Chapter 1
A Brief Introduction to the History of Pollution: From Local to Global

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Abstract The way pollution can be defined has greatly varied in the course of history, according to times and places. It has long retained a moral and religious dimension. That some substances were "out of place" is attested since at least ancient civilisations. In France, as in most European countries, this pollution has been dealt with in the Middle Ages and in the early Modern period by removing dirt and dirt-producing activities onto the fringe of cities. This began to change at the end of the 18th century when states started to promote industry as a means of power. New pollutions also appeared with the birth of the modern chemical industry. But in the 20th century the scale of pollution changed dramatically: it became more intensive, with a growing number of pollutants discharged in the biosphere; more global, affecting all places on earth; more lasting, with disastrous cumulative effects.

Keywords Nuisance · Pollution · Environment · History

1.1 Pollution: What Are We Talking About?

Whoever wants to talk about pollution history must first precise *what* he is talking about. Indeed, the notion of pollution can cover very different things according to times and places. Today's pollution is not yesterday's, even less that of the eighteenth century or of the Middle Ages. This is not mainly due to the fact that "they did not know" that this or that product was a pollutant, but to the fact that each society defines pollution according to its own criteria, beliefs, perceptions and feelings. Each society has its own conception of what is clean and unclean, healthy

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and unhealthy and, as anthropologist Mary Douglas put it (Douglas 1966), its specific conception of order. In this order, pollution is just what is "out of place". Indeed, no product is a pollutant in itself, but it can become one in specific circumstances (when it is introduced where it should not be) or according to other products it is associated or mixed with. Easy examples: coal or oil, as long as they remain in the earth where they formed over the millennia, are no pollutants. But they become so when we burn them; arsenic is not a pollutant, as long as it is not ingested in quantity by humans or animals. It can even become a medicine when used by homoeopaths in infinitesimal doses. The experts working, today, on the REACH classification are confronted to this issue: pollution does not depend on the product, but of what you make of it.

It is interesting to have a look at the origins of the word "pollution" itself. We'll do so for the French language. The word pollution comes from the Latin *pollutio* which meant dirt and appeared in French in the twelfth century. It has, at that time, lost its Latin sense and means stain or impurity, with both moral and religious connotations. In the seventeenth and eighteenth centuries, French dictionaries provide two different definitions for the word pollution: (1) profanation of a religious sanctuary; (2) obscenity committed on one's body by indecent touching. The first occurrence of the term pollution close to the meaning we give it today is to be found in the 1874 edition of the Littré Dictionary: "action of dirtying with litter". The example provided to illustrate this definition was drawn from the *Journal Officiel de la République française* [official publication of the French Republic] issued on the twentieth of November of the same year. Historians who read the records confirm that the word do appear with this meaning in the 1860s and 1870s, though it was used for water only. It would extend to air and soil at the end of the century. But the Littré is the only dictionary to note its appearance with this meaning as early as the last third of the nineteenth century, which proves that it was not so common yet. The 1930s edition of the Académie française dictionary still sticks to the old meanings. And the 2010 edition of the reference dictionary *Le Robert* gets the wrong century, dating the modern meaning from the 1960s!

This digression by the evolution of the word attests how strongly and how long the word pollution kept its old religious or moral meaning, and the relationship long maintained between dirt and impurity. It also explains why historians studying the nineteenth century or beginning of the twentieth century records find so often pollution called "the demon", or the "modern demon"—in French as well as in English (Bernhardt and Massard-Guilbaud 2002, p. 16). Incidentally, the monks were the first to try hard to clean and sanitize their environment, bringing in their monasteries large amounts of water and draining used waters away, as early as medieval times. Clean water was seen as the main remedy against material and moral stain. In medieval and early modern painting, running waters and fountains are metaphors of moral purity (Fournier 2002).

