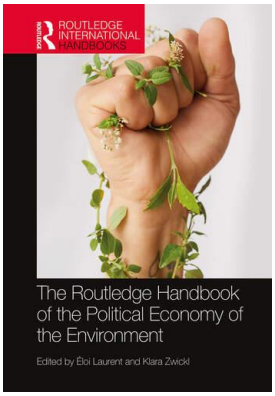

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The sustainability-justice nexus

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THE SUSTAINABILITY-JUSTICE NEXUS[1]

Éloi Laurent

Introduction: the social-ecological approach

"As a system approaches its ecological limits, inequality only increases": with these words written more than 30 years ago, the Brundtland Commission (United Nations World Commission on Environment and Development 1987) sealed the profound intertwining of unsustainability and inequality. By linking justice and sustainability in a "sustainability-justice nexus" (Agyeman et al. 2002)[2], a number of scholars have echoed this linkage in recent years, arguing that our societies will be more just if they are more sustainable and more sustainable if they are more just (Laurent 2011a, 2020; Dasgupta and Ramanathan 2014; Motesharrei et al. 2014; Gough 2017; Chancel 2020). Bridging the challenge of sustainability and the issue of justice inevitably leads to the need to think about social and ecological problems and policies together. When this is done, it appears that it makes environmental sense to mitigate our social crisis and social sense to mitigate our environmental crises. This is the basic statement of the social-ecological approach and the focus of this chapter.

The social-ecological approach (Laurent 2011a, 2020) considers the reciprocal relationship between its two dimensions, demonstrating how social logics determine environmental degradation and crises, and in turn exploring the social consequences of this degradation of the human environment. On the matter of inequality, the social-ecological approach is a two-way street: social inequalities feed ecological crises while ecological crises in turn aggravate social inequalities.

The first arrow of causality, which runs from inequality to environmental degradation, can be labelled "integrative social-ecology," as it shows that the gap between the rich and the poor and the interaction of the two groups lead to increased environmental degradation and accelerated ecological crises that affect every member of a given community (e.g. greater inequality leads to a lesser adaptation capacity of groups to climate change).

The reciprocal arrow of causality, that goes from ecological crises to social injustice, can be labelled "differential social-ecology," as it shows that the social impact of ecological crises is not the same for different individuals and groups, given their socioeconomic status (the most vulnerable socially appear to be "ecological sentinels" in the sense that they are first and foremost affected by current ecological crises, such as low-income groups in flooding regions, for instance in the US state of Louisiana).

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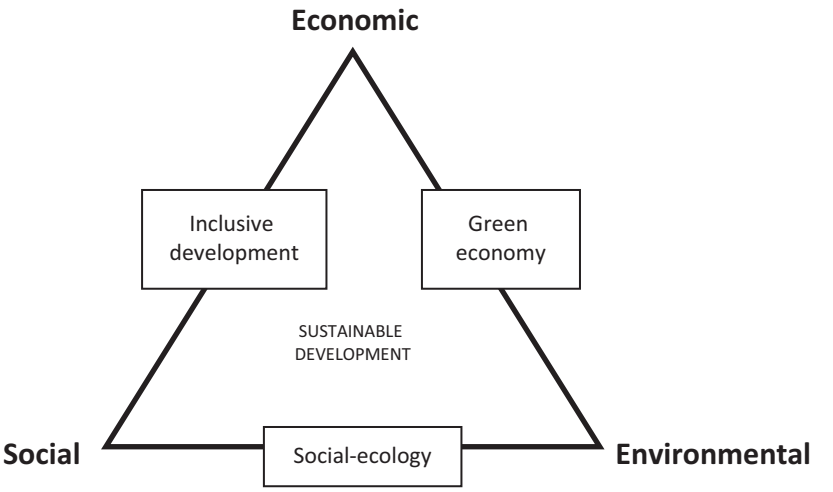

Figure 3.1 The three linkages of sustainable development
Source: Own illustration.

Environmental risk is certainly a collective and global horizon, but it is socially differentiated. Who is responsible for what and who bears the consequences? Such is the basic question of the social-ecological approach, and it is a response to a blind spot in sustainable development studies.

Indeed, as sustainable development assembles three dimensions (economic, social, and ecological) and while the economic-social and economic-ecological links have been explored in great detail in recent years (resulting in, respectively, the "inclusive development" and "green economy" paradigms, see Figure 3.1), the social-ecological link is more obscure, although it is becoming the focus of growing academic and policy attention. This chapter intends to shed some light on what appears to be a missing link in sustainable development.

The first section briefly reviews the available empirical evidence on the inequality and ecological crises; the second section reviews the transmission channels of the inequality crisis to environmental degradations; the final section reviews the different types of social inequality resulting from environmental degradations and crises.

Tacking stock of our twin crises[3]

Empirically, it is hardly debatable that intranational inequality on the one hand and environmental degradation and natural resource consumption on the other have been going up simultaneously in the last three decades.

