# International Organizations and Biodiversity

**Margaret Goud Collins,** International Institute for Applied Systems Analysis (IIASA), Laxenburg, Austria



## Introduction

Biodiversity is an inherently international concern. Species distributions and the ecosystem services that they support are not defined by national boundaries. As a reflection of societal interests in those ecological benefits, international organizations have grown up to study, develop, regulate, and conserve the systems on which much of human well-being depends. These organizations, many of which were founded in response to the need for international cooperation in such areas as wildlife and wilderness conservation, scientific research, agriculture, forestry, water resources, aquatic resources, trade, pharmaceutical development, and economic development, have incorporated biodiversity concepts into their missions. Moreover, a number of issues are overlapping concerns of these different groups – invasive species control, for example, is where agriculture, forestry, and wildlife conservation meet up with trade.

As the interest in these issues has increased, and the complexity of, and threats to, global biological systems have become clearer, the diverse scientific communities studying science and policy related to biodiversity have developed stronger international ties. A central tenet of the new field of "sustainability science," which focuses on the complex, dynamic interactions between nature and society, holds that "societies are complex adaptive systems, composed of individual agents who have their own priorities, and who value the macroscopic features of their societies differently. Resolving those competing perspectives is at the core of addressing sustainability" (Levin and Clark, 2010). The emphasis on social–ecological systems makes biodiversity a central element in the global network of institutions researching sustainability. However, the array of international organizations concerned with biodiversity and ecosystem services can themselves be viewed as a complex adaptive system, forming coalitions and adopting interests in response to scientific developments, economic forces, policy initiatives, and environmental changes.

International cooperation is crucial for the scientific investigation and conservation of biodiversity, and for the maintenance of the ecosystem services that biodiversity supports. International organizations foster and coordinate that cooperation, creating a complex network of governmental and nongovernmental international bodies to finance and conduct biodiversity research and conservation activities. Many of them participate in the provision of policy advice through national and international initiatives, undertaken in response to unprecedented ecosystem challenges stemming from economic development and climate change. Other organizations focus on the industries and public services that depend on biodiversity and ecosystems. Increasingly, the interests and mandates of these organizations overlap, requiring collaboration and cooperation among – and even within – the organizations, as it is not unusual for different bureaus within the same association to address different sides of the biodiversity question.

## UN Leadership on International Biodiversity Issues

Within this network of organizations, the United Nations (UN) serves as a hub, both for intergovernmental cooperation and for partnerships with governments, nongovernmental organizations (NGOs), and industry. In each of the subject areas discussed here, UN agencies are crucial for both coordinating and funding international activities. Biodiversity-related issues have been among UN concerns since its earliest days, and the role of the United Nations Educational, Scientific and Cultural Organization (UNESCO) in the creation of the International Union for the Conservation of Nature (IUCN) offers one of the earliest examples of UN promotion of international cooperation through NGO partnerships. Since its creation in 1972, the United Nations Environment Programme (UNEP) has been at the heart of the UN environmental activities, and the Global Environment Facility (GEF) was established in 1991 to provide coordinated funding for global environmental issues (GEF Website, 2011). However, environmental concerns are woven into activities throughout the organization. On the UNEP website, a diagram of the "environmental DNA" of the UN system lists 44 UN entities that play explicit roles in environmental issues (UNEP Website, 2011), and most of these include biodiversity and ecosystems among their priorities. The ubiquity of biodiversity interests was summarized in a report prepared for the International Year of Biodiversity (IYB) in 2010 (UN Environment Management Group, 2010). The recognition that the 2010 biodiversity conservation targets had not been met, and the importance of the challenges, led the UN to designate 2011–2020 as the International Decade on Biodiversity, in order to highlight the urgency of achieving the next set of decadal goals (CBD Website, 2011).

The most significant global assessment of biodiversity and ecosystem services to date, the Millennium Ecosystem Assessment (MA), was a joint initiative of four intergovernmental organizations and NGOs – UNEP, UNESCO, World Bank, and the World Resources Institute (WRI) – with support from a total of seven UN entities. It enlisted the skills of more than 1360 experts worldwide, and their findings provide a framework for understanding the importance of biodiversity and ecosystems for human well-being, as well as a record of the state and transformations in ecosystems around the world (Reid *et al.*, 2005). The MA sparked a renewed recognition of the pervasiveness and increasing urgency of biodiversity and ecosystem concerns, as a consequence of which the UN General Assembly approved in 2010 the creation of an Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES). The IPBES will create a new intergovernmental institution, comparable to the Intergovernmental Program on

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Climate Change (IPCC), to provide a mechanism to contribute to global policy deliberations through regular assessments of biodiversity and ecosystem services. These assessments will be performed by the global academic, governmental, industry, and NGO communities with interests in biodiversity (IPBES Website, 2011). The new institution may, in turn, help introduce more coherence and consistency into the conservation and development strategies of governments, industries, and NGOs, if IPBES is able to lead to common, and improved, understandings of the baseline conditions, possible future scenarios, and complexities of ecosystem change.

