



LEARN & ACT Teacher's Guide

Conservation of Biodiversity

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Introduction 1: Where did everyone go?



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- Who killed all the elephants?

At one time, elephants ruled the African continent, and over 20 million herds roamed the continent in the 19th century alone. However, during the 20th century, the number of elephants has decreased by more than 95%, and there are now less than 400,000 left. Elephant hunting is illegal. However, from 2007 to 2014, poachers killed 30,000 elephants every year. This is because ivory trades at a high price, ranging from \$1,100 to \$2,100 per kilogram, with the trade in ivory made illegal.

- Red List of Death, 35,500 Endangered Species:

The International Union for Conservation of Nature and Natural Resources (IUCN) publishes the 'Red List', a list of endangered species of flora and fauna every two to five years. According to the IUCN announcement in 2021, more than 35,500 species are threatened with extinction. This is a figure equivalent to 28% of all organisms surveyed. According to the report, mainly mammals, amphibians, coniferous forests, sharks and rays, and corals are at critical risk of extinction. Among them, 40% of all species of amphibians are at risk of extinction.

Introduction 2: The 6th mass extinction is already underway!

 The 6th mass extinction is already underway!

What is extinction?
Extinction means the loss of one type of organism from an ecosystem.

What is a mass extinction?
Mass extinction is the extinction of more than **70%** of all species on Earth.

↓

Disappearance of dinosaurs and the next 6th mass extinction
Destruction of nature by humans.

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- What is extinction?

Extinction means the loss of one type of organism from an ecosystem. Since all living things have their own unique functions within the ecosystem, extinction of one species also affects other species, causing a chain of extinction.

• What is a mass extinction? :

Mass extinction is the extinction of more than 70% of all species on Earth. The earth has undergone five major mass extinctions, and the causes are "change in sea level due to continental movement," "meteor impact," "massive volcanic eruption," "climate change," and "atmospheric and ocean oxygen content." These changes were mostly spontaneous. During the 5th mass extinction, dinosaurs became extinct and mammals began to flourish.

• Disappearance of dinosaurs and the next 6th mass extinction:

The 6th mass extinction crisis that will permanently destroy the earth's ecosystem is approaching us closer than we think. This is because many animals are becoming extinct at a rapid rate due to the destruction of nature by humans. Many scientists are warning us that the Earth has already entered the era of the 6th mass extinction. In 2017, a team led by Professor Gerardo Cevalos in Mexico reported that "billions of wildlife have been lost over the past few decades, and about a third of the 27,600 mammals, birds, amphibians, and reptiles have lost their species." Researchers from Stanford University who participated in the study together analyzed that "77 mammal species, 140 bird species, and 34 amphibians disappeared from Earth in the last 500 years." This is more than 114 times faster than the normal rate of extinction, and the researchers warn that the rapid extinction of plants and animals will seriously affect not only the ecosystem but also human society.

1. What is biodiversity?

01. What is biodiversity?

What is biodiversity?

'The total variety of organisms on Earth'

The three elements of biodiversity



Species Diversity



Genetic diversity



Ecosystem Diversity

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Biodiversity:

The total variety of living organisms on Earth is called biodiversity. Various living things exist on Earth, from animals, plants, and microorganisms. And they live with different genes in various environments such as forests, grasslands, deserts, and ice-covered land and seas. The Worldwide Fund for Nature defines biodiversity as "the abundance of all living things on Earth, including millions of species of plants and animals, microorganisms, the genes they contain, and the complex and diverse ecosystems that make up their environment."

● The three roots of biodiversity

- ① Species Diversity - A variety of species that exist in an ecosystem. The more diverse and complex the species, the healthier and stable the ecosystem remains.
- ② Genetic diversity - Variety of genetic variations that exist among individuals constituting a species. It is the result of genetic mutations in a species to adapt to and survive in a variety of environments.
- ③ Ecosystem Diversity - Diversity of the living environment. Living things on Earth live in various ecosystems such as wetlands, deserts, forests, seas, agricultural land, and lakes.

● Protecting biodiversity:

Protecting biodiversity means respecting the millions of species of animals and plants on Earth and the ecosystems surrounding them. From invisible microorganisms to large and small animals and plants, innumerable diverse natural environments, and human beings, it is to help all living species that exist on Earth interact with each other and live in symbiosis.

