People's Democratic Republic of Algeria
Ministry of Higher Education and Scientific Research
University Centre SALHI Ahmed - Naâma
Institute of Sciences
Department of Agricultural Sciences

Course : Handout

Environment and Sustainable Development

Intended for 2nd year Bachelor's degree in Natural and Life Sciences, Agricultural Sciences track

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Academic year: 2025-2026

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SYLLABUS

- ***Course information***

Target audience: 2nd year Bachelor's degree in Natural and Life Sciences, Agricultural Sciences track

Semester: 3

Course title: Environment and Sustainable Development

Credits: 02

Coefficient: 02

Teaching unit: Discovery 2.1.1

Hours: 60 hours/semester

Weekly hours: 1 hour 30 minutes/week
Duration: 15 weeks

- ***Place of the course in the program***

The Environment and Sustainable Development course is part of *the fifth discovery unit* of the Agricultural Science Bachelor's degree program ***(code: UED 2.1.1).***

- ***Assessment methods***

Student assessment is divided into continuous assessment and a semester exam:

-*A final exam* in the form of a medium-length test, which accounts for *60% of the final grade*

-The exam consists of two parts: one part with a synthesis question in which students are asked to solve an environmental problem, and one part with direct questions that students must answer.

-Practice is provided via online *QUIZZES* to help students learn how to answer this type of question.

-*Continuous assessment* during *tutorials* with a *40%* contribution *to the final grade*. This assessment is calculated based on the average of the activities that will be graded afterwards.

-These activities are generally *exercises* to be completed at the end of the tutorial , *reports*, and *short tests*.

-This part also includes an online assessment component that comprises pre- and post-assessment tests for each learning activity

- Course overview

1. This course aims to raise students' awareness of the issues, content, and actions involved in sustainable development. Its goal is to make them aware that it is possible to take action to preserve the environment through their education, as well as on their own scale, in terms of their consumption, daily activities, and society.
2. During their university education, regardless of their specialization and future career aspirations, students will have the opportunity to learn about and experiment with their knowledge of sustainable development.
3. Sustainable development is currently one of the responses emerging around the world to address the current combination of major ecological, economic, and societal challenges facing the world.

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Introduction

The term *development* encompasses a wide range of meanings: it can refer to evolution, improvement, or progress in various fields economic, social, industrial, or cultural. When associated with the notion of *environment*, it takes on a particular dimension that goes beyond mere economic growth. It then refers to a type of development that integrates the preservation of nature, biodiversity, and vital resources, with a long-term perspective.

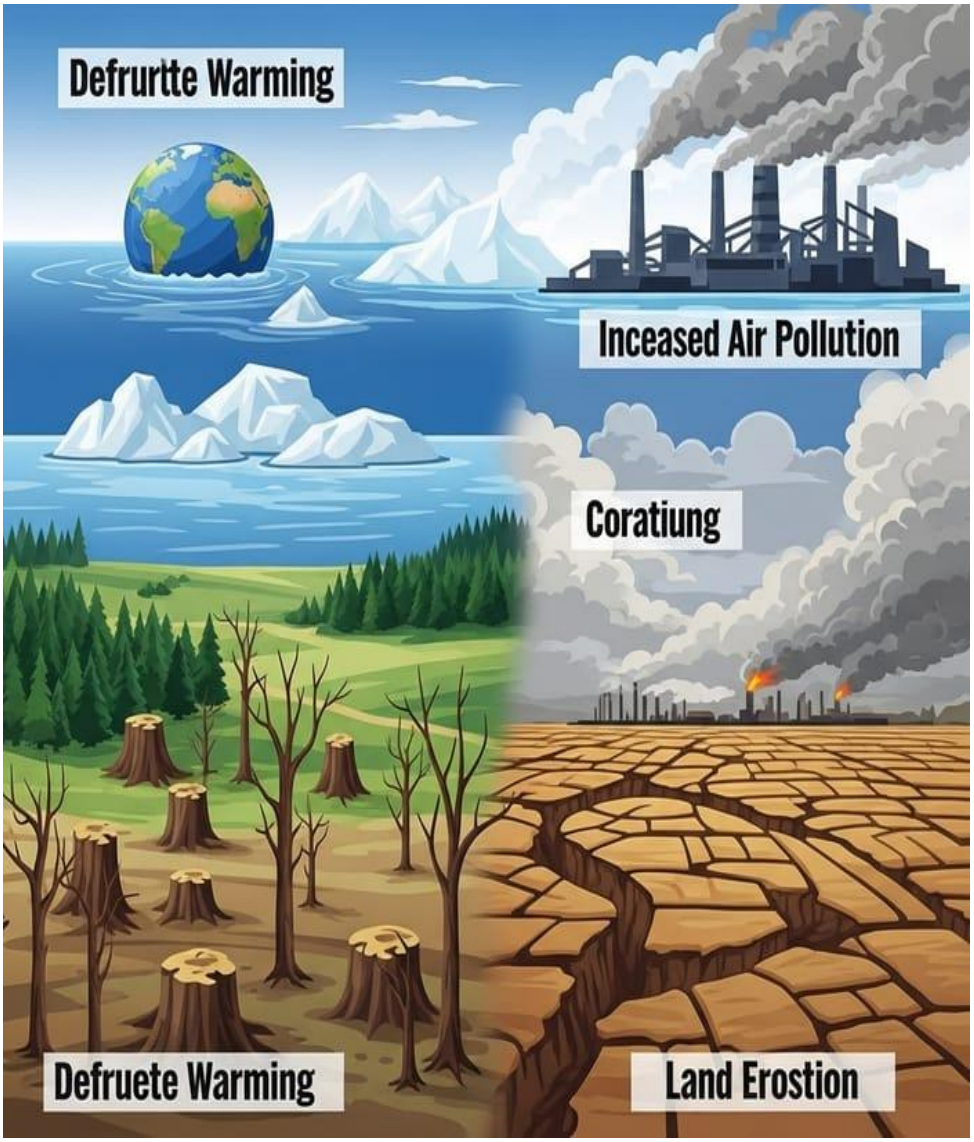
The concept of **sustainable development** was popularized by the Brundtland Report (1987), which defines it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition is based on three interdependent pillars: **economic efficiency**, **social equity**, and **environmental sustainability**. The objective is to reconcile the requirements of human progress with the protection of the ecosystems that support life on Earth.

Contemporary environmental challenges are numerous and closely interconnected: water and air pollution, the accumulation of household and industrial waste, soil degradation, biodiversity loss, rapid urbanization, and climate change. These phenomena directly affect many sectors such as agriculture, energy, transportation, urban planning, public health, and land management. Likewise, public policies in these areas, in turn, influence the state of the environment. Although the intensive exploitation of natural resources has contributed to economic development, it has also generated significant ecological impacts that threaten the resilience of natural and human systems.

In the face of these challenges, sustainable development proposes a **global, integrated, and cross-sectoral approach** that recognizes the interdependence between human societies and their environment. It is not only about mitigating damage but also about rethinking modes of production, consumption, and governance to build a viable future. This paradigm calls for action at multiple scales — local, national, and international — and involves all actors: public authorities, businesses, scientists, civil society organizations, and citizens.

The aim of this course is to understand the theoretical and historical foundations of sustainable development, analyze its current issues and contradictions, and examine the strategies, tools, and policies that enable its implementation. We will also explore concrete case studies to connect concepts with real-world territorial and practical experiences.

Prerequisites



Before starting a course on *Environment and Sustainable Development*, it is essential that students have a basic understanding of several key environmental concepts. This prior knowledge provides a strong foundation for the in-depth discussions, analyses, and sustainable solutions that will be explored throughout the course.

- ***Global Warming***

Students should be familiar with the causes and consequences of global warming. This includes understanding the role of greenhouse gases (such as carbon dioxide, methane, and nitrous oxide) and how human activities — particularly the burning of fossil fuels, industrial emissions, and deforestation — intensify the greenhouse effect. Global warming leads to rising global temperatures, melting polar ice, sea-level rise, and an increase in the frequency and intensity of extreme weather events. Familiarity with these processes helps students understand why sustainable development strategies are urgently needed.