This article attempts both to catalog institutions and their missions, and to capture the dynamism of their interactions and activities. It outlines the framework of international organizations concerned with biodiversity issues in a variety of contexts, with sections focusing on such topics as biodiversity conservation, biodiversity research, collecting and archiving biodiversity data, and the confluence of biodiversity issues with economic activities such as agriculture, fisheries, forestry, and trade.

## International Organizations and Biodiversity Conservation

Wildlife and habitat conservation were the primary concerns of the first international conservation organizations, which served as the kernel of what became the global environmental movement of the late twentieth century. Early conservation organizations, such as the Wildlife Conservation Society (founded in 1895 as the New York Zoological Society) and Flora and Fauna International (founded in 1903 in the United Kingdom as the Society for the Preservation of the Wild Fauna of the Empire), developed early conservation norms. They were then joined by new international organizations as the scope of conservationists' interests broadened. The new and evolving organizations began to apply the groups' lessons and approaches worldwide.

Intergovernmental conservation efforts were among the earliest activities of the UN, principally through UNESCO. Shortly after its establishment in 1945, UNESCO partnered with governments and national organizations to launch the IUCN, initiating a tradition of partnerships between international governmental organizations and NGOs to accomplish conservation ends. The initial focus of IUCN in the 1950s was on endangered species and protected areas, and in 1963 the organization established the Red List of Threatened Species, aimed at drawing attention to the magnitude and importance of threats to biodiversity worldwide (IUCN Website, 2011; International Union for the Protection of Nature, 1948).

IUCN was joined in succeeding decades by an array of international organizations focused on conservation of threatened species and the ecosystems in which they lived. The World Wildlife Fund (WWF) was founded in 1961 to advocate for the protection of wildlife and wild places around the world. Their campaigns used "flagship species," such as the iconic panda of their logo, to raise awareness and stimulate action and funding for their global activities and advocacy (WWF Website, 2011). In the 1980s, the Nature Conservancy went international with its successful US model of purchasing and managing ecologically valuable properties, joining WWF and Conservation International (CI) in pioneering "debt-for-nature" swaps in Latin America and elsewhere (The Nature Conservancy Website, 2011). CI was founded in 1987, and their approach emphasizes partnerships with businesses and governments to provide resources and develop policies for the conservation of biodiversity and natural habitats in concert with economic development (Conservation International Website, 2011). CI has prioritized the preservation of areas they have designated as Biodiversity Hotspots, defined as places with very high numbers of endemic species in immediate need of conservation action in order to survive (CI Website, 2011a). Other international NGOs focus their efforts on narrower swaths of the biodiversity spectrum, such as BirdLife International, Botanic Gardens Conservation International, and the World Association of Zoos and Aquariums. Some concentrate on regional biodiversity conservation concerns, such as the Africa Wildlife Foundation, founded in 1961.

Biodiversity and conservation were among the central concerns in the explosion of environmental interest and activism in the 1970s, and intergovernmental conservation activities saw a concomitant growth. Since 1971, UNESCO has sponsored the Man and the Biosphere (MAB) Program with an emphasis on integrating conservation with human activity, overseeing the creation of a World Network of Biosphere Reserves (WNBR) as a testbed for research into innovative approaches to sustainable relationships between human societies and natural systems. Since the approval of the first WNBR site in 1978, the network has grown to encompass 580 sites in 114 countries. The mandate of the program has evolved from conservation and managed resource use to incorporate research into mitigation and adaptation to climate change in a broad range of ecosystems.

