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## Biodiversity

“Environmental sustainability is everybody’s challenge....Our goal must be to meet the economic needs of the present without compromising the ability of the planet to provide for the needs of future generations.”

Secretary-General Kofi Annan in the *Millennium Report*

### Vital statistics

- Species have been disappearing at 50-100 times the natural rate, and this is predicted to rise dramatically.
- Based on current trends, an estimated 34,000 plant and 5,200 animal species – including one in eight of the world’s bird species – face extinction.
- About 30 per cent of the main farm animal breeds are currently at high risk of extinction.
- Some 65 million hectares of forest were lost in the developing world between 1990 and 1995 because of over-harvesting.
- Plant-based medicines provide more than 3 billion people with their primary health care.
- Fish catches have increased nearly fivefold during the last half-century, but almost 70 per cent of ocean fisheries are either fully exploited or over-fished.
- More than half the world’s coral reefs are currently at risk.

### Biodiversity – the web of life

Biological diversity – or biodiversity – is the term given to the variety of life on Earth and the natural patterns it forms. The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes and, increasingly, by the influence of humans. It forms the web of life of which we are an integral part and upon which we so fully depend.

This diversity is often understood in terms of the wide variety of plants, animals and micro-organisms. So far, about 1.75 million species have been identified, mostly small creatures such as insects. Scientists reckon that there are actually about 13 million species, though estimates range from 3 to 100 million. Biodiversity also includes genetic differences within each species – for example, between varieties of crops and breeds of livestock. Yet another aspect is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers and agricultural landscapes. It is the combination of life forms and their interactions with each other and with the rest of the environment that has made Earth a uniquely habitable place for humans.

### We are changing life on Earth

Protecting biodiversity is in our self-interest. Nature’s products support such diverse industries as agriculture, cosmetics, pharmaceuticals, pulp and paper, horticulture, construction and waste treatment. The loss of biodiversity threatens our food supplies, opportunities for recreation and tourism, and sources of wood, medicines and energy. It also interferes with essential ecological functions.

Just consider the many goods and services provided by ecosystems:

- Provision of food, fuel, fibre and shelter and building materials
- Purification of air and water, detoxification and decomposition of wastes
- Stabilization and moderation of the Earth’s climate
- Moderation of floods, droughts, temperature extremes and the forces of wind
- Generation and renewal of soil fertility, including nutrient cycling

- Pollination of plants, including many crops; control of pests and diseases
- Maintenance of genetic resources as key inputs to crop varieties and livestock breeds and medicines
- Cultural and aesthetic benefits

While the loss of such charismatic animals as pandas, tigers, elephants, rhinos, whales and various species of birds catches our attention, it is the fragmentation, degradation and outright loss of forests, wetlands, coral reefs and other ecosystems that poses the gravest threat to biological diversity.

Our cultural identity is also deeply rooted in our biological environment. Plants and animals are symbols of our world, preserved in flags, sculptures and other images that define us. We draw inspiration just from looking at nature's beauty and power.

While loss of species has always occurred as a natural phenomenon, the pace of extinction has accelerated dramatically as a result of human activity. We are creating the greatest extinction crisis since the natural disaster that wiped out the dinosaurs 65 million years ago. These extinctions are irreversible and, given our dependence on food crops, medicines and other biological resources, pose a threat to our own well-being.

### **An Agreement for Action**

While concern for the environment is constant in history, heightened concern about environmental destruction and loss of species and ecosystems in the 1970s led to concerted international action. In 1972, the United Nations Conference on the Human Environment (Stockholm) led to the establishment of the United Nations Environment Programme (UNEP). In the following years, Governments, often under UNEP auspices, signed a number of regional and international agreements to tackle specific issues, such as protecting wetlands and migratory species and regulating the international trade in endangered species.

Twenty years later, in 1992, the largest-ever meeting of world leaders took place at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil. An historic set of agreements was signed at the "Earth Summit", including two binding agreements, the Convention on Climate Change, which targets industrial and other emissions of greenhouse gases such as carbon dioxide, and the Convention on Biological Diversity, the first global agreement on the conservation and sustainable use of biological diversity. Over 150 Governments signed the treaty at the Rio Conference, and since then more than 175 countries have ratified it.

The Convention has three main goals:

- the conservation of biodiversity;
- sustainable use of the components of biodiversity; and
- sharing the benefits arising from the commercial and other utilization of genetic resources in a fair and equitable way.