- ***Planet Earth***

Students should have a general understanding of the structure and functioning of the Earth, including its main natural systems — the atmosphere, hydrosphere, lithosphere, and biosphere — and the interactions among them. This knowledge provides the context for understanding environmental issues, as human activities can disrupt these natural cycles, leading to climate change, ecosystem degradation, and resource depletion. Recognizing the finite nature of Earth's resources is essential for developing sustainable management practices.

- ***Habitat Loss***

An understanding of habitat loss and its drivers is crucial. Urban expansion, agricultural development, mining, infrastructure construction, and pollution are among the major causes of habitat degradation and fragmentation. This leads to biodiversity decline, the disruption of ecosystem services, and increased vulnerability of species and human communities. Habitat loss is a central topic in sustainable development, as it directly relates to land-use planning, conservation strategies, and development models.

- ***Deforestation***

Students should also have a basic understanding of deforestation — its causes, processes, and impacts. Deforestation occurs primarily due to logging, agricultural expansion, urbanization, and infrastructure projects. Its consequences include biodiversity loss, soil erosion, disruption of water cycles, reduction of carbon sinks, and negative effects on indigenous and local communities. Recognizing these impacts is essential to understanding the global and local challenges of sustainable land and forest management.

These prerequisites enable students to actively engage with more advanced topics, such as environmental governance, sustainability strategies, policy frameworks, and innovative solutions. They also foster critical thinking on the interactions between human activities and the planet's environmental systems.

Chapter 1: Basic concepts of the environment and sustainable development

1. **Introduction to the concept of the environment**

1.1. **Definition of the environment**

The environment encompasses everything around us, including both *natural* and *artificial* elements where human life unfolds. It is also defined as the set of natural physical, chemical, and biological conditions that influence living organisms and human activities.

A. Legal definition of the environment

The legal definition of the term environment depends on and is subject to regulatory constraints; it is the subject of rights and obligations. It is therefore covered by a specific legal discipline known as environmental law

For Michel Prieur, the environment is (a definition used in most legal texts) "the set of elements which, in the complexity of their relationships, constitute the framework, the milieu, and the conditions of human life, as they are or as they are perceived."

In Algeria, legislation defines the environment in Law No. 03-10 of July 19, 2003 as follows : "Abiotic and biotic natural resources such as air, the atmosphere, water, soil and subsoil, fauna and flora, including genetic heritage, interactions between these resources, as well as sites, landscapes, and natural monuments."

B. General definition of the environment

The environment is generally defined as the physical, chemical, and biological characteristics of ecosystems that have been modified to a greater or lesser extent by human activity.

Environmental sciences study the consequences of these changes on humans, plants, and animals at the individual, ecosystem, and biosphere levels. It is important to distinguish environmental sciences from ecology, which studies natural or minimally altered environments.

1.2. **Components of the environment:**

1.2.1. **Living beings**

Every living thing is born, lives for *a variable period of time*, and then dies. All living organisms draw water and nutrients from their environment to meet their needs and promote growth. However, some temporarily stop feeding, such as marmots in hibernation, or less obviously, such as plants. The ability to

move does not automatically distinguish between *living* and *non-living things*. For example, air moves in the form of wind, but is not considered to be alive. Although breathing is generally associated with all living beings, some microorganisms, such as the tetanus agent, can live in oxygen-free environments and therefore do not breathe. The ability to *reproduce* is a characteristic common to all living things, ensuring the perpetuation of their species.

1.2.2. Non-living things

Non-living entities *are not capable of reproduction*. They include mineral elements such as the atmosphere, water, and rocks, as well as materials derived from living organisms and human creations.

Additional information:

→Mineral components

Mineral elements include:

- The atmosphere, composed mainly of dinitrogen (or nitrogen), oxygen, carbon dioxide, and rare gases, as well as water vapor in varying proportions.
- Water, present in fresh or salt form, liquid, solid, or gaseous, covering approximately four-fifths of the Earth's surface, plays an essential role in the environment.
- Soil, a thin layer between the atmosphere and the subsoil, formed by the decomposition of living organisms and the weathering of rocks.
- The subsoil, comprising a variety of rocks that differ according to region and geological conditions.

→Materials derived from living organisms and human creations.

Non-living entities are characterized by their inability to reproduce. This includes natural elements such as rocks, water, and air, as well as man-made objects such as buildings, vehicles, and electronic devices. In addition, decaying organic materials such as feathers, pieces of wood, and leaves are no longer considered living once they can no longer reproduce.

1.3. **Human impact on the environment**

1.Waste disposal

has *harmful* consequences for ecosystems. The growing accumulation of waste, whether domestic or industrial, alters natural environments, thereby reducing the diversity of animal and plant species. Industrial waste, often dumped into waterways, causes *contamination*, particularly with *heavy metals* such as *mercury* and *lead*, causing damage.

serious to human health, as in Minamata, Japan. In addition, water pollution threatens sensitive aquatic species, such as pearl and caddisfly larvae, which can only survive in very pure environments. When water quality declines, these species are replaced by others that are less sensitive to *pollution*, leading to changes in the composition of the fauna and flora of waterways.