The focus on conservation of wildlife and habitat was a central theme of the UN Conference on Human Environment in Stockholm in 1972, and of the UNEP, which was founded shortly afterward. UNEP emerged as a key player in international biodiversity research and conservation. The 1970s also saw the negotiation and adoption of international legal instruments for biodiversity protection, including the following:

- The Convention on Wetlands of International Importance, or the Ramsar Convention, provided a framework for the conservation and wise use of wetlands, particularly ones of importance for waterfowl; the list of Ramsar sites in 2011 numbered 1952 (Ramsar Website, 2011).
- The Convention Concerning the Protection of the World Cultural and Natural Heritage, or the World Heritage Convention, oversees the preservation of sites that are valuable to the entire world citizenry, whether natural or cultural. Adopted and administered by UNESCO, the list in 2011 contained 936 properties (World Heritage Convention Website, 2011).
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force in 1975, to monitor and regulate the interstate transport of wild animals and plants to ensure sustainability.

- The Convention on Migratory Species of Wild Animals (CMS) was signed in 1979 to regulate the conservation and management of migratory species. Administered by UNEP, CMS develops and promotes regional and global agreements related to specific migratory species, among which are bats, cetaceans, and gorillas.

These piecemeal tactics for protection highlighted the need for a global approach to the protection of species, an issue that was galvanized after the 1987 National Academy of Sciences Conference on BioDiversity highlighted the urgency of a wise policy of conservation and development, and Gro Harlem Brundtland's 1987 report *Our Common Future* called for a Species Convention. UNEP took the lead in drafting what became the Convention on Biological Diversity (CBD). The convention was approved at the 1992 UN Conference on Environment and Development – the Earth Summit – as was the UN Framework Convention on Climate Change (UNFCCC). The three goals of the convention are the conservation of biodiversity, the sustainable use of biodiversity components, and the fair sharing of the benefits of genetic resources (Juma and Henne, 1997). The CBD obligates signatories to develop national plans for biodiversity conservation, and the CBD organization develops programs of work to achieve its conservation goals.

As the understanding of the complexity of environmental systems and their interactions with human society has grown, the agendas of all of these organizations have evolved. All have contributed to the MA and have incorporated its core findings regarding the linkages between ecosystems and human well-being. Each organization maintains a distinct strategy and focus, but their missions and work programs have developed to encompass the importance of ecosystems for the preservation of species, the importance of understanding and harnessing broad economic and political forces for conservation, and the critical role of raising global public awareness of the importance of biodiversity and ecosystem services.

## International Organizations and Scientific Research Cooperation in Biodiversity

The concept of biodiversity arose from the scientific community, whose members have a long history of international cooperation in studying and promoting the conservation of natural systems. Scientific research is woven into the activities and strategies of every one of the international governmental and nongovernmental conservation organizations discussed earlier. The scientific community participates in and is supported by the conservation community, in a complex and evolving system of interactions.

The earliest international organizations dedicated to promoting international cooperation in biological research were the International Union of Biological Sciences (IUBS), founded in 1919, and the International Union of Microbiological Sciences (IUMS), founded in 1927, the memberships of which were national scientific societies. IUBS was among the founding members of the International Council for Science (ICSU) in 1931, formed as an umbrella organization to promote international cooperation in science, and IUMS joined in 1982. With its wide-ranging scientific overview, ICSU has promoted interdisciplinary, integrated scientific approaches to global environmental issues, including a number of programs that have made significant contributions to international cooperation in biodiversity research. These include the Scientific Committee on Problems of the Environment (SCOPE; founded in 1969), the Scientific Committee on Ocean Research (SCOR; founded in 1957), the Program on Ecosystem Change and Society (PECS; founded in 2008), and the four programs devoted to global change research: the World Climate Research Program (WCRP; created in 1980), the International Geosphere–Biosphere Program (IGBP; created in 1986), the International Human Dimensions Programme on Global Environmental Change (IHDP; created 1996), and the International Programme of Biodiversity Science (DIVERSITAS; established in 1991 by IUBS, UNESCO, and SCOPE, which were joined by ICSU and IUMS in 1996). In addition to the international coordinating function provided by the ICSU family, some scientific professional societies are international in scope. Most notably, the Society for Conservation Biology has a broad international membership of scientists, social scientists, economists, and professionals such as lawyers and teachers interested in science and policy of biodiversity and ecosystems.

These nongovernmental, scientific coordinating organizations have played a crucial role in defining international scientific priorities, promoting international research collaboration, and providing input to national and international policy deliberations. ICSU is often called upon to represent the international scientific community in UN fora and has served as a partner to UN agencies in achieving their scientific goals. For example, in preparation for the UN Commission on Sustainable Development's "Rio + 20" conference in June 2012, ICSU organized regional science and technology workshops, and participated in intergovernmental preparatory meetings. ICSU's programs are generally organized with input from intergovernmental organizations such as UNEP and UNESCO, and thus reflect global governmental priorities and needs for input.