Science and data with respect to climate change, biodiversity destruction, ecosystem degradation, and natural resource consumption, ever more precise and robust, are now widely consensual: climate is changing rapidly and in some places dramatically, ecosystems and nature's contributions to human well-being have been substantially degraded, biodiversity has been considerably eroded, and natural resource consumption is at an all-time high.[4]

Regarding inequality dynamics, two fundamental results have been established recently. First, Piketty and his co-authors have documented the rise of domestic inequality (or "within countries" inequality): in the last three decades, income and wealth inequality has grown in all

regions of the world, albeit at different speeds and from different initial situations (Alvaredo et al. 2018). Second, Milanovic (2016) has shown that if domestic inequality has increased, international inequality (or "between countries" inequality) has on the contrary started to decrease since 2000 but at a very slow pace: the Gini index of unweighted international inequality stands today close to 0.55. In short, the world is more equal than 30 years ago (but still at a very high level of inequality), but countries are a bit more unequal. The most remarkable evolution is the fact that weighted international inequality has started to decrease under the influence of the development of Global Asia, especially China and India. It remains that when all trends are conflated to measure inequality between global citizens (considering all people in the world regardless of where they live), inequality has in fact increased: the top 1% income share has grown significantly while the bottom 50% has stagnated (Alvaredo et al. 2018), and the world's Gini index stands close to 0.63.

The twin crises of inequality and damage to the biosphere are thus an undeniable empirical reality that demands to be analytically explained and remediated through policy.

According to Dobson (1999), there are three ways to relate justice principles and environmental issues: by considering that environmental quality (goods and "bads") is unevenly distributed among the members of a society; by making justice into a condition of possibility of sustainability; and, finally, by doing justice to the environment or by doing justice in the name of the environment (that is, by recognizing a right to nature and creatures who inhabit it in one form or another).

When considering the second option, Dobson denies that inequalities contribute to environmental unsustainability. He recognizes that environmental amenities and damages are distributed according to the level of income, but according to him, the fact that greater social justice (for example, through a more even distribution of environmental ills) improves environmental sustainability has not received empirical evidence. On the contrary, Dobson argues, there are many cases in which social justice and sustainability will contradict one another: improving the distribution of income and power could aggravate and not correct environmental unsustainability. This section argues against this view and highlights five channels through which inequality in fact harms sustainability.

Let's first consider the micro-ecological level, that is, the behavior of rich and poor in isolation. With respect to the rich, Veblen showed that the middle class's desire to imitate the lifestyles of the upper class can lead to a cultural epidemic of environmental degradation. Veblen called this phenomenon "conspicuous consumption," and the bigger cars, larger houses, more luxurious goods, and so on that the rich buy and the middle class desire have a heavy environmental toll. With regard to the poor, Indira Gandhi explained in her speech at the first international environmental summit in Stockholm in 1972 that "poverty and need are the biggest polluters." In the developing world, poverty is indeed leading to unsustainable environmental degradation, such as the dramatic depletion of forest cover in Haiti and Madagascar, the product of a losing trade-off between present and future welfare (see UNEP 2010; Barrett et al. 2011). Since the wealth of the world's poor lies in natural capital because of lack of access to other forms of capital, the depletion of such natural resources leads to further impoverishment. The eradication of poverty, thus, is not only a social benefit but also an environmental one, provided that it takes the form not of a game of consumerist catch-up but of a redefinition of comprehensive wealth, its components, and its indicators (World Bank 2009).

On the macro-ecological level – where the interaction of rich and poor and its environmental outcome is considered – it can be shown that a political economy process lies behind environmental degradation (Boyce 1994, 2002). "Winners" of environmental degradation are able to impose the costs onto the losers because the losers are either not yet born, ignorant of the

consequences of the degradation, or lacking in the power to limit them. Five macro-ecological channels through which rich and poor interact in environmental degradation, crises, and policies stand out in particular.

How inequality pollutes the planet[5]

Inequality increases the need for environmentally harmful and socially unnecessary economic growth

Inequality inflates the need for economic growth. If wealth accumulation in a given country is increasingly captured by a small fraction of the population, as it has been the case in many OECD (Organisation for Economic Co-operation and Development), emerging, and developing countries in the last three decades, the rest of the population will need to compensate with additional economic development. Krugman (2002) summed this up well: "Here's a radical thought: if the rich get more, that leaves less for everyone else." Since virtually no country in the world has managed to decouple (in absolute or net terms) economic growth from its negative environmental impact (Parrique et al. 2019), for example carbon emissions or waste, more economic growth currently means more of such "bads," whether locally or globally.[6] In the United States, between 1993 and 2011, 1% of the population managed to capture 75% of economic growth. A more even distribution of income (i.e. a growth of income of 2% for the top 10% and bottom 90% of the income distribution alike) would have reduced the total growth necessary to meet the needs of the vast majority of Americans and led to a small decline in CO_2 emissions (Laurent 2020). A more comprehensive empirical assessment has shown that if the US were to reduce inequality to the level of Sweden (halving their Gini index), emissions would go up by only 1.5%, suggesting that a very substantial but lower reduction in inequality would in fact decrease emissions (Laurent 2013).

But the equalization of economic conditions could, in fact, increase the ecological challenge since the marginal increase of environmental degradation is higher at the bottom of the income distribution than at the top.

