwood and Brazilian rosewood, in order to ensure that they are not overexploited through such trade.

Despite significant investments and existing cooperation, progress towards sustainable forest management is still limited, and the continuing loss of forests and forest degradation in many developing countries, particularly in the tropics, poses a critical challenge. Increasing demand for food, fibre and fuel can trigger unplanned land-use changes, including large scale deforestation. There is a need to improve forest management capability, and enhance reforestation and forest rehabilitation efforts. Holistic management approaches are needed to ensure forest protection, including against fires and invasive alien species, in order to maintain or improve capacity to produce wood and non-wood products, mitigate climate change, protect soils and watersheds, safeguard wildlife habitat and conserve biodiversity.

Approximately 12% of the world's forests are designated for the conservation of biodiversity (FAO, 2010). The remaining 88% of forests nevertheless offer substantial potential for the conservation and sustainable use of biodiversity. The integration of biodiversity-related concerns, particularly in the management of tropical forest concessions, is being developed through the implementation of new national forest policies and laws but as yet remains incomplete.

A particular concern is the rapid depletion of the common as well as uncommon wildlife species in the world's major tropical rainforest regions as a consequence of the highly commercialised bushmeat trade destined for urban markets. By continually overhunting the unique rainforest fauna, not only may a number of species become extinct in the near future, but the ecological functions and services of these global biodiversity hotspots may also become severely impaired, including the forest's carbon sequestration capacities for climate change mitigation.

The programmes of UN agencies, notably FAO and UNDP on wildlife and protected area management seek to conserve and sustainably manage wild animal species and their habitats with a view to making wise use of them for income and food generation, and thereby improving the livelihoods of poor rural people.

In the field of forest genetic resources, major emphasis is being placed on sharing and transfer of information, know-how and technologies, through a wide range of tools and mechanisms, in close collaboration with national and international partners. The FAO Global Information System on Forest Genetic Resources contains information related to the conservation, enhancement and use of forest genetic resources, by species, in each country. The Commission on Genetic Resources for Food and Agriculture has requested FAO to prepare a first report on the state of forest genetic resources.

C. FISHERIES

THE IMPORTANCE OF BIODIVERSITY FOR FISHERIES

Capture fisheries and aquaculture production supplied the world with about 110 million tonnes of food fish in 2006. Fish protein comprises 15-16% of total world animal protein supply and, overall, fish provide more than 2.9 billion people with at least 15 percent of their average per capita animal protein intake (FAO, 2008a). Aquaculture continues to be the fastest growing animal food-producing sector with an average annual growth rate of 8%; it current provides around half of all fish consumded worldwide and will soon overtake capture fisheries as a source of food fish.

Of capture fisheries, about 90% comes from the oceans and seas. These catches have remained relatively stable since the mid-nineties and reached a relatively low level in 2006. The share of catches from the open ocean, the international waters outside of the fishing zones under the jurisdiction of coastal countries, has increased in recent decades and reached about 13% of all marine catches in 2006. Close to one-third of these catches were deep-water species. In 2006, for the first time, catches from inland waters exceeded 10 million tonnes, representing 7% of total fishery production, mostly in developing countries, particularly in Asia and Africa.

Fisheries and aquaculture, directly or indirectly, play an essential role in the livelihoods of millions of people around the world. In 2006, 43.5 million people were directly engaged, part time or full time, in primary production of fish, either by fishing or in aquaculture. In the last three decades, employment in the primary fisheries sector has grown faster than the world's population and employment in traditional agriculture[3].

Lakes, rivers, ponds, streams, groundwater, springs, cave waters, floodplains, as well as bogs, marshes and swamps, provide a rich supply of biodiversity that is often an important local source of food and income. The full value and roles of this resource are difficult to quantify as a total contribution to livelihoods. It is known however, that such resources are particularly important in rural areas in developing countries, and there is great need to better understand, recognize and estimate their contribution to food security and nutrition.

Aquatic ecosystems not only support the globally important fishery sector, they provide numerous ecosystem services including water supply, energy production, transport, recreation and tourism, maintenance of the hydrological balance, sediment and nutrient retention and habitat for a diverse range of fauna and flora and micro-organisms.

[3] FAO The State of World Fisheries and Aquaculture 2008

THE IMPACT OF FISHERIES OF BIODIVIERSITY AND ECOSYSTEM SERVICES

Approximately half of all monitored fish stocks are now fully exploited, producing catches close to their maximum sustainable limits with no room for further expansion. Over a quarter are overexploited, depleted, or slowly recovering. The remaining fish stocks are underexploited or moderately exploited. The large numbers of stocks that are either fully or over-exploited indicate that the maximum potential for the world's marine capture fisheries has been reached and that management measures are needed to reduce overexploitation. In particular, more attention has to be given to highly migratory species stocks that are shared between two or more administrative regions, and to stocks in the open ocean. Despite the social and economic importance of fisheries, attempts at sustainable management have been unsuccessful in many parts of the world and a global response is urgently needed (FAO, 2008b)

Human pressures on rapidly diminishing areas of inland waters resources are increasingly compromising many of the ecosystem services crucial to the wellbeing of peoples and their livelihoods. Habitat change, leading to the degradation and loss of inland water ecosystems and species, has been mainly driven by land conversion and development of infrastructure such as dams, dikes, and levees. Uncontrolled aquaculture development has led to mangrove loss in some regions. The unsustainable use of water is a particularly important driver of biodiversity loss, particularly as there are significant, and increasing, competing demands placed on water. Over-harvesting of inland waters in recreational, subsistence and commercial fisheries is also a major threat and can lead to population declines of indigenous species.

The introduction of invasive alien species is the second most important cause of decline of freshwater species after habiat loss. Exotic species have been introduced for fisheries, aquaculture or biological control purposes. Aquatic ecosystems may be affected by introduced species through predation, competition, mixing of exotic genes, habitat modification and the introduction of pathogens. On the other hand, adequately managed aquatic species introductions can improve production and economic benefit from fisheries and aquaculture.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Efforts need to be enhanced to achieve and maintain sustainable levels of harvesting from marine and inland capture fisheries. This will require improved management as well as the adoption of regulatory and institutional measures to address overfishing, overcapacity and illegal, unreported and unregulated (IUU) fishing. An ecosystem approach to fisheries is called for, to protect and conserve ecosystems while providing food, income, and livelihoods from fisheries in a sustainable manner. A combination of measures has been proposed within this framework, including banning some fishing practices, setting up marine protected areas, and regulating or constraining access rights (FAO, 2008a).

There is increasing international support for regionally and globally coordinated approaches to flag and port State controls in order to avoid the development of "flags of convenience" and "ports of convenience" and improve fisheries compliance. In this context, FAO adopted in 1993 a legally-binding Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas. It thereafter developed the Model Scheme on Port State Measures to Combat Illegal, Unreported and Unregulated Fishing (Port State Model Scheme) in 2005. The Scheme ultimately led to the adoption in 2009 of a legally-binding Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Uregulated Fishing. As a complement to FAO's set of binding and non-binding instruments aimed at fisheries management and trade, CITES provides a legally-binding regulatory scheme for international trade in listed aquatic species such as cetaceans and various species of fish, molluscs and corals, aiming to ensure that they are not overexploited through such trade.

Because of the limited potential growth of global catches of wild fish stocks, sustainable expansion and intensification of fish production through the responsible development of aquaculture should become a major objective of policy making. Adaptation measures to climate change are also necessary to build resil-ience. Mitigation measures, such as reducing carbon emissions through reduction of fishing fleet capacity, are also needed.

Recognizing the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishery and aquacutlure sectors and also taking into account the biological characteristics of the resources and their environment and the interests of consumers and other users, FAO, intergovernmental organizations, the fishing and aquaculture industry and non-governmental organizations elaborated the Code of Conduct for Responsible Fisheries. The Code describes how fisheries should be managed responsibly, and how fishing operations themselves should be conducted. It then addresses the development of aquaculture, the linking of fisheries with other coastal zone activities, and the processing and selling of the catch. The importance of countries co-operating with one another in all aspects of fisheries is also highlighted. Implementation of the Code is also underpinned by the implementation of four International Plans of Action addressing specific threats to marine biodiversity: to reduce fishing capacity and eliminate overfishing; to combat illegal fishing; to protect birds from accidental capture in longline fisheries; and to improve shark fisheries management.

FAO is formally mandated by its constitution to undertake the worldwide collection, compilation, analysis and diffusion of data and information in fisheries and aquaculture. The compilation of accurate, relevant and timely data in a standard form facilitates monitoring, comparisons and analyses of status and trends that are essential to underpin the responsible development of the world's fisheries and aquaculture sectors and the sustainable utilization of the resources.

The accidental capture in fisheries of animals such as marine mammals, sea turtles, sea birds and sharks is being addressed. FAO is promoting the use of Guidelines to Reduce Sea Turtle Mortality in Fishing Operations, which build on global efforts aimed at developing techniques that reduce sea turtle mortality due to fisheries and show that changes in fishing techniques and practices, coupled with the use of «turtle-friendly» technology, can make a difference.

FAO is facilitating the sharing of experiences of livelihoods based on traditional integrated agriculture and aquaculture, such as rice farming in many Asian communities, in which the areas flooded for rice cultivation are also home to a wide variety of fishes and other aquatic organisms, many of which are important sources of human nutrition. This rich and important diversity is usually not considered in national statistics, policies, and legal frameworks, but more recently, the value of rice-associated biodiversity for people and their livelihoods is increasingly being recognized by international fora such as the International Rice Commission (IRC) and Parties to the Ramsar Convention.

AGRICULTURE, FORESTRY AND FISHERIES IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

Successful implementation of the wealth of existing international instruments will continue to be pursued within and across the sectors to strengthen countries' efforts to conserve and sustainably use biodiversity. The movement towards sustainability in agriculture, fisheries and forestry de facto includes mainstreaming biodiversity. With support from FAO, UNDP and other organizations within the UN system, these biodiversity-dependent sectors will continue to promote and facilitate adoption and application of the ecosystem approach by farmers, foresters and fishers and associated dependent communities as well as private sector interests. This can be achieved by promoting a number of sector-specific management approaches, including sustainable agriculture, sustainable production intensification, sustainable forest management and sustainable use of aquatic resources.

Effective national planning and enabling policy and institutional frameworks are essential, as are significant public and private sector investments and full engagement of all relevant stakeholders, particularly including indigenous peoples who are often important stewards of biodiversity. Integration of scientific and traditional and local knowledge and cultural awareness are necessary to promote and facilitate changes in management of biological resources and ensure the adoption of sustainable harvesting practices. Best practices will continue to be advanced to avoid or minimize adverse impacts on biodiversity and ecosystem services from resource development and harvesting in all three sectors. In particular, greater efforts are needed to protect soil, soil biodiversity, and water and air quality. Measures will also continue to be developed and implemented to address the other main drivers of biodiversity loss i.e. to prevent habitat loss, overexploitation, the spread of invasive alien species and pollution. This will require improved efforts to reduce land use change and deforestation, more efficient use of inputs, improved management of wastes and better post harvest management in order to maintain crucial ecosystem services.

Global, regional and national forums for agriculture, forestry and fisheries will ensure continued intergovernmental discussion on achieving sustainability in each sector, and expert guidance will also continue to be development and disseminated to countries. Global assessments under the FAO Commission on Genetic Resources for Food and Agriculture on the state of genetic resources for food and agriculture and other biodiversity will provide a basis for decision making and the further preparation of sectoral Global Plans of Action. These efforts will in particular contribute to the strategic goal of improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity.

Efforts will continue to improve efficiency in order to reduce energy waste, the production of greenhouse gases and the consumption of water and other resources. This is particularly important within the agriculture and forestry sectors as 40 percent of land biomass, and thus biological carbon, is directly or indirectly managed by farmers, herders and foresters. It is in their interest to adopt management practices and production systems that combine mitigation and adaptation.

CHAPTER 5
SOCIAL SERVICES: - HEALTH, KNOWLEDGE AND CULTURE

A. HEALTH

Human health ultimately depends on ecosystem products and services (such as an adequate supply of fresh water, food and fuel) which are needed for good human health and productive livelihoods. Biodiversity loss can have significant direct human health impacts if ecosystem services are no longer adequate to meet social needs. Indirectly, changes in ecosystem services affect livelihoods, income, local migration and, on occasion, may even cause political conflict. The resultant impacts on economic and physical security, freedom, choice and social relations themselves have far-reaching effects on wellbeing and health. In addition, biological, health, and pharmacological sciences can learn much through an increased understanding of the biophysical diversity of microorganisms, flora and fauna. Loss of biodiversity may limit discovery of potential treatments for many diseases and health problems.

THE IMPORTANCE OF BIODIVERSITY FOR HUMAN HEALTH

The nutritional impact of biodiversity

Biodiversity plays a crucial role in human nutrition through its influence on world food production, as it ensures the sustainable productivity of soils and provides the genetic resources for all crops, livestock, and marine species harvested for food.

Access to a sufficiency of a nutritious variety of food is a fundamental determinant of health.

The karat banana cultivar of Micronesia's Pohnpei, which is rich in β -carotene and is well accepted by young children, has proved effective in combatting Vitamin A deficiency which has severe consequences for young children in the developing world.

At present, the health of about 1 billion people is compromised as a result of excessive consumption of food energy, while a similar number are chronically undernourished. Undernutrition is the single most important cause of global ill health, despite aggregate global food production that is sufficient to meet the needs of all. In the future, loss of productive capacity in areas with current burdens of undernutrition through adverse global scale environmental changes threatens to worsen these nutritional disparities. Nutrition and biodiversity are linked at many levels: the ecosystem, with food production as an ecosystem service; the species in the ecosystem and the genetic diversity within species. Nutritional composition between foods and among varieties/cultivars/breeds of the same food can differ dramatically, affecting micronutrient availability in the diet. Consumption of one food variety over another can make the difference between micronutrient deficiency and micronutrient adequacy. In order to guarantee that local diets are healthy, and that the average level of nutrient intake is adequate, biodiversity level has to be kept high[4].

Human efforts to enhance food production through intensified processes (irrigation, use of fertilizer), plant protection (pesticides) or the introduction of new crop varieties and cropping patterns will have an impact on global nutritional potential, but will also affect biodiversity and, as a result, human health. Habitat simplification, species loss and species succession often increase the vulnerability of communities to ill health (WHO, 2010). The impact of irrigation development on malaria, schistosomiasis and other vector-borne diseases stands as a well-documented example.

Sweet potato cultivars can differ in their carotenoid content by two orders of magnitude or more; protein content of rice varieties can range from 5 to 13%; provitamin-A carotenoid content of bananas can be less than 1 mcg/100 g in some cultivars and as high as 8,500 mcg/100 g in others.

[4] The Cross-cutting Initiative on Biodiversity for Food and Nutrition, led by FAO in collaboration with Biodiversity International, provides the decisive impetus to increase awareness on the crucial link among biodiversity, cultivar-specific nutrient composition data and food and nutrition security. FAO supports countries to generate, compile and disseminate nutrient composition and consumption data based on biodiversity. Baselines are being updated in order to reflect the knowledge that has been gained in the past decade including through the international framework and conventions such as United Nations Conference on Environment and Development, the United Nations Convention on Biological Diversity (CBD) .

Biological products and traditional medicine

Many communities rely on natural products collected from ecosystems for medicinal and cultural purposes, in addition to foods. Traditional medicine is the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness (WHO, 2008).

The use of medicinal plants is seen as the most common form of medication in traditional medicine and complementary medicine worldwide. Medicinal plants are supplied through collection from wild populations and cultivation. Even in modern times, traditional medicine continues to play an essential role in health care, especially in primary health care, and in some countries has been widely incorporated into the public health system. The World Health Organization (WHO) has estimated that traditional medicines are used by some 60% of the world's population. In Sub-Saharan Africa, medicinal plants are the backbone of the traditional health care system and play a key role in treating diseases and reducing the severity of disease symptoms, including HIV/AIDS symptoms such as nausea, and secondary illnesses such as skin infections.

While some species are cultivated commercially, wild harvest is still the main source of raw materials for medicinal use. Harvest can provide an important source of income to local people but if not managed appropriately can damage wild plant populations, threatening species, habitats and the healthcare practices dependent on them.

International actions to address concerns regarding unsustainable harvests of medicinal plants were initiated in the mid-1980s. In 1988, WHO, IUCN – The World Conservation Union and WWF convened the International Consultation on Conservation of Medicinal Plants in Chiang Mai, Thailand. Outcomes of this consultation included the 'Chiang Mai Declaration', calling for action to "Save the Plants that Save Lives", publication of the proceedings of the meeting in 1991 and, the joint WHO/IUCN/WWF Guidelines on the Conservation of Medicinal Plants', published in 1993.

THE UN'S WORK ON THE PROTECTION OF MEDICINAL PLANTS

At the request of the World Health Assembly resolutions, WHO has been collaborating with other organizations in the United Nations system (e.g. FAO, UNESCO, WIPO, UNIDO, ICSP) and nongovernmental organizations (e.g. IUCN, WWF, TRAFFIC INTERNATIONAL, WSMI, FIP) in various area related to traditional medicine, including research, protection of traditional medicinal knowledge and conservation of medicinal plants resources.

For example, WHO has developed guidelines on good agricultural and collection practices for medicinal plants. Although such practices are the first step in quality assurance, on which the safety and efficacy of herbal medicinal products directly depend, they also play an important role in protecting natural resources of medicinal plants for sustainable use. The WHO guidelines note the importance of addressing species conservation and social issues related to medicinal plant use (WHO, 2003). Other guidelines relate to contaminants and residues in herbal medicines, especially those that may impact on the safety of finished herbal medicine products (WHO, 2007). As a complement to the work undertaken by WHO and its partners, CITES provides a legally-binding regulatory scheme for international trade in listed animal and plant species which are used in traditional medicine in order to ensure that they are not overexploited through such trade.

Infectious diseases

Functioning ecosystems such as forests, wetlands, and coastal zones play a critical role in regulating infectious diseases. The great majority of infectious diseases which affect humans are transmissible between humans, other mammals, birds and reptiles. These diseases are transmitted either directly or via insect or rodent vectors, such as mosquitoes serving to transmit malaria, dengue, and filariasis from person to person. Sometimes these diseases negatively affect the host-reservoir species, but often they are asymptomatic carriers of the pathogen. The transmission of infectious diseases is highly sensitive to environmental disturbance and changes in biodiversity.

Increasingly, human activities are disturbing both the structure and function of ecosystems and altering native biodiversity which can play an important role in regulating or transmitting human disease. Such disturbances influence infectious disease dynamics by determining where and when during the year disease pathogens, vectors, and reservoir hosts such as birds or mammals, can survive and proliferate and be present or absent to transmit disease to humans.

Major environmental processes affecting biodiversity and infectious disease dynamics include deforestation, land-use change, water management (e.g. through dam construction or irrigation), uncontrolled urbanization or urban sprawl, resistance to pesticide chemicals used to control certain disease vectors, climate variability and change, human and animal migration and international travel and trade, and the accidental or intentional human introduction of pathogens (Patz *et al* 2004). Such disturbances reduce or increase the abundance of pathogens and organisms which serve as disease vectors and host-reservoirs, modify the interactions among organisms, and alter the interactions between organisms and their physical and chemical environments.

Mental health and biodiversity

Availability and access to biodiversity plays a large role in the cultural services provided by nature, such as education, recreation, spirituality, religion, inspiration and sense of place, all of which directly bear on people's mental health. Sacred species and places have great spiritual and religious importance in many parts of the world. Human engagement with other species and with nature in general has been shown to help relieve stress and mental fatigue, enhance a sense of wellbeing, tranquility, and positive outlook, and have significant restorative benefits for mental and physical health (Maller et al 2006, Ulrich *et al*, 1991).

Climate change, biodiversity and health

Biodiversity provides numerous ecosystem services that are crucial to human wellbeing at present and in the future. Climate is an integral part of ecosystem functioning and human health is impacted directly and indirectly by climate change. Direct effects on health include concerns such as increased risk of mortality from heat waves. However, the indirect effects (i.e climate-induced changes in the distribution of productive ecosystems, and the availability of food, water and energy supplies) are likely to have a greater overall impact on human health, and are often mediated by local ecological conditions. Changes in biodiversity affect the distribution of infectious diseases, nutritional status and patterns of human settlement.

