

Chapter 2: The dimensions of the environmental crisis

Introduction

Our Earth is fragile and precious. Over thousands of years, our planet has evolved and given rise to complex and balanced ecosystems that only natural and other dangers from space (particularly meteorites) could disrupt.

But population growth and the development of human activities have disrupted these fragile balances.

Today, the depletion of natural resources, the constant increase in energy demand and the colonisation of spaces and territories are causing upheavals, the most visible consequences of which include an increase in the greenhouse effect and climate change.

1. Major environmental crises:

Everything that happens on Earth, whether natural phenomena or human activities, has an impact on the environment. The impact of these phenomena or activities can be extremely significant, affecting one or more environments: soil, water, air, natural resources (reserves) or the biosphere (plants, animals, human beings).

1.1 Natural factors:

1.1.1: Earthquakes

1.1.2: Floods

1.1.3: Droughts

1.1.4: Tsunamis and cyclones

1.1.5: Meteorites

1.2 Anthropic factors

1.2-1 Resource depletion

Resource depletion due to human overconsumption affects biodiversity, plant resources (deforestation, plant harvesting), species extinction, but also minerals and raw materials.

- ✚ Non-renewable resources: these are mainly mineral raw materials and fossil fuels, which are exhaustible stocks.
- ✚ Renewable resources: this type of resource can be consumed without being exhausted because they can regenerate continuously

With the population explosion, which mainly took place during the 20th century, the natural resources essential to human life have become scarce. At the beginning of the 21st century, their depletion has become one of the most pressing issues for the future of humanity.

The situation has deteriorated considerably. Even biological resources, considered renewable, are so heavily exploited that they no longer have time to replenish themselves. Human exploitation has reached such levels that not only productivity (interest), but also standing biomass, necessary for the maintenance of the resource (capital), are being consumed at an accelerated rate. The same is true for water, which is intrinsically recyclable, and for soil, which is naturally regenerative because it is the result of a dynamic process. Not only are surface waters and groundwater exposed to increasing pollution, but the way they are used today is more akin to mining than to the exploitation of a recyclable resource. Given population growth, water availability has already become insufficient in 55 developing countries. As for soil, its erosion is due to poor farming practices, deforestation and overgrazing.

If humanity continues on its current trajectory, by 2050 it will consume three times more raw materials than it does today. In forty years' time, the 9 billion people on Earth will consume 140 billion tonnes of minerals, hydrocarbons and biomass (wood, crops, livestock), according to a report by the UNEP (United Nations Environment Programme). Oil, Coal, gas, water, etc. However, **natural resources are not inexhaustible.**

1.2.2. Global warming

The main causes of global warming include:

- Combustion of fossil fuels (coal, oil, gas)
- Deforestation (most often for agriculture)
- The main sectors emitting CO₂ are, in order:
 - Energy
 - Industry
 - Forestry
 - Agriculture
 - Transport
 - Residential and commercial buildings

1.2.3 The destruction of biodiversity

Pollution, irresponsible exploitation of human resources and climate change have, of course, disastrous repercussions on flora and fauna. As forests are the largest reservoir of terrestrial biodiversity, deforestation also plays a sinister role in the extinction of animal and plant species. Despite this observation, the WWF explains that from 1990 to 2015, deforestation amounted to more than 240 million hectares and **that 170 million hectares are still at risk of disappearing by 2030.**

1.2.4 Pollution:

1.2.4.1- Definition of pollution

Pollution is the degradation of the environment through the introduction into the air, water or soil of substances that are not naturally present in the environment. It causes disruption to the ecosystem, the consequences of which can include the migration or extinction of certain species that are unable to adapt to the change.

1.2.4.2- Current causes of pollution

- Pollution linked to energy production and use
- Industrial pollution

- Solid waste
- Agricultural pollution.

1.2.4.3- Classification of pollution

Pollutants belonging to different classes can have similar effects. There are three main groups of pollutants:

A. Physical pollutants

- Heat
- Radioactive pollution
- Noise
- Light pollution

B. Chemical pollutants

- Liquid hydrocarbons
- Detergents and surfactants
- Plasticisers
- Phthalates
- Pesticides
- Eutrophication substances
- Heavy metals
- Medicines and cosmetics

C. Biological pollutants

- Algal toxins,
- Pathogenic germs,
- Parasites.

