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Biodiversity and Rural development in ACP countries

Resources on ACP Biodiversity and Rural development

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Introduction

Biodiversity is the foundation of ecosystem services to which human well-being is intimately linked. No feature of Earth is more complex, dynamic, and varied than the layer of living organisms that occupy its surfaces and its seas, and no feature is experiencing more dramatic change at the hands of humans than this extraordinary, singularly unique feature of Earth. This layer of living organisms— the biosphere— through the collective metabolic activities of its innumerable plants, animals, and microbes physically and chemically unites the atmosphere, geosphere, and hydrosphere into one environmental system within which millions of species, including humans, have thrived. Breathable air, potable water, fertile soils, productive lands, bountiful seas, the equitable climate of Earth's recent history, and other ecosystem services are manifestations of the workings of life. It follows that large-scale human influences over this biota have tremendous impacts on human well-being. It also follows that the nature of these impacts, good or bad, is within the power of humans to influence[2].

The planet's biodiversity is remarkable. No fewer than 1.5 million species have been named and described; at least three times this and possibly many more await discovery (Novotny et al. 2002). This biodiversity provides incalculable benefit to humanity. Most directly, it comprises a vast genetic storehouse of medicines, foods and fibers (Myers 1983). Strong evidence suggests that biodiversity endows stability to ecosystems (Naeem and Li 1997), sheltering humanity from disease and natural disasters. Moreover, these ecosystems yield services of substantial economic value (Costanza et al. 1997), although most of these remain significantly undervalued. Least tangibly but no less importantly, all of the world's societies and cultures value species for their own sake, over and above any utilitarian purpose (Wilson 1984).

Biodiversity and the Millennium Development Goals

A major challenge currently facing the international community is finding ways to transform these precarious living conditions for the poorest of the poor. One global initiative that intends to do this is the campaign to achieve the Millennium Development Goals (MDGs). Biodiversity is dealt with explicitly under the seventh MDG, which is a commitment to ensure environmental sustainability. But it is clear that the conservation and sustainable use of biological diversity is also central to achieving many of the other goals. The first goal of eradicating hunger, for example, depends on sustainable and productive agriculture. And that in turn relies on conserving and maintaining agricultural soils, water, genetic resources and ecological processes. The capacity of fisheries to supply hundreds of millions of the world's people with the bulk of their animal protein intake, for example, depends on maintaining ecosystems (such as mangroves and coral reefs) that provide fish with habitats and sustenance. Three of the goals (numbers 4, 5 and 6) are aimed at improving health and sanitation. Each of these requires healthy, functioning freshwater ecosystems to provide adequate supplies of clean water, and a sustainable supply of genetic resources for both modern and traditional medicine[3].

1. A definition of Biodiversity

Biodiversity is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." The importance of this definition is that it draws attention to the many dimensions of biodiversity. It explicitly recognizes that every biota can be characterized by its taxonomic, ecological, and genetic diversity and that the way these dimensions of diversity vary over space and time is a key feature of biodiversity. Thus only a multidimensional assessment of biodiversity can provide insights into the relationship between changes in biodiversity and changes in ecosystem functioning and ecosystem services. Biodiversity includes all ecosystems—managed or unmanaged[4] .

1.1. Measuring Biodiversity: Species Richness and Indicators

In spite of many tools and data sources, biodiversity remains difficult to quantify precisely. But precise answers are seldom needed to devise an effective understanding of where biodiversity is, how it is changing over space and time, the drivers responsible for such change, the consequences of such change for ecosystem services and human well-being, and the response options available. Ideally, to assess the conditions and trends of biodiversity either globally or sub-globally, it is necessary to measure the abundance of all organisms over space and time, using taxonomy (such as the number of species), functional traits (for example, the ecological type such as nitrogen-fixing plants like legumes versus non-nitrogen-fixing plants), and the interactions among species that affect their dynamics and function (predation, parasitism, competition, and facilitation such as pollination, for instance, and how strongly such interactions affect ecosystems). Even more important would be to estimate turnover of biodiversity, not just point estimates in space or time. Currently, it is not possible to do this with much accuracy because the data are lacking. Even for the taxonomic component of biodiversity, where information is the best, considerable uncertainty remains about the true extent and changes in taxonomic diversity.

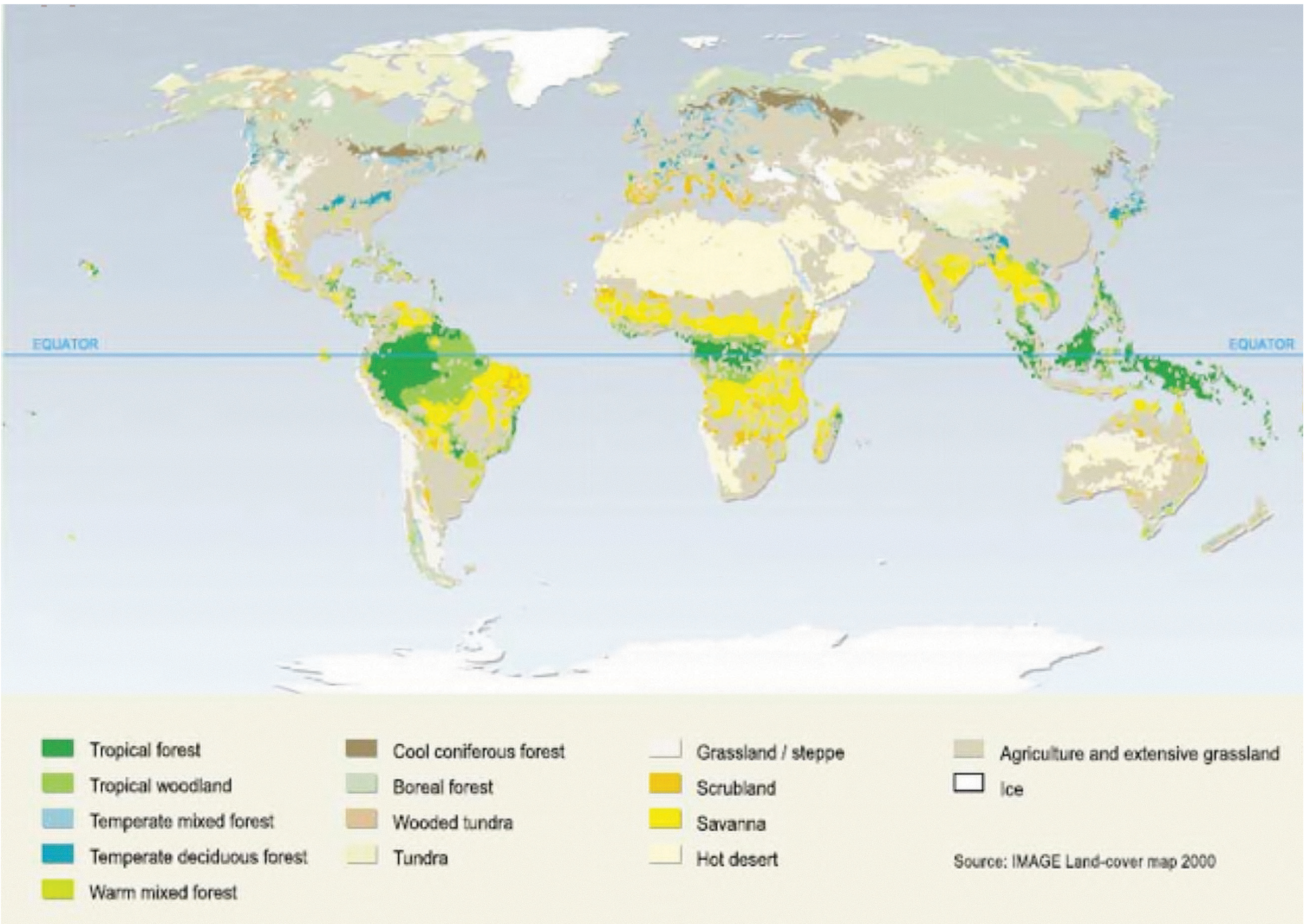
1.2. Where Is Biodiversity?

The biodiversity found on Earth today consists of many millions of distinct biological species, which is the product of nearly 3.5 billion years of evolution. Recent estimates of the total number of species range from 7 to 20 million, of which only about 1.75 million species have been scientifically described. The best-studied groups include plants and vertebrates (phylum Chordata), whereas poorly described groups include fungi, nematodes, and arthropods. Species that live in the ocean and in soils remain poorly known. For most groups of species, there is a gradient of increasing diversity from the Poles to the Equator, and the vast majority of species are concentrated in the tropical and subtropical regions.

Biodiversity is essentially everywhere, ubiquitous on Earth's surface and in every drop of its bodies of water. The virtual omnipresence of life on Earth is seldom appreciated because most organisms are small (<5 centimeters); their presence is sparse, ephemeral, or cryptic, or, in the case of microbes, they are invisible to the unaided human eye.

Documenting spatial patterns in biodiversity is difficult because taxonomic, functional, trophic, genetic, and other dimensions of biodiversity have been relatively poorly quantified. Even knowledge of taxonomic diversity, the best known dimension of biodiversity, is incomplete and strongly biased toward the species level, megafauna, temperate systems, and components used by people. This results in significant gaps in knowledge, especially regarding the status of tropical systems, marine and freshwater biota, plants, invertebrates, microorganisms, and subterranean biota.[5]

Land-cover Map for the Year 2000[6]



2. Building on a commitment to biodiversity

Many of the world's governments have endorsed the Fifth World Congress' recent call to expand protected area networks for conserving biodiversity strategically, building on 15 years of momentum that has seen the establishment of the following organizations and actions:

- 1992 – The Convention on Biological Diversity (CBD) is established at the Earth Summit in Rio de Janeiro, to which 188 nations are now parties. It requires parties to inventory national biodiversity; Integrate biodiversity protection into relevant policies and programmes; Identify and monitor activities that harm biodiversity, and protect biodiversity through a range of measures that include the creation of protected areas and the implementation of regulations and incentives aimed at ensuring its sustainable use and, develop National Biodiversity Strategies and Action Plans (NBSAPs).

- 2000 - The Conference of the Parties to the Convention on Biological Diversity adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms[7] resulting from modern biotechnology.

- 2000 – The Millennium Development Goals recognize "land area protected to maintain biological diversity" as a core measure to achieve Goal 7 on environmental sustainability, and towards all eight goals aimed at reducing poverty.

- 2002 – The Sixth Conference of the Parties of the CBD formalizes a target to significantly reduce the rate of biodiversity loss by 2010.

- 2002 – World Summit on Sustainable Development affirms the above target in its

- Johannesburg Plan of Implementation.

- 2002 – The United Nations includes biodiversity as one of five priority issues for sustainable development ("WEHAB" Water, Energy, Health, Agriculture and Biodiversity).

- 2010: International Year of Biodiversity, the Conference of the Parties to the Convention on

- Biological Diversity will be held in Nagoya Japan in October 2010.

- Other international instruments are key to the preservation of Biodiversity such as:

- The 1982 United Nations Convention on the Law of the Sea (UNCLOS 1982) and the FAO Code of Conduct for Responsible Fisheries (CCRF 1995) provide the umbrella for FAO's work in fisheries[8] .

- 1983: FAO Conference adopts the International Undertaking on Plant Genetic Resources as the first international agreement on plant genetic resources for food and agriculture and establishes the CGRFA.

- 1996: The rolling Global Plan of Action for the Conservation and Sustainable Utilization of

- Plant Genetic Resources for Food Agriculture (GPA)

- Publication of the first State of the World's Plant Genetic Resources for Food and Agriculture to provide an assessment of the current situation of plant genetic resources and lay the foundation for the GPA. Periodic updating of this Report is undertaken by FAO to facilitate revision of the GPA in light of emerging issues and trends.

- 2001: the FAO Conference adopts the ITPGRFA as a legally binding outcome of the revision of the International Undertaking on Plant Genetic Resources.

- 2004: International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and establishment of the Global Crop Diversity Trust to ensure ex situ crop conservation in perpetuity.

Protecting genetic resources

The International Treaty on Plant Genetic Resources for Food and Agriculture, an international binding agreement with the overall goal of supporting global food security, was adopted by the FAO Conference in 2001 and entered into force in 2004. The Treaty allows governments, farmers, research institutes and agro-industries to work together by pooling their genetic resources and sharing the benefits from their use – thus protecting and enhancing our food crops while giving fair recognition and benefits to local farmers who have nurtured these crops through the millennia. In today's world, the pressure is on to improve agricultural production by developing food crops that can adapt to environmental changes and meet the growing food demands of a constantly increasing population. Under the Treaty, crops that produce our food – our breads, our curries, our tortillas, and our couscous – are put into a common pool. As nations ratify the Treaty, they begin the process of setting up national commissions and committees to oversee implementation. This means ensuring conformity of the country's laws, regulations and procedures with its obligations under the Treaty and providing guidance for including the relevant genetic resources in the Treaty's Multilateral System (MLS).

The Treaty's truly innovative solution to access and benefit sharing, the Multilateral System, puts 64 of our most important crops – crops that together account for 80 percent of the food we derive from plants – into an easily accessible global pool of genetic resources that is freely available to potential users in the Treaty's ratifying nations for some uses.

3. Role of Biodiversity

3.1. Biodiversity and its link to Ecosystem Services

Biodiversity plays an important role in ecosystem functions that provide supporting, provisioning, regulating, and cultural services. These services are essential for human well-being. Ecosystem functioning, and hence ecosystem services, at any given moment in time is strongly influenced by the ecological characteristics of the most abundant species, not by the number of species. The relative importance of a species to ecosystem functioning is determined by its traits and its relative abundance. For example, the traits of the dominant or most abundant plant species—such as how long they live, how big they are, how fast they assimilate carbon and nutrients, how decomposable their leaves are, or how dense their wood is—are usually the key species drivers of an ecosystem's processing of matter and energy. Thus conserving or restoring the composition of biological communities, rather than simply maximizing species numbers, is critical to maintaining ecosystem services. Local or functional extinction, or the reduction of populations can have dramatic impacts on ecosystem services.[9]

3.2. Supporting Services

Biodiversity affects key ecosystem processes in terrestrial ecosystems such as biomass production, nutrient and water cycling, and soil formation and retention—all of which govern and ensure supporting services. The relationship between biodiversity and supporting ecosystem services depends on composition, relative abundance, functional diversity, and, to a lesser extent, taxonomic diversity. Although the stability of an ecosystem depends to a large extent on the characteristics of the dominant species (such as life span, growth rate, or regeneration strategy), less abundant species also contribute to the long-term preservation of ecosystem functioning. There is evidence that a large number of resident species, including those that are rare, may act as "insurance" that buffers ecosystem processes in the face of changes in the physical and biological environment (such as changes in precipitation, temperature, pathogens)[10] .

