

# Facts on Biodiversity

A Summary of the Millenium Ecosystem Assessment Biodiversity Synthesis



**BIODIVERSITY** contributes to many aspects of human well-being, for instance by providing raw materials and contributing to health. Human actions, however, often lead to irreversible losses in terms of diversity of life on Earth and these losses have been more rapid in the past 50 years than ever before in human history. What factors are responsible for this rapid loss of biodiversity? What would need to be done to significantly slow this trend?



## Biodiversity: What is it, where is it, and why is it important?

Biodiversity is the measure of the number, variety and variability of living organisms. It includes diversity within species, between species, and among ecosystems. The concept also covers how this diversity changes from one location to another and over time. Indicators such as the number of species in a given area can help in monitoring certain aspects of biodiversity.

Biodiversity is everywhere, both on land and in water. It includes all organisms, from microscopic bacteria to more complex plants and animals. Current inventories of species, though useful, remain incomplete and insufficient for providing an accurate picture of the extent and

distribution of all components of biodiversity. Based on present knowledge of how biodiversity changes over time, rough estimates can be made of the rates at which species become extinct.

Ecosystem services are the benefits people obtain from ecosystems. Biodiversity plays an important role in the way ecosystems function and in the many services they provide. Services include nutrient and water cycling, soil formation and retention, resistance against invasive species, pollination of plants, regulation of climate, as well as pest and pollution control by ecosystems. For ecosystem services it matters which species are abundant as well as how many species are present.

## Why is biodiversity loss a concern?

Biodiversity provides many key benefits to humans that go beyond the mere provision of raw materials.

Biodiversity loss has negative effects on several aspects of human well-being, such as food security, vulnerability to natural disasters, energy security, and access to clean water and raw materials. It also affects human health, social relations, and freedom of choice.

Society tends to have various competing goals, many of which depend on biodiversity. When humans modify an ecosystem to improve a service it provides, this generally also results in changes to other ecosystem services. For example, actions to increase food production can lead to reduced water availability for other uses. As a result of such trade-offs, many services have been degraded, for instance fisheries, water supply, and protection against natural hazards. In the long term, the value of services lost may greatly exceed the short-term economic benefits that are gained from transforming ecosystems.

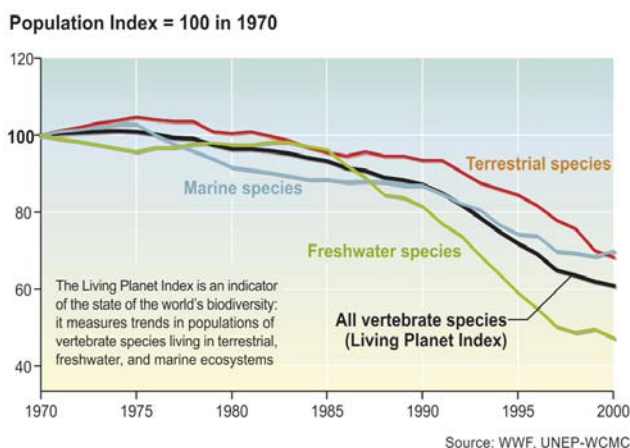
Unlike goods bought and sold in markets, many ecosystem services are not traded in markets for readily observable prices. This means that the importance of biodiversity and natural processes in providing benefits to humans is ignored by financial markets. New methods are being used to assign monetary values to benefits such as recreation or clean drinking water. Degradation of ecosystem services could be significantly slowed down or reversed if the full economic value of these services were taken into account in decision-making.

Over the last century, some people have benefited from the conversion of natural ecosystems and an increase in international trade, but other people have suffered from the consequences of biodiversity losses and from restricted access to resources they depend upon. Changes in ecosystems are harming many of the world's poorest people, who are the least able to adjust to these changes.



Biodiversity loss increases our vulnerability to natural disasters.

## What are the current trends in biodiversity?



The WWF Living Planet Index shows trends in the overall abundance of wild species.

Virtually all of Earth's ecosystems have been dramatically transformed through human actions and ecosystems continue to be converted for agricultural and other uses. The current loss of biodiversity and the related changes in the environment are now faster than ever before in human history and there is no sign of this process slowing down. Many animal and plant populations have declined in numbers, geographical spread, or both. Species extinction is a natural part of Earth's history. Human activity has increased the extinction rate by at least 100 times compared to the natural rate.

Comparing different types of measurements of biodiversity loss is not simple. The rate of change in one aspect of biodiversity, such as loss of species richness, does not necessarily reflect the change in another, such as habitat loss. Moreover, some aspects of biodiversity loss are not easily measured, for instance the fact that the same species are increasingly found at different locations on the planet and that overall biodiversity is decreasing.