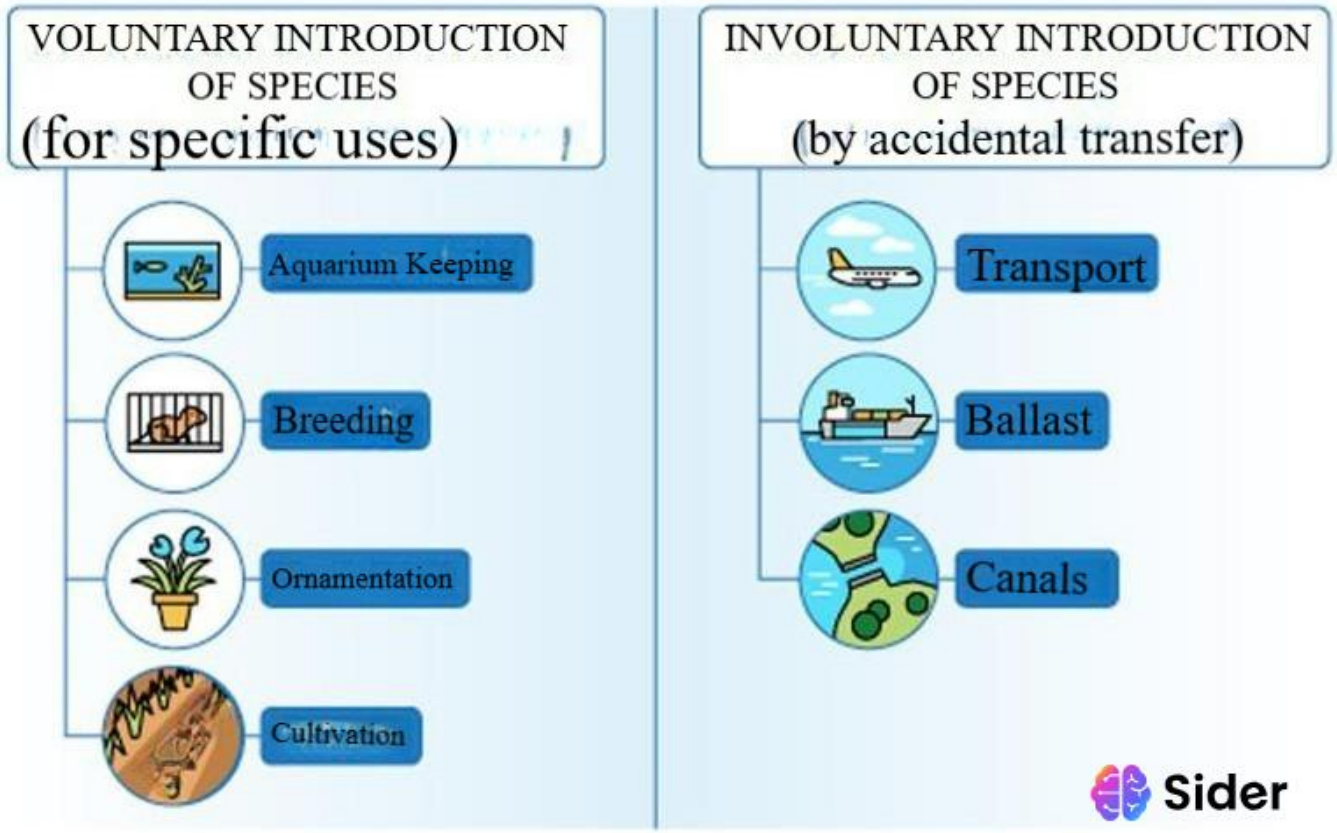
2. Oil spills

Oil spills, resulting from accidents involving *oil tankers* such as the Erika in 1999, cause major *ecological disasters*. Birds are particularly vulnerable, as their feathers are severely affected by hydrocarbons, preventing them from flying and condemning them to certain death. These disasters also lead to the destruction of the fauna and flora of the affected coasts, requiring considerable long- term efforts to restore these ecosystems to their natural state.

***3. Overfishing*:**

Overfishing was driven by *the population explosion* of the 1950s, which led to growing demand for animal feed. This demand led to uncontrolled exploitation of fish stocks until the 1970s. Although certain regulations were put in place, modern fishing techniques, supported by advanced technologies such as satellites and sonar, enable massive catches. Trawlers use increasingly larger nets, contributing to *a* significant *decline* in the populations of various *marine species.*

*4. **The introduction of a devastating species***



Species introductions can also be *unintentional*: unexpected transport due to river and maritime trade or the construction of canals connecting two previously separate seas, accidental release along with ballast water, seed trade, etc. For example, crepidula were accidentally transported to the coasts of the English Channel during the oyster trade.

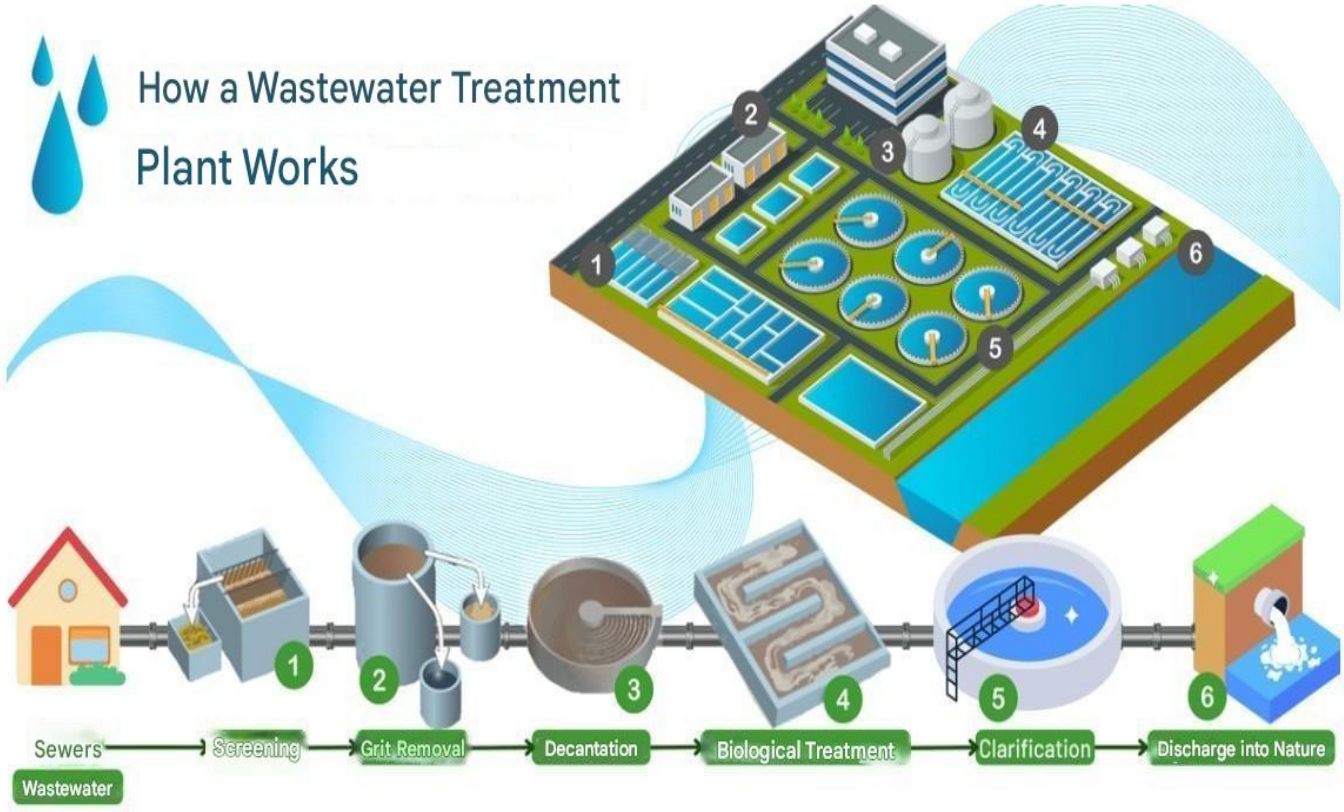
1.4. Positive initiatives have been taken to protect the environment:

1.4.1. The construction of wastewater treatment plants

Wastewater *treatment plants* have been built to treat wastewater, first removing solid waste through screening, sand removal, and degreasing, then breaking down organic pollutants using bacteria.
The resulting sludge is collected and recycled, allowing the purified water to be returned to nature.

Example

By transforming agricultural residues into compost to fertilize the soil.



Reminder: How a wastewater treatment plant works

A wastewater treatment plant is a facility designed to clean wastewater before it is discharged into the environment. Here are the main processes involved in the operation of a typical wastewater treatment plant:

1 ***Pre-treatment***: Raw wastewater enters the treatment plant and first goes through a pre- treatment process. This usually involves removing large debris, such as branches, leaves, plastics, and other unwanted objects, using screens and sieves.

2 ***Screening and grit removal***: The wastewater then passes through a screening process, where larger particles are removed, followed by a grit removal stage, where sand and other heavy particles are separated from the water.

3 ***Grease removal***: Grease and oil are often present in wastewater, particularly from industrial activities or restaurants. In this stage, grease and oil are separated from the water using grease traps.

4 ***Biological treatment***: The main part of the wastewater treatment process often consists of biological treatment, where microorganisms, such as bacteria and fungi, are used to break down the organic matter present in wastewater. This can be done in aeration tanks where the microorganisms are activated by air, or in biological filters.

5 ***Settling***: After biological treatment, the wastewater passes through settling tanks where suspended solids are separated from the treated water. These solids, called activated sludge, are usually recycled back into the process or disposed of appropriately.

6 ***Advanced treatment (optional)***: In some wastewater treatment plants, advanced treatment may be used to remove additional contaminants, such as nutrients like nitrogen and phosphorus, or to disinfect the treated water before it is released into the environment.

7 ***Release or reuse****:* Once the water has been properly treated, it can be released into the environment, often into rivers or lakes, in accordance with environmental standards, or reused for non-potable purposes, such as agricultural irrigation or watering green spaces.

In summary, a wastewater treatment plant works by removing debris, grease, and organic matter from wastewater, then using biological and chemical processes to break down and remove remaining contaminants, producing treated water that meets environmental standards.