3.3. Regulating Services[11]

Invasion resistance

The preservation of the number, types, and relative abundance of resident species can enhance invasion resistance in a wide range of natural and semi-natural ecosystems. Although areas of high species richness (such as biodiversity hot spots) are more susceptible to invasion than species-poor areas, within a given habitat the preservation of its natural species pool appears to increase its resistance to invasions by non-native species.

Pollination: Pollination is essential for the provision of plant-derived ecosystem services, yet there have been worldwide declines in pollinator diversity. Many fruits and vegetables require pollinators, thus pollination services are critical to the production of a considerable portion of the vitamins and minerals in the human diet.

Climate regulation: Biodiversity influences climate at local, regional, and global scales, thus changes in land use and land cover that affect biodiversity can affect climate. The important components of biodiversity include plant functional diversity and the type and distribution of habitats across landscapes. These influence the capacity of terrestrial ecosystems to sequester carbon, albedo (proportion of incoming radiation from the Sun that is reflected by the land surface back to space), evapotranspiration, temperature, and fire regime—all of which influence climate, especially at the landscape, ecosystem, or biome levels.

Pest, disease, and pollution control: The maintenance of natural pest control services, which benefits food security, rural household incomes, and national incomes of many countries, is strongly dependent on biodiversity. Yields of desired products from agroecosystems may be reduced by attacks of animal herbivores and microbial pathogens, above and below ground, and by competition with weeds. Increasing associated biodiversity with low-diversity agroecosystems, however, can enhance biological control and reduce the dependency and costs associated with biocides. Moreover, high-biodiversity agriculture has cultural and aesthetic value and can reduce many of the externalized costs of irrigation, fertilizer, pesticide, and herbicide inputs associated with monoculture agriculture.[12]

4. Threats to Biodiversity and Repercussions of Biodiversity Loss

4.1. Understanding Biodiversity Loss

For the purposes of assessing progress toward the 2010 targets, the Convention on Biological Diversity defines biodiversity loss to be "the long-term or permanent qualitative or quantitative reduction in components of biodiversity and their potential to provide goods and services, to be measured at global, regional and national levels" (CBD COP VII/30). Under this definition, biodiversity can be lost either if the diversity per se is reduced (such as through the extinction of some species) or if the potential of the components of diversity to provide a particular service is diminished (such as through unsustainable harvest). The homogenization of biodiversity—that is, the spread of invasive alien species around the world—thus also represents a loss of biodiversity at a global scale (since once- distinct groups of species in different parts of the world become more similar) even though the diversity of species in particular regions may actually increase because of the arrival of new species.

4.2. Scenarios and future trends

Local knowledge about biodiversity and natural resources management has allowed people to subsist in often challenging environmental conditions. However, the magnitude and intensification of more recent developments is threatening both this adaptive capacity and nature's biodiversity itself. Issues such as climate change, over-harvesting, environmental degradation, globalization, and commercialization have serious impacts on biological and human systems. Many genetic varieties have disappeared and hence people will loose their understanding of biological resource use. The result is an erosion in the foundations which uphold our agricultural systems and food security. Agricultural systems are underpinned by the interdependence between biodiversity and local knowledge of both men and women.

Further declines are projected over the coming decades because of factors such as population growth, changing land use, economic expansion and global climate change. Leading international economic organizations such as the World Bank and the OECD confirm these worrying predictions. The OECD has described a highly daunting combination of challenges facing humanity: tackling climate change, halting biodiversity loss, ensuring clean water and adequate sanitation, and reducing the human health impacts of environmental degradation (OECD 2008). During 2007 and 2008, the push to develop biofuels resulted in massive changes in land use and a steep increase in the price of some staple food crops. Continuing high rates of economic growth in some of the large developing economies have resulted in demand outstripping supply for several commodities, putting even greater pressure on natural systems. Recent evidence of climate change suggests much faster and deeper impacts than previously predicted, including the risk of human conflicts caused by competition for biodiversity resources and ecosystem services (WBGU 2008).

Millenium Ecosystems Assessment scenarios13

The approach to scenario development used in the Millennium Ecosystems Assessment (MA) consists of a combination of qualitative storyline development and quantitative modeling based on assumptions about the evolution of indirect drivers such as economic and population growth.

- The Global Orchestration scenario explores the possibilities of a world in which global economic and social policies are the primary approach to sustainability.

- The Order from Strength scenario examines the outcomes of a world in which protection through boundaries becomes paramount.

- The Adapting Mosaic scenario explores the benefits and risks of environmentally proactive local and regional management as the primary approach to sustainability.

- The TechnoGarden scenario explores the potential role of technology in providing or improving the provision of ecosystem services.

Results of inaction could be devastating, for example Natural areas will continue to be converted to agricultural land, and will be affected by the expansion of infrastructure and by climate change. By 2050, 7.5 million square kilometres are expected to be lost, or 11% of 2000 levels[14]. Land currently under extensive (low-impact) forms of agriculture, which often provides important biodiversity benefits, will be increasingly converted to intensive agricultural use, with further biodiversity losses and with damage to the environment. Almost 40% of land currently under extensive agriculture is expected to be lost by 2050.[15] 60% of coral reefs could be lost by 2030 through fishing damage, pollution, disease, invasive alien species and coral bleaching, which is becoming more common with climate change. (Hughes et al. 2003).

4.3. The need for Conserving and using Biodiversity

The loss of biodiversity poses a serious threat to agriculture and the livelihoods of millions of people. Conserving biodiversity and using it wisely is a global imperative as it provides the foundation for our agricultural systems and to improve yield, quality, resistance to pests and diseases and adapt to changing environmental conditions, such as global warming.

There are different approaches to conserving biodiversity[16]:

On farm management: involves the maintenance of crop species on farm or in home gardens. The effectiveness of strategies to maintain and use crop or livestock diversity on farms depends on the extent to which local varieties continue to meet the needs of farmers and communities. The approach taken needs to be one that is embedded in the community and reflects its values and concerns. Many plant genetic resources, especially those of minor crops, are managed as part of agricultural production systems.

In situ conservation: refers to the maintenance and use of wild plant populations in the habitats where they naturally occur and have evolved without the help of human beings.

The wild populations regenerate naturally, and are dispersed naturally by wild animals, winds and in water courses. There exists an intricate relationship, often interdependence, between the different species and other components of the environment (such their pests and diseases) in which they occur. The evolution is purely driven by environmental pressures and any changes in one component affect the other. Provided that changes are not too drastic, this dynamic co-evolution leads to greater diversity and better adapted germplasm.

Ex situ conservation of germplasm takes place outside the natural habitat or outside the production system, in facilities specifically created for this purpose. Depending on the type of species to be conserved, different ex situ conservation methods may be used.

The importance of genebanks has increased significantly over the last several decades. As commercial agriculture has expanded many farming systems that preserved local agricultural diversity have been transformed and local varieties have been lost. Controlling powerful social and economic forces so that they do not result in genetic erosion is often not possible, certainly not in the short term. As a result, genebanks often represent the only option for conserving biodiversity. In genebanks[17], biodiversity is managed so that breeders, farmers and researcher can use it in their work. To make the genetic resources useful to farmers, breeders and researchers, genebank managers must carefully document the collected materials, make the information available and establish a transparent and safe system for its distribution.

Complementary conservation

The various conservation approaches discussed above have distinct advantages and disadvantages, but the most effective conservation system should incorporate elements of both. They need to be used in a complementary manner. A complementary conservation strategy involves striking the right balance between different methods employed. It depends on the species being conserved, the local infrastructure and human resources, the number of accessions in a given collection, its geographic site and use of the conserved germplasm.

5. Agricultural biodiversity

5.1. What is Agricultural Biodiversity[18] ?

Agricultural biodiversity is a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes (COP decision V/5, appendix). Agricultural biodiversity is the outcome of the interactions among genetic resources, the environment and the management systems and practices used by farmers. This is the result of both natural selection and human inventive developed over millennia. The following dimensions of agricultural biodiversity can be identified:

(a) Genetic resources for food and agriculture:

- Plant genetic resources, including crops, wild plants harvested and managed for food, trees on farms, pasture and rangeland species,
- Animal genetic resources, including domesticated animals, wild animals hunted for food, wild and farmed fish and other aquatic organisms,
- Microbial and fungal genetic resources.

(b) Components of biodiversity that support ecosystem services upon which agriculture is based.

These include a diverse range of organisms that contribute, at various scales to, inter alia, nutrient cycling, pest and disease regulation, pollination, pollution and sediment regulation, maintenance of the hydrological cycle, erosion control, and climate regulation and carbon sequestration.

(c) Abiotic factors, such as local climatic and chemical factors and the physical structure and functioning of ecosystems, which have a determining effect on agricultural biodiversity.

(d) Socio-economic and cultural dimensions: agricultural biodiversity is largely shaped and maintained by human activities and management practices, and a large number of people depend on agricultural biodiversity for sustainable livelihoods. These dimensions include traditional and local knowledge of agricultural biodiversity, cultural factors and participatory processes, as well as tourism associated with agricultural landscapes.

5.2. Biodiversity and agriculture are strongly interdependent

Biodiversity is the basis of agriculture. It has enabled farming systems to evolve ever since agriculture was first developed some 10,000 years ago. Biodiversity is the origin of all species of crops and domesticated livestock and the variety within them. It is also the foundation of ecosystem services essential to sustain agriculture and human well-being. Biodiversity and agriculture are strongly interrelated because while biodiversity is critical for agriculture, agriculture can also contribute to conservation and sustainable use of biodiversity.

5.3. Special nature of agricultural biodiversity

Biodiversity is essential to:

- ensure the production of food, fibre, fuel, fodder... Agricultural biodiversity provides humans with food and raw materials for goods - such as cotton for clothing, wood for shelter and fuel, plants and roots for medicines, and materials for biofuels - and with incomes and livelihoods, including those derived from subsistence farming.
- maintain other ecosystem services : agricultural biodiversity also performs ecosystem services such as soil and water conservation, maintenance of soil fertility and biota, and pollination, all of which are essential to human survival.
- allow adaptation to changing conditions. Genetic diversity of agricultural biodiversity provides species with the ability to adapt to changing environment.
- and sustain rural peoples' livelihoods: the importance

of agricultural biodiversity encompasses socio-cultural, economic and environmental elements.

The Conference of the Parties has recognized “the special nature of agricultural biodiversity, its distinctive features, and problems needing distinctive solutions” (COP decision V/5, appendix). Indeed, several features set agricultural biodiversity apart other components of biodiversity:

- Agricultural biodiversity is essential to satisfy basic human needs for food and livelihood

- Agricultural biodiversity has been - and is still - shaped and developed through human activities and practices over generations. Farmers' communities play a key role as custodians and managers of agricultural biodiversity. This is why local and traditional knowledge and culture are integral parts of agricultural biodiversity management.

- Because of the degree of human management, conservation of agricultural biodiversity in production systems is inherently linked to sustainable use.

- Much agricultural biodiversity is conserved ex situ in gene banks or breeders' materials.

- For crops and domestic animals, diversity within species is at least as important as diversity between species and has been greatly expanded through agriculture.

- Many farming systems are based on alien crop species introduced from elsewhere; this creates a high degree of interdependence between countries for the genetic resources.

- The interaction between the environment, genetic resources and management practices that occurs in situ within agro-ecosystems often contributes to maintaining a dynamic portfolio of agricultural biodiversity.

5.4. The evolution of agriculture threatens agricultural biodiversity

Agriculture has to face two main challenges in relation to Biodiversity:

- to sustain agricultural biodiversity and ecosystem services provided by, and necessary for, agriculture, and

- to mitigate the negative impacts of agricultural systems and practices on biodiversity which is not used directly whether in the same or other ecosystems.

To address these challenges, agriculture is required to take into account different drivers of change such as:

(a) indirect drivers, e.g. demography (and the expected major growth world population and food demand), economy (e.g. globalization, market, and trade forces), socio politics (e.g. consumption choices, and policy, institutional and legal frameworks), and science and technology;

(b) direct drivers, e.g. climate change, natural resource availability (in particular water), overuse of agricultural chemicals, land-use changes.

All these drivers contribute to the loss of biodiversity both in agricultural and other ecosystems, threatening human well-being. While agriculture contributes significantly to conservation and sustainable use of biodiversity, it is also a major driver of biodiversity loss. The Earth's biodiversity is being lost at an alarming rate, putting in jeopardy the sustainability of agriculture and ecosystem services and their ability to adapt to changing conditions, threatening food and livelihoods security. The major challenge for agriculture is to ensure food security, adequate nutrition and stable livelihoods for all, now and in the future, by increasing food production while adopting sustainable and efficient agriculture, sustainable consumption of resources, and landscape-level planning to ensure the preservation of biodiversity.

During the last decades, worldwide biodiversity has been lost at an unprecedented rate in all the ecosystems, including agro-ecosystems. Homogenization of agricultural production systems, mainly due to intensification of agricultural systems coupled with specialization by plant and animals breeders and the harmonizing effects of globalization, is one of the greatest causes of agricultural biodiversity

loss, through genetic erosion and the increasing levels of genetic vulnerability of specialized crops and livestock. According to the FAO, it is estimated that about three-quarters of the genetic diversity found in agricultural crops has been lost over the last century, and this genetic erosion continues. For example, today, 90% of our food energy and protein comes from only 15 plant and 8 animal species, with disturbing consequences for nutrition and food security. Wheat, rice and maize alone provide more than 50% of the global plant-based energy intake. In addition to agricultural biodiversity, modern agricultural practices can also impact biodiversity in other ecosystems through several ways such as unsustainable demands on water (for irrigation for example), overgrazing, as well as excessive use of nutrients and chemical inputs to control weeds, pests and diseases that result in problems of pollution and eutrophication. Furthermore, land and habitat conversion (in particular forests, wetlands, and marginal lands) to large-scale agricultural production also cause significant loss of biodiversity.

