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Third Year – Agroecology

السنة الثالثة زراعة و بيئة

**PROTECTION OF BIOLOGICAL ENTITIES...**

**PROTECTION DES ENTITÉS BIOLOGIQUES**

**Dr.REBBAH Abderraouf Chouaib**

**2025-2026**

# Protection des entités biologiques



- Semestre : 6
- Unité d'enseignement de méthodologie
- Matière 2 : Protection des entités biologiques
- Crédits : 04
- Coefficient : 02

# Contenu de la matière



- **INTRODUCTION**
- **CHAPTER 1: GENERAL OVERVIEW (*GENERAL PRINCIPLES*)**
- **CHAPTER 2: LEGISLATION AND BIODIVERSITY PROTECTION**
- **CHAPTER 3: BIODIVERSITY AND ANTHROPOGENIC ACTIVITY**
- **CHAPTER 4: FLORA AND ECOLOGICAL SIGNIFICANCE**
- **CHAPTER 5: FAUNA AND ECOLOGICAL SIGNIFICANCE**
- **CONCLUSION AND FUTURE PERSPECTIVES**



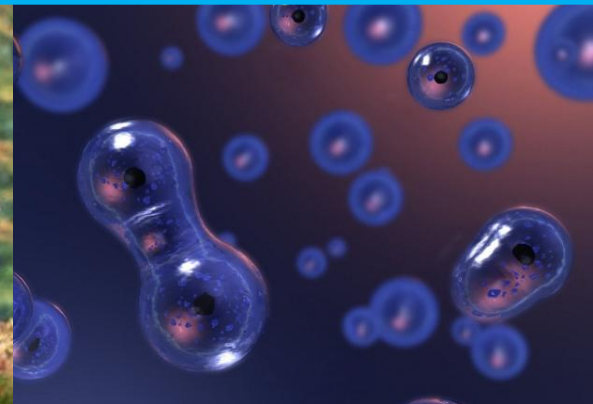
# INTRODUCTION

- **Biological entities, or biodiversity**, encompass the full range of life on Earth, from microorganisms to complex ecosystems, and represent an invaluable wealth through their diversity, complexity, and the essential services they provide, such as oxygen production, climate regulation, pollination, and the provision of medicines.
- However, **this biodiversity** is severely **threatened by human** activities such as deforestation, pollution, overexploitation of resources, and climate change, leading to an accelerated disappearance of species and ecosystem degradation comparable to a mass extinction crisis.
- **The protection of biological entities** has become a global priority, requiring conservation measures, compliance with national and international legislation, and public awareness to preserve this natural wealth and ensure our survival and well-being. This course explores the challenges of biodiversity protection by addressing legislative, ecological, and socio-economic aspects, in order to provide the tools needed to understand and act in its favor



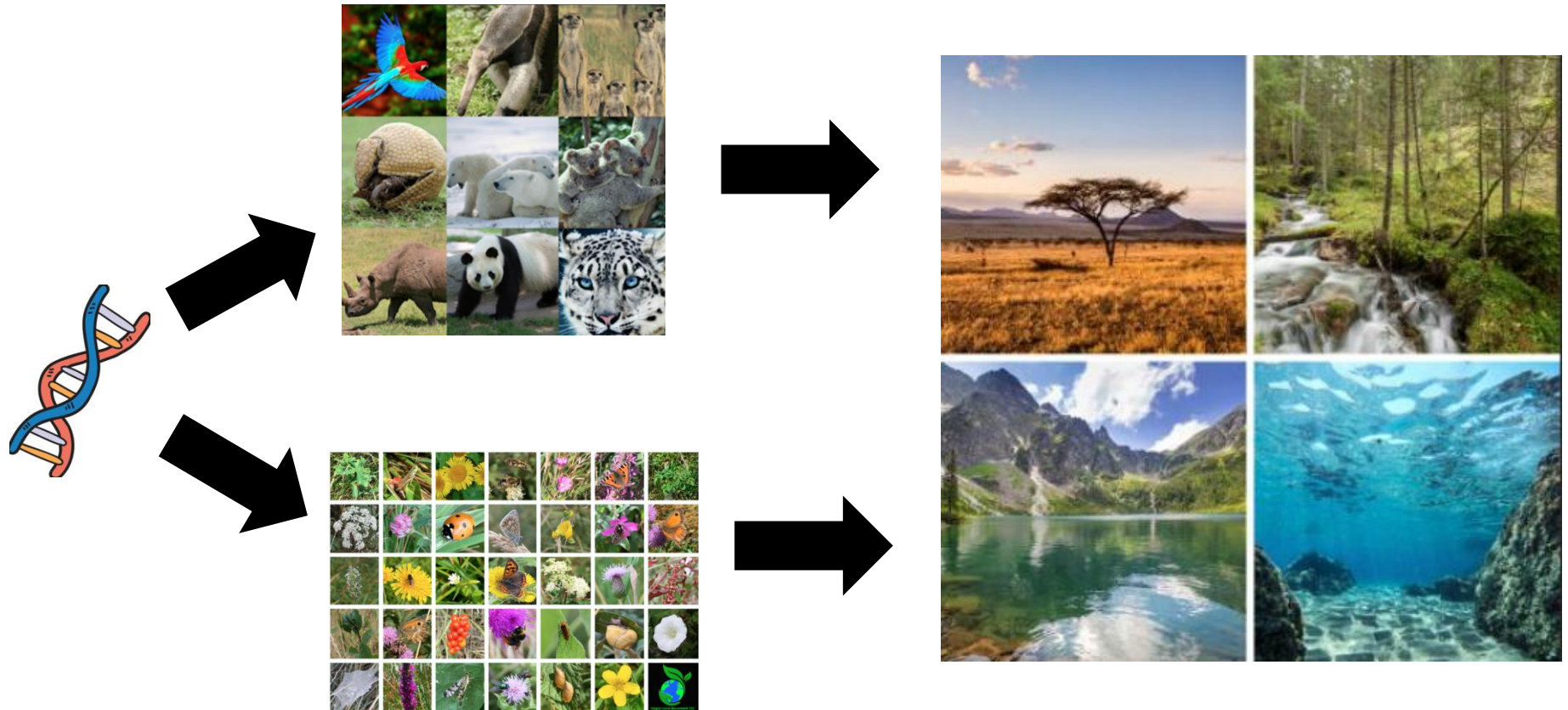
# CHAPITRE 1 : GENERALITES

**Biological entities** encompass all living organisms, from plants and animals to the microorganisms and ecosystems that host them. They constitute **biodiversity**, which is essential for the functioning of ecosystems by playing key roles such as pollination, climate regulation, water purification, and food production. However, human activities (deforestation, pollution, climate change) threaten these entities, leading to an accelerated loss of biodiversity. Protecting biological entities is crucial to preserving ecosystems, maintaining ecosystem services, and ensuring a sustainable future for coming generations



# What is Biodiversity?

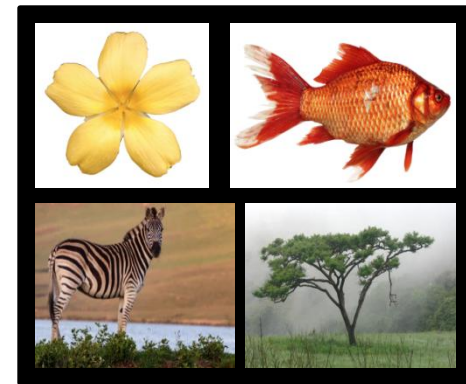
The term **biodiversity** is a contraction of the words “**biology**” and “**diversity**.” It was popularized in the 1980s by scientists and ecologists to describe the **variety of life on Earth** at all levels, from genes to ecosystems



- **Bio:** Refers to **life** or **living organisms** (from the Greek *bios*).  
**Diversity:** Refers to the **variety** or **multiplicity** of forms, species, and ecosystems.
- Biodiversity is therefore a complex concept that reflects the richness and variability of life on Earth. It is essential for the functioning of ecosystems and for the provision of ecosystem services such as oxygen production, water purification, crop pollination, and climate regulation. Preserving biodiversity is crucial to maintaining ecosystem balance and ensuring the survival and well-being of humanity.
- **Biodiversity** (biological diversity) refers to all forms of life on Earth and the interactions that connect them. It encompasses three main levels:

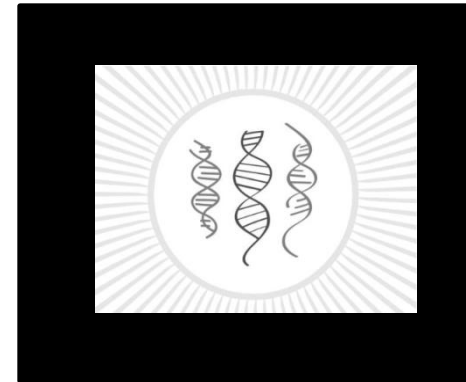
- **Species Diversity (specific diversity):**

This includes all living species, from microorganisms to plants, animals, and humans. Each species plays a unique role in its ecosystem.



- **Genetic Diversity (genetic diversity):**

This refers to the genetic variability within a single species. Such diversity allows species to adapt to environmental changes and resist diseases.

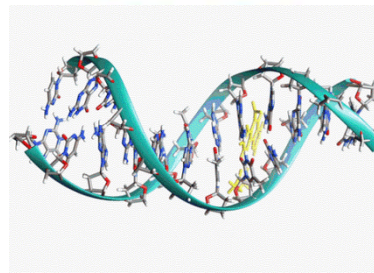
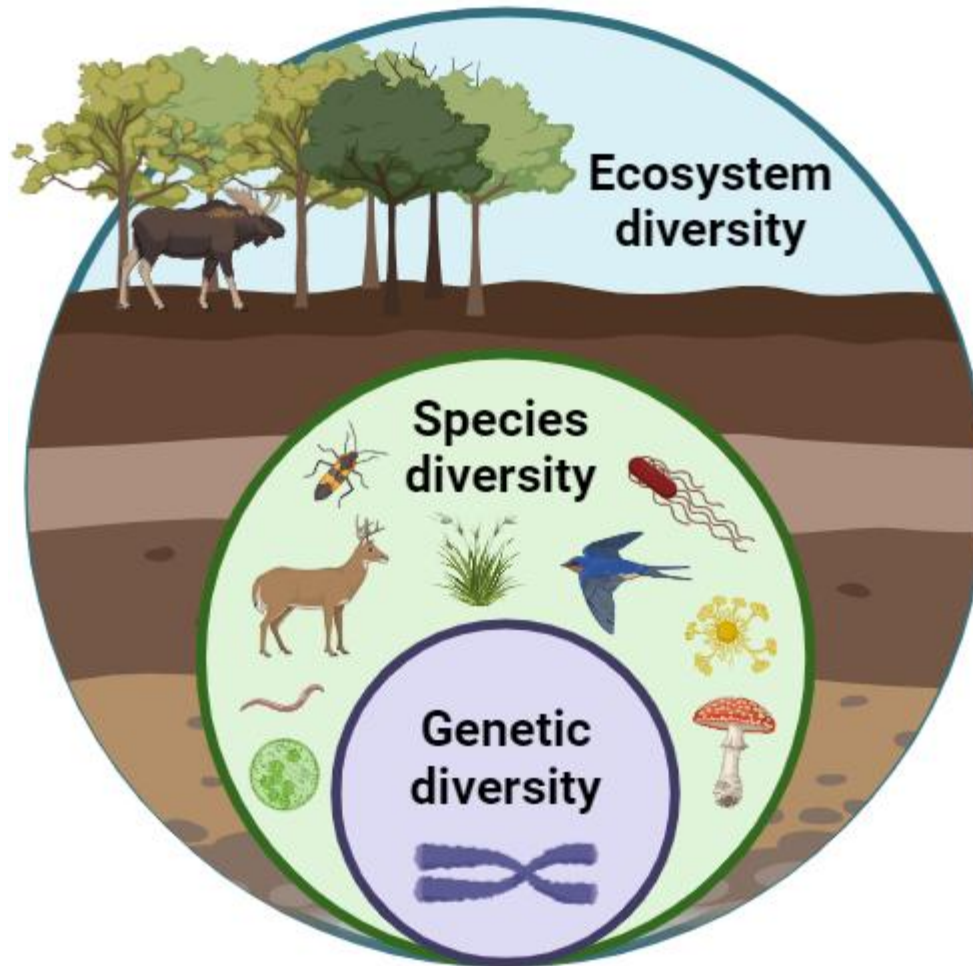


- **Ecosystem Diversity (ecosystemic diversity):**

This concerns the variety of habitats, biological communities, and ecological processes in which species interact. Ecosystems can include forests, deserts, oceans, rivers, and more



# The Main Levels of Biodiversity



# Importance of Biodiversity

## Importance of Biodiversity for Ecosystems

- Biodiversity is essential for the functioning of ecosystems and the well-being of humanity.
- It plays a crucial role in the stability of the planet and in providing services that are indispensable for our survival and quality of life



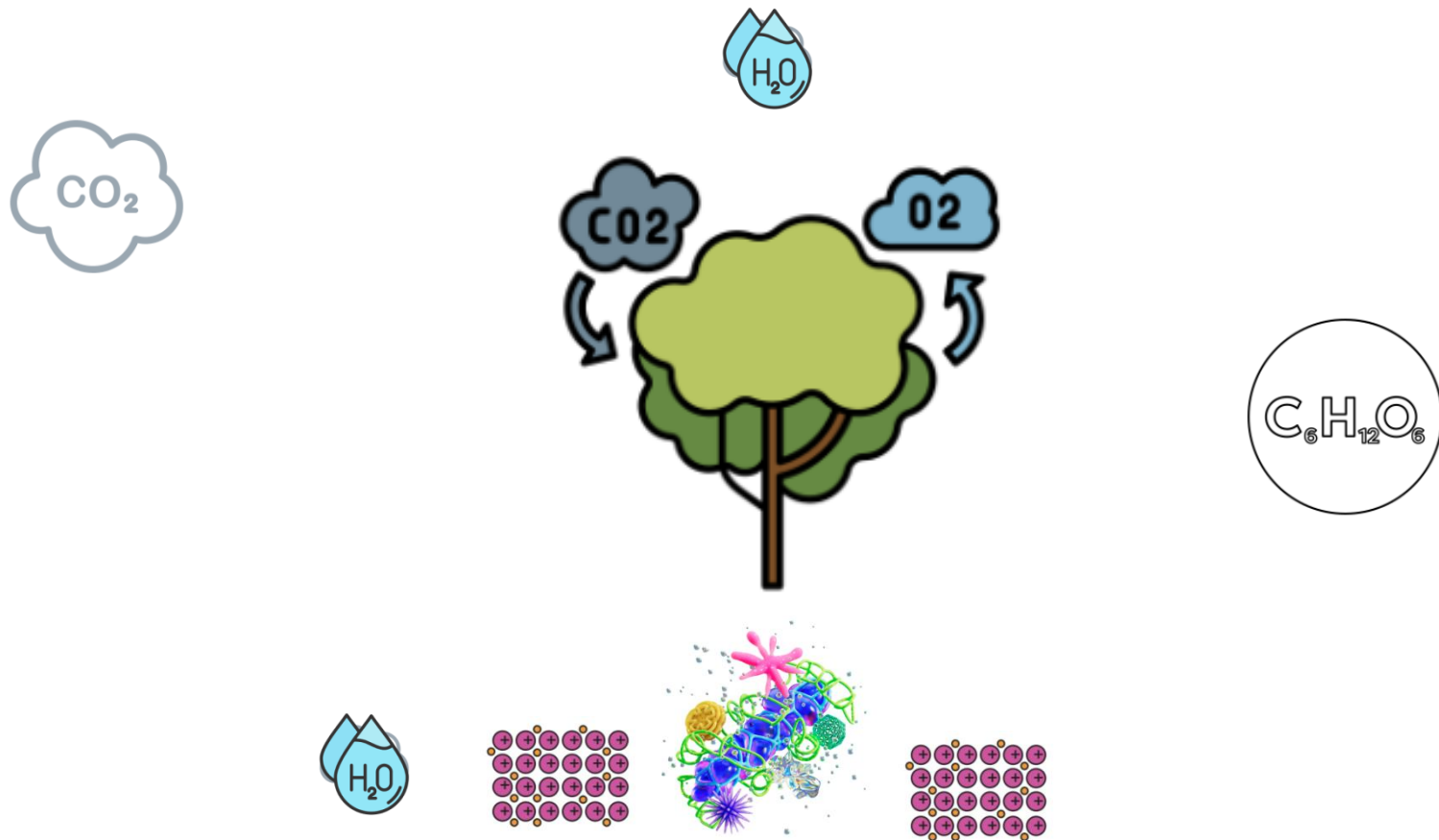
## Ecosystem Stability and Resilience

- Biodiversity ensures the **stability** of ecosystems by maintaining the balance between species and their habitats.
- The more diverse an ecosystem is, the more **resilient** it is to disturbances such as climate change or natural disasters.
- **Example:** A forest rich in plant and animal species is better able to withstand diseases or fires.