By definition, there are two ways to reduce inequality: from the bottom up and from the top down. Reducing the income of the richest segments of the world's population (the 10% that emits roughly 50% of CO_2) via adequate taxation will logically result in important cuts in emissions. Second, assuming higher emission intensity of consumption per expenditure by poorer households (based on the classical Keynesian argument of marginal propensity to consume) omits two important facts. The first one is that "luxuries" yield much more carbon emissions than "necessities" do (to borrow the very relevant distinction introduced by Gough 2017). This is the case in any given developed or developing country (as we have seen for emissions in the UK); this is also the case internationally (Otto et al. 2019): a typical "super-rich" household of two people produces a carbon footprint of 129.3 tCO2e per year, with motor vehicle use generating 9.6 tCO2e per year, household energy emitting 18.9 tCO2e per year, secondary consumption 34.3 tCO2e per year, and 66.5 tCO2e per year generated by the leading emission contributor: air travel). Second, savings as well as consumption result in environmental degradation given the short-termism and inclination toward investments in fossil fuels of prominent financial institutions fueled by the global savings surplus (such as Goldman Sachs).

Moreover, such conclusions assume that the reduction of inequality would entail spreading the lifestyles, wasteful consumption, and ecological footprint of the richest. If so, then the ecological pressure would indeed become unbearable: ecological footprint data clearly show that high-income countries drive the global "ecological deficit" (WWF 2018). But an

alternative view holds that shifting from captured development to shared development while redefining development itself can in fact create the necessary room for sustainable social progress (Laurent 2018).

Inequality increases the ecological irresponsibility of the richest, within each country and among nations

Widening inequality exacerbates the fundamental tendency of capitalist enterprises to maximize profits by externalizing cost and turning socially deprived areas into "pollution havens" within countries and across their borders. The financialization of the economy (Epstein 2016) over the past three decades has exacerbated this tendency by shortening time horizons and increasing indifference to unsustainable natural assets management. As the gap between rich and poor grows, governments and businesses find it easier to transfer the environmental damage of the activities of the rich to the neighborhoods of the poor. Income and power inequality, which tends to dissociate polluters from payers, thus act as a disincentive for ecological responsibility or as an accelerator of ecological irresponsibility (Princen 1997).

On the consumption side, the richest consumers present a paradox. They declare in surveys that they care more about the environment than the poor do, and they are indeed, according to the same surveys, more likely to adopt the best environmental practices or to favor more ambitious environmental policy (Laurent 2020). However, at the same time, they pollute more than the poor do in absolute terms because of their higher incomes and more expensive lifestyles. They are also more able to protect themselves from the negative impacts of their behavior as they become richer.

Widening inequality therefore increases not only the demand for a better environment among the richest but also their ability to acquire this good at a lower cost by transferring all corresponding environmental damages to the poorest. For example, in Spain, water has increasingly been diverted from small agricultural enterprises to large coastal tourist facilities. Wealthy tourists enjoy water as a natural amenity and are able to transfer the cost of its abduction and stress to growingly impoverished farmers who now face structural droughts (Sinha et al. 2020).

On the production side, a company faces two essential options to reduce the environmental cost of its production. On the one hand, it can try to adopt the best available technology and to reduce the environmentally harmful impact of its production, a decision that can entail a high economic cost in the short run. On the other hand, it can seek to minimize the economic cost of the social compensation public authorities might demand from it. Income and power inequality will lead the company to relocate to a socially deprived area where people have low incomes and weak political mobilization capacities. The residents of that area would be, presumably, less willing to pay for environmental quality and therefore would demand lesser compensation for environmental damage. Likewise, the feeble political capability of the residents would limit the risk of the emergence of collective action to resist the damaging production.

These dynamics also apply internationally and explain why inequality between countries can result in tragic but avoidable environmental disasters like the chemical pollution in Bhopal in December 1984 or the current degradation of the Niger Delta. Climate change is another case in point: Western societies are less likely to reduce their greenhouse gas emissions because they have little economic incentive to do so as long as they are able to adapt to the most devastating effects of climate change. The reverse is of course true for low-income countries, which contribute little to global emissions but will pay the highest human price for the coming destructive climate. The most striking example of this global injustice may be Africa. The continent

accounts for less than 3% of global emissions, but water stress in Africa due to climate change could threaten the well-being of up to 600 million people in the coming decades.

These mechanisms could also account for the striking disparity in biodiversity preservation around the world, as measured by the World Wildlife Fund's Living Planet Index. The decline of the index has been uneven. From 1990 to 2008, the index increased in developed countries by 7%, but it plummeted by 31% in middle-income countries and by 60% in low-income countries. According to the WWF, geographic factors explain only a fraction of the difference. International inequality likely plays an important role, for richer countries are able to preserve their biodiversity while simultaneously exploiting that of countries rich in natural capital but poor in income. For this very reason, evaluations of the ecological impact of a region like the EU, which imports much of its energy and raw materials, should take into account the damage done outside the region, in the original source of production and extraction (Laurent 2020).