The Convention recognizes – for the first time – that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process. It also covers the rapidly expanding field of biotechnology, addressing technology development and transfer, benefit sharing and biosafety. The Convention also offers decision-makers guidance based on the precautionary principle that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat.

Some of the many issues dealt with under the Convention include:

- Measures and incentives for the conservation and sustainable use of biological diversity.
- Regulated access to genetic resources.
- Access to and transfer of technology, including biotechnology.
- Technical and scientific cooperation.

- Impact assessment.
- Education and public awareness.
- Provision of financial resources.
- National reporting on efforts to implement treaty commitments.

### **National Action**

The Convention on Biological Diversity, as an international treaty, identifies a common problem, sets overall goals and policies and general obligations, and organizes technical and financial cooperation. However, the responsibility for achieving its goals rests largely with the countries themselves. At the national level, private companies, landowners, fishermen and farmers take most of the actions that affect biodiversity. Governments need to provide the critical role of leadership, particularly by setting rules that guide the use of natural resources, and by protecting biodiversity where they have direct control over the land and water.

Under the Convention, Governments are required to develop national biodiversity strategies and action plans, and to integrate these into broader national plans for environment and development. This is particularly important for such sectors as forestry, agriculture, fisheries, energy, transportation and urban planning.

Other treaty commitments include:

- Identifying and monitoring the important components of biodiversity that need to be conserved and used sustainably.
- Establishing protected areas to conserve biodiversity while promoting environmentally sound development around these areas.
- Rehabilitating and restoring degraded ecosystems and promoting the recovery of threatened species in collaboration with local residents.
- Respecting, preserving and maintaining traditional knowledge of the sustainable use of biological diversity with the involvement of indigenous peoples and local communities.
- Preventing the introduction of, controlling and eradicating alien species that could threaten ecosystems, habitats or species.
- Controlling the risks posed by organisms modified by biotechnology.
- Promoting public participation, and educating people and raising awareness about the importance of biological diversity and the need to conserve it.
- Reporting on how each country is meeting its biodiversity goals.

### **Taking action**

The conservation of each country's biodiversity can be achieved in various ways. "In-situ" conservation – the primary means of conservation – focuses on conserving genes, species and ecosystems in their natural surroundings, for example by establishing protected areas, rehabilitating degraded ecosystems, and adopting legislation to protect threatened species. "Ex- situ" conservation uses zoos, botanical gardens and gene banks to conserve species. There are many examples of country-level initiatives to integrate the objectives of conservation and sustainable use:

- In 1994, Uganda adopted a programme under which protected wildlife areas shared part of their tourism revenues with local people -- an approach now being used in several African countries.
- Costa Rica's 1996 Forestry Law includes provisions to compensate private landowners and forest managers who maintain or increase the area of forest within their properties.
- Through weekly "farmer field schools", some 2 million rice farmers in several Asian countries have enhanced their understanding of the tropical rice ecosystem – including the interactions between

insect pests of rice, their natural enemies, fish farmed in the rice paddies, and the crop itself – in order to improve their crop management practices. As a result, they have increased their crop yields, while at the same time almost eliminating insecticide use.

- Clayoquot Sound on the western coast of Vancouver Island, Canada, encompasses forests and marine and coastal systems. The establishment of adaptive management to implement the ecosystem approach at the local level is currently under development with the involvement of indigenous communities, with a view to ensuring rational use of the forest and marine resources.

The Convention's success depends on the combined efforts of the world's nations. The responsibility to implement the Convention lies with the individual countries and, to a large extent, compliance will depend on informed self-interest and peer pressure from other countries and from public opinion. The Convention Secretariat in Montreal regularly organizes global and regional meetings – where Governments, non-governmental organizations, the academic and scientific communities, the private sector and other interested groups or individuals share ideas and compare strategies.

### **Sharing the benefits of genetic resources**

An important part of the biodiversity debate involves access to and sharing of the benefits arising out of the commercial and other use of genetic material, such as pharmaceutical products. The treaty recognizes a country's sovereignty over its genetic resources, and provides that access to valuable biological resources be carried out on "mutually agreed terms" and subject to the "prior informed consent" of the country of origin. When a micro-organism, plant or animal is used for a commercial application, the country from which it came has the right to benefit through cash, samples of what is collected, the participation or training of national researchers, the transfer of biotechnology equipment and know-how, and shares of any profits. Work has begun to translate this concept into reality and there are already examples of benefit-sharing arrangements, such as:

- In 1995, the Philippines required bio-prospectors to get "prior informed consent" from both the Government and local peoples.
- Costa Rica's National Institute of Biodiversity (INBIO) signed a historic bio-prospecting agreement with a major drug company to receive funds and share in benefits from biological materials that are commercialized.