Two of the ICSU initiatives have an explicit biodiversity focus: DIVERSITAS and PECS. DIVERSITAS was created to integrate the broad range of biological sciences needed to understand observed loss and change in global biodiversity, and its scope evolved in concert with the insights enunciated in the MA to incorporate more policy relevant aspects of biodiversity and ecosystem change. The organization provides an umbrella for international research cooperation on topics from evolution to biodiversity data to sustainability, and cooperates in the biodiversity and ecosystem aspects of the other ICSU programs in the Earth System Science Partnership (ESSP), particularly IGBP and IHDP. DIVERSITAS is also an active partner with intergovernmental organizations, providing scientific support to the CBD and co-chairing the Biodiversity Observation Network of the intergovernmental Group on Earth Observations (GEO BON). DIVERSITAS was a leader in advocating the scientific communities' views as the proposal for IPBES was developed, and represented ICSU at the UN-sponsored negotiations for the establishment of the organization in 2011–2012.

The more recent ICSU initiative related to biodiversity and ecosystems, PECS, aims to complement the ESSP programs by

developing an international program of work on social–ecological systems, with particular focus on assessing the effects of policies and practices on the resilience of critical ecosystem services. Along with DIVERSITAS, it will provide scientific input to the proposed IPBES (ICSU Website, 2011a).

Other international organizations conduct research on biodiversity and ecosystem services, many serving as hubs of regional and global research networks. Among the organizations with significant biodiversity-related activities are the following:

- The WRI, a policy research institute addressing global resource and environmental issues founded in Washington, DC, in 1982, was a key organizer of both the 1995 Global Biodiversity Assessment and the MA. WRI collaborates with UN agencies to produce the World Resources Report biannually.
- The International Institute for Applied Systems Analysis (IIASA), an international nongovernmental institute, founded in 1972 near Vienna, Austria, conducts systems analysis research on global problems, including evolution, land use, and ecosystem services.
- The Inter-American Institute for Global Change Research (IAI) and the Asia-Pacific Network for Global Change Research (APN) are intergovernmental organizations serving as hubs for networks of research institutions working on global change issues in the Americas and the Asia-Pacific region, respectively. Both organizations promote science that cannot be conducted by any one country alone through research grants to international teams, scientific meetings, and capacity building. Biodiversity and ecosystems are key elements of their agendas.

## International Organizations and Biodiversity Data

The conduct of research, the development of conservation priorities, and the understanding of changes in ecosystems are all dependent on the analysis of reliable global data sets. The cataloging and preserving of accurate records of life on Earth presents particular challenges. The traditional repositories of biodiversity data are local institutions such as natural history museums and academic collections. They rely on international standards for the names of plants and animals that have long been overseen by the International Association for Plant Taxonomy and International Commission on Zoological Nomenclature. However, recent decades have witnessed an explosion of both remotely sensed data that offer a global context for ecosystem understanding and genetic data that offer a new understanding of the molecular basis for biological diversity. In addition, new information technologies provide previously unimaginable opportunities for global access to biodiversity data. These developments have led to an array of international organizations devoted to collecting and maintaining these data, and to making them available for use by the global science and policy communities.

The Global Biodiversity Information Facility (GBIF), established in 2001 as an intergovernmental initiative to encourage free and open access to biodiversity data via the Internet, had as of 2011 built a global network of 57 countries and 47 organizations. GBIF promotes and facilitates the mobilization, access, discovery, and use of information about the occurrence of organisms over time and across the planet (GBIF Website, 2011). The Consortium for the Barcode of Life (CBOL) is an international initiative established in 2004 devoted to developing DNA barcoding as a global standard for the identification of species. Its International Barcode of Life (iBOL) project is coordinating a 26-nation research alliance to construct a global DNA barcode reference library for that purpose. The Encyclopedia of Life (EOL) is a global partnership, begun in 2007, with a goal of compiling an online, dynamic catalog of every species on Earth. The EOL partnership included 181 content partners as of 2011, making it a link to an array of biodiversity databases on organisms from microbes to whales (EOL Website, 2011).

The UNEP World Conservation Monitoring Centre (UNEP-WCMC) is a collaboration between UNEP and the UK-based charity WCMC that supports international biodiversity conservation initiatives by compiling, storing, and analyzing biodiversity data on matters of relevance to international conventions (such as CBD and CITES), businesses (through its Proteus partnership), and conservation and research organizations. Databases supported by UNEP-WCMC include the World Database on Protected Areas; the UNEP-WCMC Species databases on organisms of conservation importance, including those protected by multilateral environmental agreements; and the CITES database of trade in protected species (UNEP-WCMC Website, 2011).