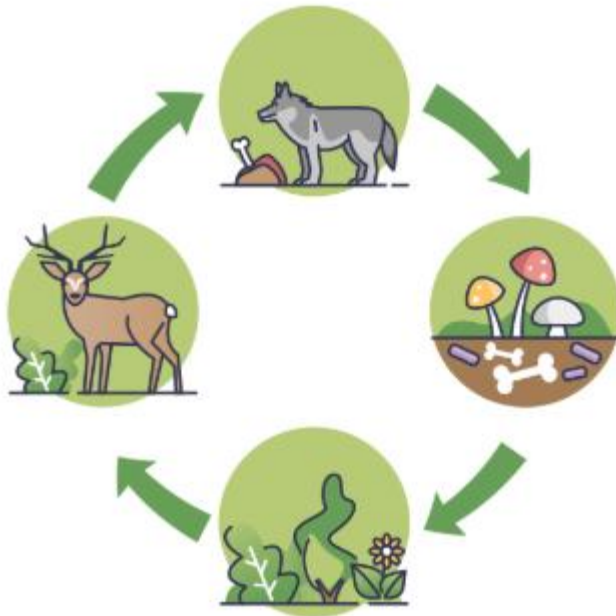
# Functioning of Natural Cycles

- Biodiversity contributes to **biogeochemical cycles** (water, carbon, nitrogen, etc.), which are essential for life on Earth. **Example:** Plants absorb  $\text{CO}_2$  and release oxygen, while microorganisms decompose organic matter to enrich the soil.

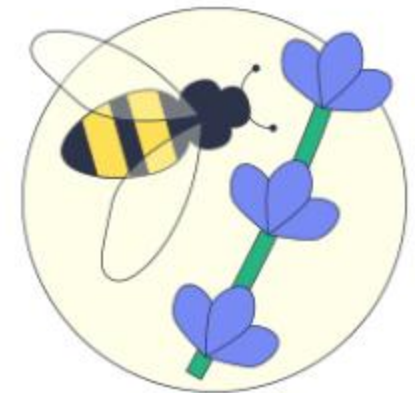
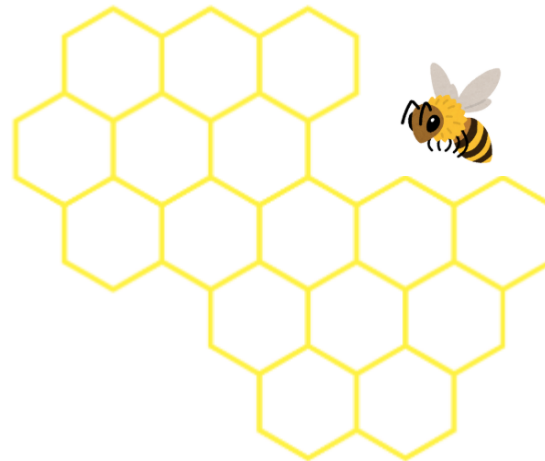


## Interdependence of Species

- Species interact with each other in **complex networks** (food chains, symbiosis, pollination, etc.). The disappearance of a single species can have **cascading effects** throughout the ecosystem. **Example:** The loss of bees affects plant pollination, threatening food production.



## Exemple



# Current Challenges

- The current challenges related to biodiversity are numerous and concerning. Some of the main issues include:
- **Climate change**
- **Species extinction**
- **Habitat degradation**



- **Climate Change:**

Global warming affects ecosystems by altering natural habitats, species' reproductive cycles, and interactions between species. This can lead to major ecological imbalances



- **Loss of Biodiversity:**

The disappearance of plant and animal species is accelerating at an unprecedented rate, mainly due to human activities such as deforestation, pollution, overfishing, and climate change.



- **Habitat Destruction:**

Urbanization, intensive agriculture, and the exploitation of natural resources lead to the destruction and fragmentation of natural habitats, threatening the survival of many species.



- **Pollution:**

Air, water, and soil pollution have harmful effects on biodiversity. Chemicals, plastics, and industrial waste contaminate ecosystems and impact the health of species



## •Overexploitation of Resources:

Overfishing, excessive hunting, and unsustainable harvesting of plants and animals threaten many species with extinction



# Biological entities = biodiversity



## 1- BOIS MORT

Un arbre vieillissant ou mort est colonisé par des insectes xylophages\* comme le **lucane cerf-volant**. Ses cavités abritent aussi des animaux cavernicoles\*.



## 2- COIN D'HERBES FOLLES

Les plantes herbacées qu'on laisse venir à maturité égalent l'espace de leurs couleurs et satisfont les besoins de nombreux insectes et oiseaux, notamment granivores\* comme la **linotte mélodieuse**.



## 3- TALUS

En plus du relief qu'il apporte à l'espace, il est colonisé par des espèces friandes de fissures et de soleil, comme l'**orvet**.



## 4- JACHÈRE FLEURIE

Véritable régal pour les yeux, elle magnétise les papillons, comme le **machaon**, et autres insectes butineurs.



## 5- ARBRE

Il attire et fidélise un nombre incalculable d'espèces animales, en particulier des oiseaux, comme le **hibou moyen-duc**.

## 6- MANGEOIRES

A n'approvisionner qu'en hiver, elles attirent une foule d'oiseaux, comme le très massif **gros-bec casse-noyaux**.



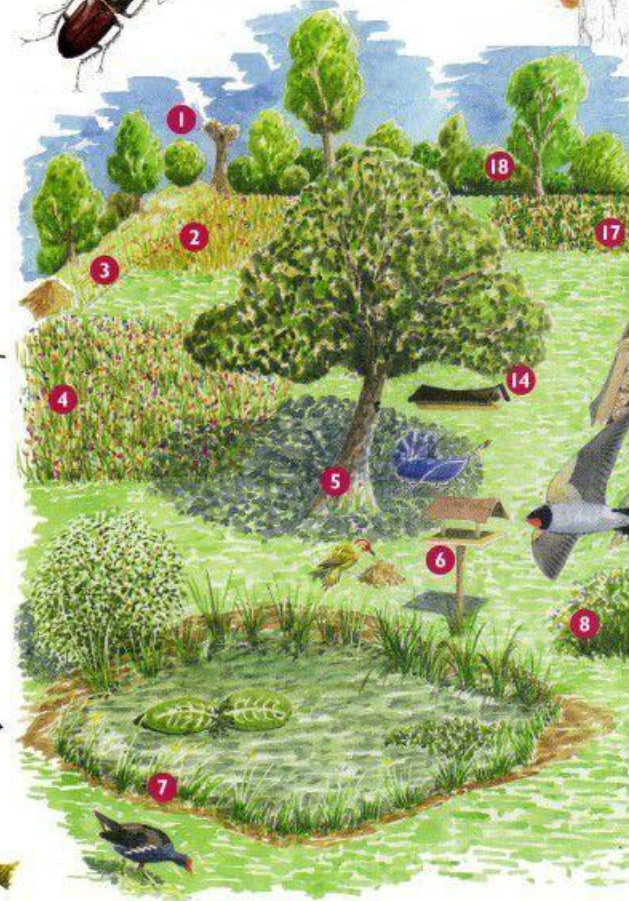
## 7- MARE

Un simple petit bassin accueille des animaux ayant besoin du milieu aquatique pour accomplir tout ou partie de leur cycle de vie comme les amphibiens (**grenouilles**...) et certains insectes (**libellules**...)



## 18- HAIE CHAMPÊTRE

La diversité de ses essences garantit la présence d'un cortège d'animaux variés qui y trouvent gîte et couvert, comme l'**écureuil roux**.



## 8- PLANTES AROMATIQUES

Leur nectar et leur pollen attirent les insectes butineurs, comme le **moro-sphinx**, qui assurent ainsi un large travail de fécondation des autres plantes du jardin, notamment fruitières et potagères.



- **Invasive species:**

- The introduction of non-native species into new environments can disrupt local ecosystems by outcompeting native species and spreading diseases.



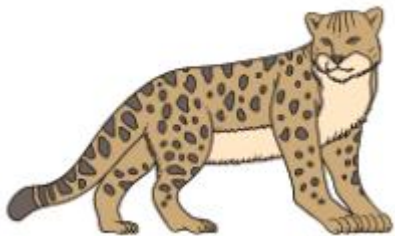
- **Pollinator decline:**

- Bees, butterflies, and other pollinators are decreasing in number, which threatens plant pollination and, consequently, food production.



- **Loss of ecosystem services:**

- Biodiversity provides essential services such as water purification, climate regulation, soil fertility, and crop pollination. Its loss compromises these services, leading to serious consequences for human societies.



- **Inequality and environmental justice:**

- The impacts of biodiversity loss and environmental changes are often unevenly distributed, disproportionately affecting poor and marginalized communities.



- **Lack of awareness and political action:**
- Despite scientific evidence, public awareness and political action remain insufficient to address the urgency of the biodiversity crisis



# Objectives of Protecting Biological Entities

- The objectives of protecting biological entities are diverse and aim to preserve biodiversity and maintain healthy ecosystem functioning. The primary objectives include:
  - 1. Biodiversity preservation:** Protecting the variety of life at genetic, species, and ecosystem levels.
  - 2. Maintenance of ecological balance:** Ensuring that natural processes and interactions remain stable.
  - 3. Conservation of natural resources:** Managing biological assets sustainably for current and future generations.
  - 4. Prevention of species extinction:** Implementing strategies to save endangered species from disappearing.
  - 5. Advancement of scientific knowledge:** Increasing our understanding of biological systems through research.
  - 6. Environmental awareness and education:** Informing the public to promote pro-environmental behaviors.
  - 7. Economic and cultural valuation of biodiversity:** Recognizing the financial and heritage value of natural ecosystems.
  - 8. Climate change mitigation:** Utilizing nature-based solutions to absorb carbon and regulate the climate.

# Conclusion

- **Biological entities** are not merely resources; they are the fundamental pillars of our biosphere's stability. However, the relationship between these ecosystems and anthropogenic activities is marked by a complexity that is often underestimated.
- In a short-term pursuit of economic gain, humanity multiplies pressures such as **habitat fragmentation**, **overexploitation**, and **pollution** exponentially increasing the risk of biodiversity loss. This dynamic is far from linear: by ignoring the systemic consequences of its actions, humanity weakens the very **ecosystem services** upon which it depends, transforming a quest for profit into a state of global vulnerability.



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# PROTECTION OF BIOLOGICAL ENTITIES

## PROTECTION DES ENTITÉS BIOLOGIQUES

Dr.REBBAH Abderraouf Chouaib

2024-2025

# CHAPTER 2: LAWS AND PROTECTING BIODIVERSITY



# LAWS AND PROTECTING BIODIVERSITY



# Environmental Law

- Environmental law is a set of laws, rules, and agreements created to protect nature and ensure sustainable development.
- It covers different areas, such as protecting biodiversity, managing natural resources, preventing pollution, and tackling climate change.
- The laws currently used to protect biodiversity are based on several international agreements, national laws, and local rules.

# Key Principles of Environmental Law

- Environmental laws are usually based on a few main ideas:
- **Prevention Principle:** It is better to prevent damage than to fix it later.
- **Precautionary Principle:** If an action might harm the environment, we should be careful, even if we aren't 100% sure yet.
- **Polluter-Pays Principle:** The person or company that causes pollution should pay for the cleanup.
- **Participation Principle:** People should have a say in decisions that affect their environment.

# The Prevention Principle

- This rule is about stopping environmental damage before it happens.
- **Example:** Carrying out **environmental impact studies** before starting a new factory or industrial project.



# The Precautionary Principle

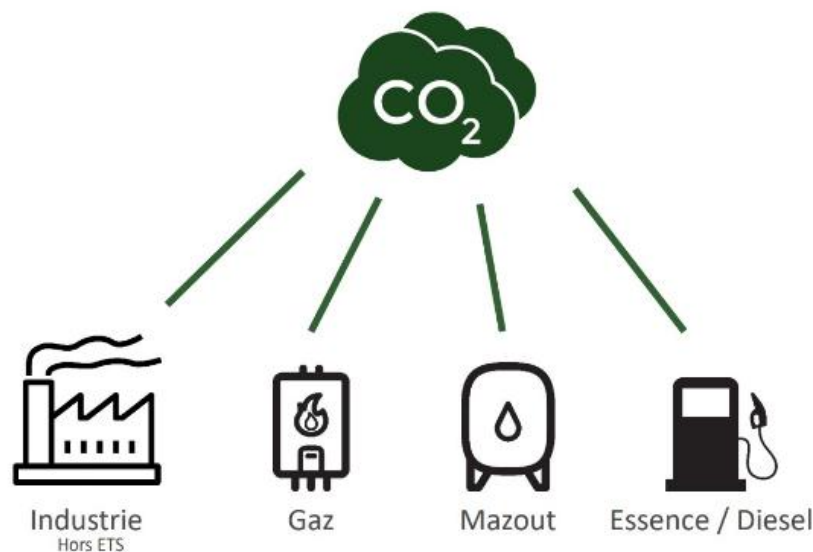
- If there is a risk of serious harm to nature or health, we should not wait for 100% scientific proof before taking action. **Example:** Banning certain pesticides that are thought to hurt bees and other pollinators.



# The Polluter-Pays Principle

- This means that whoever causes pollution is responsible for paying the costs.
- **Example:** Taxes on carbon emissions or making companies pay to clean up polluted soil.

20 euros par tonne de CO<sub>2</sub> à partir du 1 janvier 2021  
Augmentation progressive les années prochaines: 25€/t (2022) – 30€/t (2023)



# The Participation Principle

- This means that people have the right to know about and take part in decisions that affect the environment.
- **Example:** Holding **public meetings** or surveys to get people's opinions on new building projects.

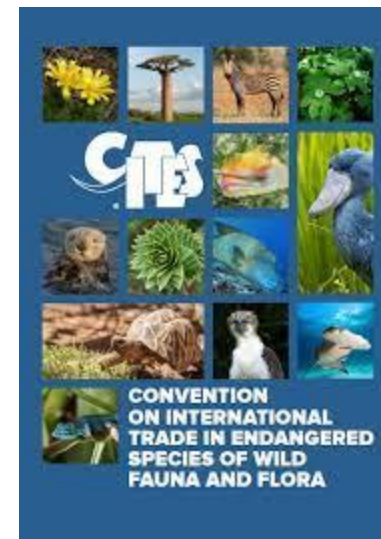


# Main Areas of Environmental Law

- **Protecting Nature and Resources:** Rules to save wildlife, plants, and natural assets like clean water.
- **Fighting Pollution and Managing Trash:** Laws to keep the air and water clean and handle waste properly.
- **Climate Change Laws:** Rules to reduce carbon footprints and deal with global warming.
- **Land Use and Planning:** Rules about where we can build and how we use the land.