### **The Biosafety Protocol**

Since the domestication of the first crops and farm animals, we have altered their genetic makeup through selective breeding and cross-fertilization. The results have been greater agricultural productivity and improved human nutrition.

In recent years, advances in biotechnology techniques have enabled us to cross the species barrier by transferring genes from one species to another. We now have transgenic plants, such as tomatoes and strawberries that have been modified to protect the plants from frost. Some varieties of potato and corn have received genes from a bacterium that enables them to produce their own insecticide. Other plants have been modified to tolerate herbicides sprayed to kill weeds. Living Modified Organisms (LMOs) are becoming part of an increasing number of products, including foods and food additives, beverages, drugs, adhesives, and fuels. Agricultural and pharmaceutical LMOs have rapidly become a multi-billion-dollar global industry.

Biotechnology is being promoted as a better way to grow crops and produce medicines, but it has raised concerns about potential side effects on human health and the environment. In some countries, genetically altered agricultural products have been sold without much debate, while in others, there have been vocal protests against their use, particularly when they are sold without being identified as genetically modified.

In response to these concerns, Governments negotiated a subsidiary agreement to the Convention to address the potential risks posed by cross-border trade and accidental releases of LMOs. Adopted in January 2000, the Cartagena Protocol on Biosafety allows Governments to signal whether or not they are willing to accept imports of agricultural commodities that include LMOs by communicating their decision to the world community via a Biosafety Clearing House, a mechanism set up to facilitate the exchange of information on, and experience with, LMOs. In addition, commodities that may contain LMOs are to be clearly labelled as such when being exported.

Exporters must also provide detailed information to each importing country in advance of the first shipment of seeds, live fish and other LMOs that are to be intentionally introduced into the environment, and the importer must then authorize the shipment. The aim is to ensure that recipient countries have both the opportunity and the capacity to assess any risks involving the products of modern biotechnology. The Protocol will enter into force after it has been ratified by 50 Governments.

Secretary-General Kofi Annan, in his *Millennium Report* has proposed convening a high-level global policy network to address these and related controversies concerning the risks and opportunities associated with the increased use of biotechnology and bioengineering.

### **A new initiative for assessing ecosystems**

During the past three decades we have become increasingly aware that the natural ecosystems on which human life depends are under threat. But we still lack detailed knowledge of the extent of the damage – or its causes. Secretary-General Kofi Annan, in his *Millennium Report*, has underscored the need to develop a truly comprehensive global evaluation of the condition of the five major ecosystems: forests, freshwater systems, grasslands, coastal areas and agroecosystems.

This proposed the Millennium Ecosystem Assessment seeks to produce just such an evaluation.

An initiative of the World Resources Institute, the World Bank, the United Nations Development Programme and the United Nations Environment Programme, among others, will draw on and collate existing sources of data and promote new research to fill the missing knowledge gaps.

The Secretary-General has called on the Member States to help provide the necessary financial support for the Millennium Ecosystem Assessment and to become actively engaged in it. Both developed and developing country Governments will benefit from the research work. The private sector will also benefit by being able to make more informed forecasts. And it will provide civil society with the information they need to hold corporations and Governments accountable for meeting their environmental obligations.

### **Joining hands**

While Governments should play a leadership role, other parts of society need to be actively involved. After all, it is the choices and actions of billions of individuals that will determine whether or not biodiversity is conserved and used sustainably.

In an era when economics is a dominant force in world affairs, it is more important than ever to have **business** willingly involved in environmental protection and the sustainable use of nature. Fortunately, a growing number of companies have found ways to make a profit while reducing their environmental impacts, thus increasing goodwill from their business partners, employees and consumers.

**Local communities** play a key role since they are the true "managers" of the ecosystems in which they live. Many projects have been successfully developed in recent years involving the participation of local and indigenous communities in the sustainable management of biodiversity.

Finally, the ultimate decision-maker for biodiversity is the **individual citizen**. The small choices that individuals make add up to a large impact because it is personal consumption that drives development, which in turn uses and pollutes nature. By carefully choosing the products they buy and the government policies that they support, the general public can begin to steer the world towards sustainable development. Governments, companies and others have a responsibility to lead and inform the public, but, finally, it is individual choices, made billions of times a day, that count the most.

On a practical level, one can join others in:

1. Beautifying school grounds and parks, using local plant species.
2. Reclaiming abandoned lots into community gardens; adopting a local park.
3. Educating one another about local species of animals and plants.
4. Forming wildlife and gardening organizations, or joining existing ones.