Although farmers' traditional knowledge is key to both sustain biodiversity and to ensure global food security, today it is as well considered by many to be part of the much-threatened global commons. Farmers are requested to both preserve biodiversity and contribute to meet the nutritional needs of a growing population. However, they do not control all factors involved including those related to agricultural policies, incentives , markets or consumption patterns, and therefore need support from government policy.

The CBD programme of work on agricultural biodiversity (decision V/5, annex) is structured to take into account the different dimensions of agricultural biodiversity and is based on four elements:

- assessing the status and trends of the world's agricultural biodiversity, the underlying causes of change, and knowledge of management practices;
- identifying adaptive management techniques, practices and policies;
- building capacity, increasing awareness and promoting responsible action; and
- mainstreaming national plans and strategies for the conservation and sustainable use of agricultural biodiversity into relevant agriculture sectors.

A more innovative and sustainable approach is to incorporate biodiversity conservation into food production practices, a strategy that is increasingly referred to as 'ecoagriculture'. This refers to the many different ways in which land can be used to produce food, while also supporting the maintenance of biodiversity and other critical ecosystem services. There is a range of methods for promoting such 'dual-use' of land, from reducing the amount of chemicals used, to providing more wildlife breeding sites on farms. The maintenance of natural pest control services, which benefits food security, rural household incomes, and national incomes of many countries, is strongly dependent on biodiversity[19] .

5.5. Biodiversity, Nutrition and Health[20]

Currently there are more than one billion hungry people in the world. One in three people worldwide, mostly women and children, suffer from diseases associated with malnutrition and the lack of vital nutrients. At the same time diseases previously associated with affluence, such as obesity, type 2 diabetes and heart disease, are on the rise among the poor in developing and developed countries. Biodiversity contributes to food security: wild-harvested food species are particularly significant to the poor and landless, in times of famine and insecurity when food supply mechanisms are disrupted, and at normal times as a complement to staple foods.

Biodiversity can improve food security by the adoption of farming practices that maintain and make use of agricultural biodiversity. Biodiversity is important to maintaining agricultural production. Wild relatives of domestic crops provide genetic variability that can be crucial for overcoming outbreaks of pests and pathogens and new environmental stresses. Many agricultural communities consider increased local diversity a critical factor for the long-term productivity and viability of their agricultural systems.

5.5.1. Declining diversity brings a decline in nutrition

The causes of malnutrition are complex, but chief among them is a general simplification of diets. In cities, people are increasingly deriving most of their energy from refined carbohydrates (chiefly wheat, rice and sugar) and processed fats and oils, which are currently cheaper than ever in many developing countries. In many countries of the developing world, traditional and indigenous foods, which are often more nutritious than modern foods traded on the global market, are being neglected and forgotten.

5.5.2. Researching the links between local biodiversity and nutrition

If a simplification in diet is responsible for a decline in nutrition levels, it follows that a diversification of diets could counter this trend. And there is considerable evidence to support this. However, one of the most difficult tasks in promoting the nutritional benefits of a diverse diet is to measure the exact contributions made by individual components of the diet. This is difficult for a variety of reasons. Food Composition Tables, for example, a primary source of information about nutrition, give detailed analytical data about a wide variety of nutrients found in a wide variety of foods. But these tables tend to measure a single 'type' of food or else to average across several varieties or cultivars. This average measure can hide large differences. In rice, for example, some varieties contain 2.5 times more iron than others. Similar differences exist for other micronutrients, and indeed for some crops and some nutrients there can be hundredfold differences between varieties. Furthermore, nutritional data on indigenous and traditional fruits, vegetables, condiments and spices are scanty and fragmented. One reason for this is that modern agriculture and nutritional sciences have not seriously considered the role of indigenous and uncultivated wild plants in the diets of rural and peri-urban populations.

5.5.3. Tapping into local knowledge

The traditional knowledge held by indigenous and other peoples in agriculture can be considered as a "storage" of knowledge, including on best practices for sustainable agriculture. This knowledge has always been essential in adapting to environmental conditions. Rural populations have relied on the environment for thousands of years, and local knowledge about that environment has persisted throughout. This unique relationship means that rural men and women have accumulated specialized information about biological variation and management, allowing to protect themselves against crop failure, animal loss, soil infertility, climate shifts, and other threatening factors. Farmers are both users and custodians of biodiversity.[21]

Ethiopian farmers, for example, have identified at least three landraces of sorghum that contain about 30 percent more protein than other varieties. More importantly, they contain 50 to 60 percent more lysine (a limiting amino acid in sorghum) than average. These varieties are recognized as having value for sick children and nursing mothers. The Luo people of western Kenya say that the leafy vegetables that form an important part of the traditional diet protect against gastro-intestinal disturbances: at least one of them, Solanum nigrum, is powerfully effective against the protozoan gut parasite Giardia lamblia.

5.5.4. Neglected and Underutilized Species

Global food security has become increasingly dependent on only a handful of crops. Over 50 percent of the global requirement for proteins and calories are met by just three, maize, wheat and rice. Only150 crops are traded on a significant global scale. Yet, surveys indicate there are over 7 000 plant species across the world that are cultivated or harvested from the wild for food. These neglected and underutilized species play a crucial role in the food security, income generation and food culture of the rural poor. Lack of attention has meant that their potential value is under-estimated and under- exploited. It also places them in danger of continued genetic erosion and disappearance. This would further restrict development options for the poor.

Neglected crops are those grown primarily in their centres of origin or centres of diversity by traditional farmers, where they are still important for the subsistence of local communities. Some species may be globally distributed, but tend to occupy special niches in the local ecology and in production and consumption systems. While these crops continue to be maintained by cultural preferences and traditional practices, they remain inadequately characterized, and neglected by research and conservation. Underutilized crops were once more widely grown but are falling into disuse for a number of reasons. Farmers and consumers are using these crops less because they are in some way not competitive with other crop species in the same agricultural environment. The decline of these crops may erode the genetic base and preventing the use of distinctive useful traits in crop adaptation and improvement.

Growing market opportunities for these species may generate additional income to those poor farmers in less favored environments where these crops have comparative advantages over staples or major crops. Climate change and the degradation of land and water resources have led to a growing interest for crops and species that are adapted to difficult environments. The poor status of underutilized and neglected species conservation severely hinders their successful improvement and promotion. Efforts need to be directed towards the better maintenance of their resource base, both through ex situ and in situ conservation methods, to ensure their development and their sustainable use by present and future generations[22].

5.5.5. Biodiversity and Health

People have known the medicinal value of certain plants for thousands of years and biodiversity has helped our understanding of the human body. So ecosystems provide huge health benefits, and thus economic benefits. There are significant direct links between biodiversity and modern healthcare (Newman and Cragg 2007) and three quarters of the world's population depend on natural traditional remedies. Despite the enormous health benefits, plants are disappearing fast and will continue to do so unless urgent action is taken. The 2007 IUCN Red List of Threatened Species identified a significant increase in species under threat during this decade. It estimates that 70%of the world's plants are in jeopardy (IUCN 2008). A recent global study reveals that hundreds of medicinal plant species, whose naturally occurring chemicals make up the basis of over 50%of all prescription drugs, are threatened with extinction. This prompted experts to call for action to "secure the future of global healthcare". (Hawkins 2008).

The biodiversity-healthcare relationship also has a strong distributional equity dimension. There is often a mismatch between the regions where benefits are produced, where their value is enjoyed, and where the opportunity costs for their conservation are borne. Transferring some of the rich world benefits back to local people could be one approach to improving incentives to conserve those natural habitats and species locally that clearly have wider benefits globally.

An important component of health is a balanced diet. About 7,000 species of plants and several hundred species of animals have been used for human food consumption at one time or another. Some indigenous and traditional communities currently consume 200 or more species. Wild sources of food remain particularly important for the poor and landless to provide a somewhat balanced diet. Overexploitation of marine fisheries worldwide, and of bush meat in many areas of the tropics, has lead to a reduction in the availability of wild-caught animal protein, with serious consequences in many countries for human health. [23]

6. Forest Biodiversity

In terms of biodiversity, tropical forests are the richest terrestrial ecosystems. Like all other types of forests, they have been used by humans since time immemorial, providing a range of goods, such as wood, foods and medicines, which have waxed and waned in perceived importance through the ages (FAO). Out of this complex situation, a richer understanding of forests is emerging, which includes recognition not only of the goods provided by forests but also of the ecosystem services that they provide, such as watershed protection, protection of soils and climate stabilization.

Demand for wood production

In 2005, about half the world forest area was designated for production of wood and non-wood forest products. Rapidly increasing demands for wood, notably from paper and pulp industries due to growing paper consumption, and from the energy generation sector to supply biofuels, is expected to put further pressures on forest resources and survival.

Forest area and deforestation

Global forest area accounted for about 4 billion hectares or 30% of total land area in 2005. The OECD Environmental Outlook Baseline projects that natural forest areas will decrease by a further 13% worldwide from 2005 to 2030, with the greatest rates of deforestation occurring in South Asia and Africa. Primary forests were lost or modified to other forest types at an average rate of 6 million ha per year over the past 15 years, and the rate of loss is increasing. Tropical and boreal forests are under pressure from deforestation and forest degradation in primary forests. With some exceptions, most of the logging in the topical and boreal regions involves “cut-and-go” operations in primary forests, i.e., short-term exploitation of industrial wood products without caring for the long-term regeneration of the forest.

Increasing plantation forests

The increasing development of intensive forest plantations for wood production is another threat to forest biodiversity. Productive forest plantations covered 109 million hectares in 2005, having increased annually by about 2 million hectares between 2000 and 2005. Although the total extent of productive plantation areas is relatively small, they provide 22% of world industrial wood supply (FAO, 2006). The area of productive plantation is expected to increase over the coming decades to meet the growing demand for wood products. Forest biodiversity in plantation forests is much less than in natural forests. Plantation forests can affect the soil structure, chemical composition, regional hydrological cycle (and regional ecosystems), and cause significant water depletion in the basin. Other environmental issues in monoculture plantations include genetic impoverishment and increased risk of spread of insects and disease. However, it has been argued that increasing wood production from plantations can reduce the pressures on natural forests for industrial wood extraction. Sustainably managed plantation forests can also play a vital role in conservation of biodiversity by acting as buffer zones for fragmented remaining forests.

Between 1990 and 2005, sub-Saharan Africa lost an estimated 47 million hectares of forests

The forests of Africa are largely concentrated in the tropical zones of Western and Central, Eastern and Southern Africa. With more than 133 million hectares of forests, the Democratic Republic of the

Congo alone has more than 25 per cent of the region’s forest cover.47 Forests play an important economic role in many countries, by providing ecosystem services for resident populations as well as being a source of food and other non-timber products. Between 1990 and 2005, the annual rate of deforestation in the region was about 0.7 per cent, with broad differences between countries.

According to FAO statistics, Burundi, Togo and Nigeria lost more than 30 per cent of their forested areas during that period[24].

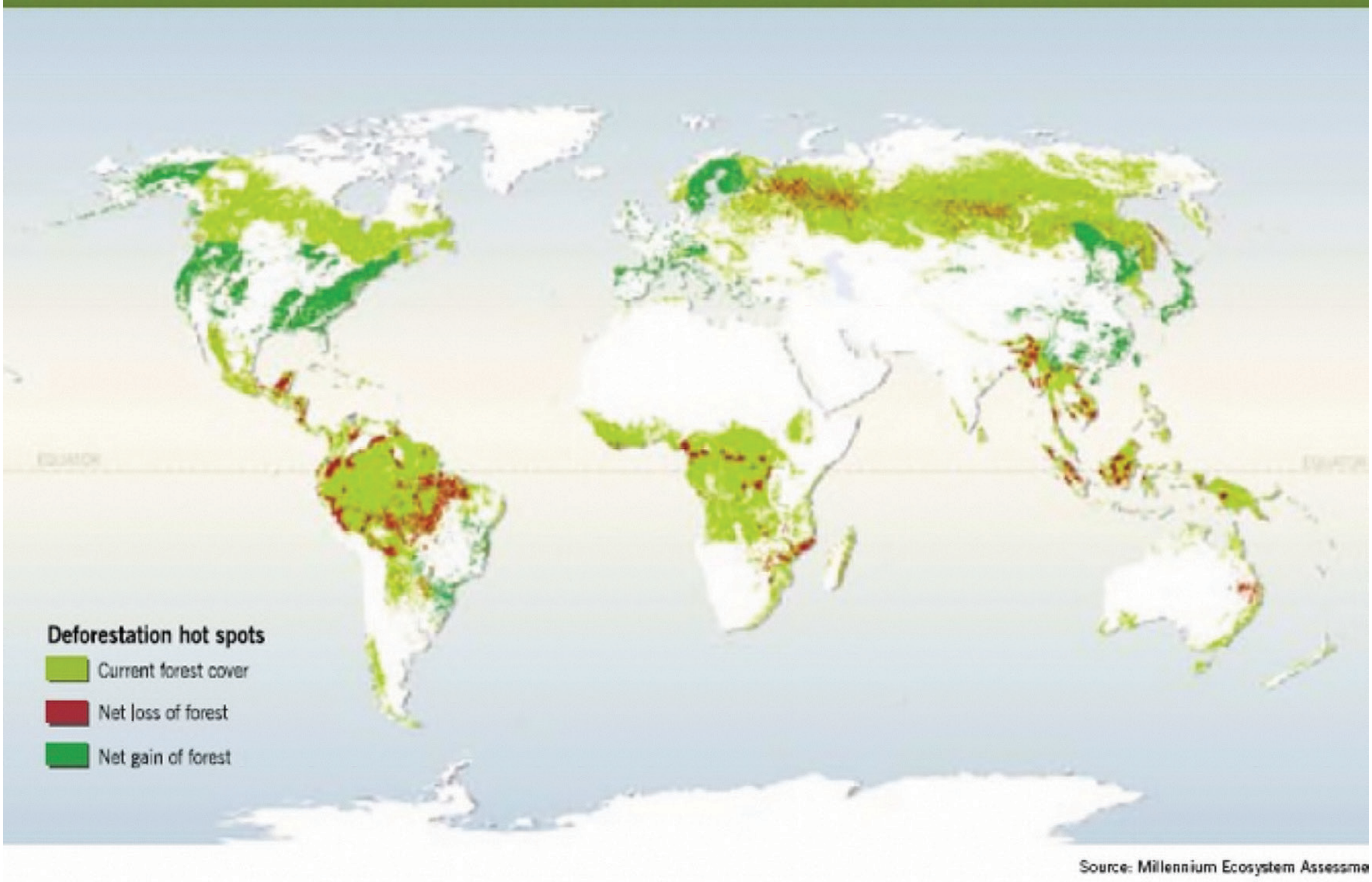
Madagascar is a biodiversity hot spot, with a high proportion of endemic species.