The fact the word pollution was not used in medieval and early modern French to talk about *material* pollution does not however mean that the nuisances created by crafts or the insufficient sanitation did not exist or that they were not sensed. The existence of pollution of anthropic origin is evidenced as early as ancient

civilisation. The analysis of samples taken off Greenland ice show that the concentration of copper began to raise above their natural level as early as 2500 BC. In the Roman period, the concentration was twice what it was before man began to mine it (Hong et al. 1996). Researchers have also shown that in the middle of the eighteenth century, the concentration of lead in the ice was ten times higher than its natural level (Boutron et al. 1993).

From the Middle Ages onto the eighteenth century, many other words were used to think and talk about pollution: the substantives dirt, stench, nuisance … the adjectives unhealthy, infectious, corrupted, soiled, rotten … Not only were these nuisances named, but they were also regulated. In all the countries where this has been studied (Poulussen 1991; Le Roux 2011; Parmentier 2008; Cavert 2016), nuisances were a juridical category. In England, the law rested on the maxim "*Sic utere tuo ut alienum non laedas*", meaning that one should not disturb others while enjoying one's own possessions. In England, the Common Law of nuisances went back to the Middle Ages and had its own jurisdiction, the Nuisance Assize. Contraveners could be fined, see their business closed or incarcerated (Cokayne 2007). In France, nuisance regulation rested on a very large corpus of edicts, arrests, orders and decrees emanating from various authorities (parliaments, police, municipalities …), formed since the Middle Ages. The case of Paris in the eighteenth century has been well studied by Thomas Le Roux (Le Roux 2011). The police dealt with nuisances according to the common law of servitudes and neighbourhood. But they also had a specific action against nuisances and the protection of public health was one of their duties. The main principle to protect the city dwellers against nuisances was their removal. All the trades dealing with animal raw materials and not least tanneries but also dying and many others had to settle outside the city, in areas that were sort of sacrificed to industry.

This was also the case for all industries using putrefaction as a means to transform materials, due to the stench they produce. The neo-Hippocratic medicine of that time, which saw in miasmas the origins of illnesses, granted a specific interest to three factors: climate, dangerous substances contained by air, water and the soil, and the mephitic vapours likely to contaminate and corrupt organisms. Those which emanated from marshes or putrefying matters were feared. The odour was then a strong indicator of pollution, and the trades that produced stench particularly dreaded. Those likely to cause fire or important noise were also under close surveillance.

This moving away, however, did not apply to all noxious trades. Tallow foundries, candle makers, some ovens, known for the nuisances they created, were allowed to stay in the city. In this case, the practice was a pragmatic mix of prevention, dialogue and surveillance, and the decisions made on the case by case basis (Le Roux 2011). Amongst the measures of prevention was the so-called survey of *commodo et incommodo*. Formalised in 1749 for the workshops which killed butchery animals, it extended then to other trades. This procedure included information, prevention and dialogue. The role of the police was to conciliate as far as possible all vested interests. Thanks to this sophisticated process, nuisances were more or less under control, in Paris, by the middle of the eighteenth century.

Complaints, that were so many at the beginning of the century, had nearly disappeared.

Although heavy modern industry had developed earlier in the United Kingdom, France was the country where this old mode of regulation, so far more or less common to all industrialised areas, was first to be upset. For this reason, we will concentrate on France to give the reader an idea of the way authorities reacted to the new pollution created by the industrial revolution, before coming back to a more global view.