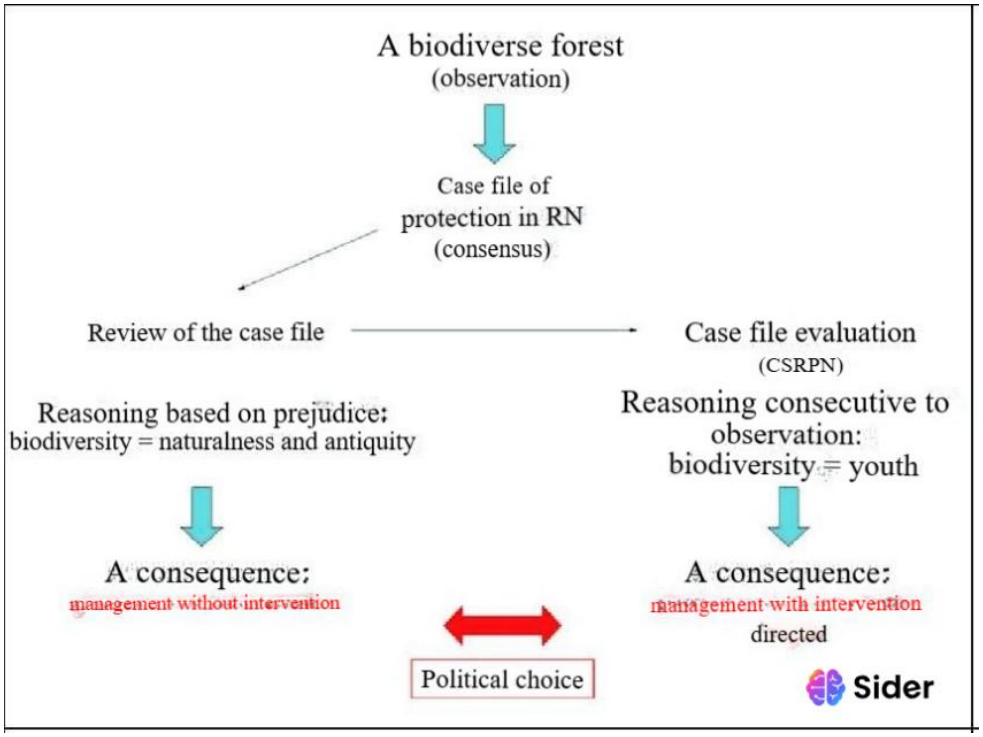
1.4.2. The creation of nature reserves

The creation of nature reserves aims to protect biodiversity by regulating human exploitation.

Reminder: How a wastewater treatment plant works

Example

The Massane nature reserve in the Pyrénées-Orientales became a strict nature reserve in 1955, thus preserving a natural balance. This action allows for the development of a population.diverse insect population thanks to the decomposition of trees on site, preserving unique plant and animal species.



The creation of the Wegscheid Regional Nature Reserve

1.4.3. Legislation regulates waste disposal

Legislation regulates the disposal of environmentally hazardous *waste*, promoting its recovery or treatment in specialized centers. Recycling waste helps to save raw materials and preserve the environment.

Example

Many hazardous substances can be recovered from electronic waste, batteries, or medical equipment and then reused in the manufacture of new products.

1.5. The main dimensions of the environmental crisis:

The environmental crisis is the result of *population explosion, waste of natural resources*, and *ecological disruption* caused by pollution. Human activities are the root cause of environmental problems. These human activities have three main categories of impact (or direct consequences), namely:

- Depletion of resources
- Pollution
- Destruction of habitats.

These three direct *consequences* of human activities are at the root of various environmental crises. These crises are grouped under the term "global environmental crisis."

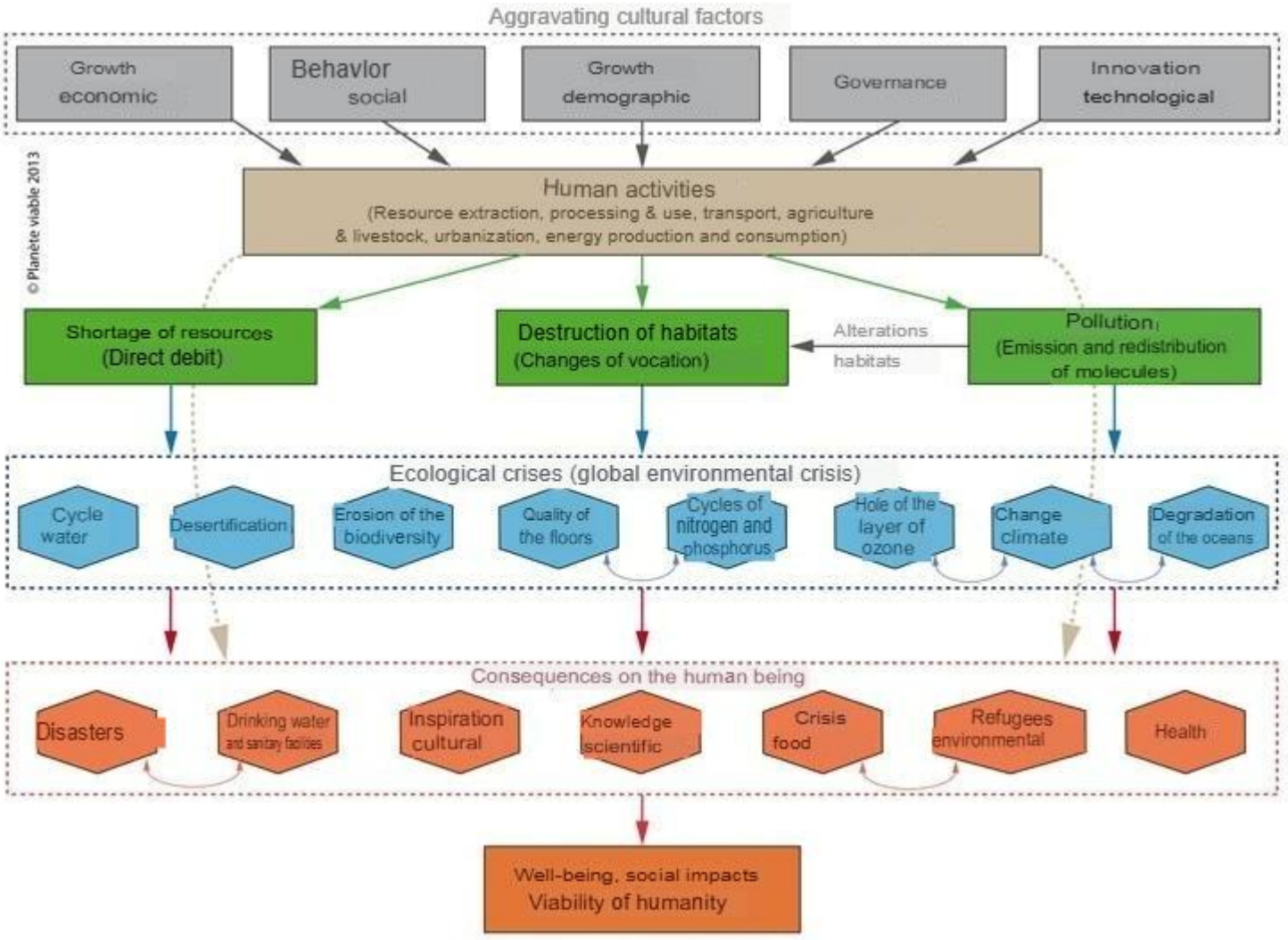


Diagram showing the links between human activities and the "cultural" factors that exacerbate them, their direct consequences (direct impacts), the environmental crises that they cause, and their human consequences

Supplement

The eight environmental crises that make up the global crisis are:

- The erosion of biological diversity (including the loss of ecosystem services)
- Degradation of the oceans (particularly acidification)
- Global warming and climate change (including sea level rise)
- Alteration of biogeochemical cycles (nitrogen, phosphorus, water)

- Declining soil quality
- Deforestation
- River transport
- Depletion of stratospheric ozone (ozone hole)