# Protecting Nature and Resources

- **Laws to Protect Plants and Animals:** Rules that make it illegal to harm or destroy rare wildlife.
- **Rules for National Parks and Protected Areas:** Laws that decide how we use and look after special nature reserves.
- **Controlling the Sale of Rare Species:** Following international rules (like **CITES**) to stop the illegal trade of endangered animals and plants.



# Pollution Control and Waste Management

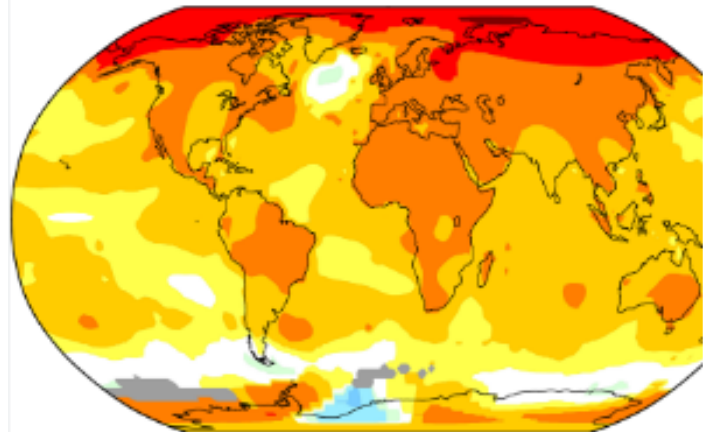
- **Air and Water Quality Regulations:** Statutory standards and monitoring frameworks for aquatic and atmospheric health.
- **Industrial Emission Standards:** Compliance with international protocols (e.g., **EU Industrial Emissions Directives**) to limit the discharge of pollutants.
- **Hazardous Waste Management:** Implementation of protocols for the cross-border movement and disposal of toxic materials (e.g., **Basel Convention** compliance).



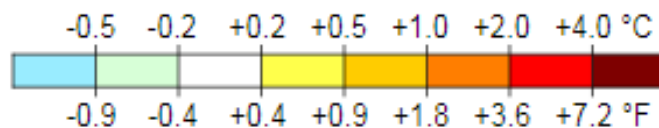
# Climate Change Legislation

- **Energy Transition Acts:** Statutory frameworks promoting renewable energy integration and enhancing energy efficiency standards.
- **Carbon Taxation and Carbon Markets:** Implementation of economic instruments such as the **EU Emissions Trading System (EU ETS)** to internalize the cost of greenhouse gas emissions.
- **Implementation of Paris Agreement Commitments:** National and international legal mechanisms designed to meet **Nationally Determined Contributions (NDCs)** for climate mitigation.

Changement de température lors des 50 dernières années

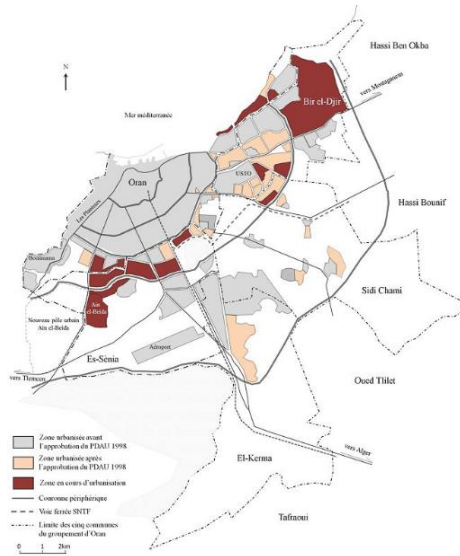


moyenne 2011-2020 vs référence 1951-1980



# Land Use Law and Spatial Planning

- **Sustainable Urban Planning Regulations:** Statutory frameworks and zoning laws designed to promote green infrastructure and reduce urban sprawl.
- **Protection of Sensitive Ecosystems:** Legal safeguards for high-conservation-value areas, including wetlands, primary forests, and coastal zones.
- **Regulatory Frameworks for Extractive Industries:** Oversight and licensing of mining and forestry operations to ensure environmental compliance and restoration.



# Examples of Environmental Laws by Country

- **In France**
- **The Environmental Code:** A big book of rules that brings together all the main laws on protecting nature, managing trash, and using energy.
- **The Climate and Resilience Law (2021):** A law created to lower carbon pollution and help the country deal better with the effects of climate change.



# • In the European Union

- **Water Framework Directive (WFD, 2000):** A legal framework established to ensure the comprehensive protection and sustainable management of water resources across Europe.
- **The European Green Deal (2019):** A strategic roadmap aiming for climate neutrality by 2050, integrating environmental sustainability into all EU policy areas.



- **In the United States**

- **The Clean Air Act (1970):** A comprehensive federal law that regulates air emissions from stationary and mobile sources to ensure ambient air quality standards.
- **The Endangered Species Act (ESA, 1973):** A key statutory framework designed to provide for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

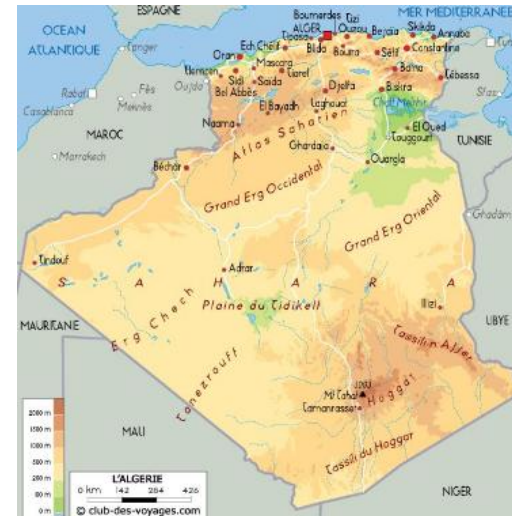


- **At the International Level**

- **Stockholm Convention on Persistent Organic Pollutants (POPs, 2001):** A global treaty aiming to protect human health and the environment from chemicals that remain intact in the environment for long periods.
- **The Paris Agreement (2015):** A legally binding international treaty on climate change, aiming to limit global warming to well below 2, preferably to 1.5 degrees Celsius.
- **The Kyoto Protocol (1997):** An international agreement that committed industrialized countries and economies in transition to limit and reduce greenhouse gas (GHG) emissions.



# Environmental Law in Algeria



- **Algeria** has a well-developed set of laws to protect the environment.
- **These laws** cover many areas, such as saving wildlife, managing waste, fighting pollution, and supporting sustainable development

# General Framework of Environmental Law in Algeria

- The Algerian environmental legislative framework is primarily based on:
- **The Algerian Constitution (Article 19 and Article 68):** The State guarantees the protection of the environment and the preservation of natural resources.
- **Law No. 03-10 of July 19, 2003, relating to Environmental Protection within the Framework of Sustainable Development:** This is the primary framework law (lex generalis) concerning the environment

- **Law No. 11-02 (2011) on Protected Areas**
- Lists the different types of protected lands, such as national parks, nature reserves, and wetlands.
- Sets rules for how to look after and protect these areas.
- **Law No. 07-06 (2007) on Forest Management**
- Sets rules for using forests and works to stop forests from being destroyed (**deforestation**).

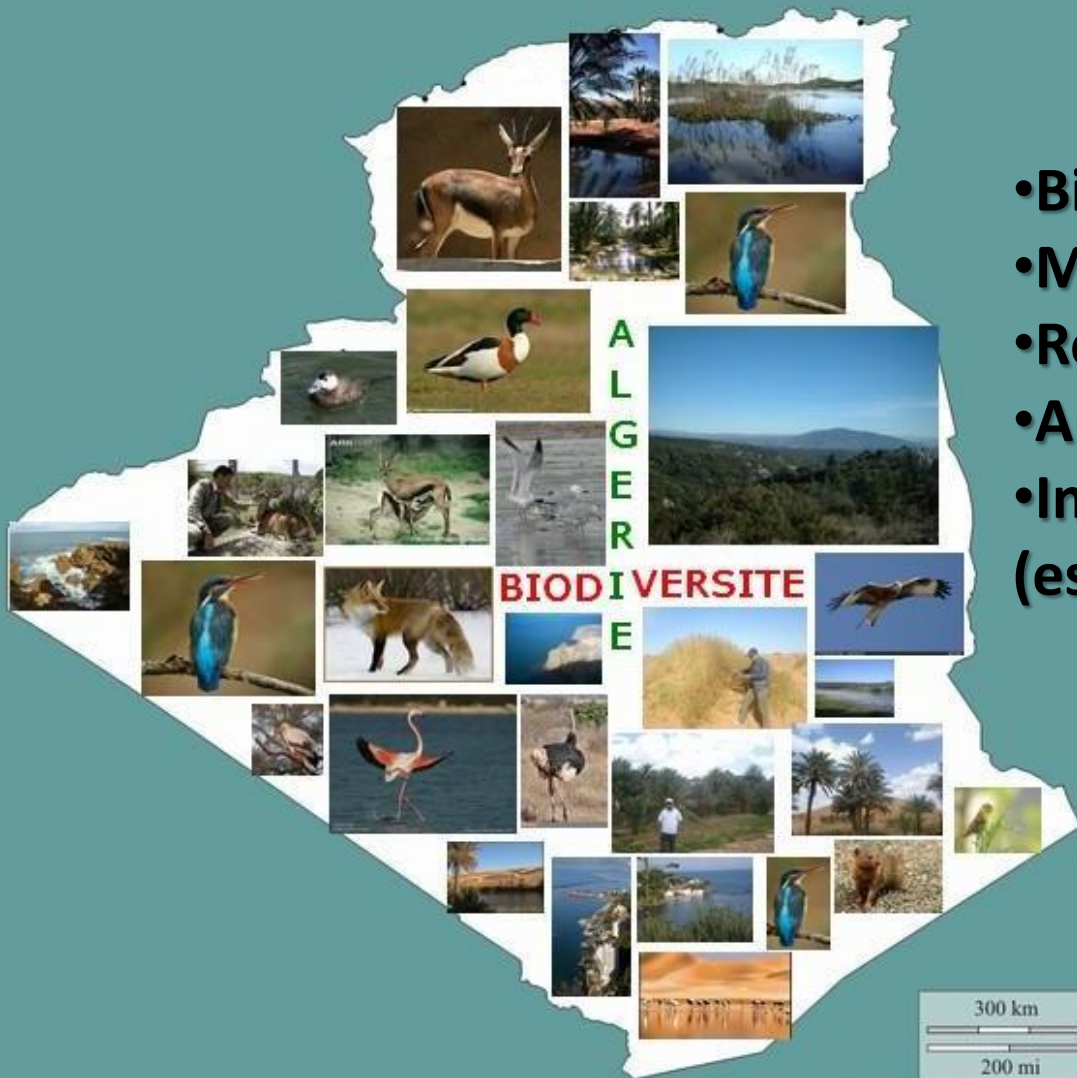
# **Examples of Algerian Environmental Legislation by Sector**

- **Biodiversity and Natural Resource Protection**
- **Law No. 04-20 of December 25, 2004, relating to Major Risk Prevention and Disaster Management**
- This act aims to anticipate and manage both natural and industrial disasters.

- **Executive Decree No. 12-03 of January 4, 2012, on the Conservation of Endangered Animal Species**
- Establishes the official list of **protected species** and regulates the **trade** and trafficking of such fauna.

12	JOURNAL OFFICIEL DE LA REPUBLIQUE ALGERIENNE N° 03	24 Safar 1433 18 janvier 2012
<p><b>Décret exécutif n° 12-03 du 10 Safar 1433 correspondant au 4 janvier 2012 fixant la liste des espèces végétales non cultivées protégées.</b></p> <p style="text-align: center;">-----</p>		
<p>Le Premier ministre,</p> <p>Sur le rapport conjoint du ministre de l'aménagement du territoire et de l'environnement et du ministre de l'agriculture et du développement rural,</p> <p>Vu la Constitution, notamment ses articles 85-3° et 125 (alinéa 2) ;</p> <p>Vu la loi n° 03-10 du 19 Jomada El Oula 1424 correspondant au 19 juillet 2003 relative à la protection de l'environnement dans le cadre du développement durable ;</p> <p>Vu le décret présidentiel n° 10-149 du 14 Jomada Ethania 1431 correspondant au 28 mai 2010 portant nomination des membres du Gouvernement ;</p> <p>Vu le décret exécutif n° 93-285 du 9 Jomada Ethania 1414 correspondant au 23 novembre 1993, complété, fixant la liste des espèces végétales non cultivées protégées ;</p> <p>Après approbation du Président de la République ;</p> <p style="text-align: center;"><b>Décète :</b></p> <p>Article 1er. — En application des dispositions de l'article 41 de la loi n° 03-10 du 19 Jomada El Oula 1424 correspondant au 19 juillet 2003, susvisée, le présent décret a pour objet de fixer la liste des espèces végétales non cultivées protégées.</p> <p>Art. 2. — Sont considérées comme non cultivées protégées les espèces végétales qui n'ont pas subi de modification par sélection de la part de l'Homme et qui :</p>		

# 16,000 identified animal species



- Birds (Avifauna): ~**465** species
- Mammals: ~**107 to 108** species
- Reptiles: ~**70 to 90** species
- Amphibians: ~**15 to 17** species
- Insects & Invertebrates: ~**20,000** (estimated)

## ■ **Pollution Control and Waste Management**

- **Law No. 01-19 of December 12, 2001, relating to waste management, control, and disposal**
  - **Regulates** the collection, transport, and treatment of waste.
  - **Encourages** waste recycling and recovery (valorization).
- **Executive Decree No. 06-104 of February 28, 2006, regarding hazardous waste**
  - **Defines** the categories of hazardous waste and sets treatment standards.
- **Law No. 05-12 of August 4, 2005, on Water**
- **Provides a framework** for the management of water resources and their protection against pollution.
- **Establishes penalties** for the illegal discharge of pollutants into watercourses and groundwater (aquifers).
- **Executive Decree No. 07-144 of May 19, 2007, relating to air quality**
- **Sets atmospheric pollution standards** for the industrial and transport sectors.



**Algeria consumes nearly seven (7) billion plastic bags per year.**

# selective sorting



# Sustainable Alternatives (Back to Tradition)



# ■ **Energy and Climate Legislation**

- **Law No. 99-09 of July 28, 1999, on Energy Management**
  - Promotes energy efficiency and renewable energy.
- **Law No. 02-01 of February 5, 2002, relating to Electricity and Gas Distribution**
  - Introduces measures to promote renewable energy sources.
- **Law No. 04-09 of August 14, 2004, relating to the Promotion of Renewable Energy**
  - Sets development targets for clean energy (solar, wind, etc.).
- **Executive Decree No. 15-319 of December 13, 2015, on Greenhouse Gas Emissions**
  - Establishes a system for monitoring and reducing industrial emissions.

## ▪ **Land Use and Urban Planning**

- **Law No. 90-29 of December 1, 1990, relating to Land Use and Urban Planning**
  - Regulates land use to prevent the destruction of sensitive ecosystems.
- **Executive Decree No. 07-167 of June 4, 2007, on Environmental Impact Assessment (EIA)**
  - Mandates an impact assessment for projects with a potential environmental impact.
- **Executive Decree No. 10-83 of March 10, 2010, on Coastal Protection**
  - Regulates the development of coastal areas to prevent the degradation of marine ecosystems.