2. Why is biodiversity important?

02. Why is biodiversity important?



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● Ensuring the safety of the ecosystem:

Biodiversity contributes to the safety of the ecosystem. If a species disappears and there are many competitors to replace it, the ecosystem can be maintained without major changes. High biodiversity creates a more dense and rigid ecosystem and plays a role in leading to a more stable cycle of the entire ecosystem.

● Provide abundant resources and spiritual abundance to mankind:

Various species provide abundant resources to mankind. The resources we get from ecosystems are very diverse, such as food, water, wood, textiles, seafood, and energy resources. In addition, the colorful landscape in which various living things coexist provides mankind with spiritual abundance, a time for reflection, and a place for leisure activities. Each region's biodiversity-guaranteed ecosystem constantly affects human activities, helping to develop unique cultures (food, housing, art) and academics in each region.

3. Status of global biodiversity (extinction of plants and animals)

03. Status of global biodiversity

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Extinction of plants and animals



Large mammals

Sea animals

Amphibians

Coniferous forests

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- Disappearing large mammals:

Large mammals are in serious danger of extinction. 97% of tigers died during the 20th century. The Balinese and Javanese tigers that lived in Indonesia have already disappeared, and the South Chinese tigers living in the Yangtze River basin in China are expected to become extinct soon. Professor Felissa Smith of the University of New Mexico warned, "If the extinction trend of large mammals such as elephants, giraffes, rhinos and tigers continues at this rate, 200 years from now, the largest land mammal will be cattle."

- Disappearing sea creatures:

The biodiversity of the sea is being greatly threatened by human overfishing, the construction of coastal facilities, and marine pollution. Among the disappearing marine animals, the most representative are marine mammals such as sea turtles, spotted seals, and southern bottlenose dolphins, sharks, and rays. Science magazine reported that "32.8% of 704 species of coral are threatened with extinction" (July 2008). "When coral reefs die, plants and animals seeking food and shelter also die," the researchers said. There is a high possibility that the entire ecosystem will collapse," he warned.

- Disappearing amphibians:

Amphibians such as frogs are experiencing the most severe extinction risk among all animals. As amphibians are major natural enemies of pests and play a key role in maintaining the balance of the ecosystem, the extinction of amphibians will have a cascading effect on the extinction of other species. According to the UN Commission on Biological Diversity, "40% of all amphibian species found by humans are at risk of extinction, which is due to excessive human activity." In addition, Science magazine published a study result that "501 species of frogs and salamanders are threatened with extinction (March 2019)."

- Disappearing coniferous forests:

Many coniferous species around the world are threatened with extinction. In 2019, a Brown University research team warned that "almost all conifers, including fir and pine, will become extinct by 2070, as climate change is accelerating the extinction of conifers."

4. Threats to biodiversity



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► "Hippo" threats to biodiversity (HIPPO):

The International Union for Conservation of Nature (IUCN) pointed out that the main causes of extinction are habitat destruction and degradation (50%) and overfishing (28%). Edward Wilson, an American biologist who first coined the concept of "biodiversity," expressed the cause of the decline in biodiversity with HIPPO.

- **H(habitat):**

Habitat destruction and deterioration. During rapid development after the Industrial Revolution, humans pushed out forests, filled the seas, locked up rivers, and laid asphalt to build cities. These changes threatened the lives of many plants and animals, and many species that did not adapt have disappeared from the earth.

- **I(invasion):**

Invasion of alien species has a very negative impact on the lives of indigenous species. Exotic species may be introduced naturally, but may also be introduced as ornamentals, food, or pets. Invasive alien species disrupt the food chain of existing ecosystems and cause the extinction of specific organisms.

- **P(pollution):**

Environmental pollution caused by pesticides, heavy metals, and toxic substances. The explosive increase in agricultural productivity in the mid-20th century was attributed to chemicals such as various pesticides and herbicides. However, the contamination of the ecosystem by the concentration of various chemicals has caused the mass extinction of wildlife, especially birds.