However, much of the island’s biodiversity is under threat from human pressure, in particular deforestation. Madagascar’s forest cover decreased substantially over the last 50 years, from 27 per

cent of the island in the 1950s to only 16 per cent circa 2000. Taking the fragmentation of forests into consideration, the decrease was even more drastic. From the 1950s to 2000, the area of interior forest more than 1 km from a non-forest edge decreased from 90,000 km2 to less than 20,000 km2, and the area in patches of greater than 100 km2 decreased by more than half[25].

Millenium Ecosystem Assessment (2005)

FIGURE 2.2 | Locations reported by various studies as undergoing high rates of change in forest cover in the past few decades



Agriculture will continue to be the source of greatest pressure on biodiversity at the global level to 2030. To meet increasing demands for food and biofuels, world agricultural land use will need to expand by an estimated 10% to 2030. Unless new policies are put in place, the area of mature forests would decrease by a further 68% in South Asia, 26% in China, 24% in Africa and by about 20% in Eastern Europe, Australia and New Zealand by 2030. This translates to more than 1.2 million km2 of mature forests lost in Africa in this timeframe[26] .

Illegal and unauthorised industrial wood production and trade

Illegal logging continues to threaten forest biodiversity in both developed and developing countries. Illegal logging can have serious environmental, social and economic costs and jeopardise international and national efforts to achieve sustainable forest management. The economic costs of illegal logging are tremendous: global market losses of USD 10 billion annually, and government losses may amount to USD5 billion in lost revenues (World Bank, 2006a). Direct driving forces of illegal logging are the higher profits obtainable than for legal logging, coupled with often low risk of apprehension and/or low penalty costs. These are exacerbated by weak forest legislation. The pressures behind illegal logging are the increasing international demand for wood products and a highly developed international supply chain.[27]

Policy responses[28]
In order to encourage sustainable forest management further and reduce illegal logging, forest

legislation and associated policy systems urgently need to improve. A range of regulatory instruments can be used, including allocating concession rights; regulating inputs and processes such as the use of chemical fertilisers and water; setting standards for intensity and species of harvesting and logging; and the obligatory implementation of environmental impact assessments. It is important that the regulations are based on the best available scientific knowledge on the forest quality and possible impacts of forest activities, and that they are followed by close monitoring of changes in forest quality.

Economic instruments – including fees or charges for harvesting and trading of industrial roundwood, charges or non-compliance fees related to certain types of forestry activities, taxation on the conversion of forest land to other uses, and subsidies for afforestation – can be used to encourage more sustainable forest management. At the same time, it is essential to remove or reform existing subsidies which promote excessive logging and access to natural forests, such as subsidies for establishing plantation forests or agricultural fields on natural forested land.

Eco-certification is another important instrument for reducing consumers' demand for wood products from unsustainably managed forests. Various certification schemes have been developed by the forest industry, environmental NGOs and the EU. It is important to develop a clear set of indicators to ensure sustainability of the forests managed under each of the certification schemes.

7. Marine and coastal aquatic biodiversity

Marine and coastal areas support a rich assortment of aquatic biological diversity that contributes to the economic, cultural, nutritional, social, recreational and spiritual betterment of human populations. Indeed, life originated in the world's oceans and over the millennia has evolved into the diverse forms used today by a variety of stakeholders, including commercial and artisanal fishers, fish farmers, developers and tourists.

More than 28 000 species of fish have been described and the vast majority of the 52 000 crustaceans and 112 000 molluscs species live in marine environments (FAO). The marine waters in 2005 produced about 84 million tonnes of seafood with catch data reported for over 1 300 marine taxa; farming of over260 taxa of fish, molluscs and crustaceans produced 18.8 million tonnes, whereas the production of kelp, seaweed and other aquatic plants contributed an additional 14.7 million tonnes. Many marine and coastal species are extremely high valued, such as tuna, lobster, crab, shrimp, abalone and numerous specialty products such as Fugu (potentially deadly puffer fish considered a delicacy in parts of Asia), surimi (pure fish protein extracts) and fishmeals and oils.

They are thus capable of generating foreign exchange and economic opportunities in many areas. The harvest of small, fast-growing pelagic species such as sardine and anchovy provides large quantities of inexpensive and high-quality animal protein that is widely used in agriculture and aquaculture feed formulation.

Coral reefs

Coral reefs are the most biodiversity-rich ecosystems (in species per unit area) in the world, more diverse even than tropical forests. Their health and resilience are in decline because of overfishing, pollution, disease and climate change. Caribbean coral reefs have been reduced by 80%in three decades. As a direct result, revenues from dive tourism (close to 20%of total tourism revenue) have declined and are predicted to lose up to US$ 300 million per year. That is more than twice as much as losses in the heavily impacted fisheries sector (UNEP February 2008). The underlying explanation for this situation is that in 1983, following several centuries of overfishing of herbivores, there was a sudden switch from coral to algal domination of Jamaican reef systems. This left the control of algal cover almost entirely to a single species of sea urchin, whose populations collapsed when exposed to a species-specific pathogen. When the sea urchin population collapsed, the reefs shifted (apparently irreversibly) to a new state with little capacity to support fisheries. This is an excellent example of the insurance value in biologically diverse ecosystems. The reduction in herbivore diversity had no immediate effect until the sea urchin population plummeted, illustrating how vulnerable the system had become due to its dependence on a single species.

Threatened biodiversity

More than a billion people rely on fisheries as their main or sole source of animal protein, especially in developing countries (Millennium Ecosystem Assessment 2005a). But half of wild marine fisheries are fully exploited, with a further quarter already overexploited (FAO 2007).

Marine and coastal biodiversity are threatened by the impacts of a growing human population that overharvests the diversity and affects the habitats that the diversity depends on. Approximately three-quarters of the world's population live within 60 km of marine coastal areas and marine and coastal biodiversity is a valued resource. FAO regularly assesses the state of world fisheries and aquaculture and has reported that of the major fish stocks, 23 percent are underexploited or moderately exploited, 52 percent are fully exploited, 17 percent overexploited, and 8 percent of stocks are depleted or recovering from depletion. Land-based activities threaten sensitive near shore areas such as coral reefs and mangrove forests with pollution, sedimentation and habitat clearing for other development.

FAO is working with international conventions such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the World Conservation Union (IUCN) to help assess the threats to marine and coastal species and promote awareness of critical issues. International plans of action have been developed on threatened marine species such as sharks and seabirds.

The FAO Code of Conduct for Responsible Fisheries aims at ensuring sustainable use of aquatic biodiversity, integrating the requirements of the 1982 Convention, the UN Fish Stocks Agreement and the Convention on Biodiversity. The implementation of the Code is underpinned by the implementation of four International Plans of Action: to reduce fishing capacity (to eliminate overfishing); to combat illegal fishing; to protect seabirds from accidental capture in longline fisheries; and to improve shark fisheries management.

8. Trade and Biodiversity

8.1. Trade rules and Biodiversity: WTO TRIPs (trade-related aspects of intellectual property rights) Agreement

Article 27.3(b) of the TRIPs Agreement: traditional knowledge and biodiversity

The TRIPS Agreement requires a review of Article 27.3(b) which deals with patentability or non-patentability of plant and animal inventions, and the protection of plant varieties. As a whole, Article 27 of the TRIPS Agreement defines which inventions governments are obliged to make eligible for patenting, and what they can exclude from patenting. Inventions that can be patented include both products and processes, and should generally cover all fields of technology. Broadly speaking, part (b) of paragraph 3 (i.e. Article 27.3(b)) allows governments to exclude some kinds of inventions from patenting, i.e. plants, animals and "essentially" biological processes (but micro-organisms, and non- biological and microbiological processes have to be eligible for patents). However, plant varieties have to be eligible for protection either through patent protection or a system created specifically for the purpose ("sui generis"), or a combination of the two.

Before Doha

The TRIPS Agreement requires a review of Article 27.3(b) which deals with patentability or non-patentability of plant and animal inventions, and the protection of plant varieties.

Paragraph 19 of the 2001 Doha Declaration has broadened the discussion. It says the TRIPS Council should also look at the relationship between the TRIPS Agreement and the UN Convention on Biological Diversity, the protection of traditional knowledge and folklore.

It adds that the TRIPS Council's work on these topics is to be guided by the TRIPS Agreement's objectives (Article 7) and principles (Article 8), and must take development issues fully into account. The review of Article 27.3(b) began in 1999 as required by the TRIPS Agreement. The topics raised in the TRIPS Council's discussions include:

- how to apply the existing TRIPS provisions on whether or not to patent plants and animals, and whether they need to be modified;
- the meaning of effective protection for new plant varieties (i.e. alternatives to patenting such as the 1978 and 1991 versions of UPOV). This has included the flexibility that should be available, for example to allow traditional farmers to continue to save and exchange seeds that they have harvested
- how to handle moral and ethical issues, e.g. to what extent invented life forms should be eligible for protection
- how to deal with the commercial use of traditional knowledge and genetic material by those other than the communities or countries where these originate, especially when these are the subject of patent applications
- how to ensure that the TRIPS Agreement and the UN Convention on Biological Diversity (CBD) support each other

The Doha mandate

The 2001 Doha Declaration made it clear that work in the TRIPS Council under the reviews (Article 27.3(b) or the whole of the TRIPS Agreement under Article 71.1) and on outstanding implementation issues should cover: the relationship between the TRIPS Agreement and the UN Convention on Biological Diversity (CBD); the protection of traditional knowledge and folklore; and other relevant new developments that member governments raise in the review of the TRIPS Agreement. It adds that the TRIPS Council's work on these topics is to be guided by the TRIPS Agreement's objectives (Article 7) and principles (Article 8), and must take development issues fully into account.

The relationship between the TRIPS Agreement and the Convention on Biological Diversity (CBD):

the discussions in the TRIPS Council

The discussion in the TRIPS Council has gone into considerable detail with a number of ideas and proposals for dealing with these complex subjects. More recently, the topic has been the subject of informal consultations chaired by the WTO director-general or by one of his deputies. The present debate focuses on how the TRIPS Agreement relates to the Convention on Biological Diversity (the last two of the topics listed above). The ideas put forward include (the documents containing the proposals and the director-general's report can be found here):

- Disclosure as a TRIPS obligation: A group represented by Brazil and India and including Bolivia, Colombia, Cuba, Dominican Republic, Ecuador, Peru, Thailand, and supported by the African group and some other developing countries, wants to amend the TRIPS Agreement so that patent applicants are required to disclose the country of origin of genetic resources and traditional knowledge used in the inventions, evidence that they received "prior informed consent" (a term used in the Biological Diversity Convention), and evidence of "fair and equitable" benefit sharing.

- Disclosure through WIPO: Switzerland has proposed an amendment to the regulations of WIPO's Patent Cooperation Treaty (and, by reference, WIPO's Patent Law Treaty) so that domestic laws may ask inventors to disclose the source of genetic resources and traditional knowledge when they apply for patents. Failure to meet the requirement could hold up a patent being granted or, when done with fraudulent intent, could entail a granted patent being invalidated.

- Disclosure, but outside patent law: The EU's position includes a proposal to examine a requirement that all patent applicants disclose the source or origin of genetic material, with legal consequences of not meeting this requirement lying outside the scope of patent law.

- Use of national legislation, including contracts rather than a disclosure obligation: The United States has argued that the Convention on Biological Diversity's objectives on access to genetic resources, and on benefit sharing, could best be achieved through national legislation and contractual arrangements based on the legislation, which could include commitments on disclosing of any commercial application of genetic resources or traditional knowledge.

In July 2008, a group of WTO members called for a "procedural decision" to negotiate three intellectual property issues in parallel: two geographical indications issues, and the "disclosure" proposal (see document TN/C/W/52 of 19 July 2008). But members remain divided over this idea.

As reported by WTO Director General in 2008, there is important common ground among WTO members on key underlying objectives, notably the importance of the TRIPS Agreement and the CBD being implemented in a mutually supportive way, the avoidance of erroneous patents for inventions that involve the use of genetic resources and related traditional knowledge and securing compliance with national access and benefit-sharing regimes. Moreover, there is wide acceptance of the need for patent offices to have available to them the information necessary to make proper decisions on the grant of patents and to avoid any undermining of the role of the patent system in providing incentives for innovation. However, the work continues to be characterized by different approaches to meeting these objectives, including whether the TRIPS Agreement needs to be amended and whether it was agreed at Doha that this issue is part of the negotiations and of the Single Undertaking. There are also different views on whether this matter should be addressed in the context of the modalities decision.