1.2 Pollution and Industrial Revolution: The French Case

The birth of a new chemistry and especially the making on an industrial scale of what was then called the "strong acids" was to challenge the former order of regulation. 1773 can be considered as a milestone. In that year began in Rouen a trial opposing the owner of a large chemical factory (actually the first industrial chemical factory of such a large size in the country), John Holker, to his neighbours who complained about the terrible effects, for the surroundings, of his new production: sulphuric acid made in lead chambers. This trial was emblematic of the turn that was rapidly going to extend to all the country and for this reason deserves a few lines here. Holker, an Englishman who had fled his country and been naturalized French, had "borrowed" (actually stolen by the way of industrial spying) this making process to his compatriot Roebuck, who implemented it on the banks of the Firth of Forth. The lead chambers process made it possible to make sulphuric acid on a large scale and at a much lower cost than the methods implemented so far. Sulphuric acid was a fundamental product to many industries, including textile. Holker was at that time the only one in France mastering the lead chamber method —as far as we can say that, the process being far from finalised. For this reason, the king was ready to protect him, whatever the nuisances he created. And this is what happened. Without entering the details of the trial, let us say that the case ended at the top of the state as an arm-wrestling contest between the Police minister (who supported the action of the police in favour of the neighbours) and the Commerce minister (who supported the industrialist). The Conseil du Roi ruled in the latter's favour, announcing times when an industrial production could be declared of national interest, whatever the consequences for the neighbours in terms of health and the environment.

But this was only a beginning, and sulphuric acid was not the only product concerned. Coal provides another example. So far, coal had been used in France by a limited number of trades. This number was now growing, not least due to the new steam engines. Although the problems caused by the carbon dioxide they gave off were well known, the government encouraged their use, partly because of wood scarcity, partly because of "the necessities of modernisation", according to the terminology of the time. The production of soda from marine salt (Leblanc process) was another industry which was strongly encouraged, in spite of the massive

release, in the atmosphere, of calcium sulphur and muriatic acid it involved. Industries using traditional processes were still regulated by old rules while the new and flourishing ones, generally using mineral (instead of organic) materials and fire (instead of putrefaction) as a tool for transforming them, were encouraged on behalf of economic modernization. A tendency had appeared to treat the pollution they emitted as a political and administrative issue rather than as a sanitary and judiciary issue.

At that time, however, the police and the civil courts still had the right to order the move or even the closing of polluting factories. They used it with more or less rigour according to the place. Chemists (who were usually both scientists *and* industrialists) then complained about what they called an "intolerable arbitrariness" (Massard-Guilbaud 2010). In the meantime, the revolutionary rulers gave these chemists a new political weight in calling for their help during the wars against the combined forces of the European monarchies (Guillerme et al. 2004). They would use this new influence to get the tendency just described formalized. The way pollution was regulated dramatically changed. The powers of police and courts were strongly reduced in favour of the administration.

This happened in France, and beyond France, in the large part of Western Europe occupied by the French, in 1810. The decree of 15 October 1810 that organised the new deal was taken after two successive reports had been asked to the chemistry class of the French Academy by the famous chemist Jean-Antoine Chaptal, also Minister of the Interior. The scientists who sat in the Academy were obviously juge and jury: scientists called to say what was or was not polluting, they were also, as industrialists, the main polluters of the country. As we can guess from this configuration, the 1810 decree was not made to protect the health of the population nor the environment. It was made to confirm that from then on, polluting industry deserved the protection of administration against their neighbours' prosecution. Or, to tell it differently, as all kinds of private property were important to the French government issued from the Revolution, to arbitrate between two forms of property and the rights associated to them: the right, for land owners, to enjoy their property without being polluted by a factory, and on the other hand the right to practise new and profitable trades without being threatened by neighbours, police and the courts. Pollution itself was not condemned, just treated as a secondary effect of trades deemed by the middle class valuable both for the economy and the working class who needed work.

When in 2010 the history committee of the ministry of Ecology decided to celebrate the bicentenary of this decree, it was difficult for historians to persuade those working for its administration that the 1810 decree was definitely not the first ever law adopted to protect the environment, as many still believe. But all historians agree that it really meant to protect industry, whatever the damages the latter could cause.