## What factors lead to biodiversity loss?

Biodiversity is declining rapidly due to factors such as land use change, climate change, invasive species, overexploitation, and pollution. Such natural or human-induced factors – referred to as drivers – tend to interact and amplify each other.

While changes in biodiversity are more clearly linked to direct drivers such as habitat loss, they are also linked to indirect drivers that are at the root of many changes in ecosystems. The main indirect drivers are changes in human population, economic activity, and technology, as well as socio-political and cultural factors.

Different direct drivers have been critically important in different ecosystems over the past 50 years. For example, in terrestrial ecosystems, the main driver has been land cover change such as the conversion of forest to agriculture. In marine systems, however, fishing, and particularly overfishing, have been the main drivers of biodiversity loss.

Overall, the main factors directly driving biodiversity loss are: habitat change, such as fragmentation of forests; invasive alien species that

establish and spread outside their normal distribution; overexploitation of natural resources; and pollution, particularly by excessive fertilizer use leading to excessive levels of nutrients in soil and water.

Recent changes in climate have already had significant impacts on biodiversity and ecosystems in certain regions. As climate change will become more severe, the harmful impacts on ecosystem services are expected to outweigh possible benefits, such as a longer growing season, in most regions of the world. Climate change is expected to exacerbate risks of extinctions, floods, droughts, population declines, and disease outbreaks.

Many drivers affecting biodiversity are stronger today than they were in the past and are also occurring together. Because exposure to one threat often makes a species more susceptible to another, multiple threats may have unexpectedly dramatic impacts on biodiversity. Drivers of extinction range from local to global in scope and from immediate to long-term in their effects. For example, the extinction of species due to habitat loss can be rapid for some species, while it may take hundreds of years for others.

## How might biodiversity change in the future under various plausible scenarios?

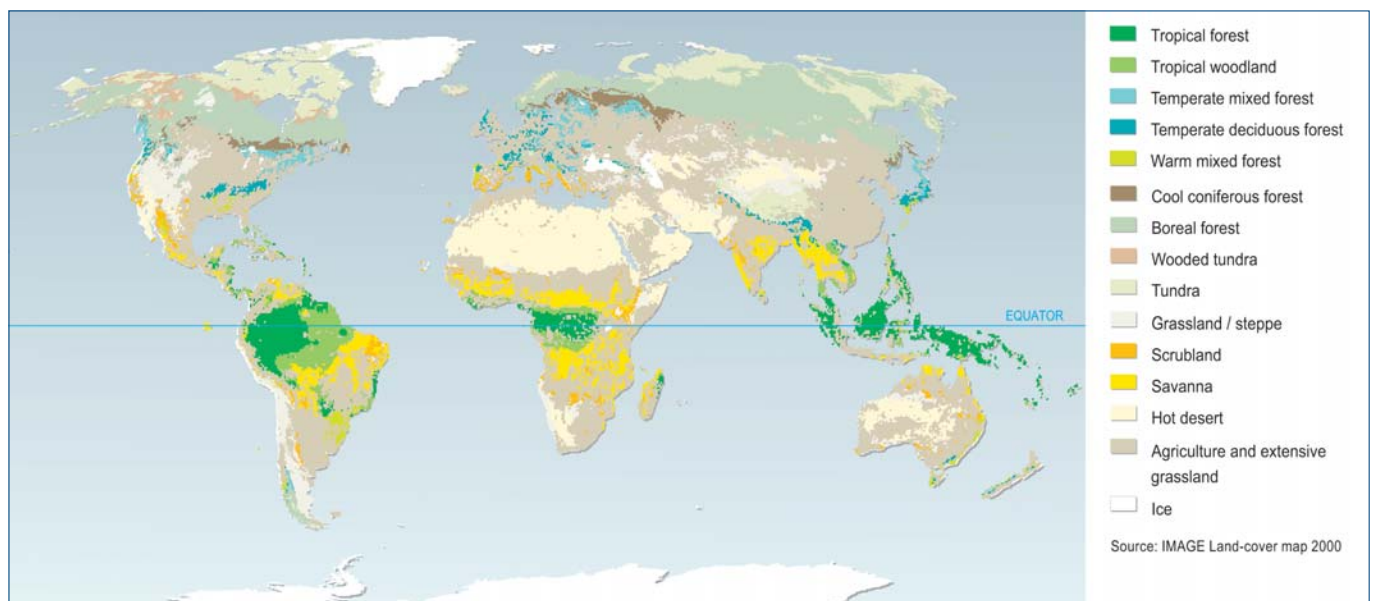
The Millennium Ecosystem Assessment developed four plausible scenarios to explore the future of biodiversity and human well-being until 2050 and beyond. The different scenarios are based on either increased globalization or increased regionalization, and an either reactive or proactive way of addressing environmental issues.