**Box:**

**Kids power**

**Paper tiger:** Kruti Parekh 13, from India promotes environmental awareness through her magic show which she has performed 1700 times. In it, she eats waste paper and produces an endless sheet of recycled paper from her mouth. She also promotes worms! Yes, worms. Put them in any bin of compostable rubbish and they will break it down into rich fertilizer in days. Kruti calls it "The 2 in 1 process - waste disposal and fertilizer all manufacture in one!"

**A class act:** In the Sultanate of Oman, the "Green Beans" a local youth environmental group have been working so hard it's a wonder they have time for their studies! "We raise money by organising sales and after school movie shows", says Hassan Al Saleh, 17. Hassan told us the money is used to buy acres of rain forest and adopt endangered animals. Twice a year, the Green Beans hold a beach clean-up. "We have come a long way in raising awareness in and out of school. If we all work together, we can make this world a better place.

**Kids for the reef:** Forty scuba divers from all over the Philippines organised a clean-up programme for the reefs in Batangas, south of Manila. "Kids for the Reef" drew young people into the project collecting waste along the shoreline. The programme made young people aware of how fragile Philippine reefs are. Of 500 known coral species, 400 are found in the Philippines. That's 400 good reasons to get involved!

**Planet Xpress:** Amy Saunders, 19, from Scotland, UK, is developing a website for young people on global issues. "Planet Xpress is a place to meet people from all over the world, exchange ideas and take positive action," says Amy. "It is run by and for young people. We need more young contributors, web-designers, out-reachers and coordinators.

**Power rangers:** Essau Lower School in the Gambia has a group of 13- and 14-year-old boys who collect used batteries and move them to a safe site. "We realized that batteries were being dumped all over," said one of them. "Young people are not aware of the health dangers they bring. We are extending this new project to many schools and ally the whole area."

*Adapted from "Pachamama", UNEP and PCI, Evans Brothers Limited, UK, 2000*

**What are the next steps?**

Economic development is essential to meeting human needs and to eliminating the poverty that affects so many people around the world. A major challenge for the 21st century will be making the conservation and sustainable use of biodiversity a compelling basis for development policies, business decisions and consumer desires.

The Convention has already accomplished a great deal on the road to sustainable development through its near universal membership, a comprehensive and science-driven mandate, international financial support for national projects, world-class scientific and technological advice, and the political involvement of Governments. It has brought together, for the first time, people with often very different interests -- Governments, the private sector, environmentalists, indigenous peoples and local communities and the concerned citizen. However, many challenges still lie ahead, such as:

- Meeting the increasing demand for biological resources caused by population growth and increased consumption.
- Increasing our capacity to document and understand biodiversity, its value and threats to it.
- Improving policies, laws, guidelines and fiscal measures for regulating the use of biodiversity.
- Promoting trade rules and practices that foster sustainable use of biodiversity.
- Securing adequate financial resources for conservation and sustainable use.
- Making better use of technology.
- Building political and popular support for the changes necessary to ensure long-term biodiversity conservation and sustainable use.

Although still in its infancy, the Convention on Biological Diversity is already making itself felt. The philosophy of sustainable development, the ecosystem approach and the emphasis on building partnerships are all helping to shape global action on biodiversity. The data and reports that Governments are gathering and sharing with each other are providing a sound basis for understanding the challenges and collaborating on the solutions.

Much, much more needs to be done. With human population expected to rise dramatically, particularly in developing countries, and the consumer revolution set for exponential expansion, species and ecosystems will face ever more serious threats. If everyone applies the concepts embodied in the Convention and make the conservation and sustainable use of biodiversity a real priority, we can ensure a new and sustainable relationship between humanity and the natural world for generations to come.

### **Suggested activities for students**

1. Join with others in:
  - Beautifying school grounds and parks, using local plant species.
  - Reclaiming abandoned lots into community gardens; adopting a local park.
  - Educating one another about local species of animals and plants.
  - Forming wildlife and gardening organizations, or joining existing ones.
  - Planting trees in supervised tree planting programs
  - Creating a species enhancement project like obtaining fish eggs from local hatcheries and raising them until it is time to release them to the wild.
  - Recycling cans, bottles and paper.
  - Composting vegetable and garden wastes.
2. Record your actions over a week to determine your environmental consciousness. Note your efforts to pick up litter, recycle, reduce consumption, save energy, use alternative transportation sources. Share your efforts with others in the class. Create a class competition for the most unusual, most extensive, most creative efforts.
3. Visit a local zoo or botanical park or invite to class staff from these areas to discuss their efforts at preserving biodiversity.
4. Identify the terms renewable, nonrenewable, perpetual, reusable and recyclable resources and explain the differences among them. Play a game in which the class is divided into teams of four. (A) Give each team 16 pieces of popcorn, candies or nuts which represent the teams' supply of a renewable resource that is replenished after each round of play. Each student can take freely from the team supply but the