Note

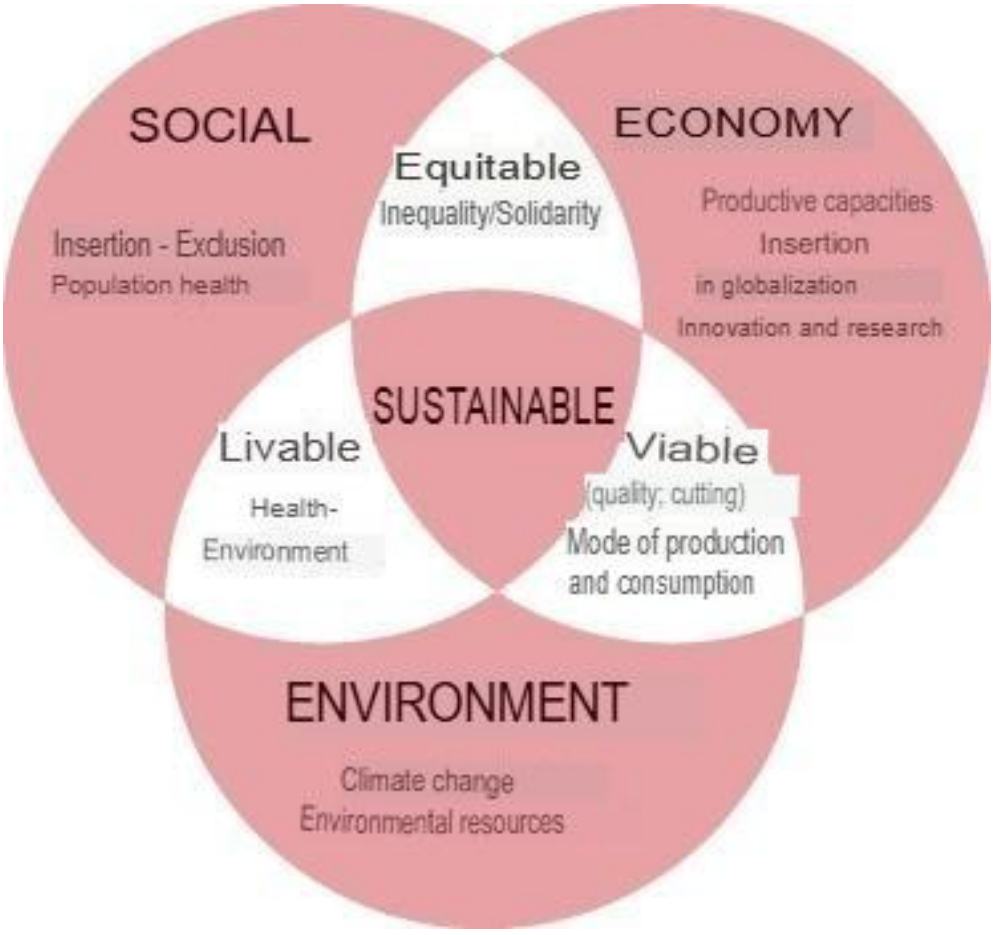
The scale *of human activities* is constantly growing, meaning that their effects are increasing proportionally. Environmental crises are also becoming more acute, and the consequences for humans are beginning to pose a serious threat. Societies in the South, which are the poorest and therefore the most dependent on nature, are the most vulnerable and are already affected, but societies in the North are by no means immune and are already feeling the adverse effects of our lifestyles. Far-reaching *societal changes* must therefore be initiated as soon as possible before the situation spirals completely out of control.

2. The concept of sustainability

2.1. Definition of sustainable development

Development*: Evolution (continuity) towards a goal while respecting the environment, society, and the economy.*

The term *"sustainable development"* was popularized by the publication of the Brundtland Report in *1987*, entitled "Our Common Future." This concept is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It is based on *three fundamental pillars: social, economic, and environmental*, aiming to reconcile economic efficiency, social justice, and nature conservation by identifying the intersections of these different pillars for sustainable development, as illustrated in the figure



2.2. History

The first model of *sustainable development* was put forward by economist Thomas Malthus in *1798* in his book *"An Essay on the Principle of Population,"* in which he studied the viability of society by highlighting the relationship between food availability and population growth.

In *1968*, the *"Rome Group,"* composed of scientists, economists, and policymakers, was formed to study the major challenges facing humanity. This group recommended halting global economic growth after commissioning a team of researchers led by Jay Forrester of the Massachusetts Institute of Technology to simulate the future of humanity.

The first conference on sustainable development was held in Stockholm in June *1972*, with the theme *"One Earth,"* giving rise to an economic model that integrates ecological concerns.

called *"eco-development."* The "Stockholm Declaration" is considered the starting point for sustainable development, setting out 26 principles focused on protecting the environment, eradicating poverty, and improving global economic conditions.

The UN adopted a convention on November 16, *1972*, to protect the world's cultural and natural heritage. In *1987*, the Bruntland Report introduced the concept of sustainable development for the first time, advocating a radical change in the development process with an emphasis on environmental protection and economic equity.

The United Nations Framework Convention on Climate Change was signed in New York on June 13, *1992*, and came into force in *1994* with the aim of stabilizing greenhouse gas concentrations in the atmosphere.

The United Nations Conference on Environment and Sustainable Development, also known as the Earth Summit, was held in Rio de Janeiro in *1992*, bringing together more than 172 countries and 2,400 non-governmental organizations. This conference resulted in Agenda 21, aimed at implementing the principles of sustainable development, as well as several agreements and declarations, including the Rio Declaration on Environment and Sustainable Development, the Convention on Biological Diversity, the Statement of Principles on Forests, and the Convention on Climate Change.

In 1993, Europe launched the *"European Sustainable Cities"* program to implement Agenda 21 on

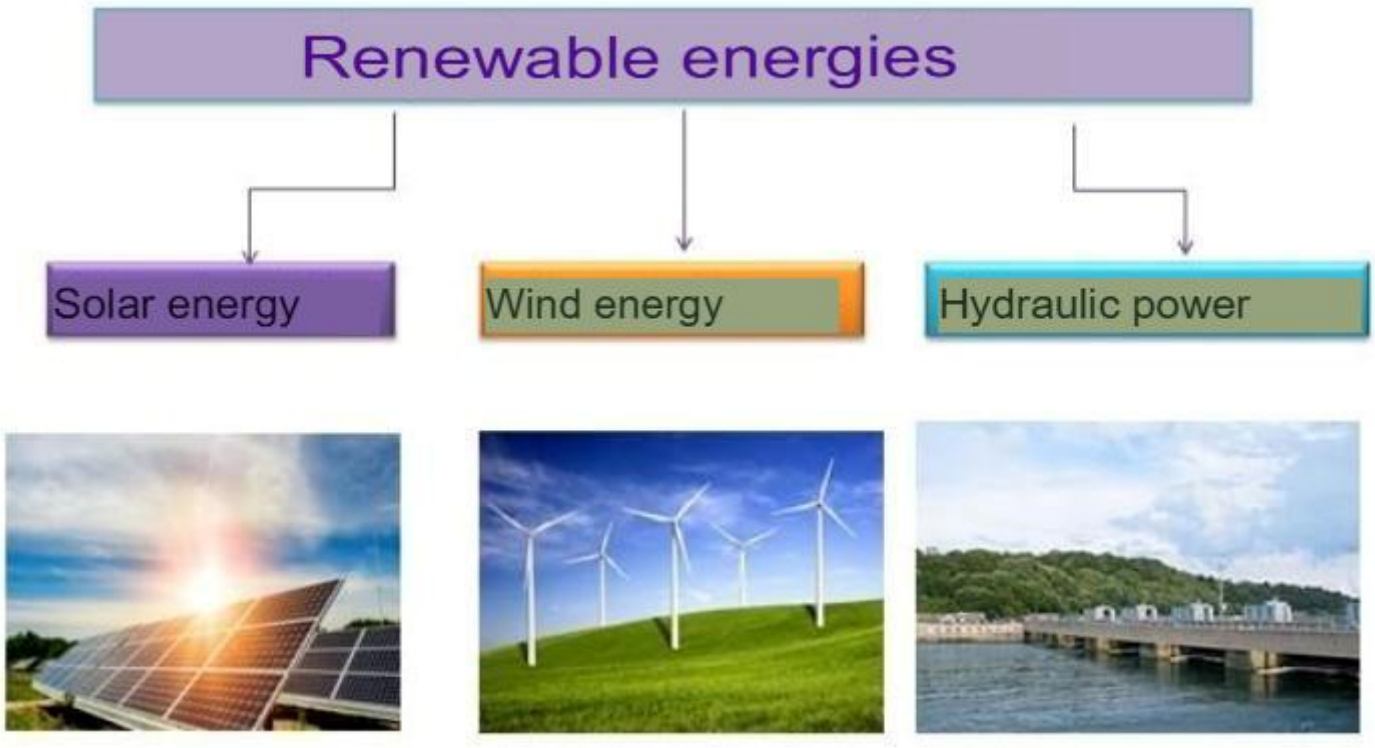
a continental scale, encouraging cities to adopt this action plan.