Extreme climate variability, such as prolonged drought and extreme rainfall places stresses on biodiversity which can in turn have an impact on agro-ecological production systems. Ocean acidification related to levels of carbon in the atmosphere also affects marine biodiversity, and availability of marine products, and warming sea-surface temperatures directly affect the integrity of coral reefs and coastal fisheries. Biodiversity losses in these systems can lead to reduction in the quantity and quality of food available, increasing risk of malnutrition, stunted childhood growth, susceptibility to infectious diseases, food poisoning and other aliments.

BOX. 7. EXAMPLES OF BIODIVERSITY AND HUMAN HEALTH LINKAGES

Changes in agro-ecosystems alter biodiversity balances important to human health. A good example is Japanese encephalitis, a disease caused by an arbovirus spread by marsh birds, amplified by pigs, and mainly transmitted by the bite of infected mosquitoes. The increased spread of Japanese encephalitis in South and South East Asia is linked to the expansion of irrigated rice mono-cultures combined with pig husbandry. This practice created an environment which facilitated a build up of viral infected mosquitoes, and a spillover of the disease, which normally remains in pig and bird populations, to human populations (Keiser et al 2005). A second example of species spillover associated with land change is the increased transmission of Lyme disease in North America, which has been associated with forest fragmentation, urban sprawl, and altered population dynamics of deer, rodents, and ticks, increasing human contact and disease risk for humans (Schmidt & Ostfeld 2001).

The role biodiversity plays in the emergence and transmission of zoonotic diseases can be seen in examples of humans coming in close contact with wild meat or live animals carrying pathogens that humans have had little exposure to and to which they possess little natural immunity (Wolfe et al, 2000). Examples include the first transmission of SIV, the precursor of HIV to humans (Kalish et al 2005) and SARS, which emerged from a previously unknown animal corona virus to become a virus readily transmissible between humans after exploiting opportunities for mixing disease strains between wild animals in 'wet markets' in Southern China (Woo et al, 2006). The Ebola and Marburg viral hemorrhagic fevers have both decimated populations of apes in Central Africa and caused explosive and highly lethal epidemics in humans (Groseth et al 2007); the transmission from non-human primates and duikers to humans has been associated with human contact with infected carcasses (Leroy et al 2004).

B. SCIENCE AND TECHNOLOGY, EDUCATION AND CULTURAL DIVERSITY

THE IMPORTANCE OF TACKLING THE ULTIMATE DRIVERS OF CHANGE IN BIODIVERSITY

Science and technology together are recognized as one of the main drivers of change affecting ecosystem structure and functioning. The Millennium Ecosystem Assessment (MA), both in its conceptual framework as well as in its final findings (MA 2005), identifies science and technology as one of the ultimate drivers of biodiversity erosion and loss. Cultural and religious factors also act as a main driver of biodiversity loss. Science and technology, and education, can positively affect cultural and belief systems so that behaviour compatible with the conservation and sustainable and equitable use of biodiversity is adopted. They can also provide elements of policy responses to other ultimate drivers of biodiversity loss by dealing with demographic change and designing governance systems that take into account multi-stakeholder perspectives and dialogue. The current debate on the contribution of cultural diversity to the resilience of social organization can play an important role in counterbalancing the perverse effects of globalization. This debate finds a parallel in discussions and actions in the area of biological diversity. Interlinkages between biological and cultural diversity, both in terms of mutual dependence and opportunities for synergy, are increasingly recognised and have been widely discussed, for example in the context of several multilateral environmental agreements (Bridgewater *et al.* 2007).

Societies where there is an investment in science and technology, particularly science education and science policy, can positively influence the institutional arrangements for ecosystem management as well as rights over ecosystem services, thus decreasing pressures on biodiversity.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Science and technology

Science and technology can have both positive and negative impacts on biodiversity. The UNESCO World Science reports (UNESCO 2005; UNESCO 2010a) give numerous accounts of research into biodiversity and biotechnology that have assisted in the management of natural resources and led to the development of applications such as pharmaceuticals from biodiversity. The latter is an example of a potentially formidable application of science and technology to the enhancement of human health, with important economic implications. One example of

potentially adverse impacts of science and technology on biodiversity is in the water management sector, where construction of large dams and similar infrastructure can have major effects on ecosystems (World Dams Commission 2000; UNESCO 2009a).

There are many examples showing how science and technology can be at the service of biodiversity conservation and the maintenance of the ecosystem services on which human wellbeing and development depend. Some notable ones are:

- In the marine environment, natural and social science-based marine spatial planning (MSP) has demonstrated that spatial planning can be one of the most effective approaches to the conservation and sustainable use of biodiversity, as it can be used to coordinate action among the actors and stakeholders operating in a given area. Successful MSP plans and programmes have been developed and implemented to tackle the designation of marine protected areas, delimit managed fishing zones, regulate transportation, reduce pollution and mitigate cumulative impacts of various sectors on biodiversity. Experiences gained in the marine environment could be applied on land in the form of landscape-level planning (UNESCO 2007/2009b).

- With regard to the adverse effects of climate change, scientific knowledge of biodiversity's responses to climate change has led to the development of theory and action based on biogeography in support of the design and implementation of climate change adaptation plans. At the same time that biodiversity science is mainstreamed further into climate change science and policy, the integration of scientific findings on the impacts of climate change on biodiversity into biodiversity strategies and action plan is also of paramount importance if biodiversity is to adapt to change in the global climate system. Linking the biodiversity and climate change agendas, through science and technology as well as in other ways, is mandatory if appropriate measures to deal with mitigation and adaptation to climate change that are compatible with biodiversity are to be taken (IPCC 2002a; CBD 2007/2009, UNESCO 2010b).

- The taxonomic knowledge base on biodiversity is characterized by large gaps thanks to the potentially huge number of species and genes yet to be described. A new generation of taxonomic tools such as metagenomics and proteomics, assisted by biodiversity informatics, has the potential to help fill these gaps (UNESCO 2010b).

- Other sectoral examples of the application of science and technologhy for achieving the three objectives of the CBD include: agricultural systems and the promotion of local varieties; the application of scientific knowledge on species and ecosystems, as well as on genetic dispersal, to programmes related to water management; and the contribution of remote sensing operations to the gathering and compilation of relevant information and data that are subsequently made available to all concerned users (GEO, GTOS, GOOS and GCOS [5]).

Velcro, infrared, sonars and self-cleaning surfaces all are examples of biomimicry, a growing scientific field of study where modern engineers, scientists and architects are turning to biodiversity, not to extract products from nature, but for inspirational, innovative and sustainable solutions to technically challenging problems. This is vitally important to such industries such as biomedicine, nanotechnology and materials science. A striking example is the Eastgate Centre building in Zimbabwe, which is modeled on termite mounds which can maintain a stable inner temperature even when outside temperatures fluctuate between 3°C and 42°C. The building uses only 10% of the energy consumed in a conventional air-conditioned building, thus reducing energy costs and CO2 emissions. Losing biodiversity means losing the potential to find innovative solutions to future problems faced by humankind.

Moreover, in addition to scientific research and monitoring, science and technology also encompass scientific assessments. Assess–ments are an integral element of the biodiversity policy-making process, in that informed decisions can be taken only on the basis of relevant, accurate and timely scientific information. It is expected that scientific assessments will be an important part of the remit of the proposed Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES 2010).

[5] GEO= Group of Earth Observation. Available online at: http://www.earthobservations.org/
GTOS= Global terrestrial Information System. Available on line at: http://www.fao.org/gtos/
GOOS = Global Ocean Information System. Available online at: http://www.ioc-goos.org/
GCOS = Global Climate Observing System. Available online at:
http://www.wmo.int/pages/prog/gcos/index.php?name=AboutGCOS

Education

Education is essential in promoting the sustainable use of biodiversity. Education for Sustainable Development is the educational process of achieving human development through economic growth, social development, and environmental conservation that is inclusive, equitable and secure. It is possible to learn to live full lives within the capacity of the Earth to satisfy our needs – this is one of the main objectives of the UN Decade on Education for Sustainable Development (2004-2013), the plan of implementation of which encompasses a specific biodiversity element (UNESCO 2010c).

Because positive changes in the underlying drivers of biodiversity erosion and loss are thought to largely depend on effective communication and education, in 2002, the Conference of the Parties to the CBD at its sixth meeting adopted the CBD Programme of Work on Biodiversity Communication, Education and Public Awareness (CEPA). This Programme of Work was developed on the basis of a Global Initiative on CEPA, jointly developed by the CBD and UNESCO as of 1998. The Global Initiative has paved the way for mainstreaming CEPA into the work of the Convention as well as those of the other biodiversity-related Conventions. It has collected case studies on experiences, solutions and emerging and unresolved issues related to biodiversity CEPA at multiple levels. Practical approaches to CEPA have been conceived in the context of the Global Initiative and the related Programme of Work. These include toolkits for CBD National Focal Points, approaches for mainstreaming CEPA into NBSAPs and the role of global campaigns, which are exemplified by the on-going International Year of Biodiversity.

It appears, based on both expert advice in the context of the Global Initiative as well as review of the CEPA Programme of Work on behalf of the CBD governing bodies, that CEPA remains an essential element for the successful implementation of the Convention's Strategic Plan. However, the success of the Global Initiative will continue to be hampered until proper political attention and funding are devoted to CEPA, in the context of the CBD and beyond.

Undoubtedly, biodiversity communication, education and public awareness is an area in which virtually all policy sectors can contribute to meeting biodiversity targets individually and collectively.

Culture

There is a growing recognition that reduced diversity makes the world and its inhabitants increasingly vulnerable to natural and human-induced changes. The past decades have seen a rise of interest in biological and cultural dimensions of diversity, the interactions between them and their connection to social and economic development. This has resulted in increasing awareness of the "inextricable link between biological and cultural diversity" (Declaration of Bélem, 1988), and the recognition of the crucial role that it plays in sustainable development (UNESCO/UNEP 2002) and human wellbeing worldwide (UNDP 2004).

The notion of the 'inextricable link' implies not only that biological and cultural diversity are linked to a wide range of human-nature interactions, but also that they are co-evolving, interdependent and mutually reinforcing. Each culture possesses its own set of representations, knowledge and cultural practices which depend upon specific elements of biodiversity for their continued existence and expression. Cultural groups develop and maintain significant ensembles of biological diversity, with knowledge and practice as the media for their management. Indigenous peoples in particular often live in areas rich in biodiversity and have particularly strong and direct links with it. Maintaining local and indigenous traditional knowledge of nature as well as innovations and practices relevant to the safeguarding of biological diversity requires their continued intergenerational transmission, which occurs mainly through language as an effective means of communicating, classifying, and organizing information (UNESCO 2008; Butchart *et al.* 2010). IFAD-sponsored programmes are helping poor farmers and indigenous peoples contribute to the preservation of species and ecosystems. Via these programmes, IFAD has learnt that when people are encouraged to value local diversity and related knowledge, it not only improves their income and nutrition, it also bolsters their self esteem.

Different types of agricultural biodiversity are used by different people, at different times, in different places. Understanding how this use differs according to gender, age, wealth, etc. is essential for understanding the contribution of biodiversity to the livelihoods of different members of a community. Moreover, local knowledge about biodiversity differs between various groups, reflecting variations in social positions. For instance, men and women differ in terms of local knowledge and this differentiation has important implications for biodiversity management and conservation. In the end, men and women's knowledge systems complement each other in rural agricultural systems, and both are equally important.

'Biocultural diversity' has arisen as an area of trans-disciplinary research concerned with investigating the links between the world's cultural and biological diversity, focusing on, inter alia, correlations between biodiversity and linguistic diversity in specific regions and localities (Maffi 2001, 2005; Wurm, 2001). Cultural biodiversity includes traditional knowledge about the uses of natural resources. For example, knowledge of medicinal plants that grow in the area, knowledge of indigenous crops suited to the local climate and knowing which are the best grasses or trees to build a house.

The concepts of 'cultural landscapes', 'historical ecology', 'biocultural heritage' and 'cultural biodiversity' have evolved to highlight the fact that biodiversity is not only used by people but is also created by them and to link different components of diversity and everyday life (UNESCO 2008). The recreational value of biodiversity ecosystems, which play a key role locally as well as in the context of the tourism sector, has been recognized as a key cultural service to local cultures and the global economy (MA, 2005).

Several intergovernmental processes, policy instruments and international scientific assessments have made explicit reference to cultural drivers when dealing with biological diversity and vice versa (Bridgewater et al. 2007). For example, the World Intellectual Property Organization (WIPO) has a programme on traditional knowledge, traditional cultural expresssions and genetic resources that aims to empower States and indigenous and local communities to negotiate a fair share of benefits derived from the exploitation of biodiversity and associated traditional knowledge. Upon request from member states and communities, WIPO undertakes a wide range of capacity-strengthening activities to support this.

The preamble to CITES recognizes the "ever-growing value of wild fauna and flora from asthetic, scientific, cultural, recreational and economic points of view". The consumptive or non-consumptive use of wildlife in fashion, food, medicines, recreation, religion and other human activities is often based on culture. Cultural practices and associated values therefore often influence policy debates and decisions in CITES on specific issues such as traditional medicines, hunting and circuses. CITES governing bodies, however, have not yet directly considered possible synergies with UNESCO, UNEP, CBD and others in dealing with the interface between cultural diversity and biological diversity.

Even though interdisciplinary research in ethnoscience, ethnobiology, ethnoecology, and ethnolinguistics has developed a number of methods to address the linkages between biological and cultural diversity, many conceptual and methodological aspects of how to study the interactions between biological and cultural diversity as well as the concrete ways of applying the myriad expressions and outcomes of such interactions need further elucidation.

In this context, great expectations are placed on the proposed joint initiative of UNESCO and CBD in relation to the interlinkages between biological and cultural diversity that will be presented for adoption at the tenth meeting of the CBD COP in Nagoya in October 2010.

CHAPTER 6
PRODUCTION AND SERVICE: - ENERGY, INDUSTRY, TRANSPORT, TOURISM

A. ENERGY

THE NEXUS BETWEEN ENERGY AND BIODIVERSITY

The nexus between energy and biodiversity is a multifaceted one; there can be positive and negative impacts on biodiversity from the many different parts of the 'energy system'. Impacts vary, but all sources of primary and secondary energy come with advantages and drawbacks. The challenge is to reduce the drawbacks and increase the opportunities for synergies with biodiversity goals by making informed choices, managing all parts of the supply chain to end use, aiming at a mix of energy sources, and ensuring cooperation amongst all players of society.

While climate change has been identified as the most pressing environmental problem linked to energy use and has received heightened attention over the past decade, there are numerous other detrimental effects on human health and biodiversity at all physical scales linked to the extraction, transportation, processing and use of primary fuels – both fossil and biomass – and the generation and transmission of electricity. All deserve more attention. In addition, as discussed in chapter 3, climate change has negative impacts on biodiversity, which can be considered secondary or indirect impacts linked to energy.

The problem is exacerbated by the fact that biodiversity is more and more under threat, calling urgently for conservation action. At the same time, global demands for energy are growing rapidly, with estimations of the world's energy needs in 2030 being almost 60% higher than today, and projections that fossil fuels will still dominate the energy mix in the near future (IEA 2009). Although most growth in energy demand is in developing countries and countries in transition seeking a greater supply of the energy services that drive development, including lighting, cooking, heat, mechanical power, transport and communication, demand for energy is also increasing in industrialized countries (Ren21, 2009).Trade-offs don't come easily as biodiversity is the basis for ecosystem services and hence the basis for human life, while energy use lies at the core of modern industrialized society.

IMPACTS CAN BE NEGATIVE AND POSITIVE

Negative impacts on biodiversity related to energy production and transport may mean habitat conversion, degradation or fragmentation, wildlife disturbance and loss of species, air, water and soil pollution, deforestation, soil erosion and sedimentation of waterways, soil compaction, contamination from improper waste disposal or spills and degradation of ecosystem functions.

Positive impacts can occur if countries and companies go beyond mitigation of negative impacts from operations and, for example, support biodiversity conservation in and around project sites and in countries and regions where they operate, particularly where capacity and resources for protecting the environment are scarce due to pressing other social and economic needs. Measures can include managing concessions as protected areas and use of buffer zones. Some renewable energy sources may provide opportunities for biodiversity enhancement, for example through the creation of nesting sites and other critical habitat on wind and solar farms or by using conservation agriculture or similar techniques in the production of biofuels.

Impacts can be primary and secondary in nature. Primary impacts are those impacts directly related to the production and use of a given energy source, while secondary or indirect impacts are triggered by operations and may begin or extend beyond a project's life cycle.

Recently, indirect impacts of the development of biofuels on climate change, biodiversity and food security due to land use change have received great attention, with indications that negative impacts may possibly outweigh benefits from bioenergy[6] (IPSRM, 2009). Secondary impacts in the oil and gas sectors has also been extensively assessed. These are the main impacts from these sectors, and relate to population changes in an area and new or additional economic activities resulting from large infrastructure investments such as roads, ports and towns. For example, immigration and new settlements due to labour opportunities in non-developed areas have led to impacts from clearing of land for agriculture, house-building, collection of wood for construction, cooking and heating, increased demands on water, illegal logging, and extraction of non-timber forest products such as fibres, medicinal plants and wild food sources from both plants and animals.

[6] Biodiversity Working Group established by the International Petroleum Industry Environmental Conservation Association (IPIECA) and the International Association of Oil and Gas Producers (OGP), working to increase awareness of biodiversity issues, encourage good practices and develop industry guidance.

Impacts can be assessed by impact category and energy source:

USE OF LAND RESOURCES AND DEFORESTATION

Energy production, consumption and use need land. The surface mining of coal, refineries, pipelines and shipping terminals, power plants and transmission lines all occupy land. Hydropower schemes can inundate large areas and their operation can cause erosion along the riverbed both upstream and downstream of the dam site. Habitat fragmentation by large reservoirs is an additional environmental impact of hydropower schemes. Similarly, biomass grown for fuel purposes requires large areas of land and, over time, can deplete the soil of nutrients. Recent biofuel developments based on production of dedicated crops have come under scrutiny. Using waste or residues may help alleviate this problem. Advanced generation biofuels and use of degraded land may help reduce the potential impact, and the production of biofuel crops on degraded land can help recover land, but these are not a panacea either. Other renewable energy technologies are not without their own impacts. Often lauded for their distributed nature, wind farms, for example, pose aesthetic concerns and wind turbines that are installed in inappropriate locations have been associated with bird deaths, noise and visual disturbances. Finally, in many developing countries, traditional biomass use is the prevailing energy source. Combined with growing populations and increased demand for energy, the harvest of firewood – a rather inefficient way to supply energy and use of resources – is a key source for deforestation.

WATER QUANTITY AND QUALITY

Most forms of energy production and transformation also involve the use of water in some manner, with associated impacts on the system that supplies the water. Fossil fuel, thermal and nuclear power stations need large quantities of cooling water to operate, and fish and other aquatic life are often killed when power stations remove water from a lake or river or raise its temperature. Coal mines often need large amounts of water to remove impurities from the coal in coal washing operations; similarly, geothermal plants can require water to extract the energy available in dry rocks. Oil and gas production in offshore environments and the shipment of crude oil and refined products pose the risk of catastrophic spills that particularly aff–ect marine and coastal environments. The water needs of biofuel plantations can be substantial, and crop choices have to be matched with local geo-climatic conditions and good agricultural practices to be applied to ensure most efficient use of water and avoid negative impacts on water quality and availability. Conversion technologies that turn biomass into fuel also need water, and end products and refinery processes need to be adapted not to overuse it. Last but not least, by blocking a river's flow, dams prevent silt from reaching the downstream basin. By modifying the hydrological regime of a river, dams can alter local climatic conditions and disrupt ecosystems (UNEP, 2005).

ACIDIFICATION AND EUTROPHICATION

Emissions of sulphur dioxide present in coal, lignite and oil fuels, and of nitrogen oxides and their secondary reaction products result in acid deposition that can affect forests, soils and freshwater ecosystems. Acidification causes changes in the chemical composition of the soil, damages vegetation and the built environment and adversely affects terrestrial and aquatic ecosystems. Nitrogen compounds can lead to eutrophication of water bodies by disrupting the nutrient balance of the affected ecosystems. Acidification and eutrophication are also part of the concerns raised in relation to bioenergy development, linked to energy crop production and the levels of fertilizer use.

INTRODUCTION OF NON-NATIVE SPECIES

Non-native species that may become invasive are a concern raised in the context of bioenergy and in oil and gas development. Many of the plants suggested as second generation biofuel crops are on the list of potentially invasive species, and hence need to be managed under application of the precautionary principle. In the oil and gas sector, non-native species have often been introduced along pipeline corridors, either through poor selection of reseeding programmes for erosion control or reforestation, or through other human activities. Both can be mitigated relatively easily by proper planning applying good care.