Overall, in all four scenarios, agricultural land will expand and forest cover will shrink, particularly in developing countries. This will lead to a continuing decline in local and global biodiversity, mainly as a result of habitat loss. More proactive approaches to the environment will be more successful in slowing these trends.

Aquatic biodiversity and specific fish populations are expected to decline due to factors such as excessive levels of nutrients, overharvesting, invasion by alien species, and pollution.

Human well-being will be affected by biodiversity loss both directly and indirectly. Direct effects include an increased risk of sudden environmental changes such as fisheries collapses, floods, droughts, wildfires, and disease. Changes will also affect human well-being indirectly, for instance in the form of conflicts due to scarcer food and water resources.

Though the average income per person is projected to rise in all scenarios, this can mask increased inequality for instance in terms of food security. Major decisions will have to address trade-offs between competing goals, for instance between agricultural production and water quality, or between water use and aquatic biodiversity. Policies that conserve more biodiversity are also promoting higher overall human well-being by preserving multiple benefits obtained from ecosystems.



Land-cover Map for the Year 2000

## What actions can be taken to conserve biodiversity?

**Protected areas** are an essential part of conservation programs, but they are not sufficient by themselves to protect the full range of biodiversity and can be difficult to enforce. To be successful, sites for protected areas need to be carefully chosen, ensuring that all regional ecosystems are well represented, and the areas need to be well designed and effectively managed.

**Market tools**, such as direct payments for ecosystem services or transfers of ownership rights to private individuals, can provide economic incentives to conserve biodiversity and to use ecosystem services sustainably.

Prevention and early intervention have proven to be the most successful and cost-effective way of tackling **invasive species**. Once an invasive species has become established, its control and particularly its eradication through the use of chemicals or through the introduction of other species is not necessarily effective and is extremely difficult and costly.

**To be conserved**, biodiversity must be integrated into the agriculture, fishery, and forestry sectors. These sectors are directly dependent on biodiversity and affect it directly. The private sector can make significant contributions, for example by adopting certain agricultural practices. Many companies now show greater corporate responsibility and are preparing their own biodiversity action plans.

**Strong institutions** at all levels are essential to support biodiversity conservation and the sustainable use of ecosystems. International agreements need to include enforcement measures and take into account impacts on biodiversity and possible synergies with other agreements. Most direct actions to halt or reduce biodiversity loss need to be taken at local or national level. Suitable laws and policies developed by central governments can enable local levels of government to provide incentives for sustainable resource management.



Biodiversity includes all organisms, from bacteria to complex animals.

Informing all of society about the benefits of conserving biodiversity, and explicitly considering trade-offs between different options in an integrated way, helps maximize the benefits to society. Ecosystem restoration is generally far more expensive than protecting the original ecosystem, but is becoming increasingly important as more areas become degraded.

Direct and indirect drivers of biodiversity loss must be addressed to better protect biodiversity and ecosystem services. Possible actions include eliminating harmful subsidies, promoting sustainable intensification of agriculture, adapting to climate change, limiting the increase in nutrient levels in soil and water, assessing the full economic value of ecosystem services, and increasing the transparency of decision making processes.

## Can the 2010 biodiversity target be met?



Biodiversity provides services and raw materials for human well-being.

In 2002, the Parties to the Convention on Biological Diversity agreed on a target to achieve a “significant reduction of the current rate of biodiversity loss at the global, regional, and national level as a contribution to poverty alleviation and to the benefit of all life on earth” by 2010.

Given appropriate actions, it is possible to achieve a reduction in the rate of biodiversity loss for certain components of biodiversity and in certain regions within that time frame.

However, a reduction in the overall rate of biodiversity loss is unlikely to be achieved by 2010. Indeed, current trends show no sign of a slowdown of biodiversity loss, and direct drivers of loss such as land use change and climate change are expected to increase further. Moreover, it can take many years for

institutions to take actions and for the positive and negative impacts of human actions on biodiversity and ecosystems to become apparent.

Since changes take place over different time frames, longer-term goals and targets—say, for 2050—are needed to guide policy and actions, in addition to short-term targets.

Even on economic grounds alone, there is substantial scope for greater protection of biodiversity. Ultimately, however, the level of biodiversity that survives on Earth will be determined not just by considerations of usefulness but also by ethical concerns. Trade-offs between promoting human well-being and limiting biodiversity loss are likely, but synergies are also possible.

## Conclusion

The Millennium Ecosystem Assessment highlights a series of main findings regarding biodiversity.

**FINDING 1.** Human actions are often contributing to irreversible losses in terms of diversity of life on Earth. Changes in biodiversity have been more rapid in the past 50 years than at any time in human history and are expected to continue at the same pace or even to accelerate.