On the one hand, a large group of developing country Members who have proposed an amendment of the TRIPS Agreement to introduce a mandatory disclosure requirement in patent applications and who want clear guidance on this matter as part of the modalities decision. On the other hand, a number of WTO Members are opposed to negotiations on this matter. They believe that the case has not been made as to how disclosure requirements of the sort proposed would contribute towards meeting the commonly accepted objectives, which these delegations believe can be met without amending the TRIPS Agreement, for example through the establishment under WIPO of improved databases on traditional knowledge available to patent examiners and through contractual arrangements under national access and benefit-sharing laws. These Members believe that these issues should not be addressed

in the context of the modalities decision. They are willing to continue fact-based discussions under the present process of work as agreed in paragraph 39 of the Hong Kong Ministerial Declaration on issues related to the relationship between the TRIPS Agreement and the CBD, but without prejudice to the outcome and the positions of Members.

8.2. Intellectual Property Rights

Intellectual property rights (IPRs) may be applied to genetic resources (GRs), including microorganisms, plants and animals[29]. The significant number of patents granted in the area of plants, and the diversity of covered subject matter, has raised intense litigation and considerable concerns in agricultural circles about the scope of patent protection and its impact on the use of seeds and the access to germplasm for further research and breeding, particularly for the production of public goods.

Increased attention has been given in the past few years to strengthening intellectual property rights (IPRs) in plant breeding. The number of countries that grant such rights has grown, the types of inventions that can be protected have expanded, and the scope of protection offered by extant IPR systems in different countries has also broadened[30]. The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS 1993) of the World Trade Organization (WTO) requires all WTO members to introduce at least a minimum level of protection in their national laws for plant varieties and inventions in biotechnology. Least Developed Countries recently managed to extend the deadline to 2013 for bringing their national IPR laws fully up to the TRIPS standards. Even so, this extension does not diminish the pressure to develop IPR legislation for plant varieties in several countries, because bilateral trade negotiations between developing countries and the USA or EU often include requirements that go beyond the TRIPS requirements (the so-called “TRIPS-plus” requirements). These developments towards strengthened IPRs arise from a trade perspective rather than from a perspective of increasing innovation in the developing countries concerned.

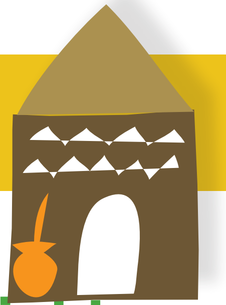
Until fairly recently in most developing countries, seed was supplied through the public sector. Recent private sector involvement has been a function of policy change. Any assessment of the specific impact of IPR regimes on seed industry performance and investment must be seen in the context of these wider changes in the commercial and policy environment. In the majority of developing countries, most of the plant breeding and some seed production still depend on the public sector, particularly national agricultural research institutes (NARIs), often supported by international agricultural research centers (IARCs). Plant breeding and seed production are already subject to a set of national regulations on variety release and seed quality control. These regulations have played an important part in determining the current evolution of seed systems in developing countries. Recently established IPR systems in the seed sector are meant to act in concert with conventional seed regulations, and in some cases they are the impetus for further changes in national seed regulations.

8.3. Economic incentives and market creation

Incentive measures can be used to try to reconcile differences between the market value of biodiversity-related goods and services to individuals and the value of biodiversity to society as a whole. They can increase the cost of activities that damage ecosystems, and reward biodiversity conservation and enhancement/restoration. Since the main policy problem facing biodiversity conservation is the problem of the global commons, economic incentives that close the gap between private and public values of biodiversity are, in principle, all that are needed. Markets for biodiversity are created by removing barriers to trade of goods or services derived from biodiversity and creating public knowledge of their special characteristics. Important steps to remove barriers are taken with the establishment and assignment of well-defined and stable property and/or use rights, and the creation of information instruments for the products. Market creation is based on the premise that holders of these rights will maximise the value of their resources over long time horizons, thereby optimising biodiversity use, conservation and restoration.

The range of economic incentives available to governments for encouraging biodiversity conservation and sustainable use includes: Financial instruments that optimise the purchase of biodiversity "services"; Offset schemes that allow an overall level of biodiversity to be maintained, with local tradeoffs; Fishing license fees or taxes; Levies for the abstraction of surface water or groundwater; Market-based support for activities that improve biodiversity quality and quantity; Access and benefit sharing regimes which create value for high biodiversity areas.

One of the more important approaches to creating markets and incentives for biodiversity is payments for ecosystem services (PES). The idea is that by requiring people to pay for services they otherwise obtained for free (because they were otherwise unsuitable for markets), overuse of these services would diminish. In recent years the use of PES schemes has been increasing and they are expected to continue to grow in popularity[31].



9. Access, benefit-sharing and farmers' rights

The Treaty facilitates access to the genetic materials of the 64 crops in the Multilateral System for research, breeding and training for food and agriculture. Those who access the materials must be from the Treaty's ratifying nations and they must agree to use the materials only for research, breeding and training for food and agriculture. The Treaty prevents the recipients of genetic resources from claiming intellectual property rights over those resources in the form in which they received them, and ensures that access to genetic resources already protected by intellectual property rights is consistent with international and national laws. Those who access genetic materials through the Multilateral System agree to share any benefits from their use through four benefit- sharing mechanisms established by the Treaty.

The Treaty recognizes the enormous contribution farmers have made to the ongoing development of the world's wealth of plant genetic resources. It calls for protecting the traditional knowledge of these farmers, increasing their participation in national decision making processes and ensuring that they share in the benefits from the use of these resources.

Stronger land use and management rights for farmers can increase their ability to grow a variety of crops. Where farmers' investments are crop specific, however, security of property rights might lead to less-diversified cropping patterns. Property rights, together with available genetic resources, affect people's capacity to manage diversity and risk. Maintaining traditional varieties that remain central to farmers' livelihood strategies demand policies that build upon local values, cultures, and traditional resource rights. Planning for the conservation and use of plant biodiversity needs to begin by identifying and consulting with local community groups and in some cases, individual farmers. Institutions may include local traditions, market forces, or cultural values. Unless carefully coordinated, the various institutions often provide contradictory sets of incentives. Understanding the mechanisms linking competing local-level and higher-order institutions to individual decision-making, requires a strategy to systematically identify the total number and various types of pathways by which local institutions influence individuals' choices[32].

9.1. IPRs and traditional Knowledge[33]

The impact of IPR laws in developing countries are potentially very negative for small farmers with 1.4 billion people depending on saved seed while patents take away this traditional practice of farmers. Patents can also make seeds more expensive for farmers.

"Biopiracy" has emerged as a term to describe the ways that corporations from the developed world claim ownership of, free ride on, or otherwise take unfair advantage of, the genetic resources and traditional knowledge and technologies of developing countries. While these and other corporations have been complaining about "intellectual piracy" perpetrated by people in developing countries, the latter nations counter that their biological, scientific and cultural assets are being "pirated" by these same businesses. The vast majority of countries formally recognize that cross-border exchange of genetic resources and traditional knowledge (TK) be carried out in compliance with the principles of the Convention on Biological Diversity. For a number of reasons, intellectual property rights, particularly patents but also plant variety protection, have become central to discussions on this matter.

9.2. Paying farmers for biodiversity conservation services

Paying farmers for environmental services (PES) is one way of compensating agricultural producers, including farmers, herders, fisherfolk and forest dwellers, for the provision of biodiversity conservation services, including agricultural biodiversity. Payments for biodiversity conservation can take a number of forms, from price premiums for eco-labelled agricultural products, to direct payments for improving land use. Barriers to the development of payments for biodiversity conservation in developing countries include limited demand and willingness to pay for the service and high transactions costs. The establishment of long term sources of funding for payments, improving information and streamlining institutions is needed to realize the full potential of payments for biodiversity conservation.

10. Climate change and Biodiversity Loss

Climate change is likely to lead to a sharp increase in species extinction rates as habitats are affected by rainfall and temperature change (Reid and Swiderska, 2008). The MA estimates that climate change will be the main driver of biodiversity loss by the end of this century. A member of the Intergovernmental Panel on Climate Change (IPCC) recently estimated that a quarter to a third of all species will become extinct by the middle of this century because of climate change (Prof. Parry, personal communication, 2008). At the same time, biodiversity loss and ecosystem degradation are expected to result in more severe climate change impacts and weaker capacity for adaptation. Thus, special care is needed to ensure that responses to one problem also bring positive (or neutral) outcomes for the other. Many of the proposals for climate change mitigation to date have paid scant attention to biodiversity conservation or the world's poor, who are particularly vulnerable to both climate change and biodiversity loss.

The scenarios developed by the Intergovernmental Panel on Climate Change project an increase in global mean surface temperature of 2.0–6.4o Celsius above preindustrial levels by 2100, increased incidence of floods and droughts, and a rise in sea level of an additional 8–88 centimeters between 1990 and 2100. Harm to biodiversity will grow worldwide with increasing rates of change in climate and increasing absolute amounts of change.[34]

Preventing deforestation may be one approach as tropical deforestation is a key driver of biodiversity loss and also contributes to around 18-25% of global CO2 emissions each year.[35]

Application of GIS to Biodiversity Monitoring

Technology plays an important role in the preservation of crop biodiversity as using a combination of technologies to create predictive computer models. If we know where a particular variety of crop originally came from we can then predict some of the characteristics of that variety. For example, if the variety comes from an arid area then we could test that for drought tolerance rather than a sample that came from a very wet or tropical country. Computer modelling also helps us to make climate change and development projections, which can help to pinpoint varieties that are endangered through rising water levels or expanding urban environments. The models would tell us that we have to quickly collect samples from that area.

These are early days for putting ICTs to use for preserving biodiversity, we are only now starting to take advantage of the technology. In the near future, we will be able to use mobile phones and other communication networks to offer crop varieties to farmers in a much more targeted way. We can use the technology to provide information on the best varieties for very specific conditions and locations to give the best yield and protection from pests, diseases and the changing environment. You cannot control everything in the natural environment but such systems could help us deliver information to farmers and give them a better chance for future food security.

An important tool for monitoring biodiversity is a geographic information system (GIS), which accommodates large varieties of spatial and aspatial (attribute) data. The information embedded in a GIS is used to target surveys and monitoring schemes. Data on species and habitat distribution from different dates allow monitoring of the location and the extent of change. The use of remotely sensed data has high potential for the inference of ecological status, because with satellite images it is possible to monitor large areas in short periods of time. Despite this known advantage and the large amount of remotely sensed data publicly available, just a few datasets (mostly related to land cover and elevation) have been used for this purpose[36] .

11. The EU action on Biodiversity[37]

In 1998, the European Commission adopted a Communication on a European Biodiversity Strategy (COM(98)42). In 2002 Council adopted the Commission Communication COM(2001)162 containing biodiversity action plans, each covering individual areas: conservation of natural resources, agriculture, fisheries, and development and economic cooperation. It outlined the steps which it considered necessary in each area and identified indicators for evaluating their effectiveness, some of which already exist, others yet to be developed. The main objectives of these action plans are to improve or maintain the biodiversity status and prevent further biodiversity loss. In 2004, the EU Biodiversity Strategy was reviewed in Malahide (Scotland), followed by a report presenting 18 priority objectives for halting biodiversity loss in the EU. In May 2006, the Commission adopted a communication (COM(2006)216) on "Halting the loss of biodiversity by 2010 - and beyond - Sustaining ecosystem services for human well-being" , which provides an EU action plan with concrete measures, and which outlines the responsibilities of EU institutions and Member States. The Action Plan includes 4 key policy areas for actions and related 10 priority areas for the EU and Member States to focus on. More recently the European Commission released a Communication on Options for an EU vision and target for biodiversity beyond 2010, COM(2010)4, 19-01-2010.

Four levels of ambition for a 2020 headline target are presented:

- Significantly reduce the rate of loss of biodiversity and ecosystem services in the EU by 2020
- Halt the loss of biodiversity and ecosystem services in the EU by 2020
- Halt the loss of biodiversity and ecosystem services in the EU by 2020 and restore them insofar as possible
- Halt the loss of biodiversity and ecosystem services in the EU by 2020 and restore them insofar as possible, and step up the EUs contribution to averting global biodiversity loss

Until the end of 2006, LIFE was the financial instrument supporting several projects in the areas LIFE-Nature, LIFE-Environment and LIFE-Third Countries. In March 2007, political agreement was reached between Council and Parliament on its successor LIFE+, bringing the total funding to nearly €2 billion for the period 2007-2013. The definitive LIFE+ Regulation, resulting from the conciliation procedure between Council and European Parliament was established in May 2007. LIFE+ has several funding programmes and consists of 3 components: LIFE+ Nature and Biodiversity, LIFE+ Environment Policy and Governance, and LIFE+ Information and Communication. Other possible funding opportunities for the Member States to support the biodiversity targets could be taken up under the CAP, the CFP, the Cohesion and Structural Funds, and the Seventh Framework Programme. Programmes financed through LIFE+ will be open to the participation of third countries notably: EFTA States; candidate countries for accession to the EU; and Western Balkan countries.

On May 3 2011, the European Commission adopted a new strategy to halt the loss of biodiversity and ecosystem services in the EU by 2020, in line with two commitments made by EU leaders in March 2010 – halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss"- and a vision for 2050: "by 2050, European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided". The strategy is also in line with the global commitments made in Nagoya in October 2010, in the context of the Convention on Biological Diversity, where world leaders adopted of a package of measures to address global biodiversity loss over the coming decade.

There are six main targets, and 20 actions to help Europe reach its goal. Biodiversity loss is an enormous challenge in the EU, with around one in four species currently threatened with extinction and 88% of fish stocks over-exploited or significantly depleted.