HAZARDOUS WASTE

Energy production leads to large quantities of hazardous wastes. Again, the nature and

significance of the environmental insults varies from technology to technology. Soil at coal-fired power plant sites can become contaminated with various pollutants, in particular heavy metals, and take a long time to return to a natural state after the plant is closed. Similarly, oil spills on land and waste products from oil refining such as wastewater sludge and residues can all easily contaminate land if not treated responsibly. At a different temporal scale, the storage of used nuclear fuel essentially precludes any future use of land in the vicinity of the storage site.

THE ENERGY SECTOR IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

All energy sources have environmental drawbacks. A diverse energy mix has been identified by the climate community as key to successful mitigation, and is also the way to minimize impacts on biodiversity. Solid land use planning and identification of the right spots for energy development is critical. The UN system has a role in bringing scientific knowledge of policy-relevance to decision-makers in governments and industry, and to convene industry and civil society to make the business case for protecting biodiversity and share and develop good practices[7].

B. INDUSTRY

NATURAL RESOURCE INDUSTRIES

Renewable and extractive resource industries such as agri-businesses and mining companies rely directly or indirectly on natural ecosystems and their resources for the supply of raw materials or ecosystem services. Many of the natural resources required by these industries are traded through a complex web of supply chains. Raw materials used in these supply chains may be categorized as: 1) 'biological resources' such as fish, timber and other forest products; 2] ecosystem services provided by landscapes and seascapes, such as fresh water for irrigation, in most cases "for free"; and 3) non-biological resources such as non-renewable oil, gas and minerals. The harvest of biological resources, use of ecosystem services, and extraction of non-biological resources by these industries can have marked impacts on ecosystems, and are a leading cause of biodiversity loss. The key drivers leading to biodiversity loss traceable to these industries include habitat conversion, pollution, climate change, the introduction and spread of alien invasive species and general over-exploitation of biological resources.

ECOLOGICAL FOOTPRINT OF VARIOUS INDUSTRIES

Many multinational companies and the thousands of suppliers that make up the often complex product supply chains to them are heavily dependent on biodiversity and ecosystem services. This realisation has led some businesses to incorporate biodiversity conservation and risk management into their long-term business models – a concept more typically known throughout the conservation sector as 'mainstreaming' biodiversity protection. Unfortunately, such good industry practices are far from being universally applied. There is an urgent need to develop sustainable industry production practices that allow profits to be realised from renewable and non-renewable resource use, without compromising biodiversity in the process.

A 'hierarchy' of threat management measures exists, and forms the basis for regulating the activities of industry. These are, in order: prevention of damage; reduction and mitigation of actual impacts while damage is still not severe; compensation and rehabilitation in situ when damage is already severe; off-setting.

Governments have a key role to play in 'regulating the conduct' of industry in production landscapes and seascapes so as to reduce the impact of production on biodiversity. Such regulation needs to occur at the planning level and across the different stages and levels of production, and requires information, sound compliance monitoring, incentives and enforcement systems.

Consumers have an important role to play in influencing industry to improve corporate policy and conduct. The challenge remains for industry to promote low-impact operations across supply chains, greening both upstream and downstream processes. The power of both internal and external market forces associated with supply chains can be harnessed to catalyse the mainstreaming of biodiversity conservation in production practices.

[7] For example, in the area of bioenergy, FAO and UNEP, as leaders of the renewables cluster of UN Energy, have developed a 'Bioenergy Decision Support Tool' to assist decision-makers in developing robust bioenergy policy and strategy by providing guidance on key questions that need to be asked when considering trade-offs, and processes that need to be undertaken to maximise opportunities and minimize risks.

Producer countries and industries will need to consider the following issues, in developing plans and activities to address any future biodiversity targets:

- **What threat specifically does the sector, and production practice, pose to biodiversity?**

  Sometimes this is obvious, as when the development of crop plantations leads to the drainage of wetlands. However, production practices may have unintended secondary effects by encouraging other economic activities, for example when mining activities in a tropical forest serve as a catalyst for in-migration by outside communities, thus increasing human consumption pressures on the ecosystem. These impacts need to be factored into the production equation when seeking to engineer sustainability. The primary and secondary threats posed by different production practices employed by different industries are sector- and context-specific, depending for instance on the extent to which other land or water uses threaten biodiversity in the production landscape.

- **Why does the threat occur?**

  Does the threat occur because the governance framework for the industry is weak, for example when policies intended to reduce environmental impacts are not enforced? Or can the threat be traced to a failure of the market targeted by the industry to incorporate the negative environmental externalities imposed by biodiversity loss. Alternatively, the threat could be traced to a lack of know-how or market penetration of technology to mitigate impacts. These factors need to be considered when developing strategies.

- **What is this ideal scenario?**

  What change in the production practices employed by any particular industry in particular locations is desirable, in order to mitigate threats to biodiversity? Does the know-how and technology exist to achieve this? What is the attached cost?

  There are tradeoffs between biodiversity persistence and economic benefits, inherent in all production practices. The question arises as to what level of tradeoff is permissible. This is a political question, framed by societal needs and values, and the answer will change over time as societal values and needs evolve. The concept of no 'net loss' has recently become a goal in the arenas of environmental impact assessment and management. This strives to ensure that development does not have an overall negative impact on biodiversity. However, as the human population grows, and its environmental footprint grows as societies become more prosperous, the prospects for achieving this are diminishing.

- **What are the drivers for the production sector to change its behaviour, and adopt production practices that have less negative impact on biodiversity?**

  Sometimes this is clear. Many consumers have in recent years become more aware of the impacts of industry on the environment. Although awareness is mostly environmentally orientated rather than biodiversity specific, this trend is increasing the reputational risks that businesses confront in failing to avoid, reduce and mitigate their impacts on biodiversity. Not only is industry faced with losses of revenue from consumer boycotts but some industries face supply side risks, owing to the depletion of the resources they depend upon. An industry dependent on biodiversity that 'mines' its resource base beyond its regenerative capacity is likely to go out of business. This may pave the way for a more sustainable industry-led approach to using natural resources and responding to the post 2010 targets.

  However, not all industries are dependent on biodiversity. The mining industry and petroleum and natural gas industries are examples—both of which have often severe indirect impacts on biodiversity. In this case there may be other risks that need to be considered. Reputational risk is one; financial risk is another—this is the risk that the company will be saddled with litigation or incur clean-up costs, as a result of poor management. The risk of losing access to future natural resource concessions also needs to be considered (as when a company's poor past environmental management record counts against it when new resource concessions are awarded).

  Finally, the risk of losing access to finance is yet another risk that companies need to consider—especially as many major banks have subscribed to the UNEP Finance Initiative,

requiring them to increase due diligence in managing the environmental impacts of their portfolios. Assessment of these risks can improve the negotiating strength of producer countries in soliciting industry investment in avoiding and reducing impacts on biodiversity.

- **Is governance and /or market reform needed?**

Sometimes mainstreaming requires improved governance—improved enforcement of existing laws aimed at strengthening environmental management, or improved accountability for decision making within production sectors. Often a mix of governance and market reform is needed. Market reforms can include the development of certification and verification systems for goods produced in environmentally sustainable and socially responsible ways – allowing discerning consumers to exercise free choice in their consumption patterns (in favour of good environmental management practice). Ultimately the economic prospects of any business will be determined in the market place, and efforts to inform and reform product markets will be needed, in order to invoke the desired changes in production by industry.

INDUSTRY IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

Successful mainstreaming will be critical in order to meet post-2010 biodiversity targets, given that most biodiversity resides on production lands—in particular lands used for renewable and extractive natural resource production. There is no easy blueprint for mainstreaming, which is a context-specific process, and which will be shaped by the answers to the above questions. Clearly, partnerships between governments and industry will be pivotal in addressing the post-2010 biodiversity challenges. The UN Compact and the private sector programmes of UN Agencies such as UNCTAD, UNDP, UNEP and UNIDO can play an important role in building capacities in government and in industry to work together to address the loss of biodiversity and ecosystem services.

C. TOURISM

THE IMPORTANCE OF BIODIVERSITY FOR TOURISM

Biodiversity and tourism are closely inter-related. On the one hand, biodiversity is a major basic resource for tourism, a sector which, if sustainably developed and well managed, can generate important economic benefits and play a critical role in the conservation and sustainable use of biodiversity. On the other hand, unsustainable tourism can threaten biodiversity and ecosystem services. Tourism is one of the largest global economic sectors and a significant contributor to many national and local economies around the world, playing an important role in alleviating poverty, creating employment, investment and trade. In spite of the various crises that have affected tourist movements in the recent past, and especially the current economic recession, this major industry has shown resilience and it looks set to bounce back stronger than before. In several destinations domestic tourism endured the crisis better and even grew significantly, often with the support of specific government measures contributing to a partial offset of the decline in international tourism.

Tourism is a primary source of foreign exchange earnings in 46 out of 50 of the world's Least Developed Countries (LDCs) (UNWTO, 2007). With international tourist arrivals projected to reach 1.6 billion by 2020 (UNWTO,2001), tourism can play an important role in contributing to the Millennium Development Goals (MDGs), particularly the alleviation of poverty, environmental sustainability and gender equality. In line with such an approach, supporting the traditional management of agricultural biodiversity can encourage local communities to have a stron–ger involvement in the growth of the tourism sector and also act as an incentive for in-situ conservation of biodiversity. Thus, tourism and the objectives of the CBD can converge in support of the MDGs on environmental sustainability and poverty alleviation.

It is recognized that the loss of biodiversity and the degradation of ecosystems may have a negative influence on tourism, especially on nature-based and wildlife tourism, which rely on a healthy environment. Biodiversity-friendly tourism could therefore contribute,

for example: a) to maintaining the quality of ecosystems through nature-based sustainable tourism products; b) to generating income for ecosystem conservation and for local populations; c) to the security of tourists and populations by constituting protection against natural disasters (e.g. mangrove barriers); and d) to adaptation to climate change in vulnerable and exposed areas.

The quality of tourism destinations depends on the quality of the ecosystem services provided by biodiversity – the interest of the tourism sector, therefore, is to promote the conservation and sustainable management of biodiversity as its natural capital. Tourism is an excellent vehicle to use to encourage actions to conserve and sustainably use biodiversity and reduce biodiversity loss, and to spread environmental awareness and positive behavioural change for sustainable consumption and production worldwide. It also increasingly provides livelihood support for communities living in and around reserves and natural areas.

Landscapes, often modelled by a dynamic interaction between traditional agricultural practices and the natural environment, and the products of such practices such as typical foodstuffs, wines and cultural traditions, are becoming key elements for an increasing segment of the tourism industry. These elements, strongly linked to biodiversity and ecosystem services, are often instrumental for the conservation of genetic resources for food and agriculture that could otherwise be lost to industrial and commercial pressures.

International events, such as the 7th session of the UN Commission on Sustainable Development (1999), the 2002 Quebec Declaration on Ecotourism and the World Summit on Sustainable Development (2002), among others, have helped highlight the global importance of biodiversity for tourism and vice versa.

The Global Code of Ethics for Tourism (UNWTO,1999), a comprehensive set of principles whose purpose is to serve as a frame of reference for the responsible and sustainable development of tourism, includes among other provisions the protection of the natural heritage composed of ecosystems and biodiversity and the preservation of endangered species of wildlife. The Global Sustainable Tourism Criteria (GSTC), launched in 2008 contains 37 global criteria which constitute an effort to come to a common understanding of sustainable tourism. These criteria are organized around four main themes: effective sustainability planning; maximizing social and economic benefits for the local community; enhancing cultural heritage; and reducing negative impacts on the environment. This last component contains a specific subsection on conserving biodiversity, ecosystems, and landscapes, with specific considerations, aimed at protecting wildlife species and ensuring that "the business contributes to the support of biodiversity conservation, including supporting natural protected areas and areas of high biodiversity value". In addition, it contains a list of potential indicators for guiding biodiversity conservation.

Tourism can have a number of direct and indirect impacts on biodiversity, such as land use conversion, unplanned tourism development, disturbance of species, unsustainable consumption, introduction of invasive alien species, discharge and disposal of waste, pollution and greenhouse gas emissions. Tourism is both a vector and a victim of climate change. Tourism contributes to climate change, for instance through the emissions of greenhouse gases from the transportation of tourists to and from destinations, which impacts biodiversity. The majority of the C02 emissions generated by tourism arise from transportation and the sector is committed to developing effective mitigation measures, particularly considering the projected growth of the industry.

There is scope for further work on how to maximise the benefits for biodiversity of tourism. This could be done through a review of the life cycle of the tourism value chain, particularly regarding the demand and supply sides, engaging all relevant stakeholders in order to develop innovative options for improving conservation benefits. Similarly, government officials may want to undertake a review of the role and responsibilities of their national tourist administrations and the policies and tools in place in order to develop strategies that are both profitable for the tourism businesses and contribute to biodiversity conservation and poverty reduction.

TOURISM IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

As a the specialized UN agency in the field of tourism, UNWTO includes tourism's contribution to the MDGS as one of its strategic objectives and recognizes that sustainable tourism can be a powerful partner for biodiversity conservation and sustainable development and a key contributor to local economies worldwide.

The United Nations through its various bodies and agencies, including UNWTO, UNDP, UNEP and the CBD are working together sharing expertise and resources to address tourism and biodiversity challenges, enhance cooperation and raise awareness on the interrelationship between tourism and biodiversity.

D. TRANSPORT

THE IMPORTANCE OF BIODIVERSITY FOR TRANSPORT

All modes of transport may potentially have an impact on biodiversity - positive as well as negative. Transport has always been, and will continue to be, one of the main pillars of our civilization, and particularly of the modern, globalised economy. Without transport, most other sectors and services would not be able to operate. Virtually everything that we use in our daily lives, including the energy that heats our homes and offices, has at least at one point or another been transported by road, rail, air or shipping. The ability to build larger oil tankers, and the containerization of cargo transport, are two developments during the last century that have completely changed the speed with which goods are transported across the globe. This has had tremendous positive effects on economies around the world. But, as the transport sector provides faster and more efficient services, the associated risks to biodiversity also increases. Several UN agencies are directly or indirectly involved in ensuring that the transport sector can provide the services humanity relies on with a minimal risk to biodiversity.

THE IMPACT OF TRANSPORT ON BIODIVERSITY

Animal Transport

Many of the world's people are still directly dependent on biodiversity – in the form of draught, pack or riding animals – for their transport needs. For poor farmers, particularly those living in areas that lack good transport infrastructure, animal transport is a vital link to the markets where they sell their products. The use of animals to carry water and other goods lightens the workloads of many disadvantaged groups, including women. A wide range of species – horses, donkeys, mules, cattle, buffaloes, Bactrian camels, dromedaries, llamas, yaks, reindeer, even sheep and goats – provide transport services. Many livestock breeds have been specifically developed for transport or as multipurpose animals that are able to combine transport with other roles. This diversity of species and breeds means that animals can provide transport across a wide range of climatic zones, elevations and terrains.

Maritime transport

Undoubtedly, one of the more advanced forms of mechanization for transport is that related to the movement of goods by sea. While more than 90 per cent of global trade is carried by maritime means, shipping also has potentially negative effects on the environment, for example through marine pollution (through accidental or operational spills of oil, grey water, or cargo) or air pollution. The International Maritime Organization (IMO) is actively addressing all these issues through regulatory frameworks in the form of conventions and technical guidelines as well as through technical co-operation.

Perhaps the single most important direct impact of maritime transport on bioidiversity is the introduction of potentially invasive aquatic species into new environments either in ships' ballast water, or attached to ships' hulls. As a result of some introductions, entire ecosystems are being changed, with ecological, economical and health impacts as a consequence. In the USA, for example, the European Zebra Mussel *Dreissena polymorpha* has infested over 40 per cent of internal waterways (Claudi and Mackie, 1994). In Australia, New Zealand and the Mediterranean, the Asian kelp *Undaria pinnatifida* is invading new areas rapidly, displacing the native seabed communities (Russell *et al.*, 2008, Schaffelke and Hewitt, 2007). In the Black and Caspian Seas, the filter-feeding North American jellyfish Mnemiopsis leidyi has depleted native plankton stocks to such an extent that it has contributed to

the collapse of entire commercial fisheries (Zaitzev and Ozturk, 2002). The transfer and spread in ballast water of pathogens and toxic organisms such as harmful algae can also have human health impacts. The global economic impacts of invasive alien species have not been thoroughly quantified but are likely to be in the region of tens of billions of US dollars per year or more (Pimentel *et al.*, 2000, Chisholm, 2004).

Air transport

The main direct impacts on biodiversity of air transport include alteration in the type, quality and extent of habitats when building airport infrastructure, and introduction of potentially invasive alien species (AEF, 2010). In addition, air traffic brings noise and light pollution, which can have local adverse impacts on wildlife species. There is also risk of bird strike. The latter is more important as a threat to human safety than as a factor having an impact on wild bird populations, but efforts to minimise the risk of strike by controlling bird numbers around airports can have more serious consequences for bird populations. Indirectly, the contribution of air transport to greenhouse gas emissions is rapidly growing, so that air transport plays an increasing role in global climate change.

Road and rail

The construction of road and rail networks is an important driver of biodiversity loss. It leads to local habitat destruction and fragmentation, creating barriers to dispersal. Road-kill may have a significant impact on populations of wild animals, including threatened species, and disturbance from traffic may affect behaviour patterns. Its most important impact, particularly in the case of roads, is to improve access enabling other forms of human disturbance, for example from agricultural settlement, extraction of timber and hunting. If not adequately controlled these can have major adverse effects on biodiversity.

RESPONDING TO CHALLENGES AND OPPORTUNITIES

Animal Transport

Mechanization, particularly if it occurs rapidly, can threaten the survival of breeds and the locally adapted, economically and environmentally sustainable transport options that they represent. Moreover, policies and programmes for livestock development and for the management of genetic resources often overlook the significance of transport functions, with a particular tendency to disregard species such as donkeys that are important to poor people. Nonetheless, the importance of transport functions was clearly expressed in many of the country reports submitted during the preparation of The State of the World's Animal Genetic Resources for Food and Agriculture (FAO, 2007) and the importance of livestock's multiple roles, including transport, is recognized in the Global Plan of Action for Animal Genetic Resources, adopted by the international community in 2007.

Maritime transport

Through IMO, the maritime sector has been actively addressing the issues of environmental impacts from shipping for more than 60 years. The current High-level Action Plan for IMO puts great emphasis on mitigation and response to the impact on the environment caused by shipping incidents and operational pollution from ships, atmospheric pollution, and transfer of invasive species (IMO Assembly Res. 1012(26)). Contributing to the achievement of the Millennium Development Goals is also one of the main strategic directions of the organization. With the Action Plan and the Strategic Plan (Assembly Res. 1011(26)) as guidance, IMO is responding to the biodiversity-related challenges both at the regulatory level and through technical cooperation and capacity building, often in partnership with other UN entities as well as the shipping industry.

As a tangible example, IMO has been pro-actively addressing the risk of transfer of harmful aquatic organisms and pathogens through ships' ballast water and sediments since the late 1980s. Because this issue is both global and trans-boundary in scope, cross-sectoral coordination and cooperation are imperative. IMO has therefore been teaming up with other organizations, such as UNDP, GEF, UNEP (in particular through its Regional seas programme), IUCN, the International Ocean Institute (IOI), and the Global Invasive Species Programme (GISP), among others, and stands prepared to increase coordination with other organizations that share these common concerns. At the regulatory level,

IMO has responded to this challenge by developing the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) and its Marine Environment Protection Committee has initiated the development of international measures for minimizing the translocation of invasive species through bio-fouling of ships, i.e. flora or fauna attached to a ship's hull.

IMO also joined forces with GEF and UNDP to implement the Global Ballast Water Management Programme (GloBallast), with a view to helping developing countries reduce the transfer of harmful aquatic organisms and pathogens in ships' ballast water. The project focuses mainly on 5 priority sub-regions, including 14 Lead Partnering Countries and over 40 Partnering Countries from the Wider Caribbean, the Mediterranean Sea, the Red Sea and Gulf of Aden, the Pacific coast of South America, and the West Coast of Africa.