The decree classified industry identified as polluting in three classes going from the less to the more so. Those of the two first classes would have to get an authorisation before being practiced, and the most polluting should also be settled far from any habitation. All would have to implement the safety and sanitary

measures imposed upon them by the administration. On the other hand, once they had been authorised, nobody could pretend to see them moved or closed. The civil courts, which in the past used this ability, could from then on only grant financial compensations to those who would suffer pollution. Pollution had become a political and administrative issue (in the sense that it was ruled by the central state or its local representatives, the *préfets*) instead of the health and sanitary problem dealt with by the police that it was in the past.

The philosophy of this decree was to remain the basis of the modern regulation, though the moving away was renounced to in favour of technical measures supposedly reducing the nuisances, and the nomenclature was modified on several occasions before being fundamentally reformed in the 1970s. People tried to use in their own favour the 1810 decree, that they often called "the decree that protects us from pollution". But this was most often to no avail, for a number of reasons. First of all, the nomenclature that classified industries according to the degree of pollution they created was done by a committee composed of industrialists and engineers, little inclined to thwart their peers. Secondly, even when appropriate measures were ordered, they usually went unheeded. Only a few cities appointed inspectors to control their implementation. The central state, on its side, did not create inspectors before 1917. Ill trained for this task, too few and without real possibility of sanction, they were rather helpless. Finally, pollution was very little analysed, measured and understood, in a time when, at the end of the century, another industrial revolution brought on the markets an increasing number of new chemical products. While a growing number of physicians understood and advertised the effects of various pollutions on health, their voice remained little heard until well into the twentieth century.

1.3 The Twentieth Century: Changes in Nature and Scale

In the 20th century, the type, level and scale of pollution changed dramatically. The historian John McNeill (2000) argues that never before were environmental changes as intensive, and to such an extent triggered by human action. In the rest of this text, we will therefore look at pollution on a more global scale.

The great wars of that century exemplify this tendency (Hupy 2008). The appalling destructions they caused, especially in the landscapes (mainly by the destruction of forests by bombings) are well recorded. But they also polluted the environments where they took place. During the First World War, chemical weapons were used massively for the first time: about 65 million shells were fired on the Western front. The consequences on the French, Belgian and Dutch ecosystems are still to be specified. The existing studies show that the concentration of lead, zinc, copper, sometimes arsenic, in the soils, are higher than they should be. The most dramatic case is that of the "Gas Place", a 70-meter-wide circle North-East of Verdun where 200,000 chemical shells were incinerated before 1928 and where nothing has been able to grow ever since. In 2012, the consumption of

water in 544 municipalities in the North of France was restricted because of levels of pollutions certainly provoked by weapons and munitions abandoned in their territories during the Great War (Masson-Loodts 2014).

Surprisingly, the most devastating polluting effect of the Second World War does not come from the radiations of the nuclear explosions of Hiroshima and Nagasaki: recent studies tend to show that the ecosystems were resilient and quickly recovered (Tsutsui 2003). More damaging seem to have been for instance the 10,000 tons of phosphorus bombs that were dropped on Hamburg in July 1943, or, more generally, the intense mining and industrialisation of the fighting countries (Hamblin 2013).

During the Vietnam war, about 70 million litres of the "agent orange" herbicide were spread over the country between 1961 and 1971, with dreadful consequences for the population (who still suffers from cancers and malformations) and the environment: 40% of the arable lands have been contaminated (Stellman et al. 2003).

Beyond the case of these major wars, most researchers agree that the period post-1945 was a turning point in terms of pollution. In *The Earth as transformed by human action*, Turner (1990) uses 10 indicators to estimate the global and regional changes in the biosphere from 10,000 years ago to the mid-1980s, among which carbon, sulphur, nitrogen, phosphorus, lead and carbon tetrachloride releases. Except for carbon, they all reach their first quartile of their 1985 total change after 1900, and, except lead, after 1945: the releases of these chemical components have therefore been far more intensive in the last half-century than in the whole of human history. Steffen (2005), in *Global Change and the Earth System*, also depicts a trajectory of deep global changes that take off around 1800 and speed up after the Second World War. As for Christian Pfister (1995), he argues that it was during the 1950s that the global threats to the earth really began, mainly because declining oil prices led to a wasteful organisation and exploitation of the world. Finally, Donald Hughes (2009) claims that "the kinds of changes inflicted by industry on ecosystems since the Second World War include some that had not been know during previous centuries. Plutonium and other radioactive wastes, non-biodegradable insecticides, chlorofluorocarbons, plastics, artificial pheromones and hormones, and many of the rest of the tens of thousands of industrial chemicals in use either did not exist or were not disseminated in major quantities until recently". All these authors emphasize the main features of the post-1945 environmental pollution, namely its intensification, its globalisation, its invisibility and its long-lasting effects.