The six targets cover:

- Full implementation of EU nature legislation to protect biodiversity
- Better protection for ecosystems, and more use of green infrastructure
- More sustainable agriculture and forestry
- Better management of fish stocks
- Tighter controls on invasive alien species
- A bigger EU contribution to averting global biodiversity loss

12. Some initiatives in ACP regions

The Pacific region

Land degradation has emerged as a serious problem in many pacific countries, with coastal land under increasing environmental stress[38]. There are a number of regional initiatives and strategies that also have linkages to the conservation and sustainable use of biological diversity, and hence both inform – and are informed by – the national strategies and action plans being developed by Pacific member nations. These include: The Pacific Plan - In 2004 there was consensus to strengthen regional cooperation and integration amongst Pacific islands countries. This became manifest through the Auckland Declaration of April 2004 where Pacific Forum leaders agreed to the development of a 'Pacific Plan' with the goal to "Enhance and stimulate economic growth, sustainable development, good governance and security for Pacific countries through regionalism." Whilst management of the natural environment or biodiversity conservation are not central themes of the Pacific Plan, there is overt reference to 'Improved Natural Resource Management and Environmental Management' in the plans Strategic Objective no. 5, with initiatives being promoted for the first three years in: sustainable development, fisheries, forestry, coastal waters, waste management, energy, freshwater management, biodiversity and climate change. The 'Action strategy for Nature Conservation in the Pacific Islands Region' was developed by the Roundtable for Nature Conservation as a result of the 7th Conference on Nature Conservation & Protected Areas, held in 2002. Its mission is to 'protect and conserve the rich natural and cultural heritage of the Pacific islands forever for the benefit of the people of the Pacific and the world. It builds upon the three pillars of sustainable development (environment, society and economy) and aims to provide guidance to a wide range of actors in the Pacific community, including governments, in the development of their plans and programmes for nature conservation. This strategy is currently in the process of review at this time, and a revised strategy for 2008-2012 is being discussed at the Alotau Conference in October 2007. This revised strategy has taken considerable guidance from the objectives and aims of the NBSAPs so far developed in the region, and the new objectives in the Action strategy have arisen from the key common themes prevalent in NBSAPs and the IBPoW.13

Additionally there are a range of further regional initiatives relevant to the conservation and sustainable use of biodiversity that are too numerous to discuss in detail here; such as the:

- Pacific Invasive Initiative (PII)
- Pacific Invasive Learning Network (PILN)
- Coral Reefs Initiative for the Pacific (CRISP)
- Locally Managed Marine Areas initiative (LMMA)
- Pacific Biodiversity Information Forum (PBIF)
- sub-regional Micronesia Challenge

Regional support for both regional and national level programmes in the conservation and sustainable use of biodiversity is also provided by a number of intergovernmental organizations active in a range environmental and humanitarian.

A final noteworthy point in contextualizing national level planning of biodiversity conservation into the wider regional framework is a mention of the 'Roundtable for Nature Conservation'. This is the Pacific's largest cross-sectoral coalition of organizations working to increase effective conservation action in the region. This Roundtable was formed in 1997 on request from Pacific island countries and territories for stronger collaboration and coordination of conservation initiatives. Its membership includes: regional and national NGOs, regional and international intergovernmental agencies, public and private donors, and national agencies leading or coordinating multi-country efforts or working on issues of regional significance. The Roundtable facilitates 'Working Groups' on key issues and is a forum for stakeholders to come together to discuss and develop new ways to address the main issues of nature conservation facing the Pacific Islands.[39]

CePaCT - a regional gene bank for the Pacific[40]

The Centre for Pacific Crops and Trees (CePaCT) is the Pacific regional gene bank which provides a repository for the entire region's collections, and also facilitates access to that diversity, both within and outside the region. CePaCT holds a unique collection of 878 accessions of taro, as well as other regionally

important crops such as yam, sweet potato, banana, breadfruit, cassava, kava, aibika and black pepper.
As well as safely conserving the region's genetic resources, CePaCT is working with country partners on crop improvement programmes, and promoting sharing through partnerships and networks. The Centre is the first outside the Consultative Group on International Agricultural Research (CGIAR) system to obtain long-term funding from the Global Crop Diversity Trust, specifically for the taro and yam collections. CePaCT supports a breeding programme for taro that is helping to get new varieties growing again in Samoa, as well as across the region. The programme has generated crosses between Asian and Pacific taro, bringing new genetic diversity to the previously narrow taro genetic base in the Pacific[41].

African region[42]

The Sahel has been greening in recent years

Greening of the Sahel as observed from satellite images is now well established, confirming that trends in rainfall are the main but not the only driver of change in vegetation cover. For the period 1982-2003, the overall trend in monthly maximum Normalized Difference Vegetation Index (NDVI) is positive over a large portion of the Sahel region, reaching up to 50 per cent increase in parts of Mali, Mauritania and Chad, and confirming previous findings at a regional scale. Some areas have greened more than what would be expected from rainfall recovery alone. In some regions (e.g., Niger Delta of Mali; south-western Mauritania), increases in vegetation can be explained by an expansion of irrigation. For other regions, such as the Central Plateau of Burkina Faso, recovery of vegetation greenness beyond what would be expected from the recovery of rainfall is thought to be the result of increased investment and improvements in soil and water conservation techniques. Some areas have registered less greening than expected from rainfall patterns.

The Niger has witnessed reforestation and population increase at the same time

Better conservation and improved rainfall have led to at least 6 million newly tree-covered acres in the Niger, achieved largely without relying on large-scale planting of trees or other expensive methods often advocated for halting desertification. Moreover, these gains have come at a time when the population of the Niger has grown rapidly, confounding the conventional wisdom that population growth leads to the loss of trees and accelerates land degradation.

An evaluation project undertaken in three areas of the Niger in 2005 (Tahoua, Tillabéri and Maradi) points to encouraging results in the locations of projects initiated to fight desertification with support from donors, compared to areas where no such project was implemented. Degraded lands have been reclaimed and restored to crop production by local populations. Water tables have risen significantly, which has made possible the development of vegetable gardens that have become significant producers at the national level. In the three regions studied, yields have increased both for millet and sorghum. Side benefits of land regeneration have included reduced vulnerability of women and reduced emigration rates.

Conserving wild plants in West Africa

In the Sahelian regions of Burkina Faso and Mali, safeguarding wild species by increasing the ex situ conservation capacity of national partners and helping local communities sustainably use and propagate them, is one of the major objectives of the Millennium Seed Bank partnership (MSBP). After selecting particular wild species that they would like to cultivate, communities are trained in specific techniques needed to promote germination, such as breaking seed coats, and how to tend the seedlings. The seedlings are then planted on farms and in home gardens, protecting the species from over-exploitation in the wild. In Burkina Faso, the MSBP has helped to support the Centre National de Semences Forestieres (CNSF) in its activities. By planting tall grasses, such as Andropogon gayanus, which reduce water runoff and prevent soil erosion, CNSF is helping farmers rehabilitate their soil and restore the Sahel. The grass can also be harvested for thatch and fodder. The initiative has been so successful that both the Burkina Ministries of Environment and Agriculture are now promoting and sponsoring CNSF to extend their work in this area. Now established as specialist centres, the seed banks in Burkina and Mali are able to cope with growing demands from government ministries for native grass seeds in their attempt to combat desertification and "re-green" the

Sahel. As demand for seeds grows, CNSF has set itself the target of producing 1 million seedlings in 2010, using 100 useful species that are most in demand from farmers, traditional healers and urban communities. And in Timbuktu, in Mali, the project is targeting species that are more suited to the most arid regions in order to help communities to better cope with climate change.

Small-scale Rooibos Tea farmers in the Northern Cape, South Africa

With the support of local non-governmental organisations (NGOs) and academic partners, a resource poor community in the Northern Cape of South Africa has established and grown a solid, memberowned, for-profit company. The Heiveld Co-operative is grounded in sustainable management of rooibos plants, it has organic and Fairtrade certifications and the capacity to process 100 tonnes of tea per season. This tea realizes premium prices on the local and international market supporting local economic diversification. Through a process of participatory action research, between farmers, academics, NGOs and practitioners, the farmers continuously work to develop and adapt sustainable practices and strategies, in order to deal with the uncertainties of future climate and the fluctuating business environment. The farmers are also involved in daily climate monitoring which informs their short and long term farming strategies.[1]

Community Markets for Conservation in Zambia

COMACO works to address ecosystem protection and poverty among small-scale rural farmers in Zambia through a business approach. The non-profit company creates economic incentive for improved land management and practices and resistance to poaching, by marketing farmers' organic produce to high end urban consumers. COMACO also supports diversification of livelihoods by training and assisting farmers and previous poachers, to start small ventures such as honey farming, animal husbandry and fish farming. With regional branches projected to be self-sufficient by 2013, COMACO represents a cost effective approach to creating sustainable livelihoods and food security that is grounded in healthy ecosystems.[2]

Collective action on the Agulhas Plain, South Africa

The Nuwejaars Wetland Special Management Area (SMA) consists of 25 private landowners, who through collective action work to convert their land use practices from "conventional" agriculture towards land use dependent on biodiversity conservation, eco-tourism and carbon-and energy neutral production. The SMA is located within a biodiversity hotspot, with biologically rich lowland fynbos, endangered Renosterveld and irreplaceable wetlands, which after centuries of inappropriate land use practices has become highly vulnerable to two inter-related climate change impacts, increasing frequency in wild fires and floods. Building on natural and human capital, the Nuwejaars Wetland SMA is using sustainable agriculture as an economic driver, together with other biodiversity economic drivers, such as eco-tourism, in order to create resilience to climate change and become a sustainable venture.[3]

Partnering with the private sector in Namibia's Bush-to-Fuel Project

The Bush-to-Fuel project is an example of a private sector investment in renewable energy, whose innovative approach works to create multiple societal benefits. Using native invader bush that is encroaching on wide areas in Namibia and reducing grazing productivity for livestock farmers, the Energy For the Future project (EFF) is paying farmers to remove the native bush in order to produce wood chips that are then used as an energy source in a cement factory. This multi-benefit project, works to mitigate climate change by reducing the carbon dioxide emissions of the cement factory by 130 000 tons by replacing coal use with wood chips and addresses the issue of bush encroachment. This project is creating 50 workplaces directly and about 200 additional ones indirectly, supports a payments for ecosystem services approach and has the potential to reduce Namibia's energy imports. The farmers are then responsible for maintaining of the area through various approaches which the EFF provide guidance on, and the monitoring is supported through an environmental management plan. Long term research is also being led by the Namibian Ministry of Water, Agriculture and Forestry.

African Leafy Vegetables (ALVs) are important sources of essential macro and micro-nutrients. In addition they offer a source of livelihood when marketed as well as contribute to crop biodiversity. Sub-Saharan Africa contains a large variety of nutritious, leafy vegetables—an estimated 800–1 000 species. In Kenya, where approximately 210 species are available, only about 10 find their way to markets (mainly African nightshade, leafy amaranth, cowpeas and spider-plant).

Nairobi the market gross value has increased by about 213% between the period 2001 and 2006. The campaign for traditional vegetables between 1997 and 2007 brought notable positive changes in growing, consuming, marketing and nutritional awareness of ALVs. The growth of this market has been greatly influenced by an increased consumer demand that has been caused by a number of factors. These include promotional strategies of local NGOs and international organizations, increased health awareness and consciousness of Nairobi dwellers, effects of HIV/AIDs, and improved ALV presentation in supermarkets and upmarket groceries. On the other hand supply has been enhanced by promotion of production in peri-urban and upcountry key production areas by international organizations and local NGOs, provision of external marketing support by NGOs, farmers' capacity for self-organization, and improvement of telecommunication technology .[4]

Caribbean region

Effective environmental management depends on a high level of public awareness and involvement, and on the availability of appropriate skills to respond to problems and issues in a timely and efficient manner. Inadequate biodiversity inventory and monitoring systems, knowledge and ability to handle biodiversity information have been identified as key challenges for the region. Low levels of awareness, knowledge and appreciation of biological resources justify the need for capacity building, institutional strengthening, public education and outreach, and civil society. Priorities in the region focus on strengthening the institutional capacity of the environmental institutions, making them more attractive employment options for skilled individuals and increasing and improving the quality of environmental education offered in the region, linking programmes more closely to the environmental skills that are and will be needed in the region.

The Caribbean region is a biogeographically distinct area of coral reef development within which the majority of corals and coral reef-associated species are endemic, making the entire region particularly important in terms of global biodiversity. Mainly due to pollution from increased suspended solids and chemical compounds, overexploitation and habitat conversion, corals in the region are becoming physically damaged or are overgrown by algae. Changes in reef fish communities throughout the Caribbean have also been reported, characterized by the reduced abundance of large-sized carnivorous reef fish such as snappers and groupers due to overharvesting. Mangrove forests, another important ecosystem, are also in decline because of coastal development and clearing linked to charcoal production. These declines in the health of marine and coastal ecosystems, as well as overcapitalization and overfishing, unregulated and illegal fishing by local fleets and reflagging of vessels and migration of fleets, will all affect the long-term viability of the Caribbean. Affecting all aspects of the environment are local and regional meteorological changes associated with global climate change. Sea-level rise of 30–50 cm for the Caribbean over the next 50 years has been considered a reasonable projection.[43]

13. Challenges ahead and needed policy responses[44]

Many of the actions that have been taken to conserve biodiversity and promote its sustainable use have been successful in limiting biodiversity loss and homogenization to rates lower than they would otherwise have been in the absence of such actions. However, further significant progress will require a portfolio of actions that build on current initiatives to address important direct and indirect drivers of biodiversity loss and ecosystem service degradation.

Protected areas, including those managed primarily for biodiversity conservation and those managed for a wide range of sustainable uses, are extremely important, especially in environments where biodiversity loss is sensitive to changes in key drivers as well as species protection and recovery measures for threatened species. Ecosystem restoration activities are now common in many countries and include actions to restore almost all types of ecosystems, including wetlands, forests, grasslands, estuaries, coral reefs, and mangroves.

Payments and markets for biodiversity and ecosystem services have helped to conserve some aspects of biodiversity and to support its sustainable use—for example, in the context of ecotourism. In many countries, tax incentives, easements, tradable development permit programs, and contractual arrangements are becoming more common and have often been shown to be useful for conserving land and ecosystem services and for bringing benefits to local communities. Agricultural policy reforms in a number of countries are now beginning to take biodiversity into account, but much more can be done to reduce harmful impacts on biodiversity and ecosystem services. Increased coordination among multilateral environmental agreements and between environmental agreements and other international economic and social institutions is key. Public awareness, communication, and education programs have both informed and changed preferences for biodiversity conservation and have improved implementation of biodiversity responses.
There is a need for increased transparency and accountability of government and private-sector performance in decisions that affect ecosystems, including through greater involvement of concerned stakeholders in decision- making facilitates. Findings and data need to be made available to all of society.