One of the critical issues in respect to marine biodiversity and the issue of marine invasive species is to increase the awareness of the extent of the problem, and the urgent need for a precautionary approach and action. IMO has therefore collaborated with the BBC and some major maritime industry partners to produce a documentary film titled Invaders from the Sea. The documentary has since proven to be one of the most important and useful awareness-raising tools available. The documentary won the gold award in the category of "Best United Nations Feature", the 2007 United Nations Documentary Film Festival. Available online at: http://www.imo.org/newsroom/mainframe.asp?topic_id=1606

Air transport

Recognizing the potential of civil aviation to transmit invasive alien species, the International Civil Aviation Orangization has adopted Assembly Resolution A35-19 committing Member States to reducing threats of potential invasive alien species and requesting ICAO to produce guidance material and standards and recommended practices to reduce risks. ICAO has conducted a worldwide survey on the problem of invasive alien species vis-à-vis international air transportation and has asked Member States to provide their best practices in combating the spread of such species via civil aviation. ICAO has also created the Bird Strike Information System which has been in operation since 1980 and at present contains information on approximately 95 000 bird strikes. This information is of great value in the development of mitigation measures for bird strikes that have minimum adverse impacts on wild bird populations.

TRANSPORT IN RELATION TO STRATEGIC PLANS AND TARGETS FOR BIODIVERSITY

With respect to maritime transport, IMO has taken various actions within the scope of the 2010 targets for biodiversity, focusing on promoting the ratification and uniform implementation of its relevant instruments. A review by the Marine Environment Protection Committee of the BWM Convention in 2009 concluded that ballast water treatment technologies were available and confirmed that sufficient ballast water management systems would be available for ships constructed in 2010 (IMO, 2009). IMO is working intensively to further catalyze the development and availability of ballast water management systems, for example through its Global Industry Alliance (GIA), which provides a forum for industry to facilitate their compliance with the Convention. At the system-wide level, IMO is also working through GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection) on several aspects related to potential impacts on biodiversity. For example, GESAMP has been mandated by IMO to evaluate the proposals for approval of ballast water management systems which make use of active substances to ensure that those systems do not pose any unacceptable risk to the environment and biodiversity. The Marine Environment Protection Committee of IMO has also initiated the development of international measures for minimizing the transfer of IAS through bio-fouling of ships.

In 1994 the OECD Environmental Policy Committee's Task Force on Transport Initiated a project on Environmentally Sustainable Transport (EST), defined as: "Transport that doesn't endanger public health or ecosystems and meets needs for access consistent with: a) use of renewable resources below their rates of regeneration and b) use of non renewable resources below the rates of development of renewable substitutes". This may provide a basis for the elaboration of future guidelines and targets relating transport to biodiversity.

CHAPTER 7
FINANCE AND TRADE

THE IMPORTANCE OF BIODIVERSITY FOR FINANCE AND TRADE

Both international trade and financial systems are inextricably linked to and dependent on biodiversity and functioning ecosystems. At the most fundamental level, trade, finance and the environment are related because economic activity is dependent on the environment for all basic inputs such as metals, minerals and soils and for the energy needed to process them (UNEP/IISD, 2005). More specifically, a significant amount of international trade is focused on biodiversity-based products, for example from fisheries and forestry, or on products and services derived from healthy ecosystems, such as agriculture, fresh water and tourism. In 2007 total world exports of agricultural products were valued at USD 876 billion, representing 6.3% of total exports, while in 2006 total world exports of fish and fish products were valued at USD 86 billion (FAO, 2008b and 2009d).

In terms of finance, the importance of biodiversity is also clear. With the current rate and scale of biodiversity loss weakening the ability of ecosystems to deliver key services, financial institutions are finding themselves increasingly exposed to greater biodiversity-related risks through companies in which they invest or which they insure. These risks may include reputational damage, liability risk, increased regulatory scrutiny, increased defaults on loans, lower investment returns, and increased insurance claims (CBD, 2010). However, with these risks also come opportunities, including opportunities for financing investments in businesses seeking to take advantage of new market opportunities for products and services that promote sustainable management of biodiversity and ecosystem services (UNEP 2007). These opportunities represent key components of a future shift to a green economy (UNEP, 2009).

THE IMPACT OF FINANCE AND TRADE ON BIODIVERSITY

Given the importance of biodiversity for both trade and finance it is not surprising that trade and finance policies and initiatives would, similarly, have a profound impact on biodiversity and the health of ecosystems.

Trade and biodiversity

Trade policies are neither inherently good nor bad for the environment. Rather, as noted in the preamble establishing the World Trade Organization, such policies may represent an economic tool to achieve, inter alia, the broader objective of sustainable development, including its three components: economic development, social justice, and environmental protection[8]. For example, governments adopted the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1973 to provide a legally-binding regulatory scheme which ensured that international trade in wild animal and plant species did not result in their overexploitation. The Convention entered into force in 1975 and celebrates its 35th year of operation in 2010. CITES is a trade-related tool aimed at preventing the overexploitation of wild animal and plant species for international trade and ensuring that such trade - and related harvesting - is sustainable, legal and traceable. How such trade tools are designed and applied by countries is of critical concern when considering the relationship between trade and the environment more generally, and trade and biodiversity more specifically.

If designed and implemented well, trade policies can have positive impacts on biodiversity and ecosystems by promoting specialization in production and therefore improving the efficiency of resource allocation. For instance, countries with abundant water resources may have a comparative advantage in producing water-intensive agricultural products, such as rice, as opposed to countries with scarce water resources. Trade liberalization helps to ensure that tariffs or other trade-distorting policies do not create perverse situations where those with relatively limited resources are encouraged to further degrade those resources. In contrast, if designed or implemented poorly, trade policies can lead to over-exploitation of natural resources, loss of wildlife habitats, degradation of ecosystem services, or even limit opportunities from sustainable trade initiatives.

As noted above, trade liberalization promotes specialization in production and also leads to changes in land-use patterns. For agriculture, this has typically led to the conversion of traditional agricultural systems, which might

[8] In the Preamble to the Marrakesh Agreement Establishing the World Trade Organization (the "WTO Agreement"), WTO Members recognize that "their relations in the field of trade and economic endeavour should be conducted with a view to raising standards of living, ensuring full employment and a large and steadily growing volume of real income and effective demand, and expanding the production of and trade in goods and services, while allowing for the optimal use of the world's resources in accordance with the objective of sustainable development, seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development".

include a diverse range of crops, to less diverse agricultural productions systems or even to monoculture. It has been estimated that by 2050 almost 40% of the land currently using low-impact forms of agriculture could be converted to intensive agricultural use (TEEB, 2008). The expansion of agricultural production, spurred in part by trade liberalization, has also led to the conversion of forests into farm lands. In the last 300 years, the global forest area has shrunk by approximately 40% with forests virtually disappearing in 25 countries and another 29 countries losing more than 90% of their forest cover (FAO, 2000 and 2005b). The resulting impact on biodiversity can be huge. Given this, the current WTO Doha negotiations focused on agricultural trade liberalization provide an excellent opportunity to "level the playing field", but they also present a risk of agricultural expansion occurring without adequate oversight and mitigation. This is particularly the case when processes driven by trade liberalization take place in a setting with insufficient domestic policies that govern the sustainable use or conservation of biodiversity, for example through land-use planning, protected areas, regulation of chemical use and pollution control, or support for sustainable agriculture.

Increasing trade has also facilitated the intentional and unintentional movement of species which may end up as invasive species in ecosystems outside their original range. Some of these species may ultimately have major impacts on biodiversity. Total annual costs from invasive alien species, including losses to crops, pastures, forests, and other environmental damage and related controls, have been estimated to be in the hundreds of billions of dollars and possibly more than USD one trillion (Pimentel *et al.*, 2001). The impact of these is discussed more fully above, under the transport section in Chapter 6.

Finance and biodiversity

The linkages between finance and finance policy and biodiversity have several dimensions, including the risks and opportunities posed by private financial institutions, public financing of projects and biodiversity protection, and the potential for establishing financial mechanisms (whether public or private) for biodiversity programmes.

Public and private financing can heavily influence company decision-making. A lack of requirements or standards associated with how this financing is used creates the risk that companies will continue to go about in a "business as usual" manner, which in the past has often meant a failure to assess biodiversity impact. For private financing, this calls for integrating biodiversity (and the wider environmental, social and governance issues) into a wide range of products and services, including loans, equity, project finance and insurance. It also calls for additional research on these issues and the wider use of extra-financial reporting (UNEP DTIE, 2009).

The UNEP Finance Initiative is currently working with the non-governmental organization, Flora & Fauna International, through a "Natural Value Initiative" to stimulate companies to integrate biodiversity issues within their business models and investors to use the information in research on environmental, social and governance issues[9]. The UNEP Finance Initiative is also working with leading insurers to improve understanding of the risks and opportunities associated with insurance and biodiversity loss and ecosystem degradation, including the insurance of forest carbon[10]. Publicly supported export credit and official aid flows can also have significant impacts on biodiversity. There is therefore a significant role for governments to integrate biodiversity considerations into Export Credit Agencies (ECAs) and Overseas Development Assistance (ODA) operations, including risk and priority assessments.

[9] For more information, see: http://www.naturalvalueinitiative.org/

[10] UNEP Finance Initiative (FI), "Insuring for Sustainability – Why and how the leaders are doing it" (2007); see also, UNEP FI "Making Forests Competitive – Exploring insurance solutions for permanence" (2008); and UNEP FI "The Global State of Sustainable Insurance – Understanding and integrating environmental, social and governance factors in insurance" (2009).

FINANCE AND TRADE IN RELATION TO STRATEGIC PLANS ANZD TARGETS FOR BIODIVERSITY

Although challenging, it is essential that trade and finance policies contribute to a world in which biodiversity and ecosystem services are sustained rather than degraded. If not, the foundation upon which trade and financial activities take place will weaken and economic and financial risks will continue to mount. Good trade and financial decision-making needs to take into account the impacts on, and opportunities arising from, biodiversity. Whether done by governments, the private sector or consumers, this sort of analysis depends on good information.

Trade and biodiversity

There are a number of issues currently being negotiated within the WTO Doha Round that, if successfully concluded, could contribute to achieving biodiversity targets. For instance, the current WTO negotiations on reducing or eliminating fisheries subsidies that contribute to overfishing is a clear example of how trade policy can be applied in a manner that contributes to biodiversity protection (WTO, 2001). It is estimated that global fisheries subsidies amount to $15-35 billion annually (Milazzo, 1998, WWF, 2001, Sumaila and Pauly, 2006). Economists and fisheries experts widely agree that many of these subsidies are a major contributor to overfishing and the current global fishing crisis (UNEP, 2008b).

A number of other WTO Doha negotiating items are also relevant to achieving biodiversity targets, including:

- the relationship between existing WTO rules and specific trade obligations in multilateral environmental agreements (MEAs);
- procedures for regular information exchange between MEA secretariats and relevant WTO committees; and
- the reduction or elimination of tariff and non-tariff barriers to environmental goods and services [11].

In addition, the WTO Doha Ministerial Declaration instructs WTO Members to pay particular attention to provisions of the Agreement on Trade-Related Aspects of Intellectual Property Rights, which has generated considerable discussion vis-à-vis CBD access and benefit-sharing provisions[12].

Further regarding intellectual property rights, WIPO's Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) is undertaking text-based negotiations with the objective of reaching agreement on a text of an international legal instrument (or instruments) which will ensure the effective protection of TK, TCEs and genetic resources. The IGC is to submit the texts of the international legal instrument (or instruments) to the WIPO General Assembly in September 2011. The Assembly would then decide on convening a Diplomatic Conference. A key feature of the work of the IGC has been and remains careful coordination and responsiveness to the work of the CBD, FAO, WTO and UNEP.

Although not currently under negotiation at the WTO, the elimination of fossil fuel subsidies may also help to contribute to meeting biodiversity objectives by reducing the production of fossil fuels. This could potentially have multiple environmental benefits for biodiversity, including reduced greenhouse gas emissions, decreased habitat conversion or destruction, as in the case of open-pit fossil fuel mining, and reduced risk of accidents, such as oil spills. The potential for eliminating fossil fuel subsidies has taken on new impetus with the recent Group of Twenty (G20) decision to phase-out inefficient fossil fuel subsidies that encourage wasteful consumption. This commitment could be used as a template for replication and extension to other subsidies with harmful effects on ecosystems and biodiversity (TEEB 2009).

[11] See WTO Doha Ministerial Declaration, para. 31. However, as noted above, the WTO negotiations, particularly the liberalization of trade in agricultural and fisheries products, also risks contributing to biodiversity loss and ecosystem degradation if there are not adequate safeguards and mitigation measures in place.

[12] For more information related to the CBD's access and benefit-sharing provisions, see: http://www.cbd.int/abs/

Trade policies that actively promote trade in environmentally-friendly goods and services can also be effective in contributing to the long-term sustainability of biodiversity. For instance, several programmes have been developed under the UNCTAD BioTrade Initiative to promote the collection, production, transformation, and commercialization of goods and services derived from native biodiversity and that are produced in a sustainable manner (UNCTAD, 2007).

Finally, and importantly, trade liberalization can be effective in contributing to economic growth and welfare improvement. This can be an important contribution to biodiversity protection in those cases where persistent poverty is contributing to biodiversity loss and ecosystem degradation.

Finance and biodiversity

The private and public sectors have an important role to play in responding to the biodiversity funding gap. A range of national and inter–national conservation finance instruments has been designed to slow, or reverse, biodiversity loss, as witnessed by the creation of the Global Environment Facility (GEF). There is also an on-going international initiative to work under the aegis of the Convention on Biological Diversity towards establishing a "green development mechanism" to enhance financing of biodiversity protection on a global scale[13].

Financing focused specifically on small communities can be a particularly effective means of addressing biodiversity loss and ecosystem degradation given that the rural poor are typically the traditional stewards of biodiversity and rely most heavily on the ecosystem services provided by biodiversity. For instance, the GEF Small Grants Programme has been active in funding conservation, sustainable use and management of biodiversity with nearly 7,000 projects amounting to just over USD 152 million in grants[14]. Micro-finance programmes can contribute to the conservation and sustainable use of biodiversity in a number of ways including, most importantly, by supporting income generation and reducing the vulnerability of the poor. Micro-finance can also support the adoption of new technologies and the creation of new enterprises that can benefit biodiversity, such as technologies and businesses associated with organic agriculture (World Bank, 2002).

In addition to direct financing, the concept of sustainable finance is gaining ground as seen by the development of voluntary principles such as the UNEP and UN Global Compact-backed Principles for Responsible Investment (now with more than 730 signatories from the investment industry representing more than USD 20 trillion in assets under management). Other activities include ongoing work by the UNEP Finance Initiative to develop Principles for Sustainable Insurance for the insurance industry, forestry investment funds, environmental liability insurance, and support to enterprises dedicated to biodiversity conservation[15].

ACTIONS BY OTHER POLICY SECTORS THAT COULD COMPLEMENT EFFORTS BY THE FINANCE AND TRADE SECTORS TO ADDRESS ADVERSE EFFECTS ON BIODIVERSITY

One of the prerequisites for ensuring that trade and finance help address the current biodiversity challenge is to ensure markets, companies and financial institutions are receiving the right price signals. A number of the world's environment ministers have come to this same conclusion and at the G8 environment meeting in Potsdam in March 2007, the environment ministers of the G8 countries together with environment ministers from five newly industrialising countries (Brazil, China, India, Mexico and South Africa) agreed to support research focusing on estimating the costs of global biodiversity loss. The Economics of Ecosystems and Biodiversity (TEEB) initiative is producing a global study on the economics of biodiversity loss with the aim of developing practical policy responses.

The TEEB initiative is attempting to overcome the fact that, unlike economic and human capital, natural capital has no dedicated system of measurement, monitoring and reporting (TEEB, 2009). Difficulties in obtaining monetary estimates of ecosystem services mean that decisions tend to be based on incomplete cost-benefit assessments. Moreover, because there is a tendency towards underestimating the value of such services, there are often few incentives to safeguard them. Given this,

[13] See http://gdm.earthmind.net

[14] See http://sgp.undp.org/

[15] The UNEP Finance Initiative will be issuing a report in 2010 that details how biodiversity mitigation tools, including offsetting, are being used within the lending business of banks, and what scope there is for improvement. Available online at: www.unepfi.org.

understanding and quantifying biodiversity and ecosystem values, and correcting price signals accordingly, is essential for providing the right incentives to economic actors so that their decisions can be made in a manner that supports the long-term sustainability of natural capital. Article 11 of the CBD calls upon States to adopt such incentive measures.

Closely linked to the issue of measurement is the issue of assessment. Article 14 of the CBD calls on States to "introduce appropriate arrangements to ensure that the environmental consequences of its programmes and policies that are likely to have significant adverse impacts on biological diversity are duly taken into account." The importance of environmental assessments has also been recognized by the WTO, which encourages the sharing of expertise and experience among its members (WTO, 2001). Assessing the impact of trade and finance policies has the potential to help safeguard biodiversity and maximize gains from trade and finance.

Perhaps the greatest value in assessments is that they can bring a wide variety of perspectives to the analysis, including those of non-trade government ministries, those with expertise in environmental and social issues, and communities that are most at risk from impacts of the policies (UNEP/IISD, 2005). A number of governments and international organizations have undertaken environmental and integrated assessments of trade and finance policies. For instance, UNEP, in collaboration with the CBD, recently launched findings and recommendations from a six-country project focused on assessing trade-related policies and biological diversity in the agricultural sector[16].

Finally, one of the most important ways in which other sectors may contribute to the mutual supportiveness of trade and biodiversity is through the establishment of official standards and trade documentation schemes. Such instruments are generally developed in the context of biodiversity to ensure that products are traded or produced in a legal and sustainable manner. As noted above, CITES was, for instance, established to ensure that international trade in specimens of listed animal and plant species does not put the survival of these species at risk. CITES accomplishes this objective by requiring that the import, export, re-export and introduction from the sea of wildlife products are authorized through a permit and certificate system. A number of UN agencies have also been effective in producing guidance documents to ensure trade does not contribute to biodiversity loss and ecosystem degradation, such as the FAO Technical Guidelines for Responsible Fish Trade (FAO, 2009e).

Voluntary standards may have a complementary role to play. For instance, two of the most recognizable standards related to biodiversity are those of the Forest Stewardship Council (FSC), which promotes sustainable forestry by accrediting certifiers that audit wood producers, and the Marine Stewardship Council (MSC), which certifies fisheries based on sustainable management practices and fish stocks[17].

Although it is difficult to identify specific objectives common to all aspects of the trade and finance sectors, there are a number of areas where biodiversity targets could help to ensure trade and finance operate more efficiently and contribute to the overarching objective of sustainable development.

In general, the trade and finance sectors will operate more efficiently when price and market distortions are eliminated. As noted above, for trade and finance policies to contribute to the sustainable use and conservation of biodiversity, it is critical that the relevant actors receive the right price signals. Getting the prices right from a biodiversity perspective requires an understanding and internalization of the costs and benefits associated with the use of bio–diversity and ecosystems. This, in turn, requires up-to-date scientific assessments and valuation studies of biodiversity and ecosystem impact. Moreover, these assessments have the potential to trigger increased financing for biodiversity.

The removal of subsidies that contribute to biodiversity loss and ecosystem degradation, such as fishery and fossil fuel subsidies, also represents an important target given that it has the dual benefit of eliminating market distortions and contributing to environmental sustainability. Promoting the development of standards and labels could also contribute to increasing trade and financing for goods whose production has a positive, or at least no overall negative, impact on biodiversity.

[16] The project was undertaken in response to CBD Conference of Parties Decision VI/5 (http://www.cbd.int/decision/cop/?id=7179); see also: http://www.unep.ch/etb/initiatives/BiodivCountryProjects.php.

[17] For more information see the Forest Stewardship Council website (http://www.fsc.org/) and the Marine Stewardship Council website (http://www.msc.org/).

CHAPTER 8
HUMANITARIAN AFFAIRS AND PEACE KEEPING

The impact of war on biodiversity is high and may include habitat destruction, pollution and loss of species. Impacts may last for a long time and may sometimes be irreversible. Some may only manifest themselves during the post conflict phase. In spite of difficult conditions and alongside efforts to help relieve human suffering, some organizations such as UNHCR strive to undertake measures for environmental conservation. Such efforts by humanitarian organizations and intervention forces are important because of the role these organizations play in supporting the rebuilding of countries after conflicts have ended. The primary focus is on aspects of the environment that are of immediate importance to human health and wellbeing, such as water pollution, soil erosion and deforestation, but growing attention is also being paid to the impacts of loss of biodiversity and ecosystem services and the benefits that conservation, restoration and sustainable use of biodiversity can offer.