Inequality, which affects the health of individuals and groups, diminishes the social-ecological resilience of communities and societies and weakens their collective ability to adapt to accelerating environmental change

A substantial body of research, initiated by Richard Wilkinson and Michael Marmot, has confirmed the negative impact of social inequality on physical and mental health at the local and national level (via stress, violence, less access to health care, etc.).[7] Inequality also acts as an underlying driver of many diseases perceived as natural or biological in the developing world. Paul Farmer, for instance, has asserted, "inequality itself constitutes our modern plague" (see studies from the World Health Organization [WHO] on "preventable burden" of diseases, especially Prüss-Üstün et al. 2016). Myriad governmental and international institutions have already begun to embrace this avenue of research in crafting policy agendas (the WHO, to name only one).

The concepts of social-ecological resilience and vulnerability are in fact now common in the discourse of environmental science. Environmental scientists have begun to describe vulnerability to "natural" disasters as a function of exposure and sensitivity to a given shock, on the one hand, and adaptive capacity and resilience, on the other. Considered within this framework, inequality increases exposure and sensitivity and weakens adaptive capacity and resilience: it acts as a multiplier of the social damage caused by environmental shocks for developed and developing countries alike (as was shown with the COVID-19 pandemic human impact on unequal societies such as the United States).

Inequality hinders collective action aimed at preserving natural resources

According to the "logic of collective action" (the classic theoretical framework formulated by Mancur Olson), a small group of wealthy individuals, convinced that they are the ones who will receive the greatest benefit from environmental protection, would be ready to pay the high cost of ambitious environmental policies. The few (richest), the argument goes, have a logistic comparative advantage over the many (poor). Accordingly, a larger group of people, with more heterogeneous revenues, would not be able to find ways to effectively organize to protect the environment.

This line of reasoning, which suggests that inequality is actually favorable to the preservation of natural resources, has been proven wrong both theoretically and empirically (Baland

and Platteau 1997; Klooster 2000). A number of studies have shown that inequality is, in fact, adverse to the sustainable management of common resources as it disrupts, demoralizes, and disorganizes human communities (see for instance Andersson and Agrawal 2011). The work of Elinor Ostrom in particular demonstrated that institutions that allow communities to preserve resources essential to their long-term well-being are based on principles of reciprocity and fairness, the very opposite of inequality. Adding to the evidence, Ostrom (2010) links equality and the ability of communities around the world to organize efficiently in order to exploit sustainably natural resources and to resist ecological shocks such as climate change.

Her critics, however, make one important point: the difficulty of extrapolating from a purely local context.

In order to account for scale, an analysis of the negative impacts of inequality on environmental decision-making must look toward national and international examples as well. The contemporary United States provides a useful illustration in this respect. Since the 1980s, the US has retreated from the ecological world stage, gradually transferring its prior role of global environmental leader to the European Union. Rapidly increasing income inequality and the corresponding political repercussions might provide an illuminating explanation for this turn of events.

Environmental policy making requires a broad consensus transcending party boundaries, and the simultaneous rise of income inequality and political polarization (understood as growing distance between parties) has reduced the possibility of such bipartisan cooperation. It is now almost impossible in the US to enact ambitious legislation of the caliber of that passed in the 1970s, which later became a model for other nations. While the EPA was formed in 1970, at the beginning of the golden decade for environmental legislation, it is now much more difficult even to confirm a director for the agency. The EPA is also, internally, the subject of political pressure motivated by industrial lobbying, especially from fossil fuels companies that have been empowered by growing economic inequality.

As studies have identified a correlation between income inequality and political polarization in the US, we can think of environmental policy as one of the many policy casualties of the "dance" between these two trends (McCarty et al. 2006). Political polarization and economic inequality both deepened over the past decade. Correspondingly, inertia in the face of environmental degradation has worsened, with the devastation of the Appalachian region and the sabotage of climate negotiations. In this latter case, as with other domestic and global environmental challenges, polarization is combined with an overall shift to the right of the political spectrum, so that the status quo caused by polarization results in a more pro-business and anti-environmental policy.

This polarization dynamic at the local and national level replicates itself on the global scene. Recent research, for instance, has shown that "support is higher for global climate agreements that distribute costs according to prominent fairness principles" (Bechtel and Scheve 2013). Equality and fairness among parties to international environmental negotiations appears to be a key feature of successful global ecological governance (like the Montreal Protocol on ozone layer–depleting substances). On the contrary, inequality in the negotiation process (procedural inequality) and/or distribution of costs (distributive inequality) among nation-states can alter the progress of ecological sovereignty pooling, as with United Nations Framework Convention on Climate Change (UNFCCC) conferences.

Finally, a recent study goes a step further by arguing that inequality could play a key role in bringing about a global ecological collapse. The study investigates the possibility of civilizational collapse, drawing on a rich literature and relying on a new model named "HANDY" (human

and nature dynamical), whose particularity is to add a social stratification variable to already existing features of earth models. Humans, in the model, are divided between "Elites" and "Commoners" and their consumption of natural resources is differentiated according to their economic and political power (Motesharrei et al. 2014).

The model's key insight is that ecological collapse can not only come about because of "the stretching of resources due to the strain placed on the ecological carrying capacity" but also due to "the economic stratification of society into Elites [rich] and Masses (or 'Commoners') [poor]." The grim conclusion of the authors regarding one of their key scenarios goes as follows: "the Elites eventually consume too much, resulting in a famine among Commoners that eventually causes the collapse of society." Yet, Motesharrei et al. (2014) also show that this seemingly irresistible collapse by inequality can be prevented through a reduction of current levels of social stratification, a more equal distribution in the consumption of natural resources, and a higher efficiency in this consumption (although technological progress alone cannot, in the model, prevent the eventual collapse).