1.4 Intensification of Pollution

First of all, environmental pollution considerably intensified after the Second World War. Several reasons can explain this, the first one being related to changes in agriculture. The use of phosphate-enriched fertilizers in agriculture started in the 19th century, and the Haber-Bosch process to create nitrate was invented in 1913. The possibility to add phosphorus and nitrogen to the soil liberated agriculture from

its previous limits and from the metabolic cycle that had been preserved so far. Indeed, up to this moment, it was necessary to restore the nutriments of the soil by the use of manure, crop rotations or the import of guano from Peru. This was no longer necessary; recycling waste from the cities, for instance, which had been a concern throughout most of the 19th century, but was becoming more and more difficult with the use of water-flowing devices, was gradually abandoned. But this took time, and it is only after 1945 that the agrarian revolution really took off, with monoculture production based on mechanisation and the massive use of both fertilizers and pesticides; it was first implemented in developed countries, and, through the "green revolution", in developing countries, mainly from the 1970s onwards. In 1940, 4 million tons of fertilizers were used in the world; it reached 40 million tons in 1965 and 150 million in 1990 (McNeill 2000, p. 54). As a consequence, nowadays, the flux of nitrogen produced by mankind is twice as important as the natural, while, for the flux of phosphate, the ratio is of 8 to 1! About half of these products ends up in waters, whether ground water, rivers, or, *in fine*, oceans. 9 million new tons of phosphate are thus accumulating every year in the oceans. The consequences are well known: a lower oxygen content of waters, and a eutrophication of rivers and estuaries (Bonneuil and Fressoz 2013, p. 23).

This more intensive agriculture has enabled a considerable growth of the human population: from 1 billion in 1800, it grew to more than 2 billion in 1945 to reach 7 billion today. Turner (1990) considers the increase of population as the major force of environmental change, especially in the 20th century. Such a growth was accompanied by a redistribution of the population and a massive urbanisation: in 2009, more human beings lived in cities than in the country; this can be considered as a decisive turning point in the history of mankind. The problems are roughly the same as in the 19th century, but greatly increased: the mere concentration of people induces massive discharges in the soils, waters and in the atmosphere, which durably affect the close and even remote environments of the towns (concentrations of metals in urban soils are between 10 and 100 times higher than in natural conditions). Mexico City or Beijing, both approaching 20 million people, are telling examples of such issues, with their legendary atmospheric pollution, the contamination of water, the high levels of heavy metals in their soils and the replacing of natural ecosystems by built land. The fact that a growing part of mankind is adopting a non-sustainable way of living, based on automobile, mass consumerism and its wasteful mentality, makes matters even worse. The world consumption of energy has considerably risen since 1800.[1] This has led, among other things, to a dramatic increase in the emission of greenhouse gases, which has reached 14 Giga tons equivalent carbon in 2000. The production of energy is responsible for 38% of these emissions, industries for 25%, transports for 24%, and heating and other uses

[1]The rise is certain, but estimates vary: McNeill believes that it has been multiplied by 40 between 1800 and 1990, and by 12 since 1900 (p. 41); Jancovici gives a factor of 150 since 1850 and 30 since 1900 (p. 19). Of course these figures hide considerable variations between countries according to their economic growth and development.

for the remaining 13%. Such levels are unknown in the history of mankind and their effects on ecosystems still to be fully measured (Jancovici 2002, pp. 150–158).