Options available to organizations for contributing to addressing biodiversity loss depend on the characteristics of the conflict and the particular role of each organization:

Humanitarian Organizations

Humanitarian organizations increasingly have developed guidelines which take into account the environmental conservation of areas where their projects take place. The further use and elaboration of such guidelines, and the enhanced integration of biodiversity considerations in the strategic policy and operational packages of relief agencies, can help reduce biodiversity loss. For example, environmentally sensitive areas can be mapped so as to avoid such areas when selecting camp locations for refugees or internally displaced people. Intensive cooperation with environmental and nature conservation organizations may improve the work of these organizations. Awareness raising and engagement of stakeholders such as refugees and host communities may help ensure the sustainability of such efforts.

Intervention Forces and the Government

For intervention forces, guidelines for military and peacekeeping activities may help prevent or limit activities which may cause biodiversity loss. Awareness and sensitivity of environmental issues and the importance of biodiversity should be created among staff. When considering whether to intervene in an area or not, threats that armed conflicts may pose to biodiversity hotspots can be added to the list of considerations that should be taken into account. In the management and direction of flows of refugees and internally displaced people, prior consideration of the environmental sensitivity of potential hosting areas can help minimize long-term costs to affected societies[18].

Other Development Organizations

Development organizations can maintain or increase their support to grass root organizations that remain active in difficult areas, as a means towards maintaining support regarding the ownership of natural resources – including biodiversity. Better coordination between humanitarian agencies and conservation groups could help mitigate damage and suffering from conflicts and could also help safeguard ecosystems that will provide resources needed to support recovery after conflicts.

Challenges to partnerships include divergent institutional expectations, lack of involvement and buy-in by staff in some cases, and matching and balancing technical knowledge and degree of involvement of humanitarian actors with that of conservation actors. Recognition that close cooperation between political, military, conservation and humanitarian organizations is needed is now a key feature of international approaches to conflict resolution. However, this recognition is not always translated into practice. Today, humanitarian agencies are often left alone to work in areas considered too dangerous to deploy other non-humanitarian actors, thus making biodiversity protection in high-risk areas difficult.

[18] For more information see: www.unhcr.org/environment

Non-Governmental Organizations

NGOs often find themselves caught between different parties involved in a conflict, and they are often left to find their own way in fulfilling their tasks. This often requires a neutral attitude towards various parties, and where possible, creation of awareness among and even cooperation with them. They should also seek diverse financial support. This is a general rule for NGOs but in times of conflict may become crucial as donors are often inclined to withdraw their financial support when a conflict breaks out. It is advisable to establish good working relations with the different opposing parties to encourage the protection and sustainable use of biodiversity.

For international nature conservation organizations, it is crucial to establish cooperation with local groups as the latter are often well informed about the exact circumstances prevailing in a conflict area, and may well continue their activities during any conflict. Flexible funding arrangements and structural agreements with humanitarian partners may facilitate such cooperation. Cross-boarder cooperation is also important, especially during regional conflicts, as it can promote dialogue and contribute to peace building.

To address the specific needs of peacekeeping field missions, the United Nations Department of Peacekeeping Operations (UN DPKO) with the technical assistance of UNEP has developed various documents including " The Environmental Guidelines for Peacekeeping Operations". The guidelines are designed to assist UN staff, in both military and civilian contexts, in addressing environmental issues that arise from their operations (UN DPKO, 2008).

REFERENCES SECTION II

Alcamo, *et al*., (2003) Ecosystems and Wellbeing: A Framework for Assessment. Island Press.

Allison, *et al*., (2009) The Copenhagen Diagnosis - Updating the World on the Latest Climate Science. A handbook of science updates that supplements the IPCC AR4 released in 2007.
http://www.copenhagendiagnosis.org/

Alkemade, *et al*., (2009) R. GLOBIO3: a framework to investigate options for reducing global terrestrial biodiversity loss, Ecosystems 12 (2009), pp. 374–390.

Ana Benítez-López, Rob Alkemade, and Pita A. Verweij (2010) "The impacts of roads and other infrastructure on mammal and bird populations: A meta-analysis". Biological Conservation, Vol. 143, No. 6. pp. 1307-1316.

AEF (2010) Aviation Environmental Federation. What are an airport impacts?.
http://www.aef.org.uk/uploads/PlanningGuide2.pdf

Bakkes and Bosch (2008) Background Report of the OECD Environmental Outlook to 2030. Overview, Details, and Methodology of Model-Based Analysis. Netherlands Environmental Assessment Agency Report 500113001.

Bridgewater, *et al*., (2007) Biological diversity and cultural diversity: The heritage of nature and culture through the looking glass of multilateral agreements. International Journal of Heritage Studies 13: 405-419.

Burlingame, B., Charrondiere, R. and Mouille, B. (2009) Food composition is fundamental to the cross-cutting initiative on biodiversity for food and nutrition. Journal of Food Composition and Analysis (FAO-INFOODS), 22 (5), 361-365.

Burtchart *et al*.,(2010) Global Biodiversity: Indicators of Recent Declines. Science.
www.sciencemag.org/cgi/content/full/science.1187512/DC1

CBD Communication, Education and Public Awareness.
http://www.cbd.int/cepa/

CBD (2007a) Reports of the CBD Group of Experts on Biodiversity and Climate Change.

CBD (2007b) Inland Waters Biodiversity - What's the Problem?.
http://www.cbd.int/waters/problem/

CBD (2009) Reports of the CBD Group of Experts on Biodiversity and Climate Change

CBD (2010) The business case for biodiversity.
http://www.cbd.int/doc/meetings/biodiv/b2010-03/official/b2010-03-01-unep-background-note-en.pdf

CBD Technical Series No. 41 (2009) Connecting Biodiversity and Climate Change Mitigation and Adaptation – Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change (AHTEG).

Chisholm, J.R.M. (2004) Initial Scoping Study to Review the Global Economic Impacts of Aquatic Bio-Invasions. Unpublished report, GEF-UNDP-IMO GloBallast Project.

Claudi, R., and Mackie, G.L. (1994) Practical manual for zebra mussel monitoring and control. Lewis Publishers, Ann Arbor.

Corvalan, C. Hales, S and McMichael, A (co-chairs) (2005) Health Synthesis Report of the Millennium Ecosystem Assessment. World Health Organization: Geneva

Declaration of Bélem.
http://www.ethnobiology.net/global_coalition/declaration.php

FAO (2000) Global Forest Resources Assessment 2000.
http://www.fao.org/forestry/fra/2000/report/en/

FAO (2005a) Miombo woodlands and HIV/AIDS interactions: Malawi Country Report.
http://www.fao.org/docrep/008/j6038e/j6038e00.htm

FAO (2005b) Global Forest Resource Assessment 2005.
http://www.fao.org/docrep/008/a0400e/a0400e00.htm

FAO (2007) The State of the World's Animal Genetic Resources for Food and Agriculture, edited by B. Rischkowsky & D. Pilling. Rome.
http://www.fao.org/docrep/010/a1250e/a1250e00.htm

FAO (2008a) The State of World Fisheries and Aquaculture.
ftp://ftp.fao.org/docrep/fao/011/i0250e/i0250e.pdf

FAO (2008b) Fishery Fact Sheets. The international fish trade and world fisheries.
http://www.fao.org/fishery/factsheets/en

FAO (2009a) Second Report on the State of the World`s Plant Genetic Resources.
Available draft document online at:
ftp://ftp.fao.org/docrep/fao/meeting/017/ak528e.pdf

FAO (2009b) The State of Food and Agriculture Livestock in the balance.
http://www.fao.org/docrep/012/i0680e/i0680e00.htm

FAO (2009c) Strategic Framework 2010-2019, FAO Conference document.
ftp://ftp.fao.org/docrep/fao/meeting/017/k5864e01.pdf

FAO (2009d) Statistical Yearbook 2009, Tables C.1 and C.2.

FAO (2009e) Responsible fish trade, FAO Technical Guidelines for Responsible Fisheries, No. 11
ftp://ftp.fao.org/docrep/fao/011/i0590e/i0590e00.pdf.

FAO and Centre for Indigenous Peoples' Nutrition and Environment CINE (2009) Indigenous Peoples' food systems: the many dimensions of culture, diversity and environment for nutrition and health - McGill University, Canada.
http://www.fao.org/docrep/012/i0370e/i0370e00.htm

FAO (2010) Global Forest Resource Assessment (FRA).
http://www.fao.org/forestry/fra/fra2010/en/

FAO and the United Nations Forum on Forests (2009) Vital Forest Graphics UNEP.

Field, C.B. *et al*., (2007) North America. Climate Change: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, 617-652.

GCOS (2010) Global Climate Observing System.
http://www.wmo.ch/pages/prog/gcos/index.php

GEO (2010) Global Terrestrial Observing System.
http://www.fao.org/gtos/

GOOS (2010) Global Ocean Observing System.
http://www.ioc-goos.org/

GTOS (2010) Global terrestrial Information System.
http://www.fao.org/gtos/

Groseth A, Feldmann H and Strong JE (2007) The ecology of Ebola virus Trends Microbiology August 13; Epub 2007 Aug 15. Review.

GSTC (2008) Global Sustainable Tourism Criteria.
http://www.sustainabletourismcriteria.org/index.php?option=com_content&task=view&id=13&Itemid=47

Haines-Young, R (2009) Land Use and Biodiversity Relationships, Land Use Policy. 26(1): S178-S186.

IEA (2009) World Energy Outlook, 2009.
http://www.worldenergyoutlook.org/docs/weo2009/WEO2009_es_english.pdf

IMO (2009) Report of the Marine Environment Protection Committee on its fifty-ninth session.

IPBES (2010) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. **Available** www.ipbes.net

IPCC AR4 (2007) Fourth Assessment Report.
http://www.ipcc.ch/ipccreports/ar4-wg1.htm

IPCC (2002a) Climate Change and Biodiversity. IPCC Technical Report V. IPCC, Geneva.

IPCC (2002b) Climate Change and Biodiversity.
http://www.ipcc.ch/pdf/technical-papers/climate-changes-biodiversity-en.pdf

IPCC (2008) Technical report on climate change and water.
http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf

IPSRM (2009) Towards Sustainable Use of Resources: Assessing Biofuels. UN Energy, 'Sustainable Bioenergy: A Framework for Decision-Makers, 2007.

IUCN (2009) Red List report.
http://data.iucn.org/dbtw-wpd/edocs/RL-2009-001.pdf

Kalish ML., *et al.*,(2005) Central African hunters exposed to simian immunodeficiency virus.
http://www.cdc.gov/ncidod/EID/vol11no12/05-0394.htm

Keiser J., *et al.*, (2005) Effect of irrigated rice agriculture on Japanese encephalitis, including challenges and opportunities for integrated vector management Acta Tropica Vol 95: 1, 40-57.

Leroy EM., *et al.*, (2004) Multiple Ebola virus transmission events and rapid decline of central African wildlife. Science. Jan 16;303(5656):387-90.

MA (2005) Millennium Ecosystem Assessment.
http://www.millenniumassessment.org/en/index.aspx

MA (2005b) Ecosystems and Human Wellbeing. Health Synthesis.
http://www.who.int/globalchange/ecosystems/ecosysbegin.pdf.

Maffi , L., (2001) On Biocultural Diversity: Linking Language, Knowledge and the Environment. Smithsonian Institution Press., Washington & London, 2001.

Maffi, L., (2005) Linguistic, Cultural, and Biological Diversity. Annual Review of Anthropology 34: 599-617.

Magrin, G., *et al.*, (2007) Latin America. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, 581-615.

Maller C, M., *et al.*, (2006) Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. Health Promotion International 21(1):45-54.

Melillo J and Sala O. (2002) Ecosystem services. In: Biodiversity: Its Importance to Human Health. Interim Executive Summary (Chivian E, ed). Boston, MA:Center for Health and the Global Environment, Harvard Medical School, 15-20.

Milazzo M., (1998) Subsidies in world fisheries: a re-examination. World Bank Technical Paper No. 406. Washington: World Bank.

MA (2005) Millennium Ecosystem Assessment: Status and Trends. Island Press.
http://www.millenniumassessment.org/en/index.aspx

OECD (2009) Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation.
http://www.oecd.org/document/40/0,3343,en_2649_34421_42580264_1_1_1_1,00.html.

Parry., *et al.*, (2007) Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, IPCC 4 AR.

Patz J, P., *et al.*, (2004) Unhealthy Landscapes: Policy Recommendations on Land Use Change and Infectious Disease Emergence Environmental Health Perspectives 112(10): 1092–1098.

Pimentel, D., *et al.*, (2000) Environmental and Economic Costs of Nonindigenous Species in the United States. Bioscience, 50(1): 53-56.

Pimentel, D., *et al.*, (2001) Economic and environmental threats of alien plant, animal, and microbe invasions. Agriculture, Ecosystems and Environment 84 (2001) 1–20.

R. Sumaila and D. Pauly (2006) Catching More Bait: A Bottom-Up Re-Estimation of Global Fisheries Subsidies. U. Brit. Columbia Fisheries Centre.

Ren21 (2009) Global Status Report. Available online at: http://www.ren21.net/pdf/RE_GSR_2009_Update.pdf

Russell, L.K., *et al.*, (2008) The expanding range of Undaria pinnatifida in southern New Zealand: distribution, dispersal mechanisms and the invasion of wave-exposed environments. Biological Invasions 10:103-115.

sCBD and MNP (2007) Cross-roads of Life on Earth—Exploring Means to Meet the 2010 Biodiversity Target. Solution-oriented Scenarios for Global Biodiversity Outlook 2. Technical Series No. 31, Secretariat of the Convention on Biological Diversity, Montreal (2007) pp. 90.

Schaffelke, B., and Hewitt, C.L. (2007) Impacts of introduced seaweeds. Botanica Marina 50:397-417.

Schmidt KA and Ostfeld RS. (2001) Biodiversity and the dilution effect in disease ecology. Ecology; 82:609–619.

Steffen, *et al.*, (2009) Assessing the Vulnerability of Australia's Biodiversity to Climate Change – Summary for policymakers.

TEEB (2008) The Economics of Ecosystems and Biodiversity: An Interim Report", p. 9.

TEEB (2009) The Economics of Ecosystems and Biodiversity for Policy Makers. Chapter 6 "Reforming Subsidies".
http://www.teebweb.org/ForPolicymakers/tabid/1019/language/en-US/Default.aspx.

Third United Nations World Water Development Report (2009): Water in a Changing World. UNESCO Publishing, Paris and Earthscan, London.

Ulrich RS., *et al.*, (1991) Stress recovery during exposure to Natural and Urban environments. J Environmental Psychology 11, 201-230.

UN (2008) Millennium Development Goals.
http://www.un.org/millenniumgoals/

UNCTAD (2007) UNCTAD BioTrade Initiative BioTrade Principles and Criteria.
http://www.unctad.org/en/docs/ditcted20074_en.pdf.

UNDP (2004) Human Development Report 2004: Cultural Liberty in Today's Diverse World. Available online at: http://un.by/en/undp/news/belarus/15-07-04.html

UN DPKO (2008) United Nations Peacekeeping Operations. Principles and Guidelines.
http://pbpu.unlb.org/pbps/Library/Capstone_Doctrine_ENG.pdf

UNEP (2005) UNEP Governing Council. Background papers for the ministerial-level consultations on energy and environment for development, chemicals management as well as tourism and the environment. Nairobi, Kenia.

UNEP (2007) Global Environmental Outlook 4. Environment for Development, United Nations Environmental Programme, Nairobi, Kenya.

UNEP (2008a) In Dead Water – Merging of climate change with pollution, over-harvest, and infestations in the world's fishing grounds (C. Nellemann, S. Hain, and J. Alder, Eds), United Nations Environment Programme, GRID-Arendal.
http://www.unep.org/pdf/InDeadWater_LR.pdf

UNEP (2008b) Fisheries Subsidies: A Critical Issue for Trade and Sustainable Development at the WTO - An Introductory Guide.
http://www.unep.ch/etb/areas/pdf/UNEP-ETB%20Brochure%20on%20Fisheries%20Subsidies_May2008.pdf

UNEP (2009) A Global Green New Deal Policy Brief.
http://www.unep.org/pdf/A_Global_Green_New_Deal_Policy_Brief.pdf.

UNEP/IISD (2005) Environment and Trade: A Handbook, Second Edition.
http://www.unep.ch/etb/areas/pdf/envirotrade_handbook_2005.pdf

UNEP DTIE (2009) Business biodiversity efforts in key industry sectors: A background note.
http://www.cbd.int/doc/meetings/biodiv/b2010-03/official/b2010-03-01-unep-background-note-en.pdf

UNEP Finance Initiative (2007) CEO Briefing. Biodiversity and Ecosystem Services: Bloom or Bust?.

UNESCO (2005) World Science Report.
http://www.iocd.org/PDF/unesco_sci_report05.pdf

UNESCO (2007) Marine spatial planning: A step-by-step approach toward ecosystem-based management. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC manual and Guides no. 53, Paris.

UNESCO (2008) Workshop on Interlinkages between Cultural and Biological Diversity.
http://unesdoc.unesco.org/images/0015/001592/159255e.pdf

UNESCO (2009a) The Third World Water Development Report.
http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Water_in_a_Changing_World.pdf

UNESCO (2009b) Visions for a Sea Change. Report of the First International Workshop on Marine Spatial Planning. Intergovernmental Oceanographic Commission and Man and the Biosphere Programme. IOC Manual and Guides no. 48, Paris.

UNESCO (2010a) World Science Report.
http://www.unesco.org/science/psd/publications/science_report2010.shtml

UNESCO (2010b) Declaration and Recommendations of the UNESCO International Year of Biodiversity Science Policy Conference.
www.unesco.org/en/biodiversity

UNESCO (2010b) IYB Travelling Exhibition.
http://www.unesco.org/mab/doc/iyb/exhibition/Panel04-3.pdf.

UNESCO (2010c) Decade on Education for Sustainable Development.
http://www.unesco.org/en/esd/

UNESCO/UNEP (2002) High-level Round Table on Cultural Diversity and Biodiversity for Sustainable Development, World Summit on Sustainable Development.

UNFCCC (2007) The Nairobi Work Programme on Impacts, Vulnerability and Adapting to Climate Change. http://unfccc.int/files/adaptation/sbsta_agenda_item_adaptation/application/pdf/nwp_brochure.pdf

UNFCCC (2010a) Cooperation with International Organizations. http://unfccc.int/cooperation_and_support/cooperation_with_international_organizations/items/2533.php

UNFCCC (2010b) REDD Web Platform on Reducing Emissions from Deforestation in Developing Countries http://unfccc.int/methods_science/redd/items/4531.php

UNFCC (2010c) FCCC/CP/2010/2, Work undertaken by the Conference of the Parties at its fifteenth session on the basis of the report of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention.

UN World Economic and Social Survey (2009) Promoting Development, Saving the Planet. http://www.un.org/esa/policy/wess/wess2009files/wess09/wess2009.pdf

UNWTO (1999) Global Code of Ethics for Tourism. http://www.unwto.org/ethics/index.php

UNWTO (2001) Tourism 2020 Vision, Madrid. http://www.unwto.org/facts/eng/vision.htm

UNWTO (2007) Compendium of tourism statistics. http://pub.unwto.org/epages/Store.sf/?ObjectPath=/Shops/Infoshop/Products/1433/SubProducts/1433-1

WCC3 (2009) World Climate Conference 3, Geneva Switzerland, September 2009. http://www.wmo.int/wcc3/page_en.php

WHO (2003) Guidelines on good agricultural and collection practices. http://whqlibdoc.who.int/publications/2003/9241546271.pdf

WHO (2004) Guidelines for good agricultural and collection practices (GACP) for medicinal plants, World Health Organization, Geneva.

WHO (2005) Report from Global survey, World Health Organization on "National policy and regulation of herbal medicines".

WHO (2007) Guidelines for assessing quatliy of herbal medicines with reference to contaminants and residues, World Heatlh Organization, Geneva.

WHO (2009) Report "Interregional workshop on the use of traditional medicine in primary health care", Ulannbaatar, Mongolia, 23-26 August 2007, World Health Organization, Geneva.