On December 11, 1997, in Kyoto, Japan, a protocol was signed by 38 industrialized countries to reduce their greenhouse gas emissions by at least 5% between 2008 and 2012. The gases concerned include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

The Kyoto Protocol allows for the sale and purchase of emission rights between countries and encourages investment in reducing greenhouse gas emissions in developing countries, offering emission credits for reductions achieved.

"Clean Development Mechanisms" can be set up in developing countries, financed by developed countries. However, the United States has refused to sign the Kyoto Protocol.

The Johannesburg Earth Summit, held from August 26 to September 4, *2002*, focused on sustainable development and the evaluation of Agenda 21. It aimed to encourage greater collaboration between rich and developing countries to reduce pollution. Despite the participation of 22,000 people from 193 countries, including 100 heads of state, little progress has been made since the Rio summit, with a lack of sustainable development strategies and insufficient aid to developing countries. New measures were considered, focusing on *renewable energy*, biodiversity, and assistance to developing countries in areas such as water, energy, health, and agriculture.

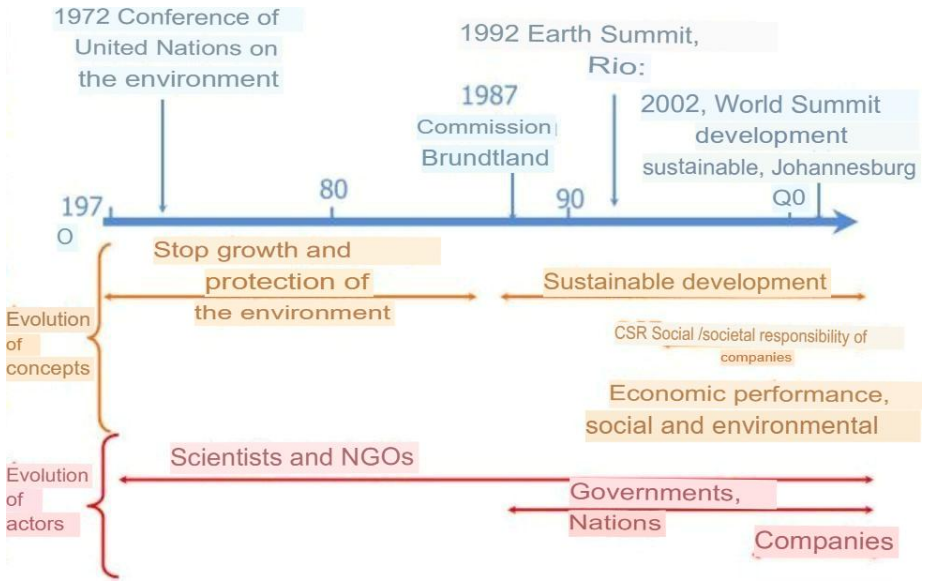


The results of this summit proved disappointing, with targets falling far short of expectations. Despite commitments to ratify the Kyoto Protocol in the near future by industrialized countries such as

Russia, China, and Canada, the United States continues to refuse to do so. In collaboration with European countries, they have limited themselves to promises of aid to poor countries, without any real change in the current global situation.

The *2007* Jakarta Summit in Indonesia aimed to establish comprehensive and sustainable development over the next 30 years. A far-reaching global reform was proposed, covering global ecological, social, economic, and political aspects, while respecting the cultural specificities of each country.

Several measures were adopted, including the establishment of a system of governance for global natural resources such as water, oceans, and the atmosphere, as well as the promotion of peace and culture on a global scale. The creation of new indicators to assess environmental preservation, the introduction of a tax on international transactions, and the promotion of education and sustainable development were also among the measures taken at the summit.



2.3. Global Change

Definition:

It is a principle of human society organization that takes into account the planet's resources and *acts* on *three* interdependent *dimensions*. It is also *global change*, which includes changes in:

The environmental dimension: human activities must be developed in such a way as not to harm the capacity for renewal of natural resources or the proper functioning of ecosystem services.

The social dimension: the development of human society requires social cohesion that guarantees access to basic resources and services (health, education, etc.) for all.

The economic dimension: economic development must enable the reduction of extreme poverty and the exercise by as many people as possible of a decently paid economic activity.

Dimension	Economic	Environmental	Social
Positive effects	Resolution of information problems	Internalization of externalities	Empathy sharing
	Action	Commitment to the local quality of life	Emotional support
	Collective		Sharing
	Risk management		Social control of citizenship
Negative effects	Lack of incentive	Collective spoliation	Exclusion
	Lack of openness	of natural resources	Segregation
	Collusion		

The effects of social relations on sustainability.

The table summarizes the effects of social relations on sustainability. The distinction between the three dimensions of sustainability is sometimes artificial, as certain phenomena transcend categories. For example, mutual aid contributes to both economic (risk management) and social sustainability.

2.4. Global change

The term *"global change"* could be broadened to include not only changes in the biosphere, such as climate change, but also the transformations in societies brought about by the process of globalization. This global perspective is essential for understanding current challenges, as it integrates environmental and social issues into a single conceptual framework. Unfortunately, this global change poses significant threats, underscoring the urgency of an adequate response.

The concept of sustainable development has emerged as a response to these challenges. It represents a framework for action that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs. Thus, *sustainable development* offers a holistic approach to addressing issues of global change, integrating environmental, social, and economic aspects.

Although the press often focuses on sustainable development, it is important to recognize that this increased attention is largely due to the emergence of the greenhouse effect as a topic of public and political debate. Reports such as that by N. Stern have helped raise awareness of the high costs of inaction in the face of climate change.

However, *global change* and sustainable development go far beyond the greenhouse effect alone. They require an in-depth analysis of potential transformations in the world and raise crucial questions about how societies will need to adapt to these changes. Ultimately, these two concepts

Chapter 2: Interactions between the environment and sustainable development

1. The principles of sustainable development:

The principles set out below were introduced into the Treaty on European Union, signed in Maastricht on February 7, 1992. The principles are based on the Rio Declaration, which commits to sustainable development.

- 1. ***Principle of prevention***

Whenever a known and identified risk is present, measures must be taken. These measures must be a priority and implement the best available techniques while respecting a minimum acceptable cost.

- 2. ***Precautionary principle***

It is imperative to adopt a precautionary approach in our decisions in order to avoid disasters that could harm health and the environment. The competent authorities must put in place temporary and proportionate measures to assess the risks involved and prevent damage. For example, restricting greenhouse gas emissions helps to mitigate global warming.