GEO BON is the biodiversity component of the Global Earth Observation System of Systems (GEOSS). It encompasses a partnership of some 100 governmental organizations and NGOs and is chaired by DIVESITAS, NASA, and the EU Biodiversity Observation Network (E-BONE). The GEO BON goal is to collect and make accessible a comprehensive collection of *in situ* and remotely sensed biodiversity observations, accompanied by tools for analysis that enable decision making in support of conservation and management of resources (GEO Website, 2011).

Among the best known independent databases is the IUCN Red List of Threatened Species. From its beginnings in 1963, the Red List has grown into "the world's most comprehensive inventory of the global conservation status of plant and animal species," utilizing resources from museums, conservation organizations, and academic institutions to provide data on approximately 45,000 species, including both threatened and nonthreatened organisms. Partners such as BirdLife International, which connects avian conservation organizations in more than 100 countries, coordinate specific elements of the database. With a new focus on scientific rigor and transparency in the 1990s, the Red List has evolved into a valuable tool for conservation strategies (IUCN Website, 2013).

## International Organizations and Biodiversity for Agriculture and Forestry

Humanitarian, commercial, and conservation concerns converge in global cooperation related to agriculture and forestry. Traditional efforts to develop seeds and efficient production

methods to aid in the fight against hunger or increase the economic viability of agricultural enterprise have been influenced by the recognition that valuable genetic resources were being lost in the process of modernization. Forest management has developed beyond the concept of maximum sustained yield to incorporate an approach that can maximize the value of a broader range of ecosystem services provided by forest ecosystems. Expanded global economic integration has accelerated the introduction of new species into far-flung corners of the globe, some on purpose, others accidentally. Some of these invaders have been so successful that their proliferation threatens the existence of the ecosystems that they have colonized, endangering both economic and cultural services that the ecosystems provide. The global intertwining of ecosystems, ecosystem services, and ecosystem threats has generated a complex international institutional framework aimed at understanding and regulating these ecosystem-dependent economic activities to increase and balance the societal benefits and costs.

## Agriculture and Biodiversity

The boom in international cooperation in agricultural research dates back to the 1950s and 1960s, when private foundations and the World Bank began funding the development of "miracle grains" in specialized research institutes around the world. These collaborations were integrated and institutionalized with the creation of the Consultative Group on International Agricultural Research (CGIAR) in 1971, funded by a consortium of donor countries, foundations, and multilateral organizations (CGIAR Website, 2011). During that same period, the erosion of plant genetic resources was attracting the attention of the UN Food and Agriculture Organization (FAO) and was widely discussed at the 1972 UN Conference on the Human Environment. Shortly thereafter, the IUCN added *Threatened Plant Species* to its Red List system, focusing on plants that fell outside the interests of the FAO (Maunder, 2001), and the preservation of plant and animal genetic resources, particularly in the context of agriculture, took a central place on the agendas of international conservation, research, and development organizations.

The FAO began in the 1970s to integrate biodiversity and sustainability into its structure and core activities. The FAO Commission on Genetic Resources for Food and Agriculture (CGRFA), established in 1983, has collaborated with CBD and CGIAR in assessments of plant, animal, and forest genetic resources, and on initiatives for the conservation and sustainable use of soil biodiversity. CGRFA also oversaw negotiations for the International Treaty on Plant Genetic Resources for Food and Agriculture, adopted in 2001 to facilitate access and share benefits, and FAO helps set standards and global frameworks for collection, storage, preservation, and sustainable use of genetic resources.

International efforts to expand seed bank collections as a hedge against species loss have been spearheaded by botanical gardens and the Global Crop Diversity Trust (GCDT), which was jointly established by FAO and CGIAR/Biodiversity International. The Trust has collaborated with the Government of Norway to establish the Svalbard Global Seed Vault as a backup conservator of the world's gene bank collections against strife and natural disaster. The Millennium Seed Bank, sponsored and hosted by Kew Royal Botanic Gardens, works with a network of international partners to conserve wild plant diversity.