- **P(population):**

Resource depletion and excessive space occupancy due to population growth. With the development of industry and science in the 20th century, the number of human beings has increased explosively, which has resulted in over-consumption of resources and environmental pollution. In particular, global warming caused by using fossil fuels is threatening mankind by causing extreme weather phenomena such as large-scale droughts, floods, and typhoons.

- **O(overexploitation):**

Overfishing, overhunting, rampant deforestation. Humanity's over-harvesting is ongoing on land and in sea. Overfishing is leading to the extinction of cetacean sharks, illegal hunting is leading to the extinction of large mammals such as elephants and rhinos, and large-scale illegal logging in the tropics leads to soil loss, wildfires, and biodiversity loss.

5. The most important pointers for biodiversity recovery



05. Most important factors for biodiversity recovery

- Continuous 'investigation of biodistribution and habitat environment'
- Continuous protection of 'rare species' and 'endangered species'
- Enactment and enforcement of 'laws' for the protection of species

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• Continuous investigation of biodistribution and habitat environment:

For the conservation of biodiversity, it is necessary to continuously investigate the distribution of living organisms and their habitats on the earth, and to identify and conserve organisms whose numbers are declining. It is necessary to establish an active network between countries and organizations, to share the actual and current status of biodiversity, and to cooperate to recognize and solve problems.

• Continuous protection of 'rare species' and 'endangered species':

In order to preserve biodiversity, it is necessary to continuously protect endangered species. The international community is designating and monitoring 'rare species' and 'endangered species' to protect endangered species, and various methods are being applied to increase their numbers. Collecting, rearing, and releasing endangered species to their native habitats, artificially protecting the remaining individuals in botanical gardens, arboretums, zoos, etc. In the case of plants, collecting and storing species through seed banks. These are some examples.

• Enactment and enforcement of 'laws' for the protection of species:

In order to preserve biodiversity, it is necessary to enact and implement laws for the protection of species at the regional and national levels as well as in the international community. Registering and protecting endangered wild animals and plants as endangered species, establishing laws to evaluate environmental impacts in advance for development projects that may affect the ecosystem, and protecting habitats where endangered species live. An example is legally designating protected areas to protect habitats where endangered species live.

6. Ecological space to focus on for biodiversity conservation



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• Tropical forests:

Tropical forests, accounting for 8% of the Earth's land area, are the most biodiversity-rich places in the world. Tropical forests, mainly distributed in Central and South America, West Africa, Central Africa, and Southeast Asia, have high temperatures and abundant precipitation, resulting in faster growth of organisms than in other regions. About half of the world's species live in tropical forests, including birds, insects, mammals, and giant trees.



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• Grasslands:

Grasslands occupying 20-40% of the Earth's land area are very important for biodiversity. Grasslands are spread on almost all continents except Antarctica and have various names such as steppe, tundra, pampas, and savannah. Grass and trees growing on the grasslands are food for many herbivores, which in turn become food for carnivores.



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• Sea:

The ocean, which occupies 70% of the earth's surface, is home to many living things in a much larger area than the land. A variety of living things, from microbes to algae, corals, fish and mammals, including whales, live in the sea. In particular, coral reefs are the most biodiversity-rich ecological environment in the sea.



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• Wetlands:

Wetlands occupying about 7% of the earth's surface are home to more than 40% of the world's species, especially 12% of mammals. Wetlands, which have been considered useless, play an important role in maintaining ecosystems, such as mitigating climate change, controlling floods, purifying pollutants, and maintaining biodiversity.

7. International efforts to conserve biodiversity (1. Conventions)



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• Convention on Biological Diversity (CBD):

The Convention on Biological Diversity is an international treaty aimed at ▲ conservation of biodiversity ▲ sustainable use of biodiversity components ▲ fair and equitable distribution of genetic resources (resources related to the genetic information of living things; plant seeds are among the most important genetic resources), and it identifies biodiversity in the three dimensions of 'species, genes, and ecosystems.' Adopted in Nairobi, Kenya in 1992, it is considered one of the three major UN international environmental conventions along with the Convention on the Prevention of Desertification and the Convention on Climate Change.

• Biosphere Reserve:

A conservation area designated by UNESCO to conserve biodiversity, promote community development, and maintain cultural values. When designated as a biosphere reserve, reckless development is suppressed, ecosystem changes are monitored, and conservation activities are conducted through a global network.

• Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES):

Adopted in Washington in 1973 to combat the illegal distribution of wild flora and fauna in international trade. About 33,000 species of living things, including 5,000 species of animals and 28,000 species of plants, are protected under this agreement.

• The Ramsar Convention to Protect Wetlands:

An international convention signed in 1971 to promote the importance of wetlands worldwide and to conserve them. A wetland is a moist land surrounded by rivers, swamps and ponds, and serves as a habitat for various living things and to purify pollutants. The Ramsar Convention is playing a role in protecting wetlands from the destruction of wetlands due to the reclamation of swamps and tidal flats in various parts of the world. As of 2018, a total of 170 countries have joined.

7. Efforts of the international community to conserve biodiversity (2. Campaigns)

07. Efforts of the international community to conserve biodiversity

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| 2. Campaigns

1) International Day for Biological Diversity



2) Global Village 60 Minutes Off Lights, Earth Hour Campaign, WWF



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• International Day for Biological Diversity:

May 22 of every year is World Biodiversity Day. It was designated during the UN Global Environment Summit in 2000 to commemorate the announcement of the Convention on Biological Diversity (May 22, 1992) to prevent and protect the disappearance of all species on Earth due to reckless and selfish destruction by humans. It focuses on raising human awareness and appealing for various related efforts on the problems caused by biodiversity loss.

• Global Village 60 Minutes Off Lights, Earth Hour Campaign:

The Earth Hour campaign was first launched in Sydney, Australia, in 2007 under the leadership of the World Wildlife Fund (WWF). Currently, more than 7,000 cities in 160 countries are participating in this world's largest environmental campaign. It is a global campaign to turn off lights for one hour on the last Saturday of March every year. It is meaningful to raise public awareness of environmental issues through simple actions. World landmarks such as Washington National Cathedral in the US, Times Square in New York, and the Eiffel Tower in France are participating in this campaign.

7. Efforts of the international community for biodiversity conservation

(3. International organizations and associations)

07. Efforts of the international community to conserve biodiversity

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| 3. International organizations and associations

- 1) Information on all living things in the world, World Biodiversity Information Organization (GBIF)
<https://www.gbif.org/>

- 2) Save Endangered Species, World Wildlife Fund (WWF)
<https://www.worldwildlife.org/>



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● Information on all living things in the world, World Biodiversity Information Organization (GBIF):

The World Biodiversity Information Organization is an international organization that collects and organizes scientific data on biodiversity through web services on the internet. Information is provided by organizations around the world and can be accessed through a single portal. It deals with information on scientific names of living things and vast information on plants, animals, and microorganisms around the world. <https://www.gbif.org/>

● Save Endangered Species, World Wildlife Fund (WWF):

The World Wildlife Fund (WWF), famous for the logo of the panda bear 'Chichi' at the London Zoo, is the world's largest private nature conservation organization established in 1961. Under the slogan of "Coexistence and Harmony of Humans and Nature," various activities related to biodiversity conservation, promotion of sustainable use of natural resources, prevention of environmental pollution, and prevention of waste of resources and energy are being carried out. In 1960, the British biologist Sir Julian Huxley, who was the first secretary-general of UNESCO, published an article on 'Animal Overfishing and Habitat Destruction in Eastern Africa' and cofounded the organization. <https://www.worldwildlife.org/>

8. COVID-19 and biodiversity



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- **COVID-19 is a red card from nature:**

COVID-19 is a strong warning from nature against human reckless development and destruction of the ecological environment. Inger Andersen, secretary-general of the United Nations Environment Program (UNEP), said, "The COVID-19 pandemic is sending a strong warning message to mankind that we need to change. Not taking care of the planet is the same as not taking care of ourselves." Humanity must take this red card seriously and prepare a global response to prepare for the next pandemic.

- **'One Health' of the World Health Organization (WHO):**

'One Health' is the slogan of the World Health Organization. It is an initiative implemented by the World Health Organization from 2004 to 2008 emphasizing the interdependence of ecosystems, humans, and animals. We pursue active cooperation and strategy establishment among medicine, veterinary medicine, and environmental health sciences.

9. What can we do to protect global biodiversity? (Brainstorm)



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