Inequality reduces the political acceptability of environmental preoccupations and the ability to offset the potential socially regressive effects of environmental policies

Surveys on the political economy of environmental policies have shown that people generally view such policies as socially regressive, which they can, in fact, be (Serret and Johnstone 2006). Growing relative and absolute inequality can thus translate into a reduced acceptability of short-term social (real or perceived) "sacrifices" for long-term (social-ecological) benefits. The failure of France to adopt a carbon tax in 2009/2010 illustrates this argument (Laurent 2020). The socially regressive effect of the tax was obvious, as the bottom 20% of French households spend 2.5 times as much of their income on energy as the top 20% of households do (Laurent 2020). Unsurprisingly, polls reported that as much as 66% of the French population opposed the carbon tax, mostly on economic grounds, with a sharp division between lower-income and higher-income social categories. The government eventually decided to abandon the project in March 2010 after a grueling political defeat amidst rising unemployment and poverty in the context of the "great recession." In 2018, this time facing a full-blown social revolt in a context of severe tax injustice (the so-called "Yellow vests" unrest), the French government decided again to suspend the carbon tax (Berry and Laurent 2019).

The public budget constraints produced by growing inequality, which translates at the macroeconomic level into lower aggregate demand and lower tax revenues, further exacerbate the problem of political acceptability. Inequality makes it more complex and costly, if not impossible, to implement effective compensation mechanisms to counteract possible regressive effects of certain environmental policies, because there are too many people to compensate with too little resource (Nordic countries have been able to successfully implement carbon taxation precisely because they have very low income inequality levels, dynamic economies, and efficient welfare states which foster social consensus). However, social compensation for policies like carbon taxes is a key factor to their political acceptability and even their economic efficiency. In fact, all countries and localities that have adopted carbon taxes over the last two decades have also adopted compensation mechanisms for households and firms that overcame the initial resistance from citizens and businesses (such as in Nordic countries and the Canadian province of British Columbia see Boyce in chapter 17).

The rise of environmental inequality[8]

While the impact of inequality on environmental crises that has been detailed in the previous section may be harder to grasp, the reverse relation is easier to understand and to explain. Environmental conditions determine well-being, most prominently through health-related factors. Therefore, environmental degradation leads to significant and socially differentiated well-being impact.

Recent work by the World Bank shows that extreme climate shocks disproportionately affect the world's poorest and threaten to tip hundreds of millions of hungry people into poverty (see Hallegatte and Walsh in chapter 8). But climate change is just as much a challenge for solidarity in European countries, as European Environment Agency data show: fluvial and coastal floods have affected millions of people in Europe in the last decade; health consequences include injuries, infections, exposure to chemical hazards, and mental health impacts; and heat waves have become more frequent and intense, causing tens of thousands of premature deaths in Europe.

To understand why environmental inequalities may be unjust, one must adopt an explicit theory of justice. Many conceptions of justice co-exist and determine different streams of environmental justice. One of them consists in embracing the capability-building and human development framework developed by Amartya Sen. In essence, the capability approach recommends that well-being be assessed beyond material conditions and also reflect the quality of life of a given person. Among the determinants of quality of life, environmental conditions appear to be of great and growing importance.[9]

Based on Sen's analytical framework, one can define an environmental inequality as a situation that results in an injustice or is unjust if the well-being and capabilities of a particular population are disproportionately affected by its environmental conditions of existence (Laurent 2020). The environmental conditions of existence consist of, negatively, exposure to pollution and risks, and, positively, access to amenities and natural resources (water, air, food). The particular character of the population in question can be defined according to different criteria: social, demographic, territorial, and so on.

Environmental justice therefore can be said to aim at identifying, measuring, and correcting environmental inequalities that result in social injustice. It implies the adoption of an effective arsenal of public policies grounded on scientific research. Yet, one should be clear that environmental justice does not imply that environmental conditions must be equal for all citizens or groups, but that they should not disproportionately affect their well-being and capabilities with respect to the rest of the population.

Different categories of environmental inequality exist and can be broken down to be properly identified and possibly addressed and mitigated.

In a first typology, one can distinguish three forms of environmental inequalities according to their generating factor:

- Inequalities in exposure, sensitivity, and access: this category refers to the unequal distribution of the quality of the environment between individuals and groups. This quality can be negative (exposure to harmful environmental impacts such as urban air pollution) or positive (access to environmental amenities such as green spaces but also water or energy considered from the perspective of their quality or price). In this category of inequalities are included social vulnerability to social-ecological risks (Seveso sites, heat waves, floods, etc.), the risk of cumulative effect of social and environmental inequalities (the educational difficulties of children in the American city of Flint, Michigan, who are exposed to heavy

lead water pollution), and the risk of longer-term social consequences of environmental inequalities (such as the effect on education or long-term income of the prenatal or perinatal exposure to urban air pollution).