As of 2011, the CGIAR comprised a consortium of 15 research centers, and their research agenda had expanded beyond crop genetic improvement to include sustainable pest management and agricultural technologies, as well as research on the efficacy of proposed agricultural policies. In particular, Biodiversity International (formerly International Plant Genetic Resources Institute), located in Rome, focuses on how agricultural biodiversity can be used to improve nutrition and make agriculture more sustainable both economically and environmentally, and the International Food Policy Research Institute (IFPRI) in Washington researches policies and practices that can improve the sustainability of food production. A number of the centers are conducting research in agricultural and agroforestry landscapes, incorporating biodiversity as an element of research programs (CGIAR Website, 2011a).

In an effort to assess the challenges facing the global agricultural enterprise, including its relationship to ecosystems, agricultural livelihoods, agricultural knowledge, and food policies, seven UN agencies launched the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). The 3-year effort culminated in a 2008 synthesis report that analyzed issues and global scenarios for agricultural goals related to reducing hunger, improving health and rural livelihoods, and fostering environmental and social sustainability. Five subglobal assessments captured the regional differences in agricultural scenarios (IAASTD Website, 2011).

Conservation organizations and the international conservation science community are also exploring the connections between agriculture and biodiversity conservation. The MA observed a dichotomy between agricultural research and conservation biology, in which, for example, research on related species and landscapes proceeded on parallel tracks and without significant communication. International organizations are involved in efforts to bridge that divide. The DIVERSITAS agroBIODIVERSITY program fosters international research cooperation "to address the trade-offs between food production, biodiversity conservation, ecosystem services, and human well-being in agricultural landscapes" (Jackson *et al.*, 2005). International conservation organizations have also added sustainable agriculture to their activities, advocating alternatives to the slash-and-burn approach that is so destructive of forest ecosystems. In these efforts, conservation organizations are finding institutional partners from the business community. For example, IUCN joined with the World Business Council for Sustainable Development to produce a 2008 report calling attention to challenges related to agriculture and food security, WWF works with partners from local producers to international markets to promote practices and policies for sustainability (World Wildlife Fund Website, 2011), and the Conservation International Center for Environmental Leadership in Business negotiates agreements with international producers such as Starbucks to promote sustainable agricultural practices (CI Website, 2013).

## Forestry and Biodiversity

As discussed in the previous section, much of the work by FAO and CGIAR on agriculture and biodiversity has elements related to forestry and forest biodiversity. However, in the context of the UNFCCC, a new international organization has become a major player in forest conservation since 2009. The UN Program for Reducing Emissions from Deforestation and Forest Degradation (UN-REDD) is an intergovernmental agreement, jointly executed by FAO, UNDP, and UNEP, to create financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development, including biodiversity conservation. UN-REDD works in close coordination with the World Bank's Forest Carbon Partnership Facility (FCPF), which assists tropical and subtropical forest countries to develop REDD strategies.

Implementation of the REDD program, with its emphasis on sustainability and improved livelihoods, is important for both conservation and the forestry industry. International conservation organizations, such as WWF, IUCN, CI, and the Nature Conservancy, as well as the intergovernmental International Tropical Timber Organization (ITTO), have longstanding programs of research, field work, and policy development related to both forestry and climate, and they are active both in UN-REDD and in advising national REDD programs. Other multilateral development banks, such as the Asian Development Bank and the Inter-American Development Bank, are developing strategies to take advantage of emerging financial incentives for forest conservation under REDD.

Accelerating international trade is leading to increasing risk of introducing destructive invasive species, which can cause severe damage to forest ecosystems and ecosystem services. These invasive organisms range from disease-causing microbes to weeds to destructive insects to imported game animals, and can lead to significant economic harm. For that reason, the international trade negotiators incorporated the right to preserve plant, animal, and human health into the rules governing international trade. The Sanitary and Phytosanitary Agreement in the General Agreement on Tariffs and Trade (GATT) was incorporated into the structure of the World Trade Organization (WTO), giving the WTO a voice in a key area of biodiversity and ecosystem conservation.

## International Organizations and Aquatic Biodiversity

Marine and freshwater biodiversity have a long history of international study and regulation, and a concomitantly broad array of organizations with interests in aquatic biodiversity. The reasons are manifold: much of the marine realm is located outside national boundaries; many marine and freshwater organisms are mobile, traveling readily between and among different national and international regimes; aquatic biodiversity provides an important source of food and resources, and the societies and industries that rely on those resources have long recognized the need to protect them from excessive exploitation and damage from pollution. More recently, new imperatives for understanding and protecting marine biodiversity have arisen because of increased understanding of the role of marine microorganisms in critical biogeochemical processes that regulate atmospheric composition and global climate, and the new and poorly understood biological effects of global ocean acidification caused by the ocean's absorption of anthropogenic greenhouse gases.

