

15. Planetary boundary 9: Chemical pollution

Introduction

The introduction of new entities into the biosphere is the ninth of the nine planetary boundaries. In 2009, defined as "chemical pollution" (Rockström et al.), It referred to radioactive elements, heavy metals and many organic compounds of human origin present in the environment.

15.1. Issues related to chemical pollution

Two main factors have led to consider chemical pollution as a planetary limit: on the one hand, because of its harmful effects on human physiological development and on the functioning of ecosystems; on the other hand, because it acts as a slow variable that affects other planetary boundaries. Indeed, chemical pollution can have an impact on the limit "erosion of biodiversity" by reducing the abundance of species and potentially increasing the vulnerability of organisms to other threats (climate change). It also interacts with the "climate change" limit by the releases of mercury into the environment (via the combustion of coal) and by the emissions of CO₂ due to industrial chemicals.

15.2. Main chemical pollutants

Three types of pollutants are treated here: plastic waste at sea, nuclear waste, varieties tolerant to herbicides.

15.2.1. Plastic waste

Plastic, used since the 1950s, represents a major environmental issue, linked both to the consumption of resources necessary for its manufacture and to the production of waste it generates.

Between 1950 and 2017, world production of plastics continued to increase, from 1.5 million tonnes in 1950 to 350 million tonnes in 2017, i.e. 0.6 kg / inhabitant and 46 kg / inhabitant, respectively. .

Each year, between 5 and 13 million tonnes of plastic waste is thrown into the sea. 80% comes from the land and 20% from maritime activities. There are many sources of land-based waste: urban waste, tourism, illegal dumping, cosmetics, polyester and acrylic fibers. Half of the waste found on European beaches is single-use plastics: bottles, capsules, lids, cigarette butts, cotton swabs, sachets of chips, candy wrappers, sanitary items, plastic bags, cutlery, straws , etc.

Plastic waste is dumped into the oceans most often through sewers or rivers. They can also be linked to natural phenomena (storm, tsunami, flood, etc.). They come in the form of macroplastics. Microplastics are tiny particles of plastic that are less than 5 millimeters in size.

Marine pollution from plastic waste has multiple consequences for the environment, economy and health. A "plastic soup" forms in the oceans, causing in particular the strangulation of marine mammals and birds in the nets, but also the alteration of the balance of ecosystems due to the transport of invasive species over long distances. , etc.

Microplastics, ingested by many marine organisms (cetaceans, molluscs, plankton or fish), are found in the food chain. In addition, plastic contains chemical additives which can be endocrine disruptors. According to IUCN, globally, an average of 700 marine species are affected, of which 17% are threatened or critically endangered.

Faced with these global environmental, economic and health challenges, the international MARPOL convention (MARine POLLution) for the prevention of pollution from ships has banned the dumping of plastic materials into the sea since 1988.

15.2.2. Nuclear waste

Another national environmental issue, 77% of electricity in France is produced from nuclear power plants. France has 13% of the world's nuclear reactors in operation and produces 18% of nuclear power.

In 2013, a little less than 1.5 million m³ of radioactive waste was present in the territory, which represents a fifth of global nuclear waste (or 19%). This volume increased by 58% between 2002 and 2016.

15.2.3. Herbicides

In France, weeding of crops is a determining factor in agricultural yields. France is the leading user of herbicides in Europe (nearly 30,000 tonnes sold in 2017). However, to put an end to the chemical weed control that had been practiced until then and which was harmful to the environment, a new approach was introduced in 1996: the selection of plant varieties tolerant to herbicides (HTV).

Studies (Collective Expertise of INRA) and experiences in the United States show that an unreasonable use could lead to the acquisition of resistance by weeds ("weeds") and thus, a loss of the benefit of mutation with consequences of an increasingly important application of herbicides and impacts on the environment. The recommendations to limit these risks concern in particular the rotation of crops and treatments. It is necessary to remain vigilant on the use of these cultures.