WHO (2008) Fact sheet N°134 on Traditional medicine. http://www.who.int/mediacentre/factsheets/fs134/en/

WHO (2010) Climate change and human health. http://www.who.int/globalchange/ecosystems/biodiversity/en/index.html

WHO (2005) Traditional Medicine Strategy. http://apps.who.int/medicinedocs/en/d/Js2297e/

WHO (2009) Protecting health from climate change, connecting science, policy and people. http://whqlibdoc.who.int/publications/2009/9789241598880_eng.pdf

WHO/IUCN/WWF (1993) Guidelines on the Conservation of Medicinal Plants. http://apps.who.int/medicinedocs/documents/s7150e/s7150e.pdf

Wolfe ND., *et al.*, (2000) Deforestation, hunting and the ecology of microbial emergence. Global Change Hum Health. 2000;1:10–25.

Woo, P. CY., *et al.*, (2006) Infectious diseases emerging from Chinese wet-markets: zoonotic origins of severe respiratory viral infections. Current Opinion in Infectious Diseases: Vol 19: 5 - p 401-407

World Bank (2002) Microfinance as a Tool to Protect Biodiversity Hotspots.
http://www.microfinancegateway.org/gm/document-1.9.24286/27.pdf.

World Bank (2009) World Development Report 2010. Focus B - Biodiversity and ecosystem services in a changing climate (pp. 124-131)
http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/Focus-B.pdf

World Dams Commission (2000) Earthscan, London and Sterling.

WTO (2001) Doha Ministerial Declaration, para. 28.
http://www.worldtradelaw.net/doha/mindec.pdf

WTO/UNEP (2009) Report Leaders' statement at the Pittsburgh summit, 24 and 25 September 2009, preamble, para. 27. For an analysis of how the WTO rule relate to energy-related subsidies, see Trade and Climate Change:, pp. 115-117

Wurm, S. A. (ed.). Atlas of the World's Languages in Danger of Disappearing. UNESCO Publishing, Paris, 2001.

WWF (2001) Hard Facts, Hidden Problems: A Review of Current Data on Fishing Subsidies.

WWF (2010) Sue Stolton, Nigel Dudley, Vital Sites. "The contribution of protected areas to human health", A research report by WWF and Equilibrium Research.

Wurm, S. A. (2001) Atlas of the World's Languages in Danger of Disappearing. UNESCO Publishing, Paris.
http://www.unesco.org/culture/ich/index.php?lg=EN&pg=00136

Zaitzev, Y. and Ozturk, B. (2002) Exotic Species in the Aegean, Marmara, Black, Azov and Caspian Seas. Turkish

SECTION III.

CHAPTER 9
STRENGTHENING THE SCIENCE-POLICY INTERFACE

Understanding the interactions between society and biodiversity requires data, expertise and knowledge from many walks of life. With its broad technical expertise base, and tradition of collaboration with a wide range of partners, the UN system is well placed to contribute to this. Efforts to keep the biodiversity agenda under review are, however, not confined to the technical level alone.

The science and policy communities need to keep themselves mutually informed and this dialogue can be helped through a well-structured science-policy interface. Two new intergovernmental initiatives are currently under development which consider ways of strengthening this interface. Through the first, the UN General Assembly is considering the modalities of establishing a regular process for global reporting on and assessment of the state of the marine environment, including socio-economic aspects. These deliberations are based on recommendation from an intergovernmental and expert-driven process jointly managed by UNEP and UNESCO/IOC in cooperation with FAO and WMO. The second process has involved intergovernmental and multi-stakeholder consideration of the possible establishment of an intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES). In June 2010, following three intergovernmental and multi-stakeholder meetings concerning the form and function of a potential IPBES, with the "Busan Outcome" governments have giving the green light to its future establishment. It is anticipated that in many ways the independent platform will mirror the Intergovernmental Panel on Climate Change (IPCC) which has assisted in catalyzing world-wide understanding and governmental action on global warming. It is intended that both new bodies and processes will help to ensure the more effective use of scientific and technical knowledge in the development and implementation of policy at all levels.

Some of the key elements necessary to strengthen the science-policy interface with respect to biodiversity and ecosystem services are addressed below, along with mention of the role the UN system is playing in facilitating these processes. To this must be added the essential role that the UN also plays in building the capacity of others to carry out these tasks.

A. ACQUISITION OF BIODIVERSITY INFORMATION: - research, modeling, monitoring and observations

The acquisition of environmental knowledge and information is done through research, monitoring and observation. In addition, modelling of environmental change, especially climate change, and the development of scenarios have become increasingly important tools both in developing understanding and supporting decision-making processes. A high proportion of the world's capacity to acquire, store and analyse environmental information is found in national public institutions, and the UN system is involved in the management of programmes, frameworks and systems that facilitate national cooperation in this area. In addition, a number of UN entities are themselves involved in environmental research and modelling.

Advances in remote sensing and geographical information systems have led to the evolution of global observing systems. UNESCO, WMO, UNEP and FAO, in partnership with ICSU, have established the Global Climate Observing System (GCOS) coordinated by WMO, the Global Ocean Observing System (GOOS) coordinated by UNESCO/IOC, and the Global Terrestrial Observing system (GTOS) coordinated by FAO. Increasingly the overall coordination and architectural development of such systems takes place under the auspices of the Group on Earth Observations (GEO)[19] and its efforts in establishing a Global Earth Observation System of Systems (GEOSS) (see Chapter 5). This system now has a biodiversity component – the GEO Biodiversity Observation Network – which may serve as a hub for further enhanced cooperation amongst key players within the UN system and outside it.

[19] The Group on Earth Observations is an intergovernmental mechanism established to develop a 10-year implementation plan for building a coordinated, comprehensive and sustained Global Earth Observation System of Systems (GEOSS). The focus of the Group is on advancing the GEOSS concept across nine social benefit areas, developing the architecture and data policy required for GEOSS, further developing the science underpinning GEOSS, promoting sustained interactions with users of Earth observations and ensuring that global capacity to produce and use Earth observations is developed.

B. BIODIVERSITY ASSESSMENTS

Assessments analyse data and information stemming from research, modelling, monitoring and observations. They range in scope and in process from environmental impact assessments of concrete projects or policies to state of the biodiversity reports used at national and sub-national levels (UNEP, 2009). At the international level a whole host of assessments has evolved over the last two decades. Much attention has been given to the design and governance structure of these processes to ensure scientific independence and credibility on one hand, and policy legitimacy and relevance on the other. The UN system has been at the forefront in developing these processes (UNEP, 2009).

The Global Environment Facility (GEF) has played a key role in funding many of the global environmental assessments. They include the Global Biodiversity Assessment (GBA) led by UNEP, and the Millennium Ecosystem Assessment (MA) which was prepared under the auspices of UNEP through a broad partnership including CBD, CITES, FAO, UNCCD, UNDP, UNESCO, UNDP, World Bank and WHO. The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) co-sponsored by FAO, GEF, UNDP, UNEP, UNESCO, World Bank and WHO was an intergovernmental process with a multi-stakeholder bureau. Both it and the Millennium Ecosystem Assessment included regional and sub-global assessment components.

Other well-established thematic assessment processes include the CBD's Global Biodiversity Outlook, the Global Forest Resource Assessment and State of the World's Fisheries and Aquaculture of FAO, and the World Water Development Report by UNESCO on behalf of the multi-partner UN World Water Assessment Programme.

A number of development assessments are also regularly produced by the UN system, including the Human Development Report by UNDP, the World Development Report by the World Bank, and various publications on economic and social affairs by DESA. These reports contain information on the social and economic aspects of sustainable development which it is critical to understand in order to address biodiversity loss.

The biodiversity assessment landscape is crowded, so it is essential that further cooperation within the UN system complements exisiting and planned intergovernmental assessment processes, and that UN entities actively seek ways to increase coherence between different assessment processes and outputs so as to ensure effective use of resources and consistent messages.

C. INFORMATION EXCHANGE AND KNOWLEDGE MANAGEMENT

In recent decades the world has witnessed developments in information and communication technologies that have revolutionised the exchange of information. These developments have facilitated the growth of national and regional environmental information networks and systems, for example in Australia[20], Brazil[21], India[22], Africa[23], the Americas[24] and the EU[25].

Networks make it possible to bridge scales, cover multiple themes, facilitate harmonisation of data and help aggregation and disaggregation of data. The UN Statistics Division works on gathering environmental data, and a number of other UN organizations are involved in gathering nationally reported data and information on environmental, social and economic issues. The development of environmental and sustainable development indicators has been on the agenda of several entities including the CBD, DESA, FAO and UNEP.

Web-based information platforms of up to date, coherent and quality assured priority data and information, indicators, early warning and alert services draw information from information networks, research, monitoring

[20] Environmental Resources Information Network (ERIN), see http://www.deh.gov.au/erin/index.html

[21] Sistema Nacional de Informação sobre o Meio Ambiente (SINIMA), see http://www2.ibama.gov.br/~cnia/sinima.htm

[22] Environmental Information System (ENVIS), see http://www.envfor.nic.in/envis/envis.html

[23] The Africa Environment Information Network (AEIN), see http://www.eeaa.gov.eg/english/main/aein.asp

[24] Inter-American Biodiversity Information Network (IABIN), see http://www.iabin.net/

[25] The European Environmental Information and Observation Network (EIONET), see http://www.eionet.europa.eu/

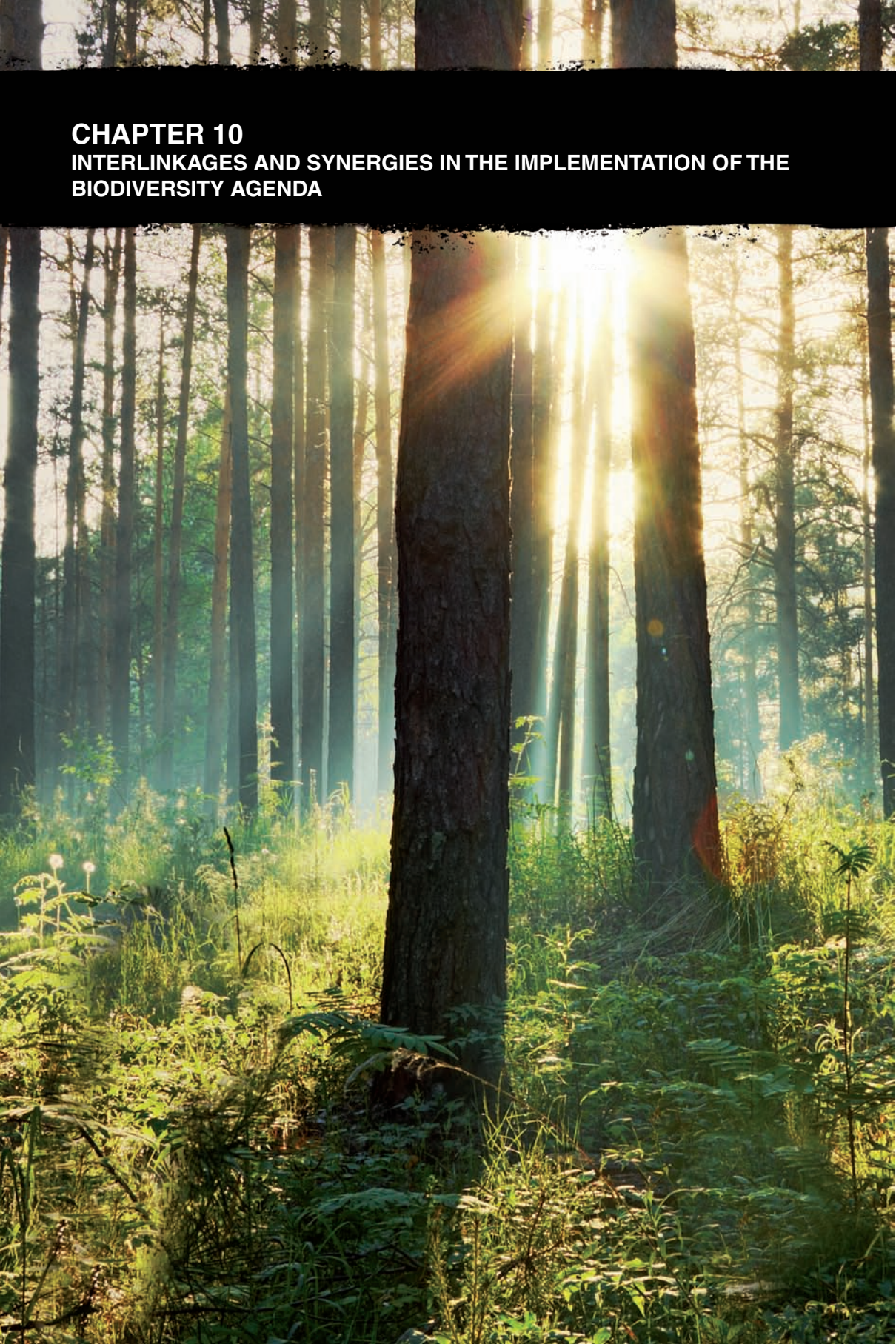
and observations. One example is the work by UNESCO IOC on the establishment of a tsunami early warning system. Another recent example is the decision in the high level declaration by the third World Climate Conference to develop with the support of WMO a Global Framework for Climate Services based on networking and the development of information systems and user interfaces (WCC3, 2009).

Biodiversity information exchange is an area where the UN system could potentially play a stronger role, building on the experience of the UNEP World Conservation Monitoring Centre and others in developing data partnerships associated with bringing together data and information from multiple sources and facilitating collaboration amongst key stakeholders. At the same time other UN bodies, such as the MEAs, are increasingly finding ways to share information and knowledge to mutual benefit, and this too could be actively built upon.

D. SCIENTIFIC AND TECHNICAL ADVICE

Many of the environmental scientific and technical advisory bodies in the UN system are intergovernmental. Several multilateral environmental agreements including the three Rio conventions and a number of other biodiversity-related conventions have prominent intergovernmental scientific and technical advisory bodies or processes. These bodies consider assessment findings, commission studies, operate networks and advise their parent bodies. The UN system can contribute to their work, but they are ultimately answerable to the member states of the agreement in question.

CHAPTER 10
INTERLINKAGES AND SYNERGIES IN THE IMPLEMENTATION OF THE BIODIVERSITY AGENDA



There are various conventions dedicated to biodiversity-related matters, including the Ramsar Convention on Wetlands (1971), the World Heritage Convention (1972), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1973), the Convention on Migratory Species (CMS, 1979), the Convention on Biological Diversity (CBD, 1992) and the International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA, 2001). In addition, the UN Framework Convention on Climate Change (UNFCCC) and the UN Convention to Combat Desertification (UNCCD) also address biodiversity issues. Further, many if not all UN agencies have activities which directly or indirectly relate to biodiversity. Yet while convention secretariats and UN agencies do engage in a consultative manner, both formally and informally, recommendations have surfaced over the years calling for a formal context in which to attempt greater cooperation and synergy between their operations at national levels. Various programmes have arisen from this call, both at the global and national levels. As post-2010 targets are devised and, it is hoped, the levels of effort and investment in conservation and sustainable use of biodiversity are greatly increased, creative, effective and efficient synergy is needed more than ever.

Moving towards a "one UN" approach at the national level may offer the opportunity to put this into practice. In addition, experts participating in a recent Nordic symposium on "Synergies in the biodiversity cluster" (Helsinki, 8-9 April 2010)[26] considered the merits of establishing an ad hoc joint working group of governments (similar to one established in the chemical and waste cluster of conventions) to lead efforts aimed at improving interlinkages and synergies related to biodiversity.

A. CURRENT GLOBAL LEVEL SYNERGIES

Together with various UN bodies and specialized agencies, the secretariats of all the multilateral environmental agreements (MEAs) are members of the Environment Management Group, which is chaired by the Executive Director of UNEP and serves as the coordination body on environmental issues for the UN system. On a number of occasions, UNEP has used its convening power to bring together representatives of MEA secretariats to discuss common administrative and substantive issues. Several meetings have been organized on the subject of harmonized reporting and information or knowledge management as well as cooperation with the World Trade Organization. In 2007 the Executive Director of UNEP established an MEA Management Team, comprising the executive heads of all UNEP-administered MEAs.

In order to enhance coherence and cooperation in implementation, a Liaison Group of Biodiversity-related Conventions (BLG) was established in 2004. The BLG currently comprises the secretariats of CBD, CMS, CITES, the International Treaty on Plant Genetic Resources for Food and Agriculture, the Ramsar Convention on Wetlands and the World Heritage Convention. Its main purpose is coordination and synergy among Secretariats, but it has also given birth to a complementary coordination mechanism among the Conventions' scientific advisory bodies (through meetings of the Chairs of Scientific Advisory Bodies, CSAB). As a member of the Joint Liaison Group of Rio Conventions (JLG), which brings together CBD, UNCCD and UNFCCC, the CBD is able to facilitate the exchange of information between the JLG and the BLG. Other coordination mechanisms involving biodiversity-related conventions focus on specific thematic areas: the Collaborative Partnership on Forests, the Global Partnership on Plant Conservation, the Inter-agency Liaison Group on Invasive Alien Species (IAS) and the Green Customs Initiative.

In order to provide a formal basis for cooperation between the conventions, various memoranda of understanding and joint work plans have been agreed by convention secretariats. Provision is usually made for these agreements to be periodically reviewed and a few have been revised, following such a review. Each convention secretariat regularly invites other secretariats to key meetings of its convention bodies or parties. The agendas for meetings of MEA governing bodies typically contain an item on cooperation with other conventions, under which interventions are made by observer conventions often highlighting specific areas of joint activity. Side events are also organized by host and observer conventions, which draw attention to issues of common interest.

[26] See report of the CSAB: http://www.cbd.int/doc/meetings/csab/csab-03/official/csab-03-03-en.doc

Convention secretariats frequently consult each other on administrative or legal issues which arise. They also exchange information or experience, both formally and informally, on shared substantive issues. In the past, convention secretariats seconded staff amongst themselves. More recently, the CBD secretariat has been requesting assistance for Parties' deliberations during meetings, for example, on climate change-related issues. Secretariats have also been entering into arrangements whereby they can share staff or consultants (e.g. the CBD liaison officer located in the CMS secretariat and the CITES-CMS coordination consultant).

While coordination among secretariats has gradually improved over the years a recent analysis carried out by the Ramsar Convention for the third meeting of Chairs of Scientific Advisory Bodies (CSAB-3)[27] suggests ample opportunity for additional joint activities, retrospective harmonization or interpretation of guidance, joint reporting and proactive collaboration leading for example to the joint development of guidance. A number of themes have already been identified that lend themselves for the proactive design of joint projects/programmes.

B. NATIONAL LEVEL SYNERGIES – LESSONS LEARNED AND OPPORTUNITIES

Perhaps the best means for strengthening coherence among the conventions, however, is national level coordination, cooperation and coherence. Sometimes the same person or office has responsibility for many or all biodiversity-related conventions, but frequently participants in the respective instruments sit in different offices and sometimes different organizations and ministries (e.g. agriculture, forestry, environment, natural resources, sustainable development, tourism, trade).

A representative for one instrument may not have the mandate or technical competence to deal with other instruments, which makes it difficult or even impossible for them to follow and represent their countries' interests in several intergovernmental processes.

Coordination among national focal points is therefore critical and this has been achieved in some countries through overarching biodiversity policies and legislation, cooperative memoranda of understanding, informal or formal consultations, joint planning or projects and institutional mechanisms such as issue-based, biodiversity or MEA committees. Biodiversity units in regional bodies (e.g. the European Commission, the Commission on Environmental Cooperation in North America and the ASEAN Centre for Biodiversity) have also made a contribution to coordination efforts. Recently, there have been government-led initiatives in the ASEAN and Oceanian regions to reduce the reporting burden under various MEAs and this has provided a basis for better coordination at both national and international levels[28]. Additionally, UNEP has conducted pilot projects on harmonized reporting for various biodiversity-related conventions in selected countries. A current UNEP/GEF project tests approaches to integrated reporting to the three Rio Conventions in Least Developed Countries and Small Island Development States[29].

The nature and effectiveness of national level coordination in all countries is not fully known but there is a general sense that such coordination is seriously lacking, as indicated by many National Capacity Self Assessments undertaken in developing countries. Indeed, responsible ministries may be actively competing with each other for broader man–dates and more human or financial resources. Efforts are underway in the BLG to develop a guidance manual for enhancing cooperation among national focal points, recognizing that it may not be useful or appropriate to propose a 'one-size-fits-all' approach. In addition, a number of issues offer the opportunity for enhanced cooperation between national focal points, ministries and agencies in charge of MEAs. This includes, among others, Reducing Emissions from Deforestation in Developing Countries (REDD); sustainable use of water, affecting all MEAs and in particular the CBD, Ramsar Convention and UNCCD; and conservation and sustainable use of dryland biodiversity, relevant in particular for the CBD, UNCCD and UNFCCC but also the other biodiversity-related conventions. Global efforts between the MEAs on these issues might provide frameworks and guidance for cooperation at the national level.