The last major fact that contributed to the huge increase of pollution in the 20th century, and mainly in its second half, is the industrialisation of the world and the growing number of heavy metals and chemicals discharged in the biosphere. The production of chemicals, that started, as we have seen, in the 19th century, has greatly increased in the course of the 20th century. About 10 millions have been synthesised since 1900, and around 150,000 have been marketed. Lead and cadmium emissions have been multiplied by 20 between 1875 and 1975, with considerable damages: in 2013 in China, the magazine *China Weekly*, revealed that nearly half of the rice sold in Guangzhou was strongly contaminated by water polluted by cadmium, recalling what happened in Japan, where, in 1980, 10% of the rice was inedible for the same reason (McNeill 2000, pp. 57–58). Lake Baïkal under the former USSR is another famous example of an ecosystem degradation by industry. Considered as one of the clearest fresh water lakes in the world, it provided untreated clean water to its inhabitants until cellulose plants were established on its shores in 1958 and discharged their effluents. Even though they closed in 2013, the addition of waste dumped into the waters and of pollution by transports have deeply altered this fragile and unique ecosystem (Hughes 2009, p. 191)

1.5 A Global and Cumulative Pollution

The second main feature of post-1945 pollution is its globalisation. This is due partly to the intensification, but also to the diffusion of industry, chemicals, and economic growth all over the world. Up to the middle of the 19th century, pollution was mainly concentrated in some urban or industrial regions, even though it was less and less contained and started to cover larger areas. It now became worldwide: no place on earth, no ecosystem remained undisturbed. Lead coming from petrol has been found in Greenland ices, and snowflakes on the South Pole have revealed traces of insecticides (Ramade 2000). The globalisation in the depletion of the ozone layer by chlorofluorocarbons, for instance, was dramatically revealed in 1985 when British scientists announced the existence of a hole over the Antarctic. This led to the Montreal Treaty in 1987, that planned to reduce by 50% in ten years the emissions of CFC. But despite its implementation and further strengthening of the legislation, the weakening of the ozone layer continues. The omnipresence of plastics, whose use has increased 20-fold in the past half century, is another sign of this globalisation: an estimated 150 million tons of plastic can already be found in all the oceans, and, at the current rate, this amount could double by 2050 (Ellen MacArthur Foundation 2016).

Moreover, what is now better perceived is the cumulative effect of pollution. As such, it is of course not new: the pollution by alkali fumes around St Helens in Great Britain in the 19th century did accumulate in the soil and along the food chain. But this is far better understood in the 20th century, mainly because of the

spread of pollution in most ecosystems. *Silent Spring*, published with great success in 1962 by Rachel Carson, is probably one of the earliest (and certainly one the most famous) studies of this phenomenon. Carson indeed demonstrates how the widespread use of DDT in agriculture, but also to destroy mosquitoes and flies in cities, was responsible for the dissemination of long-lasting pollutants, that would accumulate in the species situated high on the food chain. By the time the book was published, DDT was found in mothers' milk but also in penguins in the Antarctic; birds, especially, were threatened (the reproduction of pelicans or ospreys was put at risk), leading to a possible spring deprived of their songs… Even though the use of DDT has been banned in the United-States and in Europe, the former were producing pesticides in the 1990s at a rate thirteen thousand times faster than at the beginning of the 1960s (Radkau 2008, p. 295).