# Challenges and Perspectives of Environmental Legislation

- **Current Challenges:**
- **Inconsistent enforcement** of laws across different countries.
- **Economic pressures** and conflicts with industrial development.
- **Rapidly evolving** environmental threats (plastic pollution, the impact of AI on the environment, etc.).

# CHALLENGES AND PERSPECTIVES OF ENVIRONMENTAL LEGISLATION / DÉFIS ET PERSPECTIVES DE LA LÉGLISATION ENVIRNEMEMENALE

## CURRENT CHALLENGES DÉFIS ACTUELS



Inconsistent enforcement of laws  
Application incohérente des lois



Economic pressures  
Pressions économiques



Rapidly evolving environmental threats  
Menaces en évolution rapide

## FUTURE PERSPECTIVES PERSPECTIVES D'AVENIR



Global cooperation  
Cooepration mondiale



Sustainable innovation  
Innovation durable



Adaptive legal frameworks  
Cardes jursiqus adatativs



## Perspectives ( Outlook):

- **Strengthening** monitoring mechanisms and sanctioning powers.
- **Greater integration** of environmental law into economic policies.
- **Development** of international environmental law.

# Challenges of Environmental Legislation in Algeria

- **Current Challenges:**
- **Incomplete enforcement** of laws due to a lack of resources.
- **Industrial and economic pressure** on the environment.
- **Issues with awareness** and environmental education.

# Perspectives for Environmental Legislation in Algeria

## Outlook for Improvement:

- **Strengthening sanctions** for environmental offenses.
- **Promoting the green economy** and sustainable development.
- **Encouraging public-private partnerships (PPPs)** for environmental management.

# International Conventions



# International Conventions

There are several major international conventions aimed at protecting the environment. They cover various fields such as biodiversity, climate, pollution, and ecosystems. Here are some of the most significant ones:

## 1. Biodiversity and Ecosystem Conventions

- *Exemple : Convention on Biological Diversity (CBD).*
- *Exemple : Ramsar Convention (Wetlands).*

## 2. Climate and Air Pollution Conventions

- *Exemple : United Nations Framework Convention on Climate Change (UNFCCC).*
- *Exemple : Paris Agreement.*

## 3. Oceans and Marine Environment Conventions

- *Exemple : United Nations Convention on the Law of the Sea (UNCLOS).*
- *Exemple : Barcelona Convention (Mediterranean protection).*

## 4. Waste and Chemical Product Conventions

- *Exemple : Basel Convention (Hazardous Waste).*
- *Exemple : Stockholm Convention (Persistent Organic Pollutants).*

# Biodiversity and Ecosystem Conventions



- **Convention on Biological Diversity (CBD) – 1992**
- **Ramsar Convention on Wetlands – 1971**
- **Bonn Convention (CMS) – 1979**
- **CITES – 1973**

## ■ **Convention on Biological Diversity (CBD) – 1992**

- **Signed at:** The Rio "Earth Summit."
- **Objective:** Conservation of biodiversity, sustainable use, and the fair and equitable sharing of genetic resources.

## ■ **Ramsar Convention on Wetlands – 1971**

- **Objective:** Protection and "wise use" of wetlands of international importance.
- **Note:** In English legal texts, *utilisation rationnelle* is almost always translated as "**wise use**" (a specific Ramsar term).

## ■ **Bonn Convention (CMS) – 1979**

- **Convention on the Conservation of Migratory Species of Wild Animals.**
- **Objective:** Protection of migratory species across their entire range.

## ■ **CITES – 1973**

- **Convention on International Trade in Endangered Species of Wild Fauna and Flora.**
- **Signed in:** Washington, D.C.
- **Objective:** To regulate international trade in endangered species of fauna and flora to ensure their survival.

# Ramsar Convention on Wetlands



## Ramsar Convention on Wetlands

**Official name:** *Convention on Wetlands of International Importance especially as Waterfowl Habitat.*

**Adoption:** **2 February 1971**, in Ramsar, Iran.

**Entry into force:** **1975.**

**Number of Contracting Parties (signatory countries):**  
172 countries worldwide.

The Convention provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources

## **Objective of the Ramsar Convention:**

To ensure the conservation and the wise (sustainable) use of wetlands through local and national actions, as well as international cooperation, in order to contribute to sustainable development.

# What is a Wetland?

According to the Ramsar Convention, wetlands include:

- Marshes, swamps, and peatlands
- Lakes, rivers, and deltas
- Lagoons, estuaries, and mangroves
- Shallow coastal areas ( $\leq 6$  meters deep at low tide)
- Certain artificial sites (such as dams and rice fields)
- Wetlands may be natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salty



# Conventions on Climate and Air Pollution



- **United Nations Framework Convention on Climate Change (UNFCCC) – 1992**
- **Vienna Convention (1985) and Montreal Protocol (1987)**
- **Geneva Convention (1979) on Long-Range Transboundary Air Pollution**

- **United Nations Framework Convention on Climate Change (UNFCCC) – 1992**
  - **Objective:** To reduce greenhouse gas emissions.
  - → **Kyoto Protocol (1997):** Sets binding reduction targets for industrialized countries.
  - → **Paris Agreement (2015):** Aims to limit global warming to well below 2°C.
- **Vienna Convention (1985) and Montreal Protocol (1987)**
  - **Objective:** Protection of the ozone layer by phasing out ozone-depleting substances.
- **Geneva Convention (1979) on Long-Range Transboundary Air Pollution**
  - **Objective:** To reduce large-scale air pollutants.

# Conventions on Oceans and Marine Environments



- **United Nations Convention on the Law of the Sea (UNCLOS) – 1982**
- **London Convention (1972) on the Prevention of Marine Pollution by Dumping of Wastes**
- **MARPOL Convention (1973/78) – London**

## ■ **United Nations Convention on the Law of the Sea (UNCLOS) – 1982**

- **Signed in:** Montego Bay, Jamaica.
- **Objective:** To regulate the use of seas and oceans and to protect marine resources.
- *Note : Souvent appelée la "Constitution des océans".*

## ■ **London Convention (1972) on the Prevention of Marine Pollution by Dumping of Wastes**

- **Objective:** To reduce marine pollution caused by the dumping of harmful substances.
- *Précision : Le terme "dumping" est le terme juridique consacré pour le rejet ou l'immersion de déchets en mer.*

## ■ **MARPOL Convention (1973/78) – London**

- **International Convention for the Prevention of Pollution from Ships.**
- **Objective:** To combat marine pollution caused by ships (oil, hydrocarbons, and toxic substances).

# Conventions on Waste and Chemical Products



- **Basel Convention (1989) – Switzerland**
- **Rotterdam Convention (1998) – Netherlands**
- **Stockholm Convention (2001) – Sweden**

- **Basel Convention (1989) – Switzerland**

- **Objective:** Control of transboundary movements of hazardous wastes and their disposal.
- *Note : Cette convention vise à empêcher l'exportation de déchets toxiques des pays développés vers les pays en développement.*

- **Rotterdam Convention (1998) – Netherlands**

- **Objective:** Regulation of the international trade of hazardous chemicals.
- **Key Mechanism:** Prior Informed Consent (PIC) — l'obligation d'obtenir un consentement préalable avant l'importation.

- **Stockholm Convention (2001) – Sweden**

- **Objective:** Elimination of **Persistent Organic Pollutants (POPs)**.
- *Précision : Les POP sont des substances chimiques qui restent dans l'environnement pendant de longues périodes et s'accumulent dans les tissus gras des organismes vivants.*



Abdelhafid Bousouf University – Mila

جامعة عبد الحفيظ بوالصوف – ميلانة

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Department of Ecology and Environmen

قسم علم البيئة والمحيط

Third Year – Agroecology

السنة الثالثة زراعة وبيئة

# PROTECTION OF BIOLOGICAL ENTITIES

## PROTECTION DES ENTITÉS BIOLOGIQUES

Dr.REBBAH Abderraouf Chouaib

2024-2025

# CHAPTER 3: BIODIVERSITY AND ANTHROPOGENIC ACTIVITY

## CHAPTER 3: BIODIVERSITY AND ANTHROPOGENIC ACTIVITY

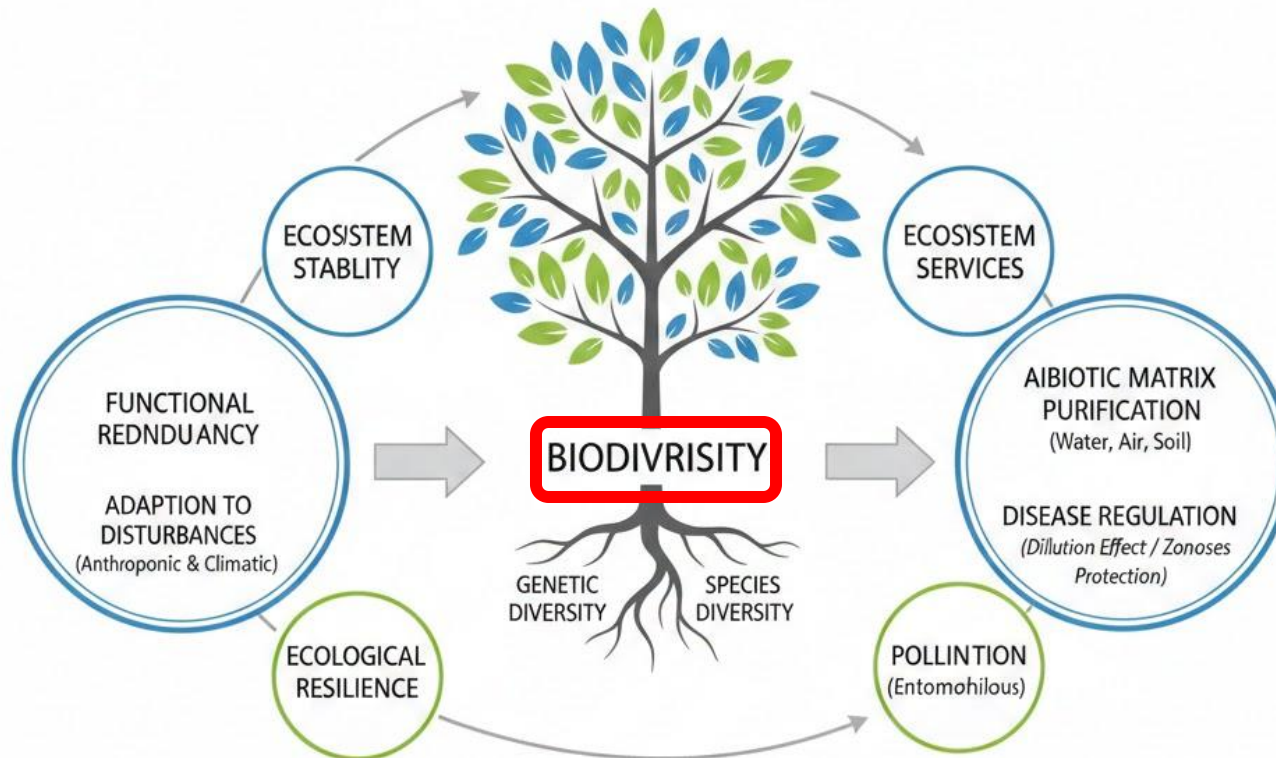


BIODIVERSITY

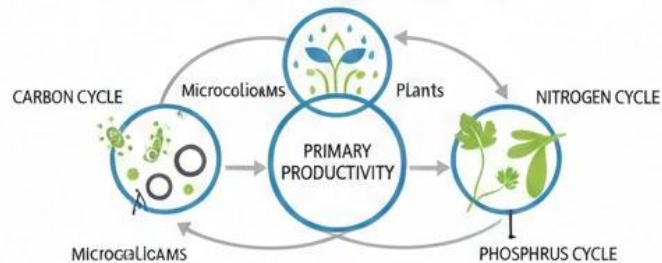
- "**Biodiversity is the diversity of living beings at all levels of biological organization: genetic, species, and ecosystems.** It ensures the functioning of **ecosystems** and the maintenance of ecosystem services. However, the intensification of **human activities (or anthropogenic activity)** is profoundly altering natural ecosystems and threatening biological entities.
- This chapter **aims to understand the interactions between biodiversity and human activities**, the pressures exerted on natural environments, and the means of reconciling human development with biodiversity protection, particularly within an agro-ecological context."

# Importance of biodiversity

- From a scientific perspective, **biodiversity and its constituent biological entities form the fundamental infrastructure of the biosphere**, ensuring the **functional stability** of **ecosystems** through complex regulatory processes. Each entity, from decomposing microorganisms to apex predators, plays a specific role in biogeochemical cycles (carbon, nitrogen, and phosphorus fluxes) and the maintenance of primary productivity.
- This specific and genetic diversity ensures ecological resilience, allowing natural systems to adapt to anthropogenic and climatic disturbances through functional redundancy. Beyond their intrinsic value, these biological interactions provide vital ecosystem services, such as the purification of abiotic matrices (water, air, soil), entomophilous pollination, and protection against the emergence of zoonoses via the dilution effect. Consequently, the long-term sustainability of human societies is inextricably linked to the preservation of the integrity of the living world



**BIOGEOCHEMICAL CYCLES**



**LONG-TERM SUSTAINABILITY OF HUMAN SOCIETIES**

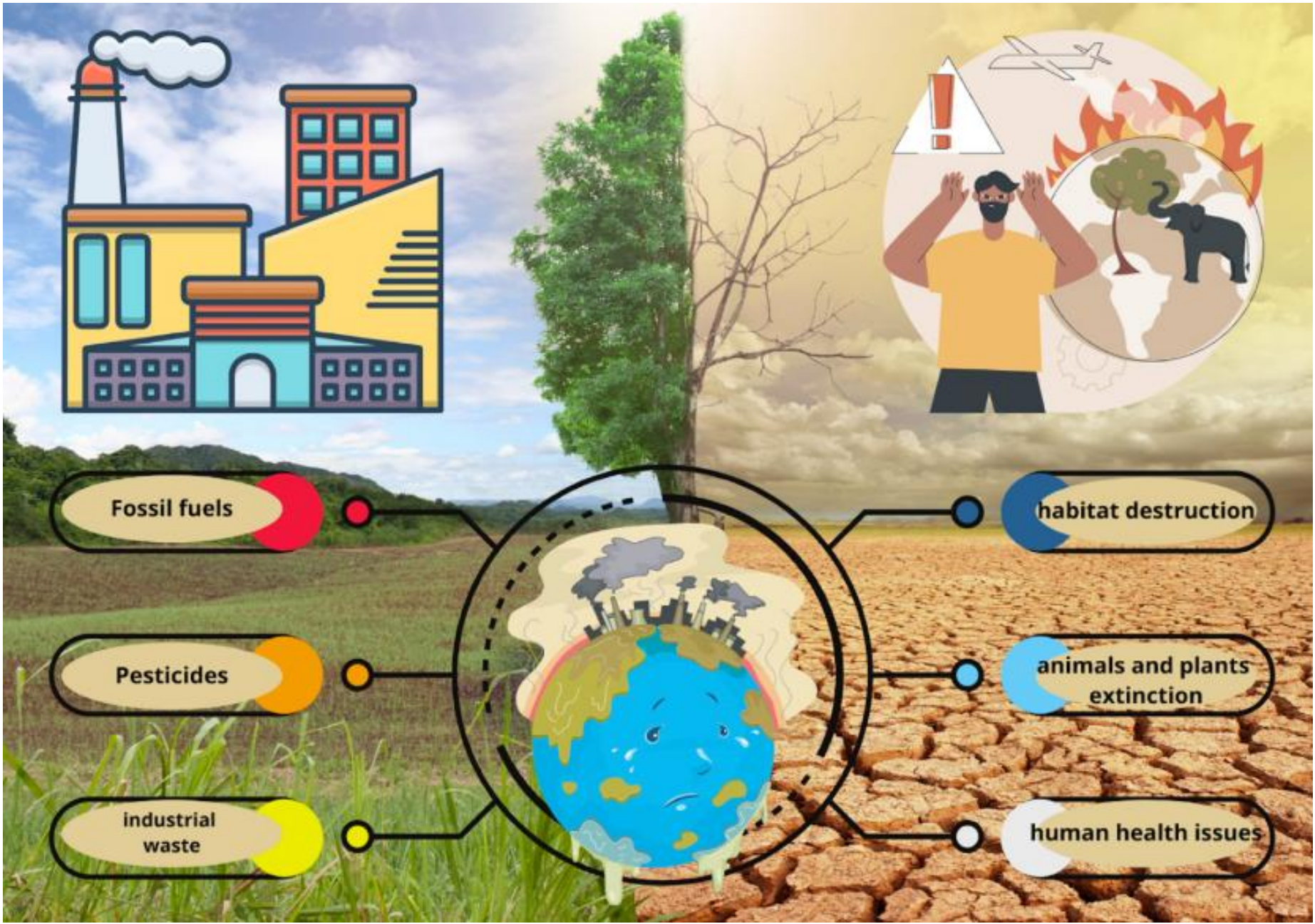
PRESERVATION OF THE LIVING WORLD'S INTEGRITY = HUMAN FUTURE

# Ecological role and benefits to humanity

- **Maintenance of ecosystem services:** air and water purification, pollination, climate regulation.
- **Sources and resources:** food, medicine, materials...
- **Cultural and educational value.**

# ***Anthropogenic activity ?***

- "Anthropogenic activity" is a fancy way of saying "**human-made.**" It refers to any process, impact, or change that originates from human actions rather than natural cycles.
- While the term is often used in a negative context (**like pollution**), it technically covers everything from the Great Wall of China to the carbon footprint of your morning toast.