[27] See report of the CSAB: http://www.cbd.int/doc/meetings/csab/csab-03/official/csab-03-03-en.doc

[28] See report of the CSAB: http://www.cbd.int/doc/meetings/csab/csab-03/official/csab-03-03-en.doc

[29] See report of the CSAB: http://www.cbd.int/doc/meetings/csab/csab-03/official/csab-03-03-en.doc

BOX. 9. LESSONS LEARNED FROM WORK ON HARMONIZATION OF REPORTING

In 2001-2004, UNEP conducted pilot projects in developing countries to test approaches to streamlined and harmonized national reporting. The results were discussed at a workshop in Haasrode, Belgium, in 2004, while in 2009, the UNEP World Conservation Monitoring Centre, in collaboration with the secretariats of biodiversity-related MEAs, issued a paper on preconditions for harmonized reporting. Significant work was also undertaken by an Issue Management Group of the EMG.

The key lessons for the national level can be summarized as follows:

• **National reporting to MEAs should be seen as a tool supporting national implementation**, providing an overview of implementation, demonstrating compliance and identifying priorities for further work.

• **Coordination and cooperation between national focal points to MEAs**, in a form suited to national circumstances, can lead to increased efficiency in resource use and in reporting outputs.

• **Coordination between institutions collecting and managing data and information required for national reporting to MEAs** can reduce the reporting burden for national focal points and help improve access to and availability of information for reporting and national implementation.

C. NEW IMPETUS FOR CHANGE – A UN COMMITMENT

The development of post-2010 biodiversity targets presents a much-needed opportunity for a fresh start in reinvigorating and streamlining implementation of the biodiversity agenda at global, regional and national levels. The "one UN" approach is well-positioned to play an important part in this.

More work needs to be done to strengthen national level coordination. This might best be achieved by supporting responsible ministries in the development and implementation of joint work plans. Implementation and reporting burdens to countries should be reduced. More regional bodies might consider coordinating their efforts related to biodiversity. At the global level, convention secretariats and UN agencies should where appropriate and if part of their mandates, focus on the issuance of joint policy statements (e.g. biodiversity and Rio+20), the promotion of coherent decision-making by governing bodies and the undertaking of joint activities such as projects related to knowledge management, reduction of the reporting burden and coordinated capacity building.

CHAPTER 11
OPPORTUNITIES FOR INTEGRATING BIODIVERSITY TARGETS INTO NATIONAL DEVELOPMENT COOPERATION

A. NEWLY DEVELOPING AGENDAS AND PRIORITIES

As set out in previous chapters, it is clear that there are new emerging issues revolving around biodiversity conservation and management, as well as old issues that are in need of new approaches. This means that much new knowledge needs to be incorporated into biodiversity action on the ground, while research and learning continue. The world needs to move beyond "business as usual" and embrace the following:

- New approaches to old and emerging challenges
- New economic accounting
- New questions and perspectives
- New scales
- New partners and partnership arrangements

B. THE DEVELOPMENT COOPERATION CONTEXT: HOW WILL BIODIVERSITY BECOME A PRIORITY ON THE AGENDA?

Development cooperation will be critical if developing countries are to make major headway in implementing the Convention on Biological Diversity and in meeting any new post-2010 targets. Halting the loss of biodiversity will require cooperation between countries as well as effective cooperation at national level of state institutions, civil society and the private sector. Both global and national strategies for biodiversity management will need to be reinforced to reverse the current trend of accelerating biodiversity loss.

The scale of cooperation needed to achieve this is unprecedented given the added challenges posed by climate change, which by compounding other threats to biodiversity is likely to amplify biodiversity loss (see Chapter 4). The UN system has a pivotal role to play in building the capacity of developing countries to meet these challenges. However, it must also review its own way of operating to ensure streamlined and effective action. In the biodiversity context it is clear that the important issues are often still perceived to "belong to selected specialist UN organizations", whilst the work set out in the previous chapters clearly indicates that a great variety of sectors affecting almost every aspect of life are dependent on healthy, biodiverse ecosystems and the services they provide.

The key to meeting biodiversity targets is implementation of pertinent actions at both local and national levels. The loss of biodiversity and ecosystem services is a global problem, yet responsibility for actions to prevent biodiversity loss lies with sovereign nation states. At the country level, there is a need for biodiversity management to become more firmly embedded in national development policies.

Most developing countries lack the capacity and funding to address biodiversity problems on their own, given their numerous other pressing social and economic development priorities. It is essential that the intricate links between biodiversity, sustainable development, poverty reduction and the long-term achievement of the MDGs are fully understood and incorporated into development frameworks.

The Paris Declaration and Accra Agenda for Action called for the harmonisation of development cooperation, to build the capacities of developing countries to achieve sustainable development. The Paris Declaration more fully empowers developing countries to drive their own development agenda. Thus, it is more important than ever to position UN assistance at the national level in order to ensure that post-2010 biodiversity targets are addressed appropriately. Bilateral donors and multilateral agencies will need to be responsive to country priorities and empower them to address the interlinked agendas of development, poverty reduction, environment and biodiversity management.

C. SETTING NATIONAL AGENDAS

Key aspects of the post-2010 biodiversity agenda are: i) country leadership in setting biodiversity management priorities and targets guided by the global state of play on biodiversity management; ii) scaling-up country level responses in addressing national priorities and targets for biodiversity management, and addressing the likely economic trade-offs through integrated approaches to development that take social and economic needs and biodiversity management objectives into account; iii) increased responsibility by the private sector in preventing and mitigating biodiversity loss attributable to company operations; and iv) multilateral and bilateral development assistance.

Instruments developed through multilateral processes, such as National Biodiversity Strategies and Action Plans (NBSAPs), serve as critical entry points for focussed development cooperation support. The current preparations for the new strategic plan of the CBD reconfirm the critical role of NBSAPs as key instruments for outlining country level plans, actions and investment priorities for the management of biodiversity. Some 160 countries have so far prepared NBSAPs. However, NBSAPs need to be better integrated into national development and economic sector plans, and into considerations relating to climate change adaptation and mitigation. NBSAPs also need to more clearly and effectively address national obligations under biodiversity-related conventions other than the CBD (e.g. Ramsar, WHC, CITES, CMS and IPGRFA) as well as sectoral processes (e.g. agriculture, forestry and fisheries). Further development of NBSAPs, and other national strategies and plans, needs to involve all stakeholders more effectively, particularly indigenous peoples who are important stewards of biodiversity but who are also often marginalised in decision-making processes.

Effective mainstreaming of biodiversity concerns and targets into such development plans may be an alternative or additional way of addressing biodiversity conservation needs. There is an urgent need to factor biodiversity management objectives into the decision-making processes of major economic sectors and concomitant national budget processes. The threat of climate change offers the opportunity for developing a new outlook on development, recognizing the role that sound biodiversity management can play in managing adverse impacts relating to climate change, or supplying ecosystem services such as shoreline protection that can buffer the effects of climate change on vulnerable communities.

Development partners have registered a commitment to support the efforts undertaken by developing countries to incorporate environmental considerations into development and monitor progress in turning policy into action. One avenue identified for doing this is to integrate biodiversity management into Poverty Reduction Strategy Papers (PRSPs) and PRSP implementation, as a key development-planning instrument. Some important questions need to be answered in reforming PRSPs to address biodiversity loss, including: 1) What benefits do the poor obtain from biodiversity? Who benefits, and when do the benefits occur? 2) What are the impacts and costs of biodiversity loss on the poor, now and in the future? 3) What options exist for the poor to obtain benefits from ecosystems in a sustainable way? 4) What alternatives exist to consumptive uses of natural resources? What are the attached costs? It is clear though that biodiversity issues to be addressed must be incorporated into economic and development planning at levels other than poverty reduction and PRSPs.

In the context of multilateral cooperation, the UN Development Assistance Framework (UNDAF) is an important cooperation instrument, negotiated between country representatives and the UN. The UNDAF can be one support mechanism to attain integrated priorities of the NBSAP or the post-2010 targets, prioritised in country development planning. UNDAF is already providing a fruitful foundation for united action as One-UN, and guides UN country support over a multi-year period. All UN organizations together with the Government of the host country plan the content of the UNDAF, which is the "work plan" for the UN system for the time period specified. A UNDAF which successfully addresses and mainstreams biodiversity concerns and any post-2010 biodiversity targets will lay a strong foundation for meaningful support for their attainment.

Although currently only just implemented in some pilot countries, the joint delivery effort of the UN system should be furthered in partnership arrangements in all countries, even if improvements are still needed. In the past, it has been difficult for the UN system to harmonize the actions of all its instruments and organs, both at national delivery level and at global support level. The "one UN" effort aims to reform this.

D. KEY AREAS OF COLLABORATION

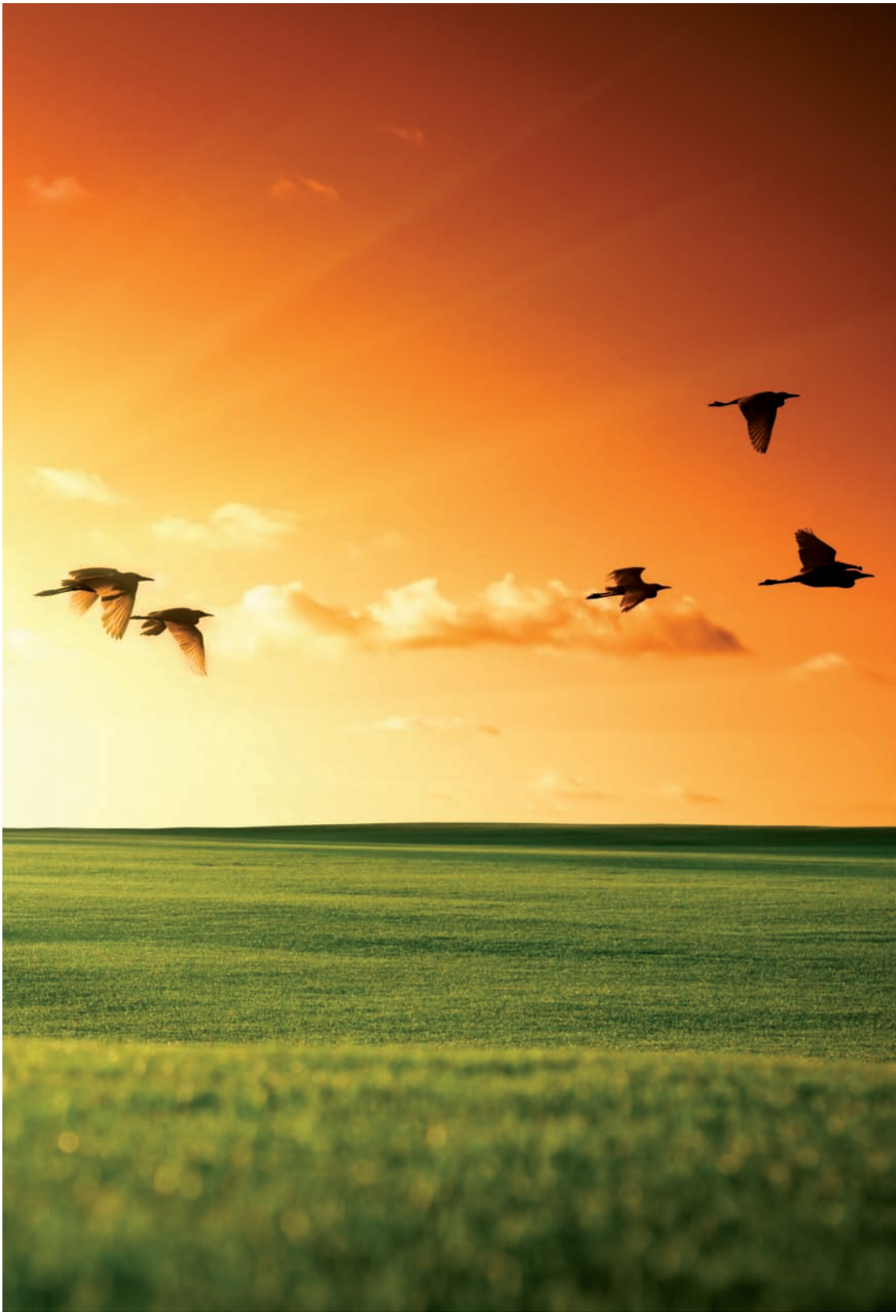
Capacity support and institutional strengthening for national action: The UN has a pivotal role to play in building the capacity of developing countries to combat biodiversity loss. Institutions require both functional and technical capacities. Four core issues can be identified that should be addressed to develop these respective capacities effectively: 1) Institutional arrangements:

the overall framework for decision-making on environmental management issues; 2) Accountability: the two-way relationship between public authorities and those who are affected by their decisions and actions; 3) Environmental leadership: the ability to influence change and motivate action; and 4) Knowledge and information, which are crucial to ensuring that environmental management initiatives have a sound scientific and technical basis and are adapted to country conditions. Development cooperation needs to be structured so as to address each of these issues, with a view towards strengthening capacity.

Tools for monitoring and evaluation, research and assessments: The UN system can offer science-based input to countries as they pursue biodiversity targets and integrate them into the global context. Agencies can offer assistance in generating, monitoring, maintaining and sharing important data on biodiversity and ecosystem services. This includes assistance in developing indicators and agreed measures of biodiversity change. Entities such as the GEO-Biodiversity Observation Network, GBIF and the Biodiversity Indicators Partnership are well placed to offer this support.

Tools for calculating biodiversity value and identifying trade-offs at the national level: Sound development policies can offer positive outcomes on multiple social, economic and environmental fronts, although invariably involving some degree of trade-off. Choices are largely a question of balance, but trade-offs must be addressed in ways that maintain or restore the capacity of ecosystems to sustain biodiversity and continue to provide critical ecosystem services to humans. The value of these ecosystem services needs to be factored into the cost-benefit calculus used to make development choices. Governments need to take the lead in developing national development strategies with specific biodiversity targets and actions for maintaining and restoring ecosystem services worked into them. The TEEB for policy-makers report demonstrates the value of ecosystems and biodiversity to the economy, to society and to individuals. It underlines the urgency of action, as well as the benefits and opportunities that will arise as a result of taking such action. The report shows that the cost of sustaining biodiversity and ecosystem services is lower than the cost of allowing biodiversity and ecosystem services to dwindle. It demonstrates how we can take into account the value of ecosystems and biodiversity in policy decisions and identify and support solutions, new instruments, and wider use of existing tool in order to pioneer a way forward. In so doing, the report addresses the needs of policy-makers and those in the policy-making process.

Identifying and addressing trade-offs requires systematic application of decision-support tools such as Strategic Environmental Assessment (SEA). SEA is an anticipatory and proactive process of analysing and weighing the environmental opportunities and constraints attached to policies, programmes and projects before they are approved and implemented. A growing number of countries including Ghana, South Africa and Vietnam are applying SEA to improve their policies, plans and programmes. Donor countries in Europe and elsewhere have agreed to support its systematic use, which should help in the identification of trade-offs.



E. FINANCIAL RESOURCES

New financial resources will be needed to manage biodiversity so that ecosystem services can continue to be maintained. A key priority for many countries is to obtain adequate environmental finance in order to meet their biodiversity management needs. Investment in biodiversity conservation can render long-term development and poverty reduction benefits, and as such should become part of national development planning and budget processes determining development finance.

Several observations may be drawn regarding the financing picture for biodiversity management:

- Overall public investment in biodiversity management relative to funding needs is very poor;
- Funding is rarely dictated by sound business planning, establishing the costs and revenue earning potential of biodiversity management;
- Allocation and employment of funds is not always effective and mechanisms for ensuring that investments have positive impact are not always in place;
- While biodiversity management can provide a significant economic stimulus, for example through growth in tourism, these benefits are rarely considered in Government finance decisions;
- Because of national variation in biodiversity resources, and in capacities to manage these resources, there are great differences between countries in terms of revenue-earning potential.
- The economic costs of inaction (failing to address biodiversity loss) are currently not adequately taken into account in decision-making.

For many developing countries the main source of funds for biodiversity conservation to date has been the international community. OECD DAC statistics show that in 2007 total biodiversity-related aid amounted to just over USD 3 billion from 21 countries and the European Union. However, this is well below the amounts needed to halt biodiversity loss. Development cooperation will never be able to underwrite the full cost of halting biodiversity loss, and though such assistance needs to be scaled up, other sources of finance will need to be tapped to address the challenge. UN assistance to countries in obtaining tools and developing their long-term financing agendas will be critical. See also chapter 7 regarding critical strategies and opportunities to address biodiversity targets related to finance and trade.

CHAPTER 12
REVIEW OF EFFECTIVENESS IN THE ACHIEVEMENT OF BIODIVERSITY TARGETS

Development of explicit biodiversity targets and of indicators for achievement of those targets can provide a sound basis for reviewing the effectiveness of measures. UN entities can play a role in the review process through structured reporting, self-evaluations and indicators. In addition evaluations allow institutions to incrementally improve their performance both individually and collectively, through results-based cooperation.

THE BIODIVERSITY INDICATORS PARTNERSHIP

To ensure the effective use of indicators at the international level, coordination mechanisms are essential for bringing together key stakeholders. The UN has played a key role in establishing such a coordination mechanism for assessing achievement towards the 2010 biodiversity target and is well placed to continue such a role post-2010.

The Biodiversity Indicators Partnership came into being when the Conference of the Parties to the Convention on Biological Diversity, in its decision VII/30, invited the UNEP World Conservation Monitoring Centre (UNEP-WCMC) to support the Convention secretariat in tracking progress in the achievement of the 2010 biodiversity target. From the outset, however, the Partnership has been of relevance to a number of multilateral environmental agreements and other processes concerned with the 2010 biodiversity targets and biodiversity change. Coordinating an international process takes time, cooperation and support from a wide range of agencies and resources. The Partnership brings together over 40 United Nations bodies and intergovernmental, non-governmental, academic and governmental organizations from around the world with the aim of providing the best available information on biodiversity trends to the global community. Membership includes several EMG members, including CITES, FAO, UNCTAD, UNEP, UNESCO and WHO. Several member bodies are also involved in the Inter-Agency and Expert Group on MDG Indicators.

The Partnership has three primary objectives: first, to generate information on biodiversity trends that is useful to decision makers; second, to ensure that improved global biodiversity indicators are available and are implemented; and, third, to enable capacity building and improve the delivery of biodiversity indicators at the national level. In addition to key stakeholders that are involved at the international policy level, the secretariat of the Convention on Biological Diversity is directly involved in the partnership and partnership's outputs are made available to advisory and governance processes under the Convention. Other major bodies, such as the General Assembly, will also consider the partnership's outputs.

The suite of global indicators developed and delivered by partners (Walpole et al., 2009) is not limited to biodiversity status and trends, but also includes key measures of threats to biodiversity, measures relating to ecosystem services and benefits (primarily provisioning), and measures relating to policy responses. In total, 29 measures are supporting 17 headline indicators in various stages of development.

Responsibility for indicator development has been delegated to subsets of the partner organizations, with each subset focusing on its area of expertise. A secretariat draws together the outputs, synthesizes them into products appropriate for specific audiences and disseminates them. With oversight on governance and process provided by representatives from United Nations agencies, key data providers, donors and user groups, and scientific input from a range of experts across the biodiversity spectrum, the partnership aims to provide timely and definitive information to a range of decision makers. In addition, engagement with the secretariats of the other biodiversity-related multilateral environmental agreements and processes is helping to encourage and facilitate the identification of potential synergies between the indicators developed under the Convention on Biological Diversity and those used under other processes.

The Partnership, established in 2007 with support from the Global Environment Facility (GEF)[30], has leveraged additional support both through the organizations involved and from donors, including the European Commission, UNEP and the Government of Sweden. Feedback from an expert workshop on the 2010 biodiversity indicators and post-2010 indicator development and other sources suggest that challenges notwithstanding the partnership has made a valuable contribution in respect of all three of its objectives and that it would be beneficial for a partnership of some form to continue beyond 2010. UN entities including

[30] See Information available at: http://gefonline.org/projectDetailsSQL.cfm?projID=2796.