- Distributive inequalities of environmental policies: the unequal effect of environmental policies according to social category, in particular the unequal distribution of the effects of tax or regulatory policies between individuals and groups, according to their place in the social category income scale (vertical inequality) and their location in social space (horizontal inequality). The differential impact of carbon taxes, which are also energy taxes, depending on income level and place of residence, for example, falls within this category of environmental inequalities.
- Inequality in participation in environmental public policies: the unequal access to the definition of environmental policies according to social and political status, policies that nevertheless partly determine the environmental conditions of individuals and groups. A well-known example of this type of environmental inequality is the lack of consultation with local populations on the choice of sites where toxic equipment such as incinerators are installed. Environmental inequality with respect to involvement in policy making means that individuals and groups with more resources have more access to environmental policy making on a local, national, or global level (simply because, for instance, they are informed of hearings or townhalls and can afford to attend and participate).

In order to include in the analysis the critically important issue of unequal impacts of individuals and groups on environmental degradation,[10] a simplified typology of environmental inequalities regarding generating factor consists in dividing them into two categories: the inequality impact *of* individuals and groups on environmental damage and definition of environmental policies and the inequality impact *on* individuals and groups of policies and environmental damage.

A second typology of environmental inequalities consists in considering their inequality vector (air pollution, environmental pollution, access to natural resources, exposure and sensitivity to social-ecological disasters, etc.). Finally, a third typology looks at criteria of inequality: according to age (exposure to heat waves of isolated elderly people), socioeconomic level (living on the ground floor in the event of a flood or under the roofs in the event of a heat wave), the quality of housing (indoor air pollution hits the poorest through insalubrity), the neighborhood (children of poor families in French cities of Marseille or Lille are more exposed to fine particle pollution and therefore its lasting social consequences), and the locality (coastal areas for storms, urban areas deprived of vegetation for heat waves).

We can thus distinguish three typologies of environmental inequalities: the first according to the event generating the inequality (or generating factor), the second according to the inequality vector, and the third according to the inequality criterion. Table 3.1 summarizes this framework.

Using this typology, we can determine that the environmental inequality experienced by a Parisian child living near dense traffic during a spike of pollution due to particulate matter 2.5 (PM 2.5) is an inequality of exposure whose vector is air pollution and criteria are age, neighborhood, and locality (at play with possible others such as race and income level). When it comes to measuring environmental inequality, multiple measures rather than single indicators are needed (see Boyce et al. 2016). We can review different types of environmental inequality according to the criteria presented in Table 3.1. Mitigating these various inequalities should be at the heart of the "just transition" (see chapter 15).

Table 3.1 A unified typology of environmental inequality

Philosophical approach	*Generating factor*	*Inequality vector*	*Inequality criterion*	*Example of environmental inequality*
Procedural justice Recognitive justice	Impact of individuals and groups on environmental policies	Exclusion from public decision-making procedures		Non-participation in the decision to install a toxic site (for example a chemical plant) in the city of residence
	Impact of environmental policies on individuals and groups	Taxation, regulatory policies, information/ awareness	Age, gender, socioeconomic level (income, health, education, etc.), spatial location, nationality, ethnic characteristics, etc.	Vertical and horizontal income inequalities caused by carbon taxation
Distributive justice	Exposure/sensitivity to damage and access to resources	Pollution, access to natural resources and environmental amenities		Unequal exposure and sensitivity to fine particle pollution in urban areas
	Impact of individuals and groups on nuisance and damage	Emissions of local and global pollution, consumption of natural resources		Carbon footprint of households in the top income deciles

Source: Author.

Air pollution

According to official WHO estimates, ambient air pollution is responsible for 4.2 million deaths per year worldwide, while indoor air pollution is responsible for 3.8 million deaths per year.

A study published in March 2019 (Lelieveld et al. 2019) estimated that outdoor pollution alone could cause up to 8.8 million additional deaths worldwide due to the underestimated health damage from fine particles and other nanoparticles that not only degrade the respiratory system but also the neurological system.

While air quality is a major determinant of quality of life for Europeans (European Commission 2017), air pollution is the greatest risk they run in terms of environmental health: the aforementioned March 2019 study estimates that the annual rate of excess mortality due to ambient air pollution in Europe would be 790,000 and 659,000 in the EU 28 (leading to a reduction in average life expectancy of 2.2 years). About 80% of heart disease and stroke cases, as well as a similar percentage of lung cancer, are linked to air pollution. Air pollution is also associated with adverse effects on fertility, pregnancy, newborns, and children (Science for Environment Policy 2018).

In France, fine particle pollution causes more than 48,000 (preventable) deaths each year, or about 8% of all deaths, as much as alcohol-related mortality, corresponding to a loss of average

life expectancy at 30 years of 9 months. If we add the health impact of two other major air pollutants (ozone and nitrogen dioxide), air pollution is responsible for 58,000 premature deaths, or about 10% of all deaths in France. A recent European study on the health impact of fine particle pollution in France reveals that if WHO standards were met, life expectancy at age 30 could increase from 3.6 to 7.5 months according to the French city studied (Pascal et al. 2013).

Inequality in environmental pollution is evident internationally: 97% of cities in low- and middle-income countries with more than 100,000 inhabitants do not comply with WHO guidelines. But even in wealthy developed countries, while air quality has improved markedly over the past decades, exposure to pollution remains far too high and uneven.