Fossil fuels

Pesticides

Industrial waste



Habitat destruction

Animals and plants extinction

Human health issues

# Anthropogenic Activity

- **Definition**

Anthropogenic activity encompasses all human actions that have an impact on the environment.

It refers to the entirety of human actions and interventions that exert a direct or indirect influence on natural environments.

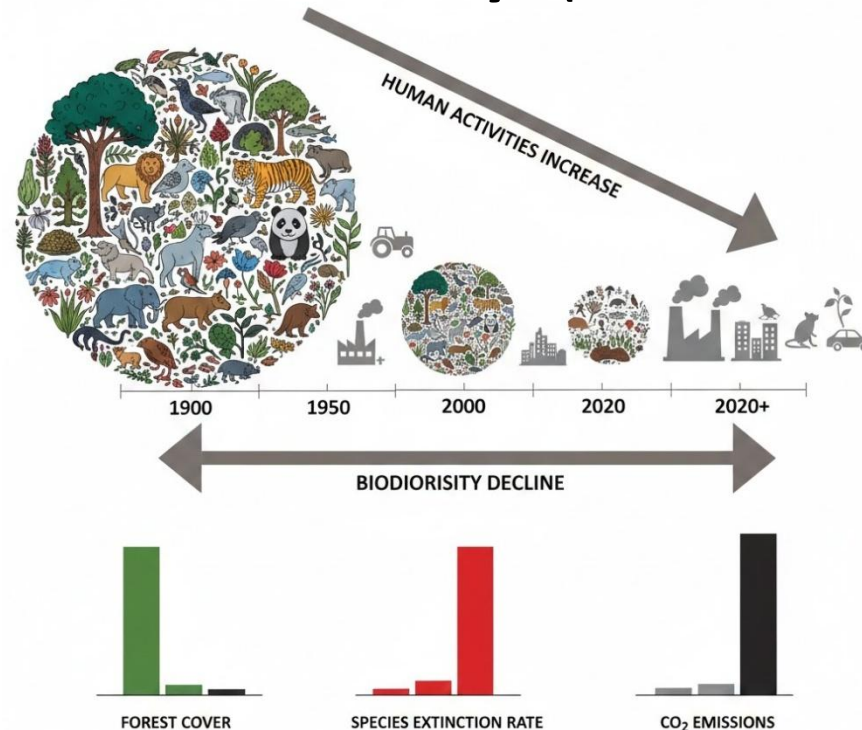
This includes economic, industrial, agricultural, urban, and cultural practices that modify terrestrial and aquatic ecosystems. The term originates from the Greek ***anthropos*** (man) and refers to the influence of human beings on their surroundings.

# Main forms of human activities impacting biodiversity

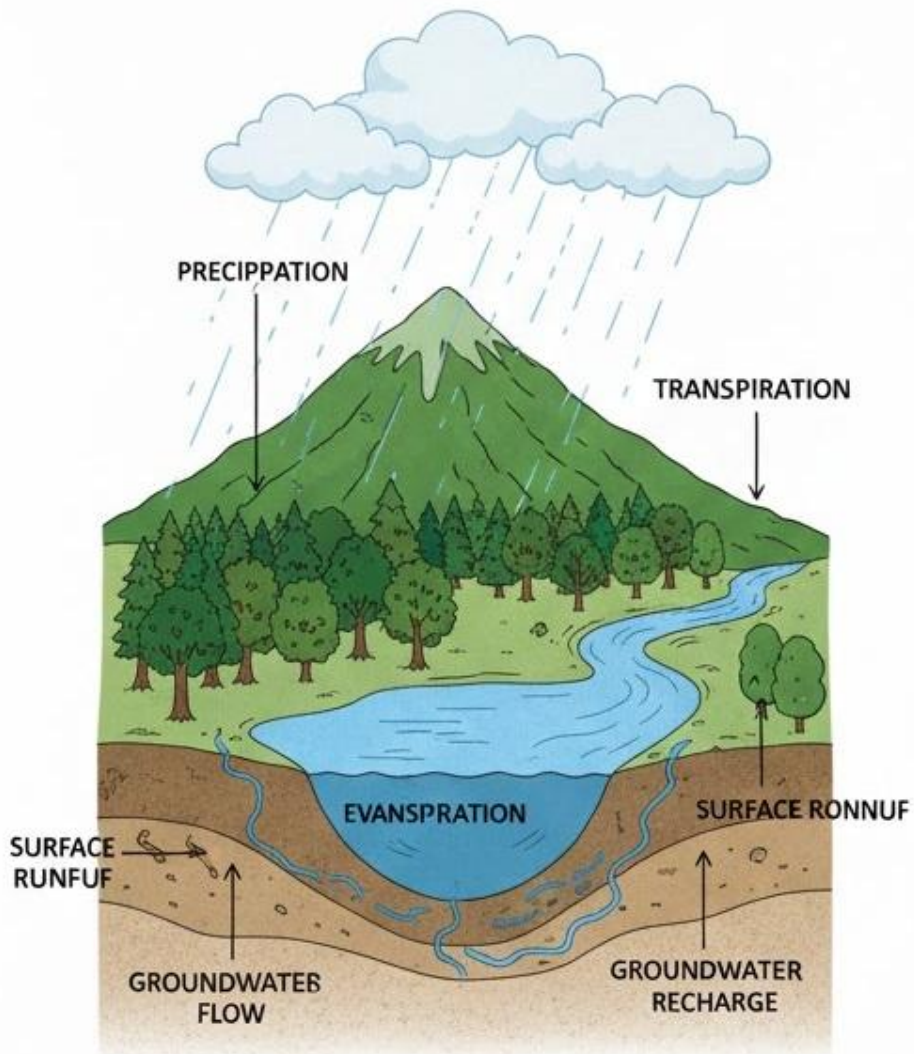
- 1. Intensive agriculture:** use of fertilizers and pesticides, monocultures, and habitat fragmentation.
- 2. Urbanization and infrastructure:** soil sealing (artificialization), fragmentation of ecosystems.
- 3. Deforestation:** habitat loss and species extinction.
- 4. Pollution:** water, air, and soil pollution.
- 5. Overexploitation of natural resources:** overfishing, hunting, and excessive harvesting.
- 6. Climate change:** driven by greenhouse gas emissions.
- 7. Invasive alien species:** introduced directly or indirectly by human activity.

# Consequences of Human Activity on Biodiversity

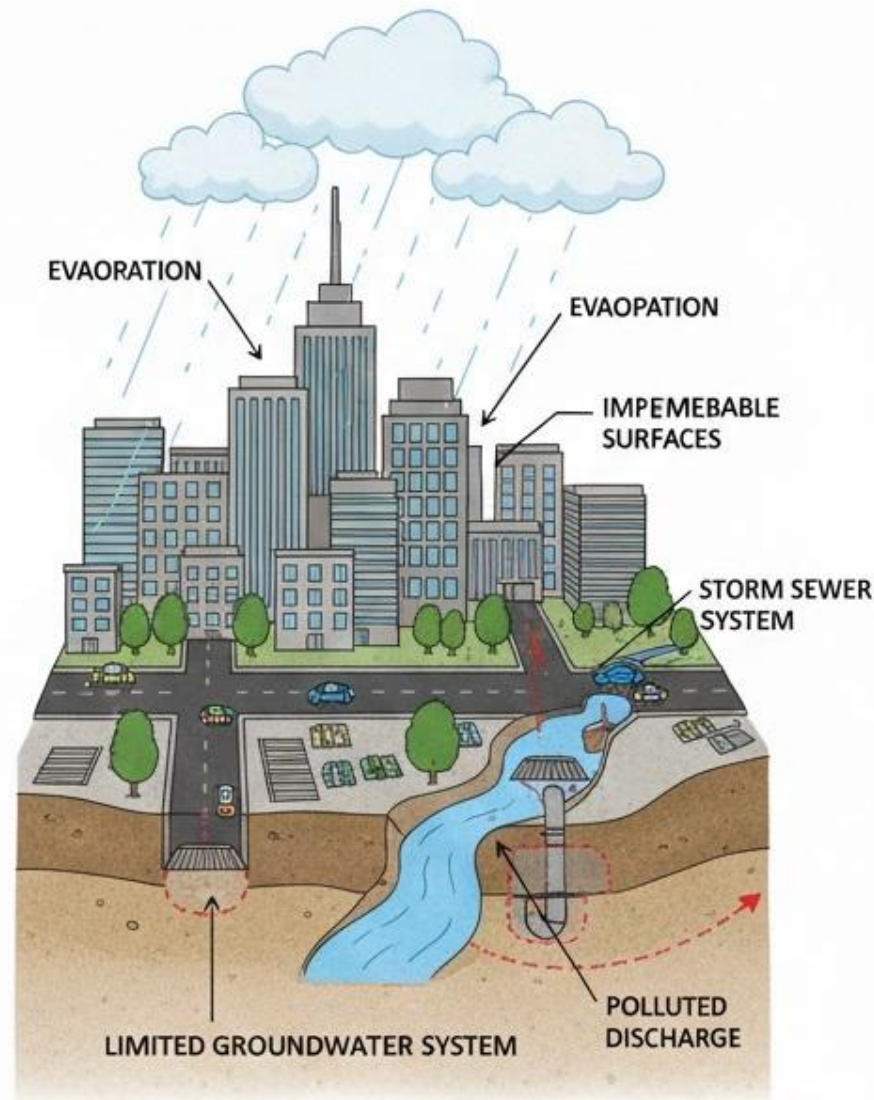
- **Reduction of biological diversity (Biodiversity loss)**
  - **Species extinction:** loss of animal and plant species.
  - **Reduction of genetic variability:** (or Decreased genetic diversity).



# NATURAL ENVIRONMENT



# URBAN ENVIRONMENT



## ▪ **Habitat Degradation**

- **Loss and fragmentation of natural environments: (or Habitat loss and fragmentation).**
- **Alteration of aquatic and terrestrial ecosystems.**

## ▪ **Disruption of Ecological Balances**

- **Loss of key links in trophic chains: (or Disappearance of specific trophic levels).**
- **Imbalance in ecological interactions: (pollination, predation, parasitism, etc.).**

# Socio-economic Consequences

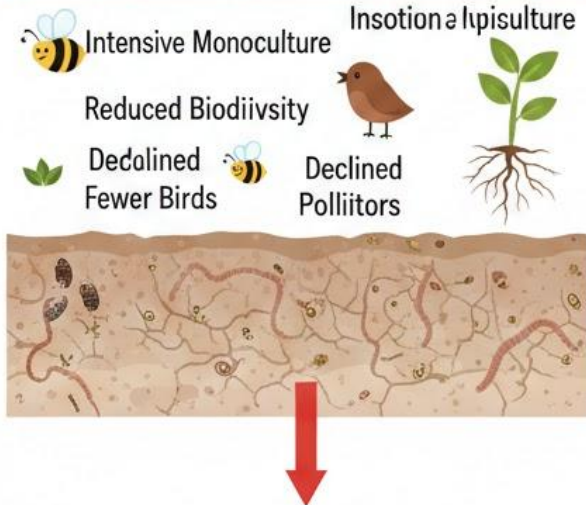
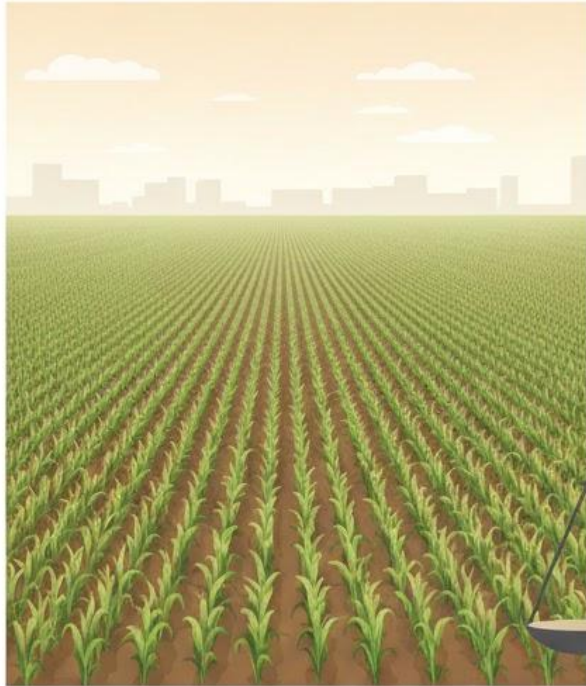
- **Decline in ecosystem services** (drinking water, clean air, pollination).
- **Threats to food and water security.**
- **Displacement of populations** (climate refugees).
- **Conflicts over land use and inequalities in access to natural resources.**

# Case Studies: Anthropogenic Impacts in Agro-ecological Contexts

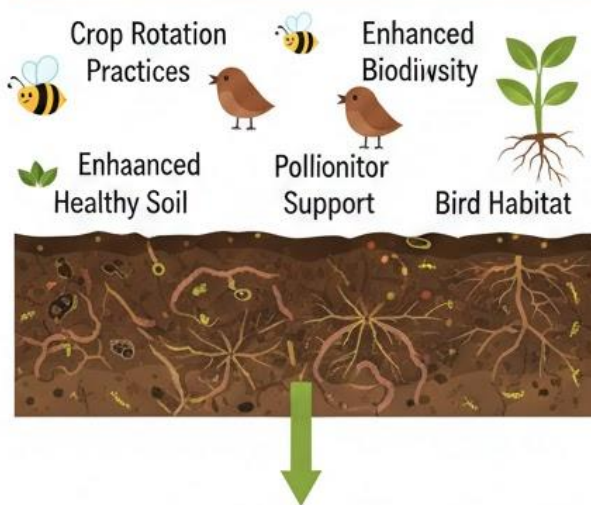
- **A. Conventional Agriculture vs. Agro-ecological Agriculture (Organic Farming)**
- **Intensive monoculture** reduces biodiversity (soil health, pollinators, birds, etc.).
- **Agro-ecology** promotes sustainable practices: crop rotation, intercropping (crop associations), and agroforestry.