UN agencies are central to marine biodiversity conservation. The UN Convention on Law of the Sea (UNCLOS) includes a Convention on Fishing and Conservation of Living Resources of the High Seas, which is one among dozens of global and regional instruments of international law designed to govern the exploitation of marine life and protect it from damage through pollution or overexploitation. There are specific agreements on whales, seals, marine mammals, sea turtles, cetaceans, sea birds, Antarctic marine life, highly migratory species, and straddling or anadromous stocks, in addition to the elements of CITES, CBD, and other treaties that apply to marine environments (International Fisheries Agreements, 2008). Some are executed by distinct international organizations such as the International Whaling Commission, set up by the International Convention for the Regulation of Whaling in 1946, which governs the conduct of whaling, maintains whale databases, and funds and publishes whale and whaling research. Another example is the Commission for the Conservation of Antarctic Marine Living Resources, which enforces the Convention on Antarctic Marine Living Resources. Other elements of the UN responsibility for marine life reside in UNDP, UNEP, FAO, CBD, and UNCLOS. Because of the UN's broadly distributed responsibilities for marine resources, a number of coordinating mechanisms have been established. In 1969, the Joint Group of Experts on the Scientific Aspects of Marine Environment Protection (GESAMP) was created to provide scientific guidance on marine issues to any of the nine sponsoring UN agencies, utilizing working groups of international experts; GESAMP prepared a report on marine biodiversity in 1997 (GESAMP, 1997) and has regularly considered biodiversity-related issues. To coordinate UN oversight of marine biodiversity, a task force on Marine Biodiversity Beyond National Jurisdiction was set up by the UN-Oceans interagency organization in 2005. The task force is jointly led by the UNCLOS and CBD.

Marine governance depends on data, and international databases are supported by a network of intergovernmental and independent international organizations. UNESCO's Intergovernmental Oceanographic Commission (IOC) manages the Global Ocean Observing System, which supports a number of remotely sensed databases related to marine biodiversity. Integrated fisheries databases are maintained by the Fishery Resources Monitoring System (FIRMS) in order to provide high-quality information for monitoring and managing fishery marine resources (FIRMS Website, 2011). FIRMS integrates data collected from a network of intergovernmental organizations such as the intergovernmental International Council for the Exploration of the Sea (ICES), which conducts research, maintains marine databases, and provides scientific advice to governments and international regulatory bodies related to the North Atlantic, and the Southeast Asian Fisheries Development Center, which promotes sustainable fisheries development in Southeast Asia, as well as conducting research and training.

International conservation and research organizations are likewise active in marine biodiversity issues. IUCN is leading an international consortium of organizations in a Global Ocean Biodiversity Initiative (GOBI), building on the Census of Marine Life assessment to compile a database to CBD standards that can be used as a scientific basis for conserving marine biodiversity (GOBI Website, 2011). The Nature Conservancy sponsors projects around the world aimed at protecting marine resources while also developing sustainable human communities adjacent to the sea. WWF has a Global Marine Program focusing on ecosystem-based management, "smart fishing," and protection of priority areas of great biological diversity. WWF is also sponsoring roundtables with aquaculture stakeholders to develop standards for sustainable aquaculture.

## Biodiversity and International Business Strategies

Biodiversity and ecosystem services are important to global economies. For that reason, international organizations engage in research to understand the role of ecosystems' "natural capital" in economics and work with businesses to ensure that economic development is compatible with the preservation of biodiversity.

The Economics of Ecosystems and Biodiversity (TEEB) is an intergovernmental initiative coordinated by UNEP to evaluate ecosystem services, including costs of biodiversity loss and strategies for governments and businesses to minimize those losses (TEEB Website, 2013).

The potential to use biodiversity as a source for the development of new commercial products, particularly pharmaceuticals and biofuels, has caused conflict between poor countries with rich biodiversity resources and the companies and nations that have the intellectual and financial resources to commercialize them. International organizations play a significant role in developing equitable solutions to those disputes. Moreover, conflicts of this sort combine with information campaigns by environmental advocates to raise public awareness of the importance of biodiversity and the negative effects that global development and trade can have. This awareness plays out in consumer preferences that create incentives for businesses to make their operations more sustainable.