- *3.* ***Principle of participation and commitment***

Sustainability requires the involvement of all social, political, and economic actors in projects. Citizens, as well as project managers and policy makers, must be committed to ensuring the success of sustainable initiatives. Forums and councils need to be set up to persuade and raise awareness among citizens of the importance of these projects for society and for the future.

- *4.* ***Principle of environmental protection***

Sustainable development is fundamentally based on respect for and protection of the environment. Without this concern, it simply could not exist. Therefore, all sustainable development projects must be designed with an ecological perspective. This involves the application of new technologies designed to reduce pollution. The main objective of these initiatives is to reduce pollution in order to preserve our planet for future generations.

- ***5. Principle of solidarity***

"Let's leave our children a viable and just world." Robert Formater

Solidarity and the equitable sharing of the Earth's resources are essential pillars of sustainable development. It is crucial that countries share raw materials fairly, preserving a share for future generations. This solidarity must extend between states, particularly between industrialized and developing nations, as well as between different generations. Responsible economic management of natural resources is therefore essential to uphold this principle.

- ***6. Principle of responsibility***

Those involved in sustainable development initiatives must bear the costs associated with prevention and precautionary measures. Entities responsible for pollution must also bear the costs associated with their harmful emissions, as well as the expenses incurred to reduce and combat this pollution. The prices of goods and services must reflect the costs they generate, both in terms of their production and consumption. These prices must be proportional to the level of pollution

generated, so that the biggest polluters bear a greater financial burden. A concrete example is the imposition of taxes on large industrial companies responsible for high pollutant emissions.

- ***7. Ethical principle***

Production and consumption processes must be designed to minimize negative social and environmental impacts. It is essential to prevent waste, overexploitation of resources, and inequalities between individuals. Human aspects must be fully taken into account, in particular by ensuring that workers' incomes enable them to meet their basic needs and by guaranteeing respect for their rights, including with regard to working hours and conditions.

- ***8. Principle of subsidiarity***

In politics, it is stipulated that decisions must be made at the administrative level closest to the field. Similarly, responsibility is also decentralized according to this principle.

- ***9. Polluter pays principle***

This principle stipulates that whoever causes damage in terms of pollution must also pay for the clean-up. Examples: It is difficult to establish responsibility in the case of former industrial sites. In terms of the cost of pollution by households, taxes are already in place (waste, water, electricity, etc.) to try to control consumption and waste.

Additional information: *Areas targeted by sustainable development*

- Poverty
- Health
- Housing
- Pollution
- Management of seas, forests, and mountains
- Desertification
- Water resource management and sanitation
- Agricultural management
- Waste management.

Advice*: How to ensure sustainable development*

Maintain environmental integrity: to *ensure* the health and safety of human communities and preserve the ecosystems that sustain life.

Ensure social equity: to enable the full development of all women and men, the growth of communities, and respect for diversity.
Aim for economic efficiency: to create an innovative and prosperous economy that is environmentally and socially responsible.

2. Sustainable development challenges

The environmental challenges we face are becoming increasingly worrying, exacerbating the situation on the planet. Here are some of the main challenges

2.1. *Industrial and natural risks*

The aim is to prevent natural and technological risks by analyzing the environmental aspects of natural disasters and industrial incidents, such as fires and accidents involving hazardous chemicals (pollution). The objective is to ensure safety and protect the environment.

2.2. *Natural resources*

It is essential to manage natural resources, particularly water, rationally by avoiding waste and promoting reuse, while minimizing the risk of soil and water contamination.

2.3. *Climate change*

Climate change is one of the main concerns for the future of humanity, due to global warming caused by greenhouse gas emissions from industrial activities. Its impacts include rising sea and ocean levels, changes in ecosystems, loss of biodiversity, and desertification.

2.4. *Energy savings and the development of renewable energies*

It is crucial to reduce and rationalize energy use while promoting the development of renewable energies to replace dirty and polluting energies, such as fossil fuels.

2.5. *Biodiversity and ecosystems*

Protecting ecosystems and biodiversity is essential to maintaining environmental balance in the face of pressure from human activities. It is crucial to reduce and remedy various types of pollution to ensure their preservation.

2.6. *Use and preservation of non-renewable resources*

Faced with growing consumption of certain non-renewable raw materials, it is imperative to conserve their use, promote recycling, and consider substitutes for more sustainable exploitation.

2.7. *Waste management*

The issue of waste management has become a major concern since the 1990s. Every individual, as a consumer, user of waste collection services, or contributor to waste sorting and recycling, has a role to play in improving waste management. Simple actions, such as reducing waste production and sorting waste more effectively, can help preserve the environment and improve everyone's quality of life.

3. Sustainable Development Goals (SDGs):

In September 2015, the United Nations General Assembly officially adopted the *"universal, integrated, and transformative"* 2030 Agenda for Sustainable Development, a set of 17 goals (SDGs). The goals must be implemented and achieved in every country from 2016 to 2030.

Supplement

Sustainable Development Goal:

- *1. No poverty*: End extreme poverty in all its forms, ensuring that every person has the resources necessary to meet their basic needs, such as food, water, housing, and health care.
- *2. Zero Hunger*: Ensure food security, improve nutrition, and promote sustainable agriculture to end hunger and ensure equitable access to sufficient food for all.
- *3. Good health and well-being*: Ensure healthy lives and promote well-being for all at all ages, with a focus on disease prevention, access to quality healthcare, and mental health services.
- *4. Quality education*: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, in order to foster personal and economic development.
- *5. Gender equality*: Achieve gender equality and empower all women and girls by eliminating discrimination and ensuring their equal participation in all areas of society.

- *6. Clean water and sanitation*: Ensure access to clean drinking water and adequate sanitation for all, as well as sustainable management of water resources to preserve ecosystems and public health.

- *7. Affordable and clean energy:* Ensure access to reliable, sustainable, and affordable energy for all, while promoting the transition to renewable energy and increased energy efficiency.

- *8. Decent work and economic growth*: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all, with a focus on protecting workers' rights.

- *9. Industry, innovation, and infrastructure:* Build resilient infrastructure, promote sustainable industrialization, and foster innovation to boost economic development and meet social and environmental needs.

- *10. Reduced inequalities:* Reduce inequality within and among countries by promoting equitable economic growth, ensuring social inclusion, and combating discrimination.

- *11. Sustainable cities and communities:* Make cities and human settlements inclusive, safe, resilient, and sustainable by improving access to basic services, promoting planned urban development, and conserving natural resources.

- *12. Responsible consumption and production:* Promote sustainable consumption and production patterns by managing natural resources efficiently, reducing waste, and adopting responsible business practices.

- *13. Climate action:* Take urgent action to combat climate change and its impacts by reducing greenhouse gas emissions, building resilience to climate-related disasters, and promoting low-carbon development policies.

- *14. Life below water:* Conserve and sustainably use the oceans, seas, and marine resources for sustainable economic development, preserving marine biodiversity and protecting marine ecosystems.

- *15. Life on Land*: Protect, restore, and promote sustainable use of terrestrial ecosystems, combating deforestation, preserving biodiversity, and promoting sustainable land management.

- *16. Peace, justice, and strong institutions:* Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and transparent institutions at all levels.