# ANTHROPGENIC IMPACTS IN AGRO-ECOLOGICAL CONTEXTS

A. Conventional Agriculture



B. Agro-ecological Agriculture (Organic Farming)



- **B. Example: Impact of Pesticides on Pollinating Insects**
- **Decline of bees and other pollinators due to neonicotinoids.**
- **Repercussions on agricultural production and the reproduction of flowering plants.**

B. Healthy Ecosystem



High Agricultural Production & Plant  
Abundant Pollinators  
High Agricultural & Plant Reproduction



B. Pesticide-Affected Ecosystem



Decline of Bees & Other Pollinators  
Reduced Agricultural & Plant Reproduction  
Enhanced Agrndlivsity  
Declined Support Sol



- **Neonicotinoids** are a family of **systemic insecticides** that are chemically related to nicotine.
- These pesticides are used in agriculture to control **pests** (such as aphids, whiteflies, beetles, etc.).
- **How do they work?**
- They act on the insect's **nervous system** by binding to **nicotinic acetylcholine receptors**, which leads to:
- **Paralysis**
- Followed by the **death of the insect**
- They are described as **systemic** because the plant absorbs the product (through the roots or leaves), and it circulates throughout the entire plant (**sap, leaves, flowers, pollen**).

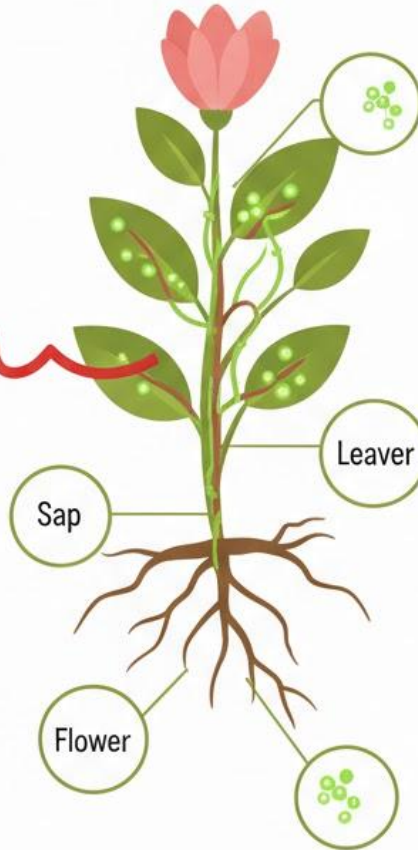
# MECHANISM OF SYSTEMIC NEONICTINOID WORK

## 1. Plant Absorption

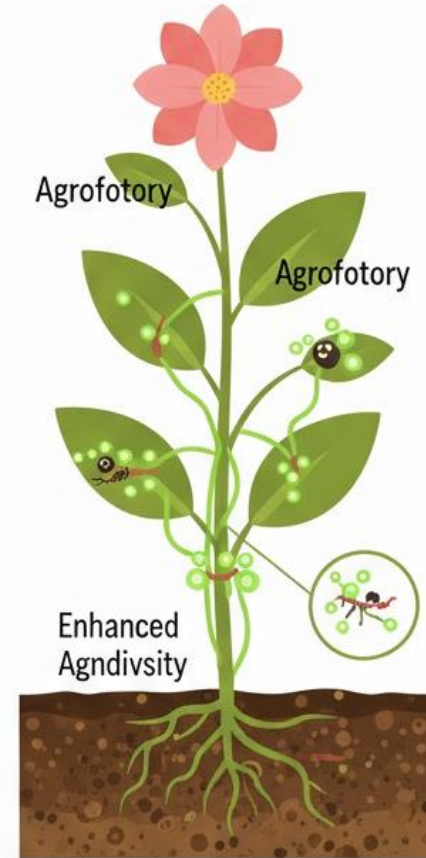


## 2. Systemic Circulation

Absorbed by roots/leaves, circulates throughout the plant (sap, leaves, flowers, pollen)



## 3. Impact on Insect



Used to control pests  
pests (aphids weistes  
Paralasis – etc.)

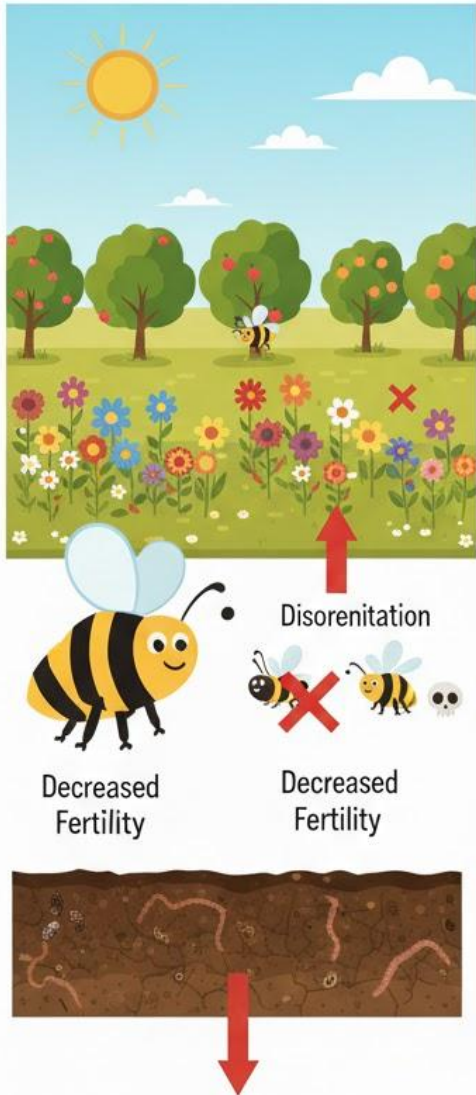


## Environmental Issues

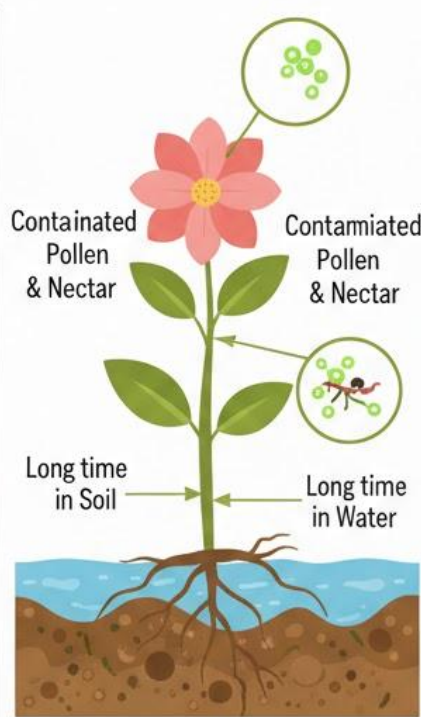
- They are highly controversial because:
- **They affect bees and other pollinators** (disorientation, decreased fertility, and mortality).
- **They persist for a long time** in the soil and water.
- **They can contaminate pollen and nectar.**
- For this reason, several neonicotinoids are **banned or restricted** in certain countries, though some remain authorized under specific conditions.

# ENVIRONMENTAL ISSUES OF NEONICOTINOIDS

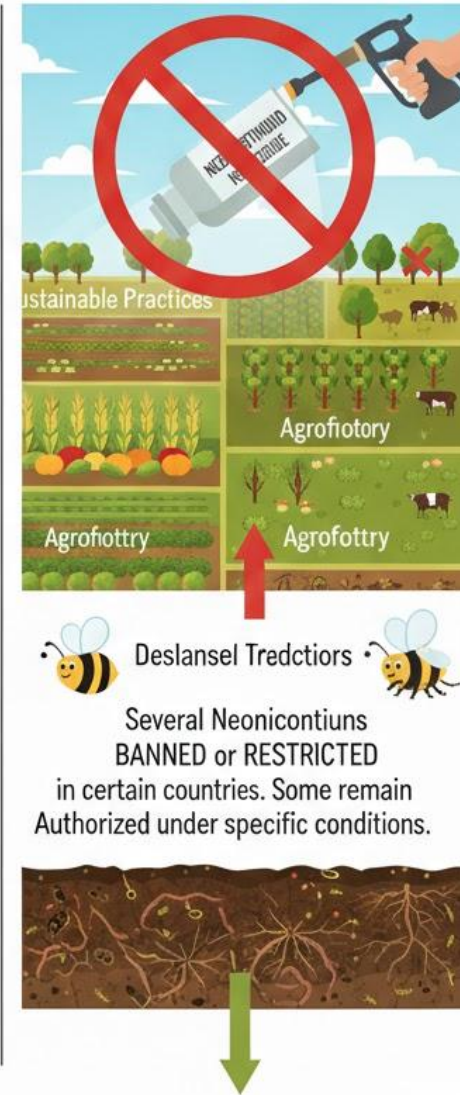
## 1. Affect Pollinators



## 2. Persistence & Contamination



## 3. Bans & Restrictions



CONTROVERSIAL DUE TO WIDE-RANGING ECOLOGICAL HARM

# Protection and Sustainable Management Strategies

## ■ A. Protected Areas and Ecological Corridors

- Establishing **nature reserves** and **national parks** to preserve core habitats.
- Creating **ecological corridors** (wildlife corridors) to allow species to move between fragmented habitats, ensuring genetic diversity.

## ■ B. Best Agricultural Practices

- **Reducing chemical inputs** by transitioning to integrated pest management (IPM) or organic farming.
- Implementing **hedgerows** and **buffer strips** to provide refuge for pollinators.
- Promoting **soil conservation** techniques (no-till, cover cropping) to maintain underground biodiversity.

## ■ C. Awareness, Education, and Environmental Policies

- **Public awareness campaigns** to educate citizens on the importance of biodiversity.
- **Environmental education** in schools to foster a "green" mindset in future generations.
- **Strengthening international and local policies** (e.g., the Green Deal, pesticide regulations, and subsidies for eco-friendly farming).

# Effects of Human Activity on Biological Entities

## ○ Major Negative Pressures

- **Habitat destruction** (deforestation, urbanization) → fragmentation and isolation of populations.
- **Soil, air, and water pollution** → toxicity for living organisms (death, sterility, mutations).
- **Overexploitation of species** → decline or extinction (overfishing, hunting, excessive logging).
- **Introduction of invasive alien species** → competition with and predation on local species.
- **Climate change** → shifting ranges, thermal stress, and phenological desynchronization.

# Impacts across different biological levels

- The human impact on the living world is profound and multidimensional. In ecology and toxicology, we often refer to a "**biological cascade**": a disruption at the microscopic level (genes) eventually destabilizes entire systems (ecosystems).

Level	Unit of Impact	Main Consequence
Molecular	DNA / Proteins	Altered biological blueprints
Organism	Single living being	Impaired health and survival
Population	Group of one species	Reduced resilience and numbers
Community	Interacting species	Disrupted food webs
Ecosystem	Living & Non-living	Loss of life-support functions

# Molecular and Genetic Level

## (The Gene)



- At the DNA scale, human impact alters the "blueprints" of life.
- **Mutagenesis:** Exposure to chemical pollutants (pesticides, heavy metals) and radiation causes genetic mutations.
- **Erosion of Genetic Diversity:** Habitat fragmentation isolates groups, leading to **inbreeding** and reducing the adaptive capacity of species in the face of climate change.
- **Anthropogenic Selection:** The intensive use of antibiotics or herbicides creates a selective pressure that promotes the emergence of **resistance genes** (superbugs, resistant weeds).

# Genetic mutations.



*The camouflage and adaptations of animals help them survive in their environment.*

# Organismal Level (The Individual)

This is where direct physiological and behavioral effects are observed.

- **Endocrine Disruption:** Certain chemicals (bisphenols, phthalates) mimic hormones, leading to genital malformations or decreased fertility.
- **Physiological Stress:** Noise and light pollution alter sleep, nutrition, and reproductive cycles.
- **Bioaccumulation:** An individual absorbs toxins that it cannot eliminate, which can lead to chronic pathologies or death.

# IMPACT DE LA POLLUTION SONORE AÉROPORTAIRE SUR LES VACHES LAITIÈRES



Augumntation du  
Bruit (Avions)



Augumetation du  
du Stress des  
Vaches Laitières

Dimiintion de la  
Production de  
Lait



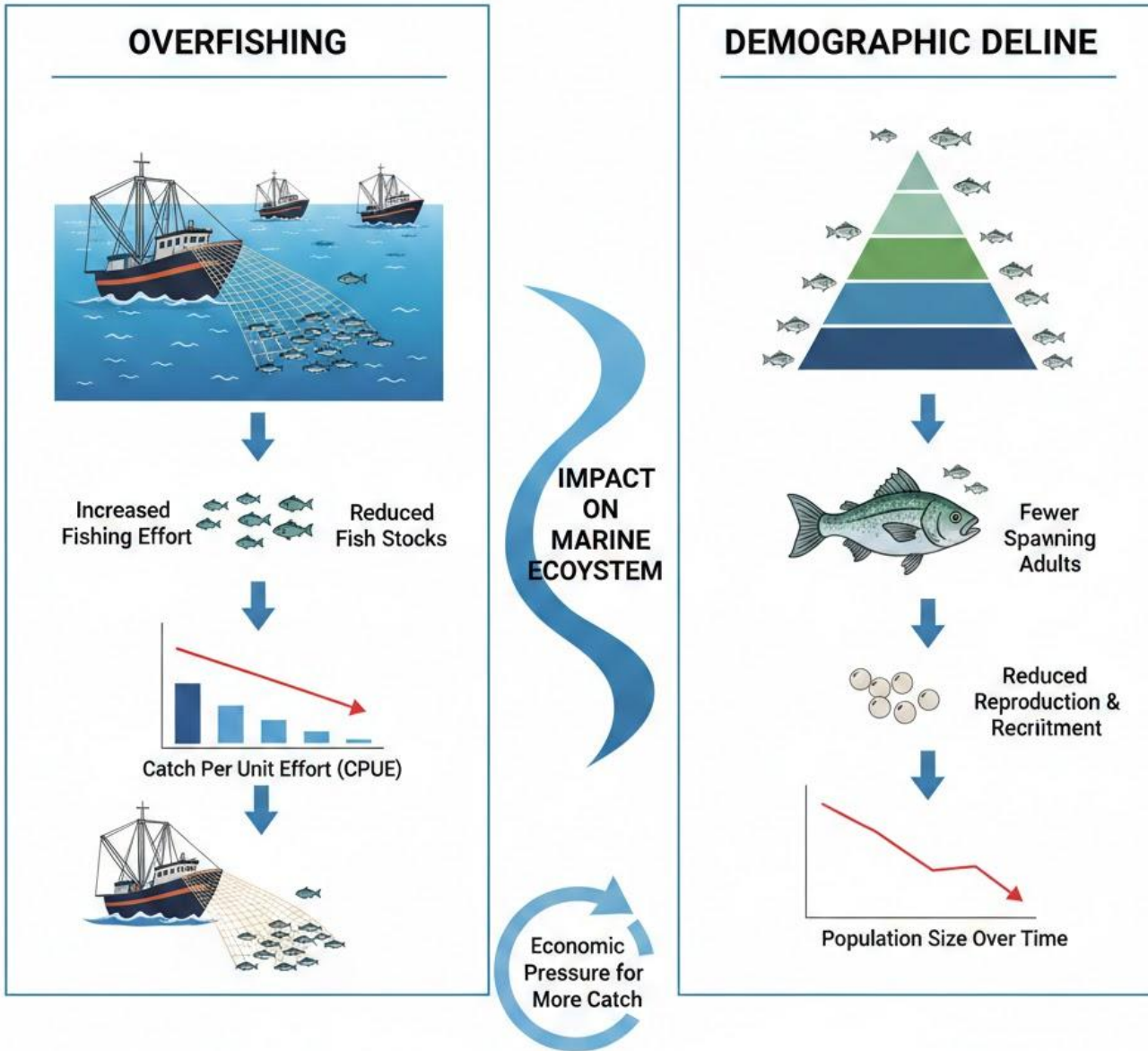
**Physiological Stress**

Pollution Sonore (Aéroports) → Stress Accru → Baisse de la Production Laitière

# Population Level

A population is a group of individuals of the same species living in a given area.

