

Chapter 1. Generalities on Pollution

1.1. The Notion of Nuisance

The term *nuisance* refers to any degradation of the environment that does not have an ecotoxicological impact but results in discomfort for those who are exposed to it. Unlike pollution, nuisances do not necessarily cause harmful effects on human health and/or on the ecological level. However, they are rightly perceived by those affected as an unfavorable modification of the environment.

1.2. The Main Causes of Pollution

The phenomena threatening the environment are of two types:

1.2.1. Natural Phenomena

These are so-called natural disturbances not caused by humans.

Drought: A dry state of the soil due to lack of moisture. This phenomenon, accentuated by decreased rainfall, leads to longer dry seasons. Drought causes major deterioration of soil characteristics, resulting in desertification. This deterioration is expressed through reduced surface organic matter, soil biological activity, and permeability.

Floods: Overflows of water that submerge land. Floods are caused by rain, snowmelt, or river floods. They cause significant damage to the environment: uprooting of trees, soil degradation, destruction of vegetation cover, wildlife and its habitat, and accelerated erosion.

Earthquakes: A set of phenomena linked to the sudden deformation of the Earth's crust in a given place, as perceived by humans. Also called *seisms* or *tremors*, earthquakes often cause environmental disturbances such as spring drying, river course deviation, relief deformation, demolition of buildings, and destruction of wildlife habitats.

Landslides: Mass movements of soil descending and carrying part or all of a slope. Landslides result in significant morphological changes of sites and total destruction of everything in their path.

Desertification: Transformation of a region into a desert due to climatic and/or human factors. Soil degradation through vegetation loss leads to dune encroachment (*erg*) or, in cases of soil erosion, stony plains (*reg* or *hamada*).

1.2.2. Anthropogenic Phenomena

These are all human-induced actions on the environment for personal development that generate nuisances.

Services: All tertiary activities such as trade, administration, liberal professions, and crafts. Main nuisances include:

- Production of waste of various types (paper, cardboard, packaging, fabric scraps, sawdust, metal filings, paints, oils, greases, etc.);
- Discharge of wastewater containing solids, oils, dyes, etc.;
- Smoke emissions (roasting, grilling, etc.);
- Noise (machines, tools, videotapes, sheet metal work, mechanics, etc.).

Agriculture: The practice of cultivating soil and producing plants and animals useful to humans. Main nuisances include:

- Plowing in steppe rangelands;
- Overgrazing;
- Deforestation for farmland expansion;
- Soil contamination from pesticides and fertilizers.

Urbanization: Rapid expansion of cities, especially since the 1970s, often at the expense of farmland and natural environments. Main nuisances:

- Production of solid and liquid waste that pollute and degrade the environment;
- Spread of waterborne diseases;
- Slums;
- Use of unsuitable land for housing;
- Loss of agricultural land;
- Pressure on water resources.

Industry: All activities producing goods from raw materials. While industry drives economic growth and competitiveness, reducing pollution and using resources rationally are vital for sustainable development. Main nuisances:

- Emission of large amounts of air pollutants;
- Discharge of toxic and organic waste into water;
- Production of hazardous industrial waste;
- Noise pollution;
- Occupational diseases.

Resource Exploitation: Current exploitation practices have significant negative effects on the environment:

- Landscape scars (quarries, mines);
- Destruction of forests;
- Overexploitation of resources;
- Biodiversity loss;
- Destruction of coastal dunes, worsening beach erosion due to excessive sand extraction.

Fishing: Fish capture activities also impact marine ecosystems:

- Overfishing;
- Use of explosives;
- Capture of juveniles;
- Use of fine-mesh nets capturing everything;
- Fishing in restricted areas.

Hunting: Like fishing, hunting affects terrestrial fauna and biodiversity:

- Capture of protected species;
- Hunting endangered species;
- Hunting during closed seasons.

Population Growth: Increase in population size over a given period. It is a key indicator for sustainable development, as rapid growth increases pressure on natural resources, the economy, and society. Main impacts:

- Land occupation;
- Pressure on water resources;
- Pressure on biological resources;
- Production of solid and liquid waste;
- Chaotic urbanization;
- Ecosystem degradation;
- Natural resource depletion.

1.3. Industrial Contamination

Energy Production: Energy production and use are major pollution sources. Fossil fuel consumption emits billions of tons of carbon equivalent as CO₂, significantly contributing to the greenhouse effect. Additionally, the use of wood as fuel in developing countries causes deforestation and indoor pollution due to poor-quality fuels. Oil extraction and combustion generate pollution: offshore spills, transport accidents contaminating oceans, refinery wastewater, and hydrocarbon waste. Combustion also releases pollutants such as CO₂, CO, SO_x, NO_x, and unburned hydrocarbons. Nuclear energy also raises concerns. Air pollutants from combustion cause severe environmental issues such as acid rain, photochemical smog, and harmful particulate matter affecting public health.

Diversification of Chemical Pollutants and Waste Accumulation: One of the most serious aspects of global pollution is the rise of synthetic chemical pollutants, particularly persistent organic pollutants (POPs). Due to their ubiquity and stability, substances like polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated solvents, organochlorine pesticides, and dioxins are now found in even the most remote parts of the biosphere.

1.4. Solid Waste

Solid waste is any residue from production, transformation, or use, any substance, material, or movable good abandoned or intended for disposal. Main pollutant sources:

- **Plastics:** About 14% of household waste, producing pollutants such as HCl, Cd, and As (used as stabilizers or colorants).
- **Batteries:** About 1% of waste, but responsible for 50–75% of Cd, Hg, and Ni pollution.
- **Paper and Cardboard:** About 28% of waste; combustion produces organic compounds, hydrocarbons, polyaromatics, and dioxins.
- **Glass.**

1.4.1. Different Types of Waste

- **Household Waste:** Solid residues from domestic life. They can be biodegradable organic matter or non-biodegradable; their composition determines treatment and recovery options.
- **Ordinary Industrial Waste:** Industrial waste similar to household waste, including scrap metals, non-ferrous metals, paper, cardboard, glass, plastics, rubber, and tires.

Some notions of degradability (approximate values given as an indication):

Paper tissue	1–2 months
Cigarette butt	6 months
Tin can	100–200 years
Plastic bottle	Up to 500 years
Glass bottle	About 4000 years

- **Inert waste:** Consists of demolition debris, excavated material, and gravel from extractive activities (mines, quarries) or road works.
- **Special industrial waste:** Specific waste from industrial activities that may contain toxic elements in varying amounts, thus posing risks to the environment. These wastes include used solvents, metalworking fluids, surface treatment baths, used oils, and pesticide waste.

1.5. Contaminants of Agricultural Origin

The intensive use in agriculture of synthetic pesticides (insecticides, fungicides, herbicides) and mineral fertilizers (nitrogen fertilizers, phosphates, and potash salts) has led to spectacular improvements in crop yields.

At the same time, the development of industrial-scale livestock farming, often involving thousands of cattle, tens of thousands of pigs, or hundreds of thousands of poultry, has also become a major source of pollution in rural areas.

Indeed, the production of massive amounts of manure and slurry generates insidious pollution of surface waters, coastal waters, and groundwater by various mineral derivatives of nitrogen (nitrates, nitrites, ammonia) and phosphates, as well as soil contamination by biogenic but toxic metals (Zn, Cu).