It is estimated that around 20% of Europeans are exposed to dangerous particles in the air they breathe (PM10).

The aforementioned study on air pollution in French cities in France (Pascal et al. 2013) also reveals the extent of territorial inequality linked to this exposure to air pollution: the impact on health varies considerably between urban areas (by a factor of two between Toulouse, the least polluted city studied, and Marseille, the most polluted) and within the urban areas themselves. Proximity to road traffic thus considerably increases morbidity due to atmospheric pollution (near roads with heavy traffic, the study revealed a 15% to 30% increase in new cases of asthma in children and chronic respiratory and cardiovascular pathologies prevalent in adults 65 years of age and over).

Thus, the overall impact of air quality on health makes it possible to highlight territorial inequality and finally the impact of pollution on the most vulnerable social groups living in urban areas. At the bottom of this chain, social injustice is compounded by the fact that air pollution can have lasting effects on children's abilities throughout their lives (Currie 2011). Likewise, current research in toxicology emphasizes the impact of the prenatal and perinatal environment on the biological and social development of children.

The issue of exposure is aggravated by that of sensitivity: a French study (Deguen et al. 2015) shows that even if the rich and poor neighborhoods of Paris are exposed to air pollution, the poorest inhabitants are three times more likely to die from severe pollution than the richest because of poorer health and less access to health care.

Risk, noise, and chemical pollution

With regard to chemical pollution of the environment, a first issue concerns the fairness of the distribution of hazardous or toxic sites (the health harms caused by these facilities cannot be proven, since it is their harmful nature that justifies their classification as toxic sites). Recent studies show that environmental exposure is far from being socially homogenous in the US (see, for example, Mohai and Saha 2015), China (see Liu 2012), or Europe (European Environment Agency 2019).

Noise, considered by many experts to be the second biggest environmental risk behind air pollution in terms of its health impact (measured in lost years of disability-adjusted life) should be treated as a form of environmental pollution. A new report by the European Environmental Agency or EEA (European Environmental Agency 2019), reviewing a number of environmental inequalities faced by European citizens (related to air pollution or exposure to extreme temperatures), documents the importance and unequal distribution of noise pollution in the EU. The EEA estimates that environmental noise causes at least 16,600 cases of premature death in Europe each year, with almost 32 million adults annoyed by it and a further 13 million suffering from sleep disturbance. In addition, cities with poorer populations have higher noise levels. The relationship between social inequalities and exposure to noise was highlighted by

a study published in early 2013 by the Regional Health Agency of the Ile-de-France region on the Paris major airport hubs (Laurent 2020). The results reveal that the share of population exposed increases with the level of socioeconomic disadvantage and that districts with a significant proportion of those exposed are those of the most disadvantaged. Other studies on noise, conducted for example in the Marseille region, arrive at less clear-cut conclusions and show in particular that it is rather the intermediate social groups that are most vulnerable to noise.

Chemical pollution is also unevenly distributed within nations as a growing body of research in France has shown in recent years. The PLAINE model built by INERIS allows, for example, the mapping of the presence of nickel, cadmium, chromium, and lead in certain parts of the country (see chapter 21). The results for the Nord-Pas-de-Calais region for cadmium document that two areas find themselves overexposed (Metaleurop and the periphery of the Lille metropolitan area). This issue of chemical pollution and overexposure of certain populations is related to the proliferation of "environmental cancer," that is to say, cancers attributable to environmental factors, which are now estimated at around 10% of all cancers in France.[11]

The occupational dimension of environmental inequalities also becomes more and more transparent. For the first time in 2011, the number of deaths from occupational diseases exceeded the number of deaths by accident in France. A considerable difference in life expectancy can be found between occupational groups (seven years between managers and workers and six years between managers and employees), with a gap that has increased rather than shrunk in the last 30 years (according to data from the French statistical agency Institut national de la statistique et des études économiques or INSEE).

At a more detailed level, exposure to endocrine disruptors (chemicals that may interfere with the body's hormonal system) is not homogeneous among occupations: industry, agriculture, cleaning, and plastic sectors exhibit the greatest degree of exposure. As in the case of particulate matter pollution, prenatal and perinatal exposure to such pollutants may have lasting adverse consequences. For instance, some studies link exposure to arsenic in utero and increased infant mortality, low birth weight, and reduced resistance to childhood infections (Farzan et al. 2013). It is this type of study that lead to the ban of bisphenol A in France, but much remains to be done on the many other endocrine disruptors.

Exposure to social-ecological disasters

Exposure to so-called natural hazards constitutes a major source of social inequality that is expected to worsen over the coming decades as ecological crises such as climate change become more severe. To put it in the phraseology of the United Nations (disaster risk reduction or DRR), "There is no such thing as a 'natural' disaster, only natural hazards": the impact of a given disaster depends on the choices we make for our lives and our environment. Every decision and every action makes us more vulnerable or more resilient.[12]

There are two possible ways to look at natural risks. The first hypothesizes that "natural" disasters occur randomly and that humans can hardly do anything about them (that is the etymology of the word "dis-aster," which essentially points to bad luck or adverse fate). The second way is to think that human responsibility lies at the heart of these events, which rather deserve the name of "catastrophes," which etymologically orients towards the idea of a happy or unhappy ending depending on human behavior. Those two worldviews have been respectively defended by French philosophers Voltaire and Rousseau during the controversy on the causes of the Lisbon earthquake in 1755 (Leigh 1967).