following rules apply: (1) At the end of the game, each team member will get to eat all the popcorn amassed (2) Each one needs to take at least one piece per round to be sustained (3) At the end of each round, the resource will be replenished by one-half of its existing amount. (B) Allow students to take freely from their team's pile, but have them record individual and group pieces. (C) Replenish by one half the number of pieces taken from the team pile. (D) Play three or four more rounds, stopping after each to find out if any of the students didn't survive. Then provide each group with the prescribed amount of new popcorn. (E) After four or five rounds, have students share what happened. In which teams did all the students survive? Which students had the most popcorn in their personal supplies? Which team had the most popcorn in its collective pile? Which teams think they would be able to keep eating popcorn forever as long as the resource kept renewing itself? On these teams, how many pieces were these students taking each round? (F) Discuss the advantages and disadvantages of using a resource in a sustainable and a non-sustainable way. What would happen if the population of the group increased as the game went on?

6. Visit a vacant lot, garden or natural site near or in your school yard to closely examine a real ecosystem in action and record the range of life forms you can find: plants, the range of small and large animals, and evidence of human life. What elements help support animals living there? Plants living there? What would happen if one of these were missing? Create a map of your findings. Prepare presentations on the value of an area in providing plant and animal habitat.

6. Web of Life Activity. (A) Create a list of categories so that everything living, non-living and human-specific would fit into at least one category. (Examples might be plants, animals, minerals, technology, culture, religion, art, emotions etc.) Post the list for everyone to see. (B) Start the game by giving a ball of yarn to a student, asking him or her to name something from one category (like flowers from the "Plant" category). Holding onto one end, the student should roll or toss the yarn to another student, who must name something from a different category and explain the relationship to the first item named, such as "painting" from art column; then hold the string and pass the ball to the third student who does the same as the second and passes it on to the fourth student. The game continues until all students are connected. (C) At that point discuss how human actions that directly affect part of the Earth System indirectly affect many other parts. Use water pollution as an example and ask which student named something that would be negatively affected. Choose one (e.g. the one that said drinking supply) and have him or her show stress by tugging the string back and forth. Discuss the effect of this vibration on others. (D) As you rewind the yarn, ask each person letting go to name something a person could do to make the Earth a healthier place. Collect these ideas, post and implement them.

#### **Additional Resources:**

##### **On the World Wide Web**

[www.unep.org](http://www.unep.org)

[www.worldbank.org](http://www.worldbank.org)

[www.undp.org](http://www.undp.org)

[www.unesco.org](http://www.unesco.org)

[www.worldresources.org](http://www.worldresources.org)

##### **Publications**

*Shaping Life on Earth: How the Convention on Biological Diversity promotes nature and human well-being*; April 2000, Secretariat of the Convention on Biological Diversity; available on the Internet at [www.biodiv.org/PubAware/pdf/CBD\\_ang.pdf](http://www.biodiv.org/PubAware/pdf/CBD_ang.pdf). Much of the above text is adapted from this publication; it is also available online in French, Spanish and Chinese.

*Global Environment Outlook 2000*; 1999, UNEP and Earthscan Publications; available online at [www.unep.org/geo2000](http://www.unep.org/geo2000); also available in printed form in French and Spanish.

*Pachamama: Our Earth - Our Future*; 1999, UNEP and Evans Brothers Limited; available online at [www.unep.org/geo2000/pacha/index.htm](http://www.unep.org/geo2000/pacha/index.htm)

*World Resources 2000-2001 -- People and Ecosystems: The Fraying Web of Life*; September 2000; WRI, UNEP, UNDP and World Bank; available online at [www.wri.org/wr2000/index.html](http://www.wri.org/wr2000/index.html).

*Taking Action: An Environmental Guide for You and Your Community*; 1995, UNEP and NGLS; available online at [www.nyo.unep.org/action](http://www.nyo.unep.org/action).

(This paper was contributed by UNEP).

Graphs/charts

Disappearing forests

<http://www.unep.org/geo2000/english/i105a.htm>