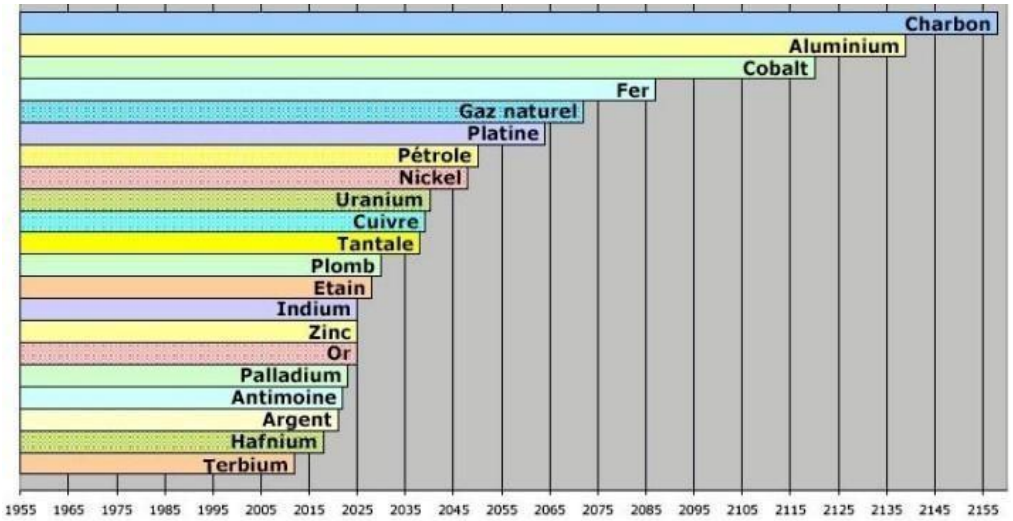
- *17. Partnerships for the goals:* Strengthen the means of implementation and revitalize the global partnership for sustainable development by mobilizing financial, technical, and technological resources, as well as strengthening public-private partnerships and international cooperation.

4. Sustainable development in Algeria

The first Algerian laws in the field of sustainable development date back to the *1990s*. The High Council for the Environment was created in *1994*. This Council is responsible for monitoring the state of the environment in Algeria, determining major strategies for environmental protection, and following up on measures at the international level. It must submit an annual report to the President of the Republic. In *2002*, the National Observatory for the Environment and Sustainable Development was created. In *2002* and *2003,* laws were enacted for the creation of new environmentally friendly cities.

5. Natural resources

Natural resources fall into two categories: *finite resources* and *renewable resources*. The former exist in finite quantities on the planet: they are not renewable and will eventually be depleted when they are consumed in their entirety (oil and metals). According to experts, *reserves* of *oil* and certain metals will be depleted by the end of the century if they continue to be consumed at the current rate. Natural resources in the second category renew themselves: they are unlimited. This is the case for animal and fish populations. However, if the natural balance is not respected, these resources can be depleted and disappear. This is the case with fish stocks: the amount of fish caught each year worldwide has risen from around 20 million tons in *1950* to almost 100 million in *2004.* Overfishing and the destruction of the seabed by trawlers raise the issue of species renewal.



Dates of depletion of our planet's exploitable resources at the current rate of consumption Note

Renewable *natural resources* also include freshwater reserves and arable land. However, they are exploited by human activities and can be seriously degraded as a result of poor management (soil or water pollution, deforestation leading to desertification, etc.). These resources are also overexploited in many parts of the world. *Agriculture* has intensified with the heavy use of fertilizers and pesticides. Similarly, the volume of water used and polluted by *human activities* continues to increase.

Chapter 3: Sustainable development indicators

1. Identification and role of indicators

Indicators are essential assessment tools for measuring, monitoring, and guiding sustainable development policies. They are used to identify potential weaknesses, highlight areas requiring adjustment, and guide decision-making at various levels. An indicator synthesizes a multitude of information into an interpretable signal, often derived from scientific or technical expertise. It thus contributes to formulating priorities, implementing appropriate policies, and evaluating their impacts.

2. Objectives of using indicators

The use of indicators aims to:

Raise awareness decision-makers decision-makers and the population to economic economic, social and environmental
dimensions of public policies.

- Assess the long-term consequences of current decisions and behaviors.
- Measure progress toward sustainable development goals (SDGs) by comparing starting conditions and subsequent trends.

According to the UN's **2025 Sustainable Development Goals Report**, only two global indicators are currently on track to meet the 2030 targets. Progress remains insufficient in key areas such as poverty, education, environmental health
environmental health, and water management.

3. Ecological footprint

The ecological footprint is a global indicator that measures the pressure exerted by human activities on ecosystems. Developed in the 1990s by Mathis Wackernagel and William Rees, then popularized by the WWF, it assesses the area needed to produce the resources consumed (food, energy, housing, material goods) and absorb the waste emitted, particularly carbon dioxide.

The biologically productive area is divided between forests, pastures, cultivated land, marine areas, built-up land, and energy areas. In 2007, humanity had an average of 1.8 hectares at its disposal. per person, but consumed an average of 2.5. This overexploitation has increased: according to the **Global Footprint Network 2024**, global ecological overshoot is now equivalent to 1.75 planet Earths.

For example, to produce one kilogram of beef, approximately ten square meters of pasture, eleven square meters of cultivated land, two and a half square meters of built-up area, and twenty-one square meters of energy equivalent are needed to absorb CO_2 emissions.
There are significant differences between countries: in 2023, the average ecological footprint per capita

was 8.6 hag in the United States, 4.9 hag in France, and 2.3 hag in Algeria.

4. Economic indicators

4.1 Per capita GDP growth rate

Gross domestic product per capita remains a standard indicator for measuring economic performance. However, it is insufficient for assessing well-being or sustainability, as it does not take into account wealth distribution, environmental impacts, or quality of life.

4.2 New measurement tools

In 2024, the World Bank adopted a new scorecard incorporating 22 indicators covering poverty, shared prosperity, gender equality, climate change, and economic resilience. This approach aims to focus more on actual results than on macroeconomic aggregates alone.

5. Social and human indicators

5.1 Human Development Index (HDI)

The HDI, established by the UNDP, combines three fundamental dimensions: health (life expectancy), education, and standard of living. In 2023, Algeria had an HDI of 0.745, placing it in the category of countries with high human development.

5.2 Happy Planet Index (HPI)

The HPI assesses the ability of societies to achieve well-being while minimizing their ecological impact. It is based on three components: life expectancy (ideal target: 85 years), life satisfaction measured by international surveys (Gallup, World Values Survey), and ecological footprint (Living Planet Report). This indicator highlights that sustainable happiness requires the efficient and equitable use of natural resources.

5.3 Well-being Index (IB)

Defined by Prescott-Allen, this index combines human well-being and ecological well-being. Human well-being is based on health, education, wealth, social cohesion, and equity.
Ecological well-being measures the capacity of ecosystems to maintain their diversity, adapt to change, and meet human needs.
Recent data show a significant deterioration in the ecological well-being index in North Africa, particularly related to water stress and desertification.

6. Environmental indicators

6.1 Environmental Performance Indicator (EPI)

The IPE, created by Yale and Columbia in 2006, assigns a score between 0 and 100 based on twenty-four criteria divided into six categories: environmental health, air pollution, water resources, biodiversity, natural resources, and climate change.
In 2024, Denmark, Finland, and Sweden topped the rankings, while several African countries scored below 40. Algeria scored 47.3, reflecting progress in waste management but persistent challenges in water and biodiversity.

6.2 Water-related indicators (SDG 6)

The United Nations Environment Programme report indicates that progress on indicators 6.3.2 (water quality), 6.5.1 (integrated water resources management), and 6.6.1 (status of aquatic ecosystems) is insufficient. In some regions, the situation is deteriorating due to overexploitation and climate change.

7. Indicators by sector

7.1 Economic

These include GDP growth per capita, inflation (CPI), unemployment rate, key interest rates, balance of payments, and consumer spending.

7.2 Social

These indicators include life expectancy, family structure, women's participation in public life, and access to education and healthcare.
economic and social development, the role of education, social mobility, solidarity, and the organization of rural and urban areas.

7.3 Ecological

These relate to climate change (intensity of greenhouse gas emissions), the state of the ozone layer, air quality, waste production, intensity of use of water, forest and fishery resources, and biodiversity (endangered species, diversity of habitats, areas of key ecosystems).

8. New tools and perspectives

Innovative approaches are emerging in indicator monitoring. In 2025, researchers presented a framework called **SustainFM**, using fundamental geospatial models and artificial intelligence to track SDG progress

based on satellite imagery and open data.

Countries such as Poland and France have also developed experimental indicators based on spatial data to assess access to transportation, public spaces, and local biodiversity.

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