International organizations have developed programs designed to assist enterprises with their sustainability strategies. These programs vary depending on the scale of the business, ranging from households looking to raise their incomes beyond subsistence levels through collection of organic, wild collected products, to global exporters of agricultural products that require a "green" certification for their biodiversity-friendly products and production methods. The International Trade Center (ITC), a joint program of the UN and the World Bank, works with small and medium-sized enterprises to comply with green certification schemes, both to ensure sustainable supply of "biodiversity products" or organic crops and to improve access to markets for small producers. They offer information, advisory services, and training for producers in developing countries (UN-ITC, International Trade Center Website 2011).

The Forest Stewardship Council (FSC) is one example of an international organization that uses a certification program to promote responsible management of the world's biodiversity resources. The FSC develops standards and conducts inspections to assure that forest products are being harvested with due respect to both forest-dependent communities and biodiversity (FSC Website, 2011). To certify the standards of the FSC, it has collaborated with environmental organizations such as WWF, which endorses the FSC on its website. It is also a member of the ISEAL Alliance, the global association for social and environmental standards (ISEAL Alliance Website, 2011). Other biodiversity-related accrediting organizations that are members of ISEAL include the International Federation of Organic Agriculture Movements, International Organic Accreditation Service, the Marine Aquarium Council, the Marine Stewardship Council for sustainable wild seafood, the Rainforest Alliance/Sustainable Agriculture Network, the Roundtable on Sustainable Biofuels, and Union for Ethical Bio Trade for ingredients from native biodiversity.

## Civil Society and Biodiversity

A number of international organizations doing research related to international economic development are engaged in work related to biodiversity conservation as an element of sustainable development. Likewise, relief organizations are recognizing that damage to ecosystem services is a consequence of relief activities during humanitarian crises, and mitigating those damages can be a valuable addition to planning. The convergence in interests and activities between these organizations, such as the International Institute for Environment and Development in London, the Center for Global Development in Washington, the Red Cross, and the international science and conservation organizations discussed earlier (*see* International Organizations and Biodiversity Conservation), demonstrates the breadth of the biodiversity agenda and its importance to all elements of human well-being.

Destruction of ecosystems and threats to biodiversity are endemic to human activity, and the international conservation community has recognized that humanitarian crises such as natural disasters, military conflicts, and the refugee emergencies that result can be compounded by the environmental consequences of the international interventions meant to relieve human suffering. In consequence, international conservation organizations have formed Stewardship Council partnerships to help in aid and recovery planning. For example, the UN High Commissioner for Refugees (UNHCR) has worked with international partners to develop sound environmental practices in establishing and operating refugee camps, both to mitigate degradation and to avoid conflicts over resources (UNHCR Website, 2011). UNHCR worked with CARE International, and relief workers in the field, to develop a toolkit to help field workers and managers make rapid environmental assessments to help minimize adverse environmental impacts and conflicts with surrounding communities (UNHCR, 2009). Likewise, WWF has worked with the Red Cross to develop guidelines for environmentally sustainable reconstruction efforts, a partnership that developed in the aftermath of the Indian Ocean tsunami in 2004 (WWF 2011a).

## Conclusion

This article offers a framework for understanding how international organizations contribute to the understanding and handling of the questions of biodiversity and human well-being. Although the author has made efforts to include the most important of the groups working in this sphere, the discussion cannot be considered exhaustive and, in addition, is in a constant state of flux, as organizations form, disperse, and change names or focus. Some important organizations and initiatives have undoubtedly been omitted.

*See also*: Agricultural Invasions. Agriculture, Industrialized. Agriculture, Sustainable. Agriculture, Traditional. Agrobiodiversity. Biodiversity in Logged and Managed Forests. Biodiversity Informatics. Biodiversity-Friendly Farming. Commons, Institutional Diversity of. Conservation Efforts, Contemporary. Conservation Movement, Historical. Conserving Biodiversity Outside Protected Areas. Convention on Biological Diversity. Ecology of Agriculture. Economic Control of Invasive Species. Economics of Agrobiodiversity. Ecosystem Services. Feeding the World and Protecting Biodiversity. Fish Conservation. Framework for Assessment and Monitoring of Biodiversity. Human Impact on Biodiversity, Overview. Indigenous Strategies Used to Domesticate Plants in Brazilian Amazon. Introduced Plants, Negative Effects of. Loss of Biodiversity, Overview. Mammals, Conservation Efforts for. Plant Conservation. Plant Invasions. Priority Setting for Biodiversity and Ecosystem Services. Rainforest Loss and Change. Slash-and-Burn Agriculture, Effects of. The Global Environment Facility: Financing the Stewardship of Global Biodiversity. The Value of Biodiversity. Timber Industry

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