**FINDING 2.** Biodiversity contributes directly or indirectly to many aspects of human well-being, for instance by providing raw materials and contributing to health. Over the past century, many people have benefited from the conversion of natural ecosystems to agricultural land and from the exploitation of biodiversity. However, these changes have increased poverty among some social groups.

**FINDING 3.** Although many individuals benefit from activities that lead to biodiversity loss and ecosystem change, the full costs borne by society often exceed the benefits. This is revealed by improved valuation techniques and growing knowledge about ecosystems. Even when the benefits and costs of ecosystem changes are not entirely known, a precautionary approach may be justified when costs could be high or changes irreversible.

**FINDING 4.** Factors such as habitat change, climate change, and a growing population and consumption will continue to cause losses in biodiversity and changes in ecosystem services at the present pace or even faster.

**FINDING 5.** Many of the actions that have been taken to conserve biodiversity and promote its sustainable use have been successful in limiting biodiversity loss. Overall the losses are now occurring more slowly than they would have in the absence of these actions taken by communities, NGOs, governments, as well as business and industry. To achieve greater progress towards biodiversity conservation, it will be necessary – but not sufficient – to strengthen a series of actions that focus primarily on the conservation and sustainable use of biodiversity and ecosystem services.

**FINDING 6.** Unprecedented additional efforts would be needed to achieve a significant reduction in the rate of biodiversity loss at all levels by 2010.

## GLOSSARY GLOSSARY GLOSSARY GLOSSARY GLOSSARY GLOSSARY GLOSSARY GLOSSARY

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

**Biodiversity** Biodiversity is a contraction of biological diversity. Biodiversity reflects the number, variety and variability of living organisms. It includes diversity within species (genetic diversity), between species (species diversity), and between ecosystems (ecosystem diversity).

**Drivers (of ecosystem change)** Any natural or human-induced factor that directly or indirectly causes a change in an ecosystem.

**Ecosystem(s)** An ecological unit made up of a complex system of interactions between living communities (plants, animal, fungi, and microorganisms) and the environment they live in. Ecosystems have no fixed boundaries; a single lake, a watershed, or an entire region could be considered an ecosystem.

**Ecosystem services** The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth.

**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.

**Land cover** The physical coverage of land, usually expressed in terms of vegetation cover or lack of it. The human use of a piece of land for a certain purpose (such as irrigated agriculture or recreation) influences land cover.

## Facts on Biodiversity

This *foldout* presents a faithful summary of one of several leading scientific consensus reports produced in 2005 by the Millennium Ecosystem Assessment (MA): *Ecosystems and Human Well-being: Biodiversity Synthesis*.

A more detailed summary can be found at [www.greenfacts.org/biodiversity](http://www.greenfacts.org/biodiversity) in English, French, Dutch and Spanish

The *Millennium Assessment* was launched by UN Secretary-General Kofi Annan in 2001 to provide scientific information concerning the consequences of ecosystem change for human well-being and options for responding to those changes. It involved over 1300 scientists from 95 countries and a partnership among several international organizations, including the Convention on Biological Diversity, UN Convention to Combat Desertification, Ramsar Convention on Wetlands, Convention on Migratory Species, five UN agencies, the World Bank, and IUCN.

The *Biodiversity Synthesis Report*, one of the main products of this work, responds to requests for information received through the Convention on Biological Diversity (CBD) and provides an overview of the links between the state of our ecosystems and the biodiversity they contain. The full report is available at: [www.millenniumassessment.org](http://www.millenniumassessment.org)

## PARTNERS

The following partners teamed up to make this information available to a wider audience:



**Countdown 2010** collaborates closely with countries, regions, and civil society to help governments reduce biodiversity loss by 2010. At the World Summit for Sustainable Development and other occasions, world leaders committed to achieve this 2010 biodiversity target and thus to meet the challenges outlined in this report.

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**GreenFacts asbl/vzw**, an independent non-profit organisation based in Brussels, has prepared this summary of the Biodiversity Synthesis Report and published it online. GreenFacts' mission is to make complex scientific consensus reports on health and the environment accessible to non-specialists. Its summaries are produced under the control of the GreenFacts Scientific Board composed of independent scientists.

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The **UNEP World Conservation Monitoring Centre** is the biodiversity assessment and policy support arm of the United Nations Environment Programme, the world's foremost intergovernmental environmental organization. For over twenty-five years the Centre has been undertaking scientific research and providing practical policy advice to help decision makers recognise the value of biodiversity and apply this knowledge to all that they do.

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The **World Conservation Union (IUCN)** brings together some 10 000 scientists and experts from 181 countries in a unique worldwide partnership to protect biodiversity and work for the sustainable use of natural resources. Within this framework, the IUCN Regional Office for Europe in Brussels has the mission to foster and fortify a European network of excellence in environmental research, policy and best practice.

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