- **Demographic Decline:** Overexploitation (overfishing, poaching) reduces the number of individuals below the **natural replacement threshold**.
- **Skewed Ratios:** Climate change can influence the sex of newborns in certain species (such as sea turtles, whose sex depends on sand temperature), threatening the long-term survival of the population.



**OVERFISHING & DEMOGRAPHIC DECLINE:  
A VICIOUS CYCLE**

# Community Level

A community comprises all populations of different species interacting in the same location.

- **Invasive Species:** The intentional or accidental introduction of species by humans (e.g., the Asian hornet) destabilizes local interactions (predation, competition).
- **Biotic Homogenization:** "Generalist" species (which adapt everywhere) replace "specialist" species, making ecosystems worldwide increasingly similar and fragile.
- **Breakdown of Symbiosis:** **Coral bleaching** is the classic example of a broken relationship between two species (coral and algae) due to warming waters.



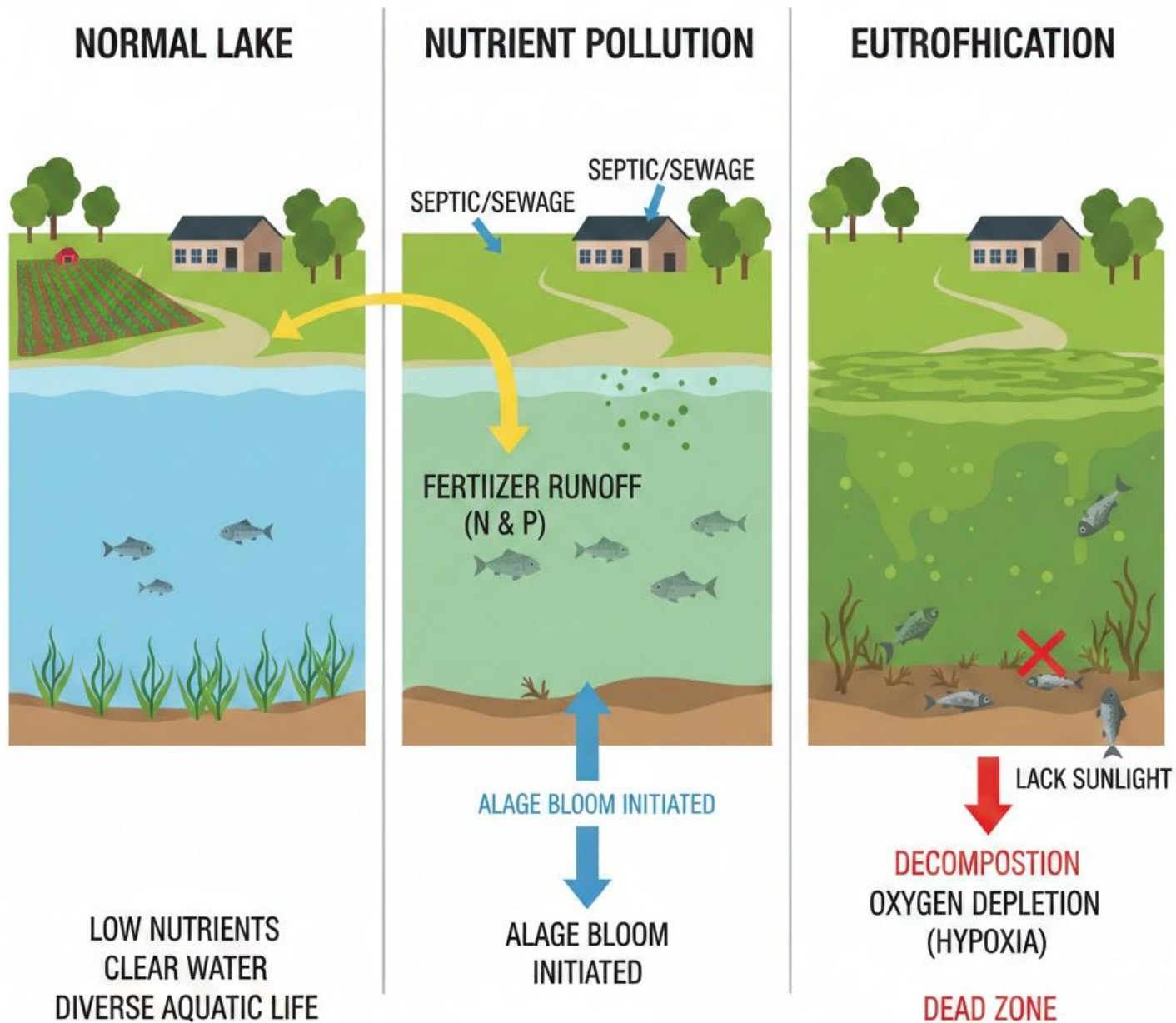
**"Generalist"** species (which adapt everywhere) replace **"specialist"** species

# Ecosystem Level

This is the most complex level, including living beings and their physico-chemical environment.

- **Alteration of Biogeochemical Cycles:** Excess nitrogen and phosphorus (fertilizers) cause the **eutrophication** of lakes and coastal areas, creating oxygen-depleted "**dead zones**."
- **Habitat Loss and Fragmentation:** Urbanization and deforestation transform continuous ecosystems into disconnected "islands," unable to regulate local climate or filter water.
- **Degradation of Ecosystem Services:** Global degradation reduces nature's capacity to provide us with clean air, food, and protection against natural disasters.

# EUTROPHICATION CYCLE



# Human use of biological entities

- Human use of biological entities (biodiversity) refers to the various ways in which humans exploit living organisms (plants, animals, microorganisms) and ecosystems to meet their needs. This use can be either direct or indirect:
  - **Food and Nutritional Use**
  - **Medicinal and Pharmaceutical Use**
  - **Industrial and Economic Use**
  - **Ecosystem Services (Indirect Use)**
  - **Cultural and Social Use**

# Using Biological Entities as Bioindicators

- The use of biological entities as **bioindicators** is a practical and effective method for assessing environmental health. Rather than solely measuring **physico-chemical parameters** (such as pH or nitrate levels), we observe the response of living organisms, which act as a true "mirror" of both past and present pollution.

# What is a Bioindicator?

- A **bioindicator** is an organism (animal, plant, microorganism) or a group of organisms whose status, behavior, or presence allows for the characterization of an ecosystem's health. There are generally two distinct approaches:
- **Presence/Absence Indicator:** The disappearance of a **sensitive species** indicates environmental degradation.
- **Bioaccumulator:** The organism stores pollutants (heavy metals, pesticides) within its tissues, allowing for the measurement of long-term contamination.



- **Common Name:** White Water Lily
- **Scientific Name:** *Nymphaea alba*



- **Common Name:** Yellow Water-lily
- **Scientific Name:** *Nuphar lutea*

The white water lily is sensitive to pollution; it prefers clear waters with low nutrient levels. Its presence generally indicates:

**Good water quality.**

**Low organic pollution.**

Conversely, its absence or decline can signal:

**Eutrophication** (excessive nutrient enrichment in the water).

**An increase in turbidity** or chemical pollutants.

Species sensitive to specific pollutants or human pressures serve as bioindicators, allowing for the diagnosis of environmental health:

- **Lichens:** Indicators of **air quality**.
- **Aquatic invertebrates:** Indicators of **freshwater quality**.
- **Amphibians:** Sentinels of **wetland ecosystem health**.
- **Birds or bats:** Indicators of **biodiversity and habitat balance**.

# CONCLUSION

- Biodiversity is at the heart of properly functioning ecosystems and the sustainability of agricultural systems.
- Human activity, if left unchecked, constitutes a major threat. **Agro-ecology** represents a viable transition path toward agricultural practices that respect biodiversity. Protecting biological entities requires collective action at every scale.
- The relationships between biological entities and human activity are complex and multifaceted. Humans are simultaneously **consumers, disruptors, protectors, and managers** of the living world. A deeper understanding of these interactions is essential to reconciling human development with the preservation of biodiversity, with a focus on long-term sustainability.

Dear human! If you  
don't destroy me



I will give you shelter,  
food, water & oxygen



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# Contenu de la matière



- INTRODUCTION
- CHAPTER 1: GENERAL OVERVIEW (*GENERAL PRINCIPLES*)
- CHAPTER 2: LEGISLATION AND BIODIVERSITY PROTECTION
- CHAPTER 3: BIODIVERSITY AND ANTHROPOGENIC ACTIVITY
- **CHAPTER 4: FLORA AND ECOLOGICAL SIGNIFICANCE**
- CHAPTER 5: FAUNA AND ECOLOGICAL SIGNIFICANCE
- CONCLUSION AND FUTURE PERSPECTIVES

# CHAPTER 4: FLORA AND ECOLOGICAL SIGNIFICANCE



- **Definition and classification of flora**
- **Ecological role of flora**
- **Flora and ecosystem services**
- **Floristic indicators and bioindication**
- **Threats to flora**



- **Definition and Classification of Flora**
- **Definition of flora**
- **Types of flora:**
  - **Vascular flora** (phanerogams, pteridophytes)
  - **Non-vascular flora** (bryophytes, algae, lichens)
- **Floristic diversity:**
  - **Endemism**
  - **Rare species**
  - **Invasive species**

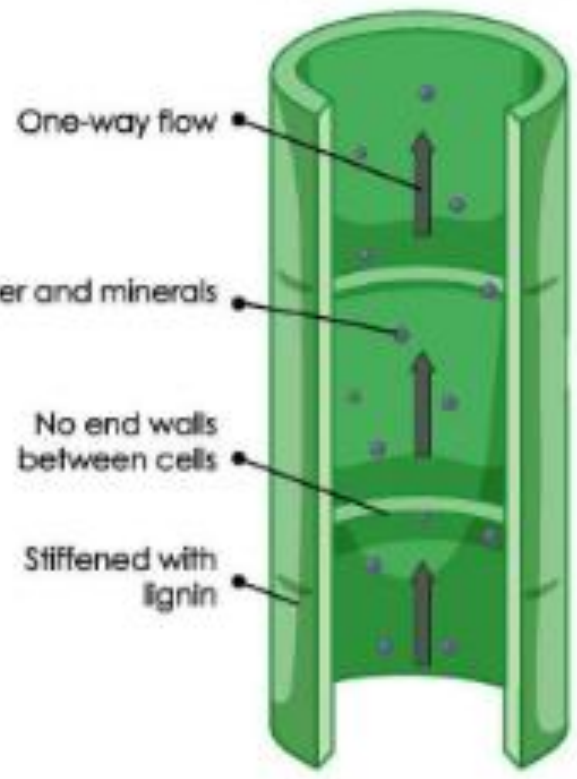
# what is flora !

- It is a general term used to describe the collective vegetation of a specific region, such as "the flora of the Amazon rainforest" or "algerian flora."

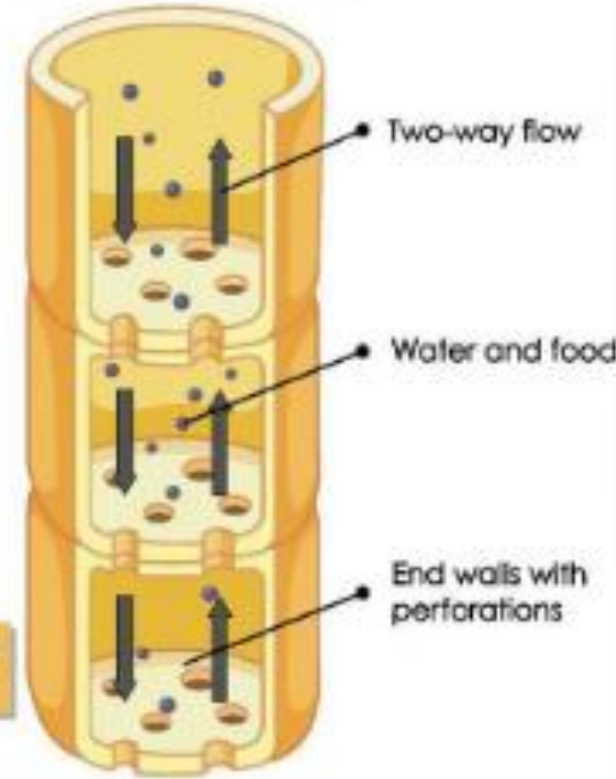
# Definition of Flora

- Flora refers to the ensemble of plant species present in a given geographical area, whether local, regional, national, or global. It includes all plants, from the smallest, such as mosses, to the largest, such as trees, and encompasses both native (indigenous) species and introduced (exotic) species. Flora can be studied from different angles: taxonomic, ecological, and functional.