1.2.4.4- Types of pollution

A- Air pollution

Air pollution can be defined as the presence of impurities in the air that can cause significant discomfort to people and damage to property. Air pollution is therefore strongly influenced by the climate, particularly wind, temperature, humidity and atmospheric pressure.

The various pollutants, their origins and their risks are specified in the table Below.

Main pollutants in indoor air	Origin	Risks
Sulphurdioxide (SO ²)	80% industry 10% residential and tertiary, district heating	- Respiratory conditions - The cause of acid rain
Particulate matter (PM)	10% road transport	- Respiratory tract irritation - Carcinogenic risk
Nitrogen dioxide (NO ₂)	50% road transport 25% industry 10% natural 5% residential and tertiary, district heating	- Impairs respiratory function - Chronic respiratory disorders; at high doses may cause damage
Carbon monoxide (CO)	30% road transport 30% residential and tertiary, district heating 30% industry	- Disrupts the transport of oxygen in the blood: may cause anaemia, dizziness, migraines and be fatal in high doses.
Ozone (O ₃)	Secondary pollutant resulting from the photochemical transformation of certain pollutants (NO _x and VOCs) in the presence of solar radiation (UV)	- Eye irritation - Lung damage - Damage to plants - Contributes to the greenhouse effect
Volatile Organic Compounds (VOCs)	Road transport industry, use of Solvent	- Ozone formation - Respiratory discomfort - Mutagenic and carcinogenic risks (benzene)

B- Soil pollution

A site is considered polluted when it poses a permanent, real and potential risk to human health and/or the environment due to pollution resulting from current or past activities. The spread of pollution will vary depending on the composition of the soil:

- Gravel with coarse centimetre-sized particles;
- Sand with fine millimetre-sized particles;
- Silty sand with very fine micrometre-sized particles

- Main pollutants

- Heavy metals (arsenic, chromium, copper, cadmium, mercury, nickel, lead, zinc, etc.)
- Hydrocarbons (petrol, fuel oil, oils, etc.)
- Chlorinated or aromatic solvents
- Plant protection products (pesticides, herbicides).

- Sources of pollution to be taken into account:

- Outdated waste disposal practices,
- Chemical leaks or spills,
- contamination due to atmospheric fallout

- Types of pollution are classified

- + According to their duration: accidental pollution and chronic pollution;
- + According to their extent: local pollution or diffuse pollution.

- Forms of soil pollution

- + **Diffuse pollution:** affects a large area. It can be caused by agricultural practices such as spreading manure or by atmospheric fallout from urban, industrial or road sources.
- + **Point source pollution:** remains very localised and intense. It is linked to
- + **Point source pollution:** remains very localised and intense. It is linked to industrial sites, waste disposal sites or other sites that are chronically or accidentally polluted (heavy metals, hydrocarbons, benzene, industrial organic solvents).

C- Water pollution

Water pollution refers to any change in the characteristics of water that is unpleasant or harmful to human use, fauna or flora. During its use, water becomes depleted or enriched with substances of all kinds, or changes temperature. The resulting pollution ends up in the natural environment (watercourses, sea). Water pollution occurs when materials are discharged into the water, degrading its quality. Pollution in water includes all superfluous materials that cannot be destroyed by water naturally.

The three main sources of pollution are:

-Urban discharges: resulting from the collection and treatment of wastewater from households, domestic, craft and tertiary activities, as well as rainwater runoff in urban areas.

-Agricultural operations: which discharge various products found in fertilisers (such as nitrate ions: NO_3^-) or plant protection products can pollute ground water and lead to the closure of drinking water catchment points if their presence is too significant.

-Industrial discharges: the proportions of pollution from different sectors vary according to the types of pollution, with the proportion of industrial origin being higher for certain toxic pollutants, for example

-Wastewater: This is a favourable environment for the establishment of bacterial microfauna (bacterial growth) which, if not treated properly, can be a source of water pollution. Chemical and biological oxygen demand (COD and BOD) will be useful in assessing the level of pollution in the water.