One of the most common long-lasting pollutions of the environment comes from metals such as lead or mercury, emanating from industries, dispersed in the air or water, and accumulating in the biosphere. The case of Minamata bay, in Japan, is a particularly well-documented example. In 1910, the Nippon Chisso company established there a chemical factory, that started rejecting mercury in the water in 1932. About a decade later, strange things started to happen to animals: fish died by hundreds, seagulls collided with walls and electric wires, and cats had an erratic behaviour, contracting the "disease of the dancing cats" before dying. Soon afterwards, around 1956, humans started to be affected: children suffered from brain lesions and were born deformed. It became clear as early as the late 1950s that mercury was at the origin of these disasters, but the company was so important for the economy of the area that it was difficult to fight it. Mercury only ceased to be discharged at the end of the 1960s, while the company was convicted a decade later. In 1990, about a hundred people had died from the "Minamata disease" while between 4 and 5 thousand were affected (Bouguerra 1997). One could add examples of nuclear pollution provoked by catastrophes such as those of Chernobyl or Fukushima.

Finally, this cumulative effect can be explained by the invisibility of most pollutions nowadays. Once again, as we have seen, they existed in the past. But then, the attention was focused on more visible nuisances: fumes, stinking waters, etc. In most developed societies today, these nuisances have been mainly displaced or covered. The population is now more and more concerned with other and more insidious forms of pollution, that are sometimes revealed belatedly. According to Herzlich and Pierret (1984), in France in the 1960s, the fear of epidemics and infectious diseases gave way to fears about the consequences of civilisation. Joachim Radkau agrees with such a statement, and believes that Western societies in general developed in the course of the 1950s–1960s a renewed concern for environmentally induced diseases, that was partially focused on cancer and the effects of nuclear technology (Radkau 2008, pp. 266–268). One has nonetheless to wait for the 1970s for a general concern over invisible pollutions, giving birth to environmental movements. In that respect, the cases of DDT and Minamata are two turning points for the United-States and Japan. In Germany, a particularly telling case is the issue of the *Waldsterben* (death of forests), which made the newspapers

headlines in 1981 and was decisive in the political organisation of ecologists in the country. As early as the 1850s, scientists had analysed the effects on forests of sulphur dioxide discharged in the atmosphere by iron mills in the vicinity of Dresden. Experiments were made on plants and cows to demonstrate the deleterious effect of such pollution—but these very innovative researches stumbled on the impossibility to determine a threshold of harmfulness. The issue reappeared now and then, but never with the intensity of the 1980s: by then, the pollution was said to be global; forests were dying because of sulphur dioxide emissions not only in Germany, but also all over the world. It was one of the first times when public opinion became aware of the possibility of global ecological catastrophes (Brüggemeier 2002).

That mankind was now capable of disrupting some of the basic cycles of nature and of transforming it on a global scale, suggested the coinage of the word "Anthropocene" in 2000 by Paul Crutzen, Nobel prize in chemistry: it described a new geological era where mankind could be considered as a geological agent per se. This notion, which is still not accepted by the international associations of geology, has led to multiple controversies. It is first difficult to determine a date when it would begin, even though a slight consensus tends towards the beginning of the industrial era at the end of the 18th century. By considering mankind as a whole, the notion also tends to disregard regional differences in the impact people have on the earth. It may also give too much prominence to economic and technological factors, while neglecting political and ideological decisions (Bonneuil and Fressoz 2013). It has nonetheless the benefit of alerting on the scale of the human impact on the earth as a whole, and on its acceleration in the last half-century or so.

Strong difficulties are thus to be faced by mankind. As Turner (1990) has shown, the three main forces of environmental change are population growth, technological innovation and socio-cultural organisation. None of them is easy to change and adapt to reach a sustainable relation with our planet. And pollution is only one of the many anthropic impacts on the environment of the earth: water control, deforestation, waste treatment, the building of lands and the destruction of biodiversity, among others, are issues that need to be addressed. But this rather bleak prospect should not obscure the efforts made, and the successes encountered, in the fight against environmental degradation. The 2005 Millennium Ecosystem Assessment, commissioned by the United Nations, offers in that sense some hope and prospects for the future: without hiding the complex implementation of solutions, it suggests some scenarios that could prevent further degradation or even allow a partial recovery of some damaged ecosystems (Millennium Ecosystem Assessment 2005).

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