# XYLEM



# PHLOEM



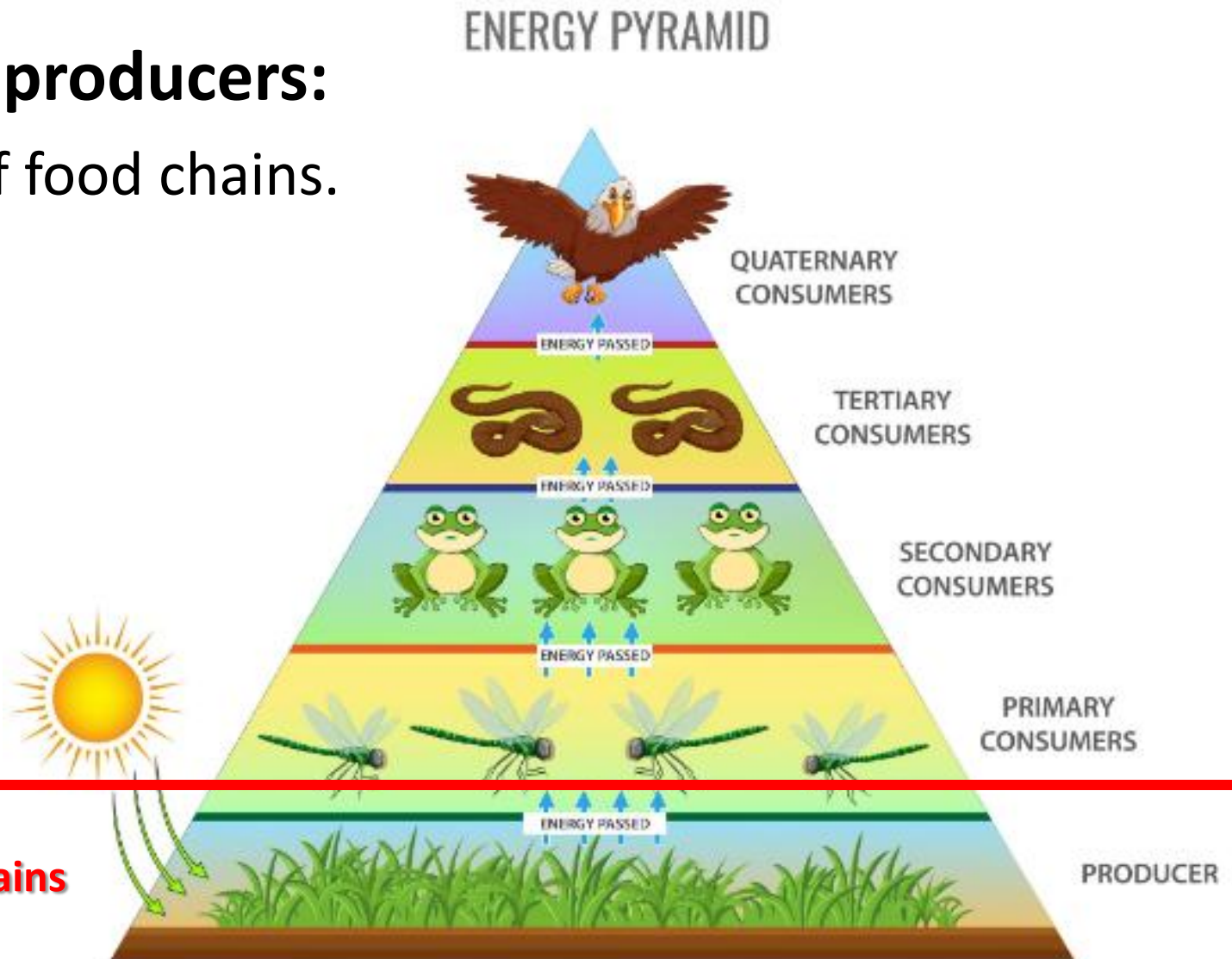
- **Classification of Flora**
- **Endemic flora:** Species found only in a specific geographical region, often due to unique climatic or geological conditions.
- **Invasive or exotic flora:** Species that are not native to the studied region and, often in the absence of natural predators, spread rapidly, potentially disrupting local ecosystems.
- **Cosmopolitan flora:** Species capable of living across a wide range of regions and ecological conditions.

# Floristic Diversity

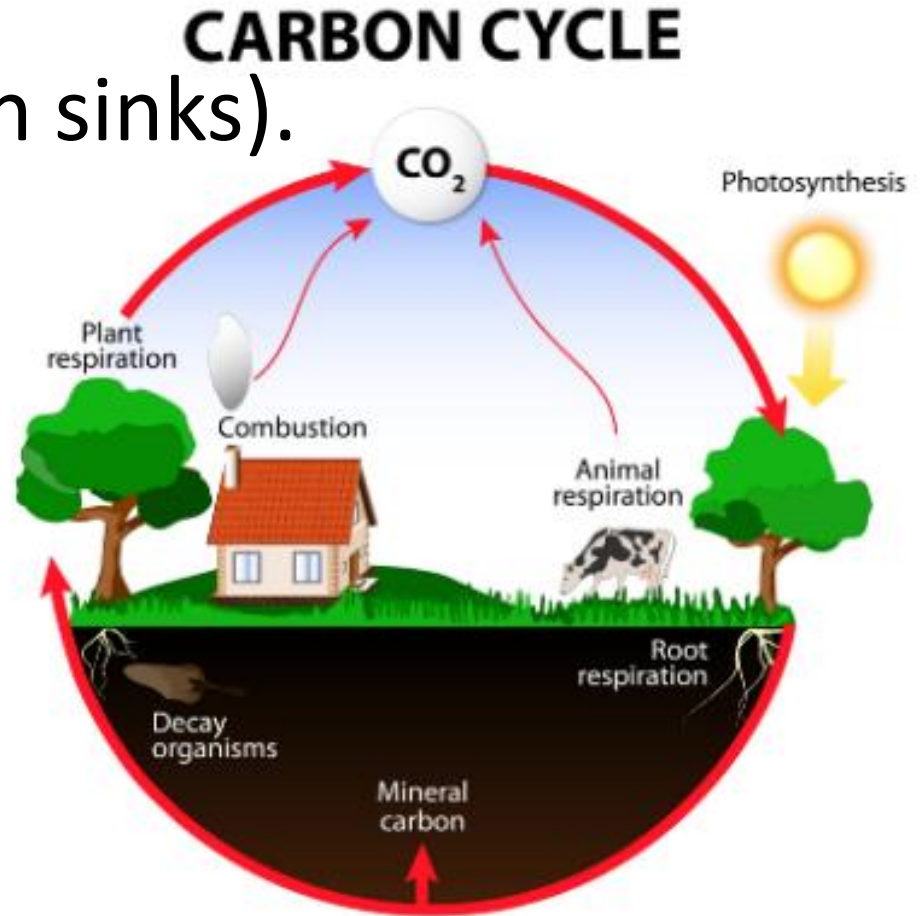
- Floristic diversity refers to the variety of plant species present in a given ecosystem. This diversity is a key indicator of ecological health and the resilience of an environment. It includes both species richness (the number of species present) and the relative abundance of these species within the ecosystem. Several factors influence floristic diversity, such as climate, soil conditions (edaphic factors), natural and human disturbances, as well as interactions between species. Floristic diversity can be studied from different angles, notably endemism, rare species, and invasive species.

# Ecological Role of Flora

- **Primary producers:**
  - Base of food chains.



- **Nutrient cycling:**
- Nitrogen fixation,
- carbon storage (carbon sinks).



- **Soil protection:**
- Fixation, erosion control.
- **Local climate regulation:**
- Evapotranspiration, shading, humidity.

# Flora and Ecosystem Services

- **Provisioning Services:**
  - Timber/wood, medicinal plants, food
- **Regulating Services:**
  - Air and water purification, biological control
- **Cultural Services:**
  - Spiritual value, aesthetic value, natural heritage
- **Supporting Services:**
  - Soil formation, photosynthesis



# Floristic Indicators and Bioindication

- Bioindicator species for soil quality or pollution
- Flora indicating climatic and ecological conditions



Rich and fertile soil: Nettle (*Urtica dioica*)



## Acidic soil: Heather (*Calluna vulgaris*) : Bruyère



### Indicators of Soil Water Management

Wet / Waterlogged soil: Soft rush (*Juncus effusus*) : Jonc



Dry / Arid soil: Breckland thyme (*Thymus serpyllum*): thyme



# Threats to Flora

- **Urbanization, intensive agriculture, deforestation**
- **Climate change**
- **Invasive exotic species**





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Third Year – Agroecology

السنة الثالثة زراعة وبيئة

# PROTECTION OF BIOLOGICAL ENTITIES

## PROTECTION DES ENTITÉS BIOLOGIQUES

Dr.REBBAH Abderraouf Chouaib

2024-2025

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# **CHAPTER 5: FAUNA AND ECOLOGICAL SIGNIFICANCE**

- **Definition and Classification of Fauna (Wildlife)**
- **Ecological Role of Fauna**
- **Fauna and Ecosystem Services**
- **Fauna and Bioindication**
- **Threats to Wildlife**

# What is Fauna?

- **Fauna** refers to the collective animal life of a particular region, habitat, or geological period. It is a strictly biological term
- It includes *every* animal from the microscopic water mite to the blue whale.
- You'll almost always hear it paired with "flora" (plants). Together, "flora and fauna" describe all living organisms in an area. It is usually used by scientists, ecologists, and in textbooks to catalog species.

# What is Wildlife?

- **Wildlife** is a broader, more functional term. It refers to living organisms (traditionally animals, but often including plants and fungi) that grow or live wild in an area without being introduced or managed by humans.
- It specifically excludes **domesticated** animals (like cows, dogs, or farm cats) and cultivated plants.
- Wildlife usually implies a level of "wildness" or an untamed state. While fauna is a list of species, wildlife is the living, breathing system of those creatures in their natural habitat. It's used in conservation, law (wildlife protection acts), and general conversation.

# Fauna definition and Classification

- **Definition and classification of fauna** (*wildlife*)
- **Vertebrate fauna:** mammals, birds, reptiles, amphibians, fish
- **Invertebrate fauna:** insects, molluscs, arachnids, etc.
- **Wild vs. domestic fauna** (ou *Wildlife vs. Domestic animals*)

# Definition of Fauna

- **Fauna** refers to the entire set of animal species living in a given geographical area at a specific time. It includes both wild and domestic animals, although in most ecological or biological contexts, the term is reserved for wild species. It is a fundamental component of biodiversity, alongside flora (vegetation) and microorganisms.
- The word "fauna" originates from Roman mythology: Faunus was the protective god of forest animals.

# Classification of Fauna

- The classification of fauna can be structured in several ways depending on the criteria used: taxonomic, ecological, geographical, or by habitat. Here are the main classifications:
- **Taxonomic (Scientific) Classification**

This is based on biological systematics (the classification of animal species according to their evolutionary relationship):

- **Invertebrates** (animals without a backbone)
  - Examples: Insects, molluscs, arachnids, crustaceans, worms.
- **Vertebrates** (animals with a backbone)
  - **Fish:** Ichthyology
  - **Amphibians:** Herpetology (covers both amphibians and reptiles)
  - **Reptiles:** Also Herpetology
  - **Birds:** Ornithology
  - **Mammals:** Mammalogy

# Classification of Animals

Vertebrates

Invertebrates

Warm-Blooded

Cold-Blooded

With Jointed Legs

Without Legs

Mammals

Birds

Fish

Reptiles

Amphibians

With 3 pairs of legs

With more than 3 pairs of legs

Worm-like

Not-worm like



Bear



Ostrich



Salmon



Turtle



Frog



Ant



Scorpion



Earthworm



Fluke Worm



Tiger



Peacock



Goldfish



Crocodile



Toad



Cockroach



Spider



Leech



Tapeworm



Whale



Eagle



Guppy



Snake



Newt



Ladybug



Millipede

# Ecological Classification

- Based on the natural environment or habitat:
- **Terrestrial fauna:** Lives on dry land (forests, savannas, mountains...)
- **Aquatic fauna:**
  - **Marine:** Oceans and seas (e.g., dolphin, shark)
  - **Freshwater:** Rivers, lakes
- **Aerial fauna:** Birds and bats, for example.
- **Cave-dwelling fauna (Cavernicolous):** Lives in caves.
- **Edaphic fauna:** Lives in the soil (earthworms, mites).

# Terrestrial fauna



# Aquatic fauna



# Aerial fauna



# Cave-dwelling fauna (Cavernicolous):



# Edaphic fauna



# Classification by Ecological Status

- **Indigenous fauna (Native):** Species native to a specific territory.
- **Introduced or Allochthonous fauna:** Species brought by humans into a foreign environment.
- **Invasive fauna:** A non-native species that disrupts the ecosystem.
- **Domestic fauna:** Species selected by humans for their needs.
- **Wild fauna:** Undomesticated species.

# Indigenous fauna (Native)

**African Chameleon**



**Chameleo africanus**  
(Caméléon d'Afrique du Nord)

**Saharian Scorpions**



**Scorpions sahariens**  
*Androctonus australis*,

**Barbary Sheep**



**Mouflon à manchettes**  
(*Ammotragus lervia*)

**Barbary Macaque**



**Barbary macaque**  
(*Macaca sylvanus*)

**Golden Eagle**



**Aigle royal**  
(*Aquila chrysaetos*)

**Houbara Bustard**



**Outarde houbara**  
(*Chlamydotis undulata*)

# Introduced or Allochthonous fauna

**Common Myna**



Martin triste  
*Acridotheres tristis*

**Eurasian collared dove**



Tourterelle turque  
*Streptopelia decaocto*

**Striped hyena**



Hyène rayée  
*Hyaena hyaena*

# Invasive fauna



**Rat noir** (*Rattus rattus*)



**Moineau espagnol** (*Passer hispaniolensis*)

# Domestic fauna



**Chat de gouttière**



# Wild fauna



# What is an Animal Guild?

- In ecology, a **guild** is a group of different animal species that use the same resources or share a similar lifestyle (same habitat, diet, hunting strategy, etc.). ➡ They are not necessarily closely related genetically (e.g., a bird and an insect can belong to the same guild!).
- **Example**
- Insectivorous bats, frogs, and certain nocturnal birds form a **guild of nocturnal insect predators**.

# Ecological Role of Fauna

- **Food chains and trophic networks:** Fauna plays a crucial role in the transfer of energy through ecosystems.
- **Biological control of populations (predator/prey relations):** Predators regulate prey populations, preventing overpopulation and ecosystem imbalance.
- **Pollination and seed dispersal:** Animals facilitate plant reproduction and the expansion of plant species across landscapes.
- **Decomposers and nutrient recycling:** Fauna breaks down organic matter, returning essential nutrients to the soil.

# Fauna and Ecosystem Services

- **Provisioning services:** Food resources, raw materials.
- **Regulating services:** Pollination, pest control (biological control).
- **Cultural services:** Ecotourism, cultural totems.
- **Supporting services:** Nutrient cycling, water regulation.

# Fauna and Bioindication

- **Sentinel species:** Amphibians, birds, bats. These species are highly sensitive to environmental changes and act as early warning systems.
- **Habitat quality monitoring (trophic bioindicators):** The presence or absence of specific animals indicates the health and pollution levels of an ecosystem.

# Threats to Fauna

- **Habitat fragmentation:** Roads, dams, and urbanization break up natural habitats, isolating populations.
- **Light, noise, and chemical pollution:** Disrupts animal behaviors, communication, and reproduction.
- **Poaching and illegal trade:** Illegal hunting and trafficking for wildlife products.
- **Climate change and loss of ecological niches:** Shifting temperatures and habitats force species to migrate or risk extinction.



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# **CONCLUSION & FUTURE PERSPECTIVES**

- Biodiversity is not simply a catalogue of species, but the indispensable **functional foundation** for the **stability of the biosphere** and the **survival of humanity**.
- This course has demonstrated that the frantic pursuit of short-term economic interests exerts unsustainable **anthropogenic pressure** on these **biological entities**. By fragmenting habitats, polluting, and overexploiting resources, humans weaken **flora and fauna**, and by extension, **the ecosystem services** (climate regulation, pollination, water purification) upon which we depend.
- Each ecological guild plays a specific role in the resilience of these systems; disrupting them weakens the entire structure.

# Global Perspectives

- To reverse this trend, a transition towards sustainable and regenerative management is imperative. This requires:
- **Strengthening international legislative frameworks** to compel economic actors to internalize the ecological cost of their activities.
- **Adopting approaches based on Nature-based Solutions (NbS)** to mitigate climate change.
- **Increased international cooperation** to protect transboundary ecosystems.

# Local Perspectives (Algerian Context)

- For Algeria, a country characterized by great ecological diversity (coastline, high plateaus, Sahara), the stakes are crucial and require targeted actions:
- **Conservation of Fragile Ecosystems:** Strengthen the protection of wetlands (Ramsar sites) against urban and agricultural pressure, and intensify the fight against desertification in steppe zones to protect the specific fauna and flora of these environments.
- **Legislation and Enforcement:** Better enforce existing laws on the protection of biological entities, particularly against poaching and the overexploitation of forest resources.
- **Sustainable Economic Valorization:** Encourage ecotourism and sustainable agricultural practices (agroecology) that allow local populations to benefit from ecosystem services without destroying them.

- **The protection of biological entities in Algeria, as elsewhere, is no longer an option but a strategic priority to ensure the ecological and socio-economic resilience of future generations.**

**"Saving nature is saving ourselves; knowing better is protecting better."**