UNEP, UNESCO, WHO, FAO have made a significant contribution to the partnership and remain well placed to maintain and enhance this contribution to any post-2010 partnership.

TRACKING PROGRESS TOWARDS THE 2010 BIODIVERSITY TARGET

The target to reduce the rate of biodiversity loss by 2010 has not been met (GBO3). In the latest reports submitted to the Convention on Biological Diversity (CBD), many governments admit that the target will be missed at the national level. Globally, the suite of indicators covering threats, status and response compiled by the 2010 BIP and used by the CBD support this conclusion (Butchard *et al.*, 2010; see Fig. 1 and Fig. 2).

Most indicators of the state of biodiversity (covering species' population trends, extinction risk, habitat extent and condition, and community composition) showed declines, with no significant recent reductions in rate. Populations of vertebrate species fell by nearly a third on average between 1970 and 2006. Natural habitats in most parts of the world continue to decline in extent and integrity. Extensive fragmentation and degradation of forests, rivers and other ecosystems has occurred. Crop and livestock genetic diversity continues to decline in agricultural systems.

At the same time, indicators of pressures on biodiversity (including habitat degradation, resource consumption and overexploitation, nitrogen pollution, invasive alien species and climate change impacts) all showed increases. Humanity's ecological footprint has reached 1.3 times the biological capacity of the Earth, having increased from 1.2 since the 2010 biodiversity target was agreed.

Biodiversity-related financing has nevertheless grown and efforts to increase levels of conservation and sustainable use have achieved some success. As illustrated in GBO3, significant progress has been achieved with four of the agreed subsidiary targets to the 2010 biodiversity target and some progress has been achieved with 15 subsidiary targets. Taking into account the achievements to date and the current trends, more work is clearly needed to effectively tackle the major pressures on biodiversity. For this and other reasons, serious consideration might be given to continuing the Biodiversity Indicators Partnership and to using the results of the 2010 BIP to focus resources aimed at ensuring the conservation and sustainable use of biodiversity.

Work carried out on indicators in the international arena by the UN and others can also lay the foundation for strengthened support to developing countries in their efforts to review the effectiveness of their own national biodiversity strategies and action plans, poverty reduction strategies, national strategies for the Millennium Development Goals and others. Such support may help strengthen the socio-economic aspects of regional and national biodiversity information networks, and clearing house mechanisms.

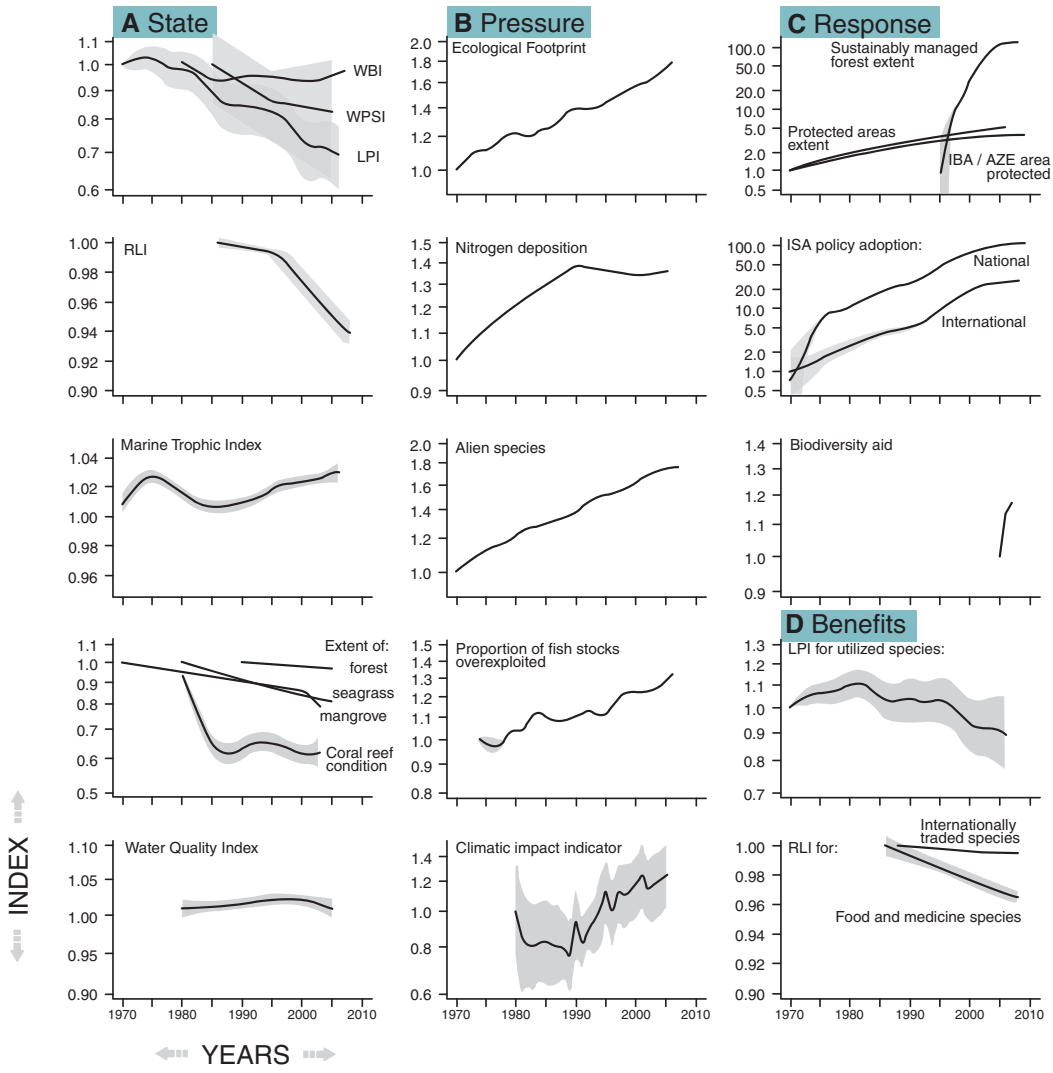


Fig.3 Indicator trends for (A) the state of biodiversity, (B) pressures upon it, (C) responses to address its loss, and (D) the benefits humans derive from it. Data scaled to 1 in 1970 (or for first year of data if >1970), modeled (if >13 data points; see Table 1), and plotted on a logarithmic ordinate axis. Shading shows 95% confidence intervals except where unavailable (i.e., mangrove, seagrass, and forest extent, nitrogen deposition, and biodiversity aid). WBI, Wild Bird Index;WPSI,Waterbird Population Status Index; LPI, Living Planet Index; RLI, Red List Index; IBA, Important Bird Area; AZE, Alliance for Zero Extinction site; IAS, invasive alien species. **From Butchart et al, 2010. Reprinted with permission from AAAS.**

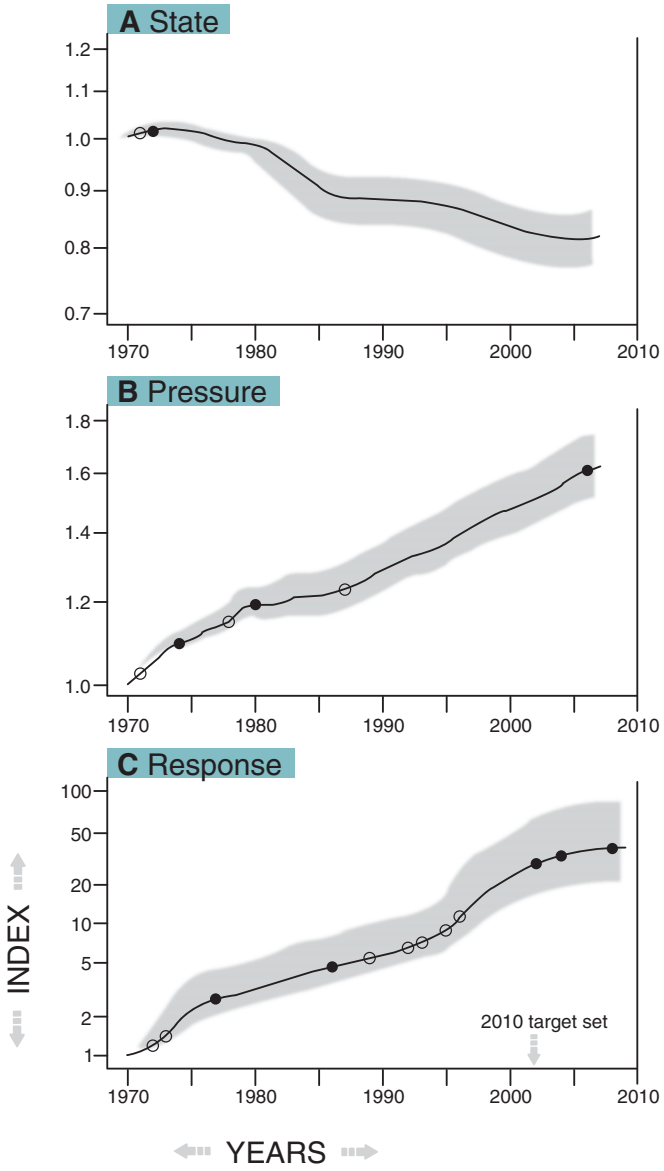


Fig. 4 Aggregated indices of (A) the state of biodiversity based on nine indicators of species' population trends, habitat extent and condition, and community composition; (B) pressures on biodiversity based on five indicators of ecological footprint, nitrogen deposition, numbers of alien species, overexploitation, and climatic impacts; and (C) responses for biodiversity based on six indicators of protected area extent and biodiversity coverage, policy responses to invasive alien species, sustainable forest management, and biodiversity-related aid. Values in 1970 set to 1. Shading shows 95% confidence intervals derived from 1000 bootstraps. Significant positive/upward (open circles) and negative/downward (filled circles) inflections are indicated. **From Butchart et al, 2010. Reprinted with permission from AAAS.**

REFERENCES SECTION III

Butchart, S. H. M. *et al.* (2010) Global biodiversity: indicators of recent declines. *Science*: 328; 1164-1168.

CBD Information Note (2009) UNEP/CBD/SBSTTA/14/5, 29 August 2009

Dudley, N. and S. Stolton (2009) Running pure: The importance of forest protected areas to drinking water. Gland, Switzerland: WWF International.

Dudley, N. and S. Stolton (2008) Safety net: Protected areas and poverty reduction.

Dudley, N. S., *et al*., (2008) Food stores: Protected areas and crop wild relatives.

Flores, M. and G. Chan (2008) Business-oriented financial planning for protected areas. Arlington, VA: The Nature Conservancy.

GBO3 (2010) Global Biodiversity Outlook, Secretariat of the Convention on Biological Diversity (2010). Montréal.
http://www.cbd.int/doc/publications/gbo/gbo3-final-en.pdf

IUCN (2009) Wildlife in a Changing World. A report based on the analysis of the 44, 838 species on the IUCN Red List.
http://data.iucn.org/dbtw-wpd/edocs/RL-2009-001.pdf

Leverington, F., M. Hockings and K.L. Costa (2008) Management Effectiveness Evaluation in Protected areas: Report for the project 'Global study into management effectiveness evaluation of protected areas'. Queensland: The University of Queensland.

TEEB (2009) The Economics of Ecosystems and Biodiversity.
http://www.teebweb.org/

UN Millennium Project (2005)
http://www.unmillenniumproject.org/

UNEP (2009) Twenty-fifth session of the Governing Council/Global Ministerial Environment Forum (UNEPGC.25/inf/12/Add.1)
www.unep.org/gc/gcss-x/download.asp?ID=1016

UNEP-WCMC (2008) State of the world's protected areas: an annual review of global conservation progress.
http://www.unep-wcmc.org/protected_areas/pubs.htm

Walpole, M., *et al.,* (2009) Tracking Progress Toward the 2010 Biodiversity Target and Beyond. *Science* 325, 1503-4.

WCC3 (2009) World Climate Conference 3, Geneva Switzerland, September 2009.
http://www.wmo.int/wcc3/page_en.php

CONCLUSIONS AND OUTLOOK

The current report is the fruit of nearly two years of interagency cooperation in response to a challenge presented to the Environment Management Group (EMG) by the President and members of the Bureau of the Conference of the Parties to the Convention on Biological Diversity. They called for the UN system to contribute to the target-setting process under the Convention. The report is distinctive in that it presents a multi-sectoral policy perspective on the biodiversity challenge. This perspective is the product of a joint writing team and further inputs from a total of some twenty-five members of the EMG, with the additional support of two observers from outside the UN system.

The questions of why biodiversity matters to sectors and how the different policy sectors can help maintain biodiversity and ecosystem services have been considered in the report. New opportunities for mainstreaming are emerging. Cooperation within the biodiversity sector and across sectors is increasingly being pursued. The "one UN" initiative is but one example in this respect. The fragmentation of the environmental institutional landscape is being addressed. Developments in the area of biological science, monitoring, modelling and forecasting are improving the ability of society at all levels to identify risks of biodiversity loss and opportunities provided by ecosystem services. Rapid advances in information and communication technologies can potentially ease the task of managing complex information and facilitate communication among a broad range of users.

The joint effort by the EMG has yielded a joint statement by the UN system. Here, executive heads of UN agencies acknowledge that biodiversity considerations need to be mainstreamed into sectoral policies and strategies, and that such efforts need to address the institutional silos of a sectoralised society, the failure of markets to internalise the value of ecosystem services, and the demanding trade-offs between different interests and concerns in society.

The statement also represents a commitment from the executives to identify opportunities for cooperation in mainstreaming biodiversity into policy sectors, within the respective mandates of their organizations. Examples of the various ways this could be achieved include:

a. using advances in environmental and social sciences, monitoring, modelling and forecasting, supporting the ongoing process on the development of an intergovernmental science-policy platform on biodiversity and ecosystem services, and using new developments in information and communication technology and knowledge management to exchange information, particularly that needed to stem biodiversity loss;

b. cooperating at all levels through the "one UN" initiative in support of efforts by governments to implement their biodiversity commitments, including those under biodiversity-related conventions, for example through capacity building and technology support;

c. supporting nationally driven efforts to arrest biodiversity loss that are fully integrated into and advanced through national development policies, strategies and programmes;

d. capitalizing on ongoing efforts, such as The Economics of Ecosystems and Biodiversity initiative, to improve the understanding of the value of biodiversity and ecosystem services and support governments in making a shift toward more sustainable development, for example through a green economy, including investment in sustainable and equitable use and conservation of biodiversity, which may generate jobs and economic wealth;

e. recognising and respecting the role of poor and vulnerable groups, including indigenous peoples, as custodians of biodiversity;

f. promoting awareness and enhancing capacities among different relevant stakeholder groups from each sector and identifying win-win situations across sectors;
and

g. reviewing progress in implementing the biodiversity agenda through structured, and streamlined reporting, self evaluations and use of internationally agreed indicators and targets.

In the statement, the executive heads of the Environment Management Group members also commit to continue cooperation under the auspices of the EMG in order to demonstrate what a multi-sectoral approach can bring to the development and implementation of the international biodiversity agenda.

It is clear that opportunities for improved mainstreaming exist, and that public institutions, such as the UN, can help set establish the framework for actions by the private sector, households and individuals to act.

The foundation for a new and multi-sectoral paradigm of cooperation is sketched out in this report. The report is not the end of the process. Rather, it signifies a milestone in a unique effort by the UN system to join hands in supporting the implementation of the biodiversity agenda by 'delivering as one' – the multi-sectoral one.

ACRONYMS

2010BIP	Biodiversity Indicator Programme
AEIN	Africa Environment Information Network
AHTEG	Ad Hoc Technical Expert Group
AnGR	Animal Genetic Resources
ASEAN	Association of Southeast Asian Nations
AWG-LCA	Ad Hoc Working Group on Long-term CooperativeAction under the Convention
BLG	Liaison Group of Biodiversity-related Conventions
BWS	Ballast Water and Sediments
CBD	Convention on Biological Diversity
CEPA	Communication, Education and Public Awareness
CINE	Centre for Indigenous Peoples' Nutrition and Environment
CITES	Convention on International Trade in Endangered Species
CMS	Convention on Migratory Species
COP	Conference Of Parties
CPF	Collaborative Partnership on Forests
CSAB	Chairs of Scientific Advisory Bodies
DAD-IS	Domestic Animal Diversity Information System
DLDD	Desertification, land degradation and drought
ECAs	Export Credit Agencies
EIONET	European Environmental Information and Observation Network
EMG	Environmental Management Group
ENVIS	Environmental Information System
ERIN	Environmental Resources Information Network
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESG	Environmental, Social and Governance issues
EST	Environmentally Sustainable Transport
FAO	Food and Agriculture Organization
FIP	International Pharmaceutical Federation
FRA	Global Forest Resources Assessments
FSC	Forest Stewardship Council
GACP	Guidelines on Good Agricultural and Collection Practices
GBIF	Global Biodiversity Information Facility
GBO	Global Environment Outlook
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GEI	Green Economy Initiative
GEO	Group of Earth Observation
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Protection
GIAHS	Globally Important Agricultural Heritage Systems
GISP	Global Invasive Species Programme
GOOS	Global Ocean Information System
GSTC	Global Sustainable Tourism Criteria
GTOS	Global Terrestrial Information System
GWP	Gross World Product
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development

IABIN	Inter-American Biodiversity Information Network
IAS	invasive aquatic species
ICAO	International Civil Aviation Organization
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICSP	Informal Consultations of States Parties
ICSU	International Council for Science Union
IDP	Internally Displaced People
IFAD	International Fund for Agricultural Development
IISD	International Institute for Sustainable Development
ILRI	International Livestock Research Institute
IMAGE	Integrated Model to Assess the Global Environment
IMO	International Maritime Organization
IOI	International Ocean Institute
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPPC	International Plant Protection Convention
IRC	International Rice Commission
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
IUUF	Illegal, Unreported and Unregulated Fishing
JLG	Joint Liaison Group of Rio Conventions
MA	Millennium Ecosystem Assessment
MDG	Millennium Development Goals
MEA	Multilateral Environmental Agreement
MSC	Marine Stewardship Council
MSP	Marine Spatial Planning
NLBI	Non-Legally Binding Instrument
ODA	Oversees Development Assistance
OECD	Organisation for Economic Co-operation and Development
PPP	Public-Private Partnership
PRSPs	Poverty Reduction Strategy Papers
REDD	Reduction in Emissions from Deforestation and Degradation
S&T	Science and Technology
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEA	Strategic Environmental Assessment
SINIMA	Sistema Nacional de Informação sobre o Meio Ambiente (Brasil)
TEEB	The Economics of Ecosystems and Biodiversity
UN	United Nations
UN DPKO	United Nations Department of Peacekeeping Operations
UN WFP	United Nations World Food Programme
UNCCD	United Nations Convention to Combat Desertification
UNCLOS	United Nations Convention on the Law of the Sea
UNDAF	UN Development Assistance Framework
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nation Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
UNEP DTIE	United Nations Environmental Programme Division of Technology, Industry and Economics
UNEP-WCMC	United Nations Environmental Programme World Conservation Monitoring Centre
UNESCO	United Nations Educational Scientific and Cultural Organization
UNESCO WHC	UNESCO World Heritage Centre
UNESCO IOC	UNESCO Intergovernmental Oceanographic Commission
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner for Refugees
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNU	United Nations University
UNU-IAS	United Nations University Institute for Advance Studies
UNWTO	United Nations World Tourism Organization
UPOV	International Union for the Protection of New Varieties of Plants
WHO	World Health Organization
WIPO	World Intellectual Property Organization
WMO	World Meteorogical Organization
WSMI	World Self-Medication Industry
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization
WWF	World Wide Fund for Nature

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Biodiversity – the variety of life on earth – is the foundation on which human civilization depends and it is disappearing fast. This comprehensive publication, produced under the auspices of the Environment Management Group of the United Nations, shows how biodiversity impinges on all aspects of human wellbeing and argues that halting its loss will require a cross-sectoral approach, something that the United Nations, with its global reach and huge range of activities and expertise, is uniquely positioned to catalyze.

The Environment Management Group (EMG) is a United Nations (UN) System-wide coordination body. It furthers inter-agency **Cooperation** in support of the implementation of the international environmental and human settlement agenda. Its **Membership** consists of the specialized agencies, programmes and organs of the United Nations including the secretariats of the Multilateral Environmental Agreements. It is chaired by the Executive Director of United Nations Environment Programme (UNEP) and supported by a secretariat provided by UNEP. More information on the EMG can be found at **www.unemg.org.**

UNEP