Sustainable intensification of agriculture: the expansion of agriculture will continue to be one of the major drivers of biodiversity loss well into the twenty-first century. In regions where agricultural expansion continues to be a large threat to biodiversity, the development, assessment, and diffusion of technologies that could increase the production of food per unit area sustainably, without harmful trade-offs related to excessive consumption of water or use of nutrients or pesticides, would significantly lessen pressure on biodiversity. In many cases, appropriate technologies already exist that could be applied more widely, but countries lack the financial resources and institutional capabili- ties to gain and use these technologies. Where agriculture already dominates landscapes, the maintenance of biodiversity within these areas is an important component of total biodiversity conservation efforts, and, if managed appropriately, can also contribute to agricultural productivity and sustainability through the ecosystem services that biodiversity provides (such as through pest control, pollination, soil fertility, protection of water courses against soil erosion, and the removal of excessive nutrients).

Governance approaches to support biodiversity conservation and sustainable use are required at all levels, with supportive laws and policies developed by central governments providing the security of tenure and authority essential for sustainable management at lower levels.

There is a need to prioritise actions in the key sectors affecting the environment: energy, transport, agriculture and Fisheries[45]. Relevant ministries need to work together to develop better co-ordinated policies so that environmental concerns are integrated into actions by key ministries such as finance, trade, industry, energy, transport, agriculture and health.

The OECD Environmental Outlook highlights the priority actions needed in key sectors to prevent the environmental damage projected to 2030:

- Energy. Fossil fuel use is the main source of carbon dioxide emissions, the principal greenhouse gas that causes climate change. The Outlook projects world energy-related carbon dioxide emissions to increase by 52% to 2030 under the no-new-policy Baseline scenario. Meanwhile, world energy sulphur and nitrogen emissions are projected to remain stable around or below recent levels. As investments in energy infrastructure lock-in technologies, fuel needs and related emissions for years to come, an appropriate policy framework is needed now to promote renewable energy and low-carbon alternative processes and fuels, including technologies for carbon capture and storage.

- Transport: Air pollution and greenhouse gas emissions from transport are growing rapidly, from passenger vehicles, aviation and marine transport, contributing to climate change globally and causing health problems in many urban areas. The Outlook projects transport- related carbon dioxide emissions to increase by 58% to 2030, while sulphur and nitrogen emissions will fall by a quarter to a third from today's levels. Transport prices rarely reflect their full social and environmental costs, resulting in over-use and sub-optimal choices about the type of transport to use. Transport pricing should fully reflect the costs of environmental damage and health impacts, e.g. through taxes on fuels (including the removal of tax exemptions) and road pricing.

- Agriculture is by far the largest user of water and is responsible for much of its pollution. The Outlook Baseline projects world primary food crop production to grow by 48% and animal products by 46% to 2030. OECD countries will account for large shares, particularly for animal products (37% in 2030 to feed 17% of the world's population). If no new policies are introduced, the conversion of natural land to agricultural use will continue to be a key driver of biodiversity loss. Under current policies, areas for biofuel crops are projected to increase by 242% between 2005 and 2030. Land-related greenhouse gas emissions are smaller than from energy sources, but still important. Production-linked subsidies have in many cases resulted in pollution of water resources and soil, and damaged ecosystems and landscape. Increasingly, production-linked payments are conditional on farmers adopting certain practices to reduce environmental harm. While such "cross-compliance" can help to reduce some of the negative environmental impacts of agricultural production, a more effective approach would be to remove environmentally harmful subsidies in the first place. Taxes on farm chemicals also help limit their use, while appropriate pricing of irrigation water would encourage more rational use of water and cost-recovery for irrigation infrastructure provision.

- Capture fisheries exert pressures on ecosystems and biodiversity through depletion of fish stocks, destruction of habitats and pollution. Those environmental pressures can undermine the productivity of affected fisheries and the livelihoods of fishing communities. Fishing opportunities are influenced by climate change, natural fluctuations and environmental pressures from other human activities. While progress is already being made in some fisheries towards an ecosystem-based approach, the worrying outlook for capture fisheries highlighted in this report could be reversed by further measures to limit total catch levels, designate fishing seasons and zones, regulate fishing methods and eliminate subsidies for fishing capacity. Stronger international co-operation is needed in this area[46].

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IIED

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OECD

OECD Environmental Outlook to 2030
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http://www.oecd.org/document/ 20/0,3343,fr_2649_34305_40138216_1_1_1_37465,00.html

OECD Environmental Outlook to 2050: The Consequences of Inaction
http://www.oecd.org/env/environmentalindicators modellingandoutlooks/oecdenvironment aloutlookto2050the consequences ofinaction.htm

UN

Millenium Development Goals
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http://www.un.org/fr/millenniumgoals/

UN Rio+20. UN Conference on Sustainable Development. 2012

http://www.uncsd2012.org/objectiveandthemes.html

UNEP-GEF. Doris Schroeder and Balakrishna Pisupati . Ethics, Justice and the Convention on Biological Diversity, October 2010
http://www.unep.org/delc/Portals/119/UNEP_Justice_Final_V2a.pdf

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http://www.unep.org/dgef/Portals/43/AgBD_publication_FINAL.pdf

World Summit on Sustainable Development
http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POI_PD.htm

Déclaration de Johannesbourg
http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/French/POI_PD.htm

Johannesburg Plan of Implementation
http://www.un.org/esa/ sustdev/documents/WSSD_POI_PD/English/POIToc.htm

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http://www.un.org/esa/ sustdev/documents/WSSD_POI_PD/French/POIToc.htm

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http://www.maweb.org/fr/index.aspx

The Division for Sustainable Development of the United Nations (UN) Department of Economic and Social Affairs:
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Guy Midgley, Sarshen Marais, Mandy Barnett and Katinka Wågsæther South African National Biodiversity Institute; Conservation South Africa; 3Indigo Development and Change. Biodiversity, climate change and sustainable development – Harnessing synergies and celebrating successes. April 2012
http://siteresources.worldbank.org/INTBIODIVERSITY/Resources/Biodiversity_Climate_Change_and_Sustainable_Development_Harnessing_Synergies_and_Celebrating_Successes.pdf

ACP regions

Biodiversity in the Pacific
http://www.sprep.org/topic/Biodiv.htm

National biodiversity Strategies in the Pacific
http://www.sprep.org/att/publication/000582_FinalRpt_NBSAPRegionalReview.pdf

Pacific Environment Information Network [PEIN] Country Profiles Directory
http://www.sprep.org/publication/PEIN_Country_Profiles.asp

Pacific Agricultural Plant Genetic Resources Network, or PAPGREN. Centre for Pacific Crops & Trees (CePaCT)
http://www.spc.int/lrd/genetic_resource.htm

Tuvalu NBSAP
http://www.cbd.int/doc/world/tv/tv-nr-04-en.pdf

SADC Regional Biodiversity Strategy
http://www.wcs-ahead.org/sadc.html

Caribbean Environment Outlook
http://www.environment-integration.eu/download/13-AmLat&Caraibe/Caribbean_EO.pdf

Websites

Biodiversity economics
http://www.biodiversityeconomics.org/index.html

Bioversity International
http://www.bioversityinternational.org/

BiodivERsA
www.eurobiodiversa.org

CABI-Centre for Agriculture and Biosciences International
www.cabi.org

CABS - The Center for Applied Biodiversity Science
www.biodiversityscience.org/xp/CABS/home/

CAPRI - CGIAR Systemwide Program on Collective Action and Property Rights
http://www.capri.cgiar.org

CBD - Convention on Biological Diversity
www.cbd.org

CEP- Caribbean region environment programme
http://www.cep.unep.org

CI - The Conservation International
www.conservation.org

CIAT- International Center for Tropical Agriculture
www.ciat.cgiar.org

CIFOR - Center for International Forestry Research
http://www.cifor.cgiar.org/

CGIAR - Consultative Group on Agricultural Research
http://www.cgiar.org/

CIMMYT - International Maize and Wheat Improvement Center
http://www.cimmyt.org/

CIRAD- Forêts
http://www.cirad.fr/en

CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora
http://www.cites.org

CMS – Convention on Migratory Species
http://www.cms.int

Countdown 2010 - Save Biodiversity
www.countdown2010.net

CTA

- Spore
  http://spore.cta.int
- CTA- Knowledge for Development/Biodiversity
  http://knowledge.cta.int/en/Dossiers/S-T-Issues-in-Perspective/Biodiversity
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  http://brusselsbriefings.net/
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EAPGRN - Eastern Africa Plant Genetic Resources Network
http://www.asareca.org/eapgren/

Earthwatch
www.earthwatch.org/europe

EEA - The European Environmental Agency
www.eea.europa.eu/themes/biodiversity

European Commission

- EC-DG Agriculture and Rural development
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- EC-DG Development/Biodiversity
  http://ec.europa.eu/development/policies/9interventionareas/environment/biodiversity/biodiver sity_en.cfm
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- EC-DG Entreprise and Industry
  http://ec.europa.eu/enterprise/index_en.htm
- EC-DG EuropeAid http://ec.europa.eu/europeaid/index_en.htm
- EC-DG Environment
  http://ec.europa.eu/environment/index_en.htm
- EC-DG Eurostat http://epp.eurostat.ec.europa.eu/portal/page/portal/forestry/introduction
- EC-DG Fisheries
  http://ec.europa.eu/fisheries/index_en.htm
- EC-DG Recherche
  http://ec.europa.eu/research/index.cfm?lg=fr

EFI - European Forest Institute
http://www.efi.int/portal/

FAO - The Food and Agriculture

Organization of the United Nations
http://www.fao.org/forestry/en/
http://fao.org/biodiversity

GEF – Global Environment Fund
http://www.globalenvironmentfund.com/

GFIS – Global Forest Information Service
www.gfis.net

GFTN - The Global Forest & Trade Network
http://gftn.panda.org/

GRAIN
www.grain.org

IAASTD- The International Assessment of Agricultural Science and Technology for Development
http://www.agassessment.org/

ICARDA - International Center for Agricultural Research in the Dry Areas
www.icarda.org

ICRISAT - International Crops Research Institute for the Semi-Arid Tropics
http://www.icrisat.org/

IFAD - The International Fund for Agricultural Development
http://www.ifad.org

IFPRI - International Food Policy Research Institute
http://www.ifpri.org

IIED- International Institute for Environment and Development
http://www.iied.org/

IISD - International Institute for Sustainable Development
http://www.iisd.org

IITO - International Tropical Timber Organisation
http://www.itto.int/

IUCN - The International Union for Conservation of Nature
http://www.iucn.org/

IPCC - Intergovernmental Panel on Climate Change
http://www.ipcc.ch/

Millennium Ecosystem Assessment
http://www.millenniumassessment.org/en/index.aspx

OAPI- African Organization for Intellectual Property
http://www.oapi.wipo.net/en/OAPI/index.htm

OECD - Organisation for Economic Co-operation and Development
http://www.oecd.org

SIWI - Stockholm International Water Institute
http://www.siwi.org/

UICN
http://www.iucn.org

UNCCD - United Nations Convention to Combat Desertification
http://www.unccd.int/

UNCTAD - United Nations Conference on Trade and Development
http://www.unctad.org

UNEP - United Nations Environment Programme
http://www.unep.org/

UNFCCC - The UN Framework Convention on Climate Change
http://unfccc.int/2860.php

World Agroforestry Centre

http://www.worldagroforestrycentre.org/

WFP - The World Food Programme
http://www.wfp.org

WHO - The World Health Organization
http://www.who.int/en/

WIPO - World Intellectual Property Organization
http://www.wipo.int/portal/index.html.en

WMO - World Meteorological Organization
http://www.wmo.int/pages/index_en.html

World Bank/Biodiversity
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTBIODIVERSITY/0,,menuPK:400959~pagePK:149018~piPK:149093~theSitePK:400953,00.html

WRI- World Resources Institute
http://www.wri.org/ecosystems/

WSSD - World Summit on Sustainable Development
http://www.worldsummit2002.org/

WTO - World Trade Organization
http://www.wto.org/

WWF - World Wide Fund for Nature
http://www.panda.org

Glossary[47]

Adaptation
Adjustment in natural or human systems to a new or changing environment.Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Afforestation
Establishment of forest plantations on land that, until then, was not classified as forest. Implies a transformation from non-forest to forest.

Agroforestry
Land-use systems that combine agriculture and forestry practices to create a more holistic, integrated, profitable, and sustainable system of food and fiber production.

Alien species
Species introduced outside its normal distribution. Invasive alien species are alien species whose establishment and spread modify ecosystems, habitats, or species.

Assisted natural regeneration
Natural regeneration of forest/other wooded land with deliberate human intervention aimed at enhancing the ability of desired species to regenerate

Atoll
A nearly circular island initally formed by a volcano, which eroded leaving a coral island consisting of a reef surrounding a lagoon.

Biocapacity
Refers to the capacity of a given biologically productive area to generate an on-going supply of renewable resources and to absorb its spillover wastes. Unsustainability occurs if the area's ecological footprint exceeds its biocapacity.

Biodiversity
Contraction of biological diversity. Quantity and variability among living organisms within species (genetic diversity), between species and between ecosystems. Biodiversity is not itself an ecosystem service but underpins the supply of services. The value placed on biodiversity for its own sake is captured under the cultural ecosystem service called "ethical values".

Biomass
The total quantity or mass of organic material produced by living organisms in a particular area, at a given time.

Biome
A major ecological community, classified according to the predominant vegetation and characterized by adaptations of organisms to that particular environment. For example, the world can be divided into at least five major biomes: aquatic; deserts; forests; grasslands; and tundra.

Biosphere
The life zone of the earth including the lower part of the atmosphere and the upper part of the lithosphere.

Biosphere reserves
Internationally recognized areas within UNESCO's Man and the Biosphere (MAB) Program that promote a balanced relationship between people and nature to reconcile the conservation of biodiversity with its sustainable use. In September, 2001, there were 411 biosphere reserves in 94 countries.

Biota
The plants, animals, and other living organisms found in a specific region

Biotechnology
Any technological application that uses biological systems, living organisms, or derivatives thereof to make or modify products or processes for specific use.

Capital value (of an ecosystem)
The present value of the stream of future benefits that a ecosystem will generate under a particular management regime. Present values are typically obtained by discounting future benefits and costs; the appropriate rates of discount are often a contested issue, particularly in the context of natural resources.

Centre of diversity
The regions where most of the major crop species were originally domesticated and developed. These regions may coincide with Centres of origin.

Centre of origin
The area in which taxon originated and from which it has spread such as area contains a large number of varieties of this taxon.

Common pool resource
A valued natural or human-made resource or facility in which one person's use subtracts from another's use and where it is often necessary but difficult to exclude potential users from the resource. See also common property resource.

Contingent valuation (CV)
Economic valuation technique based on the stated preference of respondents regarding how much they would be willing to pay

for specified benefits. A detailed description of the good or service involved is provided, along with details about how it will be provided. CV is designed to circumvent the absence of markets by presenting consumers with hypothetical markets in which they have the opportunity to buy the good or service in question. The methodology is controversial, but widely accepted guidelines for its application have been developed.

Cryogenic storage
The preservation of seeds, semen, embryos, or micro- (Conservation) organisms at extremely low temperature below – 130 C. At this tempertur4e, water is absent molecular, kinetic energy is low. Diffusion is virtually nil, and storage potential is expected to be extremely long.

Deforestation
The conversion of forested land to non-forested land as a direct result of human activities.

Diversity
The variety and relative abundance of different entities in a sample.

Dry forests
Dry Forests occur in areas that are warm, and may receive lots of rain, but have long dry seasons during which the trees lose their leaves to conserve water.

Dryland systems
Dryland systems are ecosystems characterised by a lack of water. They include cultivated lands, scrublands, shrublands, grasslands, savannas, semi-deserts and true deserts.

Ecological footprint
The area of productive land and aquatic ecosystems required to produce the resources used and to assimilate the wastes produced by a defined population at a specified material standard of living, wherever on Earth that land may be located.

Ecoregions (or ecozones)
Relatively large units of land or water that contain distinct assemblages of natural communities sharing a majority of species, climate, soils, environmental conditions, and general topography. For example, ecoregions at the continental scale would be Australia or Latin America, whereas on a country scale, the boreal forest and Atlantic Maritimes are different ecoregions of Canada.

Ecosystem
An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Examples of ecosystems include deserts, coral reefs, wetlands, rainforests, boreal forests, grasslands, urban parks and cultivated farmlands.

Ecosystem approach
A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompass the essential structure, processes,functions, and interactions among organisms and their environment. It recognizes thathumans, with their cultural diversity, are an integral component of many ecosystems.

Ecosystem assessment
A social process through which the findings of science concerning the causes of ecosystem change, their consequences for human well-being, and management and policy options are brought to bear on the needs of decision-makers.

Ecosystem services
Benefits that people obtain from ecosystems. Examples include food, freshwater, timber, climate regulation, protection from natural hazards, erosion control, pharmaceutical ingredients and recreation.

Endemic
Restricted to a particular geographic region and found nowhere else in the world.

Eutrophication
The increase in additions of nutrients [especially nitrogen and phosphorus] to freshwater or marine systems, which leads to increases in plant growth and often to undesirable changes in ecosystem structure and function.

Ex-situ
Pertaining to study or maintenance of an organism or groups of organisms away from the place where they naturally occur. Commonly associated with collection of plants and animals in storage facility botanic gardens and zoos.

Extinction
Disappearance of a taxonomic group of organisms from existence in all regions.

Forest
FAO defines "forest" as a portion of land bigger than half a hectare (5 000m2) with trees higher than 5 meters and a tree canopy cover of more than 10 %, or with trees that will be able to meet these criteria. It does not include land that is predominantly under agricultural or urban land use.

Forest degradation
Changes within the forest which negatively affect the structure or function of the stand or site, and thereby lower the capacity to supply products and/or services.

Forest improvement
Changes within the forest which positively affect the structure or function of the stand or site, and thereby increase the capacity to supply products and/or services.

Forest management
The processes of planning and implementing practices for the stewardship and use of forests and other wooded land aimed at achieving specific environmental, economic, social and /or cultural objectives.

Gene-Pool
The collection of genes in an interbreeding populations.

Genes
A chemical unit of hereditary information that can be passed from one generation to another.

Genetic diversity
The variety of genes within a particular species variety or breed.

Genetic
Are actual or potentially useful characteristics of plants, resources animals and other organisms that are determined genetically

Genotype
The genetic constitution of an organism as distinguished from its physical appearance.

Genetic
The diversity of genetic material within and between species and subspecies of animals & plants.

Geographic information system (GIS)
A computerized system organizing data sets through a geographical referencing of all data included in its collections. A GIS allows the spatial display and analysis of information.

Indirect use value
The benefits derived from the goods and services provided by an ecosystem that are used indirectly by an economic agent. For example, an agent at some distance from an ecosystem may derive benefits from drinking water that has been purified as it passed through the ecosystem.

In situ
Maintenance or study of organism within an organism native environment.

En situ
Protected areas designated specifically to protect genetic genebank variability of particular species.

Land cover
The physical coverage of land, usually expressed in terms of vegetation cover or lack of it. Influenced by but not synonymous with land use.

Land use
The human utilization of a piece of land for a certain purpose (such as irrigated agriculture or recreation). Influenced by but not synonymous with land cover.

Genera – (plural of genus) A group of organisms marked by common characteristics and evolutionary background; more precisely, it is the category of biological classification between Family and Species.

Genes
The functional and physical unit of heredity passed from parent to offspring. Genes are pieces of DNA, and most genes contain the information for making a specific protein.

Greenhouse gas
Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by

the Earth's surface, the atmosphere and clouds. This property causes the greenhouse effect.

Habitat
The location and environmental conditions in which a particular organism normally lives.

Habitat change
Change in the local environmental conditions in which a particular organism lives. Habitat change can

occur naturally through droughts, disease, fire, hurricanes, mudslides, volcanoes, earthquakes, slight increases or decreases in seasonal temperature or precipitation, etc. However, it is generally induced by human activities such as land use change and physical modification of rivers or water withdrawal from rivers.

Mangrove
A general name for several species of halophyte (plant that grows in soils that have a high content of various salts) belonging to different families of plants (including trees, shrubs, a palm tree and a ground fern) occurring in intertidal zones of tropical and subtropical sheltered coastlines and exceeding one half meter in height. The term is applied to both the individual and the ecosystem, the latter of which is termed mangal

Microhabitats
A small, usually distinctly specialized habitat, such as the tank of water inside a bromeliad.

Monotypic
Characterized by only one species. A monotypic genus or family has only one species.

Natural forest
A forest composed of indigenous trees and not classified as a forest plantation.

Non-Wood Forest Product (NWFP)
A product of biological origin other than wood derived from forests, other wooded land and trees outside forests.

Poaching
Illegal harvest of wildlife, including plants. For example, illegally collecting bushmeat or medicinal plants.

Protected area
Area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means"

Reforestation
Establishment of forest plantations on temporarily unstocked lands that are considered as forest.

Secondary Centre
Areas of genetic diversity, where a crop might have been diversity grown to a greater extent than in the region where it was first domesticated.

Secondary forest
Forest regenerated largely through natural processes after significant human or natural disturbance of the original forest vegetation.

Species
A group of organisms that differ from all other groups of organisms and that are capable of breeding and producing fertile offspring. This is the smallest unit of classification for plants and animals.

Sustainability
A characteristic or state whereby the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs.

Taxonomy
The classification, especially of plants and animal, on the basis of differences and similarities between them.

Land use
The human use of a piece of land for a certain purpose (such as irrigated agriculture or recreation).

Landscape
An area of land that contains a mosaic of ecosystems, including human-dominated ecosystems. The term cultural landscape is often used when referring to landscapes containing significant human populations or in which there has been significant human influence on the land.

Marine trophic index
The term 'Marine trophic index' is the CBD's name for the mean trophic level of fisheries landings [and one primary marine biodiversity indicator]. Trophic level measures the position of a species in a food web, starting with 'producers' (eg phytoplankton, plants) at level 0, and moving through primary consumers that eat primary producers (level 1) and secondary consumers that eat primary consumers (level 2), and so on.

In marine fishes, the trophic levels vary from two to five (top predators).

Parasitism
The consumption of one individual by another in which the consumer resides on (ectoparasite) or within (endoparasite) the body of its host or victim.

Property rights
An institution that gives someone possession rights to use things and

to prevent others from using them; includes private, collective, common, public, and state property rights.

Provisioning services
The products obtained from ecosystems, including, for example, genetic resources, food and fiber, and fresh water.

Safe minimum standard
A decision analytical framework in which the benefits of ecosystem services are assumed to be incalculable and should be preserved unless the costs of doing so rise to an intolerable level, thus shifting the burden of proof to those who would convert them.

Sustainability
A characteristic or state whereby the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs.

Taxa
Nested groups of species that reflect similarity. Familiar taxa are birds (which belong to the class Aves) and fig trees (which belong to the genus Ficus).

Taxonomy
A system of nested categories (taxa) reflecting evolutionary relationships or morphological similarity.

Total economic value framework
A widely used framework to disaggregate the components of utilitarian value, including direct and indirect use value, option value, quasi-option value and existence value.

Acronyms

ABS	Access and benefit sharing
CBD	Convention on Biological Diversity
CCD	The UN Convention to Combat Desertification
CO2	Carbon dioxide
EEA	European Environment Agency
EGS	Ecosystem global scenario
EIA	Environmental impact assessment
GFP	Good Farming Practice
ISEH	International Society for Ecosystem Health
TEV	Total economic value
GEF	Global Environment Facility
CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture
GIS	Geographical Information System
GMO	Genetically Modified Organisms
IPCC	Intergovernmental Panel on Climate Change
FAO	Food and Agriculture Organization
GB	Governing Body
GPA	Global Plan of Action for the Conservation and
GWP	Global Water Partnership
IARCs	International agricultural research centres
IIFB	International Indigenous Forum on Biodiversity
IPRs	Intellectual Property Rights
ITPGR	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	World Conservation Union

MA	Millennium Ecosystem Assessment
MDGs	Millennium Development Goals
NEPAD	New Partnership for Africa's Development
NWFP	Non Wood Forest Product
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PGRFA	Plant genetic resources for food and agriculture
PVP	Plant variety protection
PIPRA	Public Intellectual Property in Agriculture
SIDS	Small Islands Developing States
SMTA	Standard Material Transfer Agreement
TDR	Tradable development rights
TEV	Total economic value
TRIPS	(WTO Agreement on) Trade Related Aspects of Intellectual Property Rights
TSR	Total species richness
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPOV	International Union for the Protection of New Varieties of Plants
WIPO	World Intellectual Property Organization WSSD World Summit on Sustainable Development
WTO	World Trade Organization
WWV	World Water Vision

Footnotes

1 This Reader is not intended to exhaustively cover the theme of ACP Food security and the Global Economic Crisis but to provide some background information and selected information resources. Most text of this Reader has been directly taken from the original documents or websites. For additional inputs, kindly contact Isolina Boto (boto@cta.int). The Reader and most of the resources are available at http://brusselsbriefings.net/.

2 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

3 Langhammer, P.F., Bakarr,M.I., Bennun, L.A., Brooks, T.M., Clay, R.P., Darwall,W., De Silva, N., Edgar, G.J., Eken, G., Fishpool, L.D.C.,3 Fonseca, G.A.B. da, Foster, M.N., Knox, D.H., Matiku, P., Radford, E.A., Rodrigues, A.S.L., Salaman, P., Sechrest, W., and Tordoff, A.W. (2007). Identification and Gap Analysis of Key Biodiversity Areas: Targets for Comprehensive Protected Area Systems. Gland, Switzerland: IUCN. http://data.iucn.org/dbtw-wpd/edocs/PAG-015.pdf

4 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

5 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

6 http://www.maweb.org/documents/document.354.aspx.pdf

7 A Living Modified Organism (LMO) is defined in the Cartagena Protocol on Biosafety as any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology. The Protocol also defines the terms ‘living organism’ and ‘modern biotechnology’ (see Article 3).

8 A range of other international instruments deal with the protection of fauna and flora. Among them:

- the Ramsar Convention on the conservation of wetlands of 1971;
- the Washington Convention (CITES) of 3 March 1973 on International Trade in Endangered Species of Wild

Fauna and Flora;

- the Bonn Convention of 23 June 1979 on the protection of migratory species of wild fauna;
- the Bern Convention on the protection of European wildlife and natural habitats of 1982;
- the Rio de Janeiro Convention on Biological Diversity of 1992; and

Moreover, there is a set of regional conventions such as the Helsinki Convention on the Baltic Sea (1974), the

Barcelona Convention on the Mediterranean (1976) and the Convention on the protection of the Alps (1991).

9 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

10 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

11 http://www.maweb.org/documents/document.354.aspx.pdf

12 World Resources Institute, Millennium Ecosystem Assessment - Ecosystems and Human Wellbeing: Biodiversity Synthesis, 2005, http://www.maweb.org/documents/document.354.aspx.pdf

13 http://www.maweb.org/documents/document.354.aspx.pdf

14 Braat, ten Brink et al. 2008

15 Braat, ten Brink et al. 2008

16 Bioversity International: http://www.bioversityinternational.org/scientific_information/themes/conservation_and_use/overview.html

17 Plant genetic resources genebanks store, maintain and reproduce living samples of the world’s huge diversity of crop varieties and their wild relatives. They ensure that the varieties and landraces of the crops and their wild relatives that underpin our food supply are both secure in the long term and available for use by farmers, plant breeders and researchers.

18 The part on Agricultural Biodiversity is taken from the Convention on Biological Diversity (CBD) http://www.cbd.int/agro/whatis.shtml

19 http://www.maweb.org/documents/document.354.aspx.pdf

20 Bioversity International

21 Agricultural Biodiversity in FAO: http://www.fao.org/docrep/010/i0112e/i0112e00.htm

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