According to the Centre for Research on the Epidemiology of Disasters (CRED), over the 1998–2017 period, 90% of 7,255 listed natural disasters have been linked to climatic factors

(rainfall, droughts, storms, etc.), with floods and storms representing 70% of the total. In 2017, 335 natural disasters affected over 95.6 million people, killing an additional 9,697 and costing a total of US $335 billion. But this burden was not shared equally, as Asia seemed to be the most vulnerable continent for floods and storms, with 44% of all disaster events, 58% of the total deaths, and 70% of the total people affected.[13]

The EM-DAT database maintained by the CRED distinguishes between two generic categories for disasters: natural and technological. The natural disaster category is divided into five subgroups, which in turn cover 15 disaster types and more than 30 subtypes. The technological disaster category is divided into three subgroups, which in turn cover 15 disaster types.

This distinction between natural and human disasters is of course necessary and based on a completely understandable logic: the industrial accident that occurred in the Total refinery in Toulouse in September 2001 is not equivalent to the tragic earthquake that devastated Haiti in January 2010. But for the contemporary ecological crises (climate, biodiversity, ecosystems) having a human origin, the resulting disasters (floods, droughts, fires, etc.) can hardly be considered as natural.[14] Even more importantly, existing empirical studies clearly show that major contemporary ecological crises (climate change, destruction of biodiversity, degradation of ecosystems) do not have the same social impact around the world: everywhere they reveal social inequalities (that was the case when Hurricane Katrina hit the city of New Orleans in 2005, hardly affecting high-ground rich districts) and worsen them (many African-Americans were not able to recover from the disaster and had to leave the city).[15] The role of social capital for instance is crucial in social-ecological disasters.

In other words, current developments give increasing weight to Rousseau's view: social factors do play a crucial role in "natural" disasters, which are more appropriately "social-ecological" because their causes and impacts are more and more the results of actions taken by human societies.

An expression circulates in the humanitarian community that reflects the reality that "natural" disasters rarely result in fatality: "earthquakes do not kill people, buildings do." Researchers have tried to give substance to this idea by measuring since 1900 the intensity of the earthquakes that hit the planet, taking into account the population density of the regions affected and the level of wealth of their inhabitants (Hatzfeld et al. 2009). There have been 2.5 million deaths since 1900 due to earthquakes, half of them in China and 200,000 in Iran. The authors first attempt to quantify the annual risk in the different countries of death by earthquake (per million inhabitants). While this figure reaches 92 in Armenia, 41 in Turkmenistan, and 29 in Iran, it is only 0.6 in California and 0.008 in France.

But the study goes further in the analysis of data: taking into account the number of earthquakes of magnitude greater than 6, often considered as the destruction threshold, they obtain a ratio of 2,300 deaths/million/magnitude 6 in Armenia, 1,300 in Turkmenistan, and 300 in Tajikistan, but only two in California and 0.8 in France (Hatzfeld et al. 2009). Countries like Japan have learned throughout the 20th century to literally immune themselves from earthquakes' human impact, but not all countries have had the means to do so, an obvious observation when one considers the consequence of the two similarly powerful earthquakes that devastated Haiti in 2010 and barely affected Japan in 2011.

How to explain this striking difference? Rich countries have simply "learned to protect themselves from earthquakes": there is a decrease in the number of victims over time. This protection, which for some territories borders on seismic immunity, has been acquired through institutional progress.[16]

At the heart of the question of so-called natural disasters lies the issue of international and intranational inequalities. One can thus make two points that both call for action: human impact exacerbates natural disasters and makes some of them more frequent, and much of the

damage from all natural disasters occurs because of insufficient and unsustainable planning and a lack of foresight (e.g. the devastation associated with Typhoon Hayian in November 2013). Local and national policymakers must thus anticipate announced and virtually certain future disasters – especially heat waves and floods in rich countries and severe hurricanes in poor countries – if they wish to spare their citizens implacable future injustice. In particular, the role played by structural environmental inequalities but also the lack of social capital in certain communities exposed to social-ecological disasters such as heat waves or hurricanes warrants deeper analysis. For example, minorities face more exposure to the risks connected to urban heat island effect because their neighborhoods often lack tree cover or contain too many impervious surfaces, such as asphalt and concrete.[17]

Conclusion: toward a social-ecological policy

This chapter has attempted to show that the sustainability-justice nexus is a two-way street: inequality exacerbates ecological crises, which in turn aggravate inequality. There are encouraging signs that this nexus is gaining momentum in policymaking circles. At the global level, the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) have jointly launched the Poverty-Environment Initiative (PEI) in 2005 to help countries integrate poverty-environment objectives into their development plans and policies.

Conversely, it is more and more accepted that environmental inequalities can produce lasting and severe damage to the socially disadvantaged, perpetuating and exacerbating injustice. Studies on the effects of air pollution in Los Angeles have shown how exposure to atmospheric pollution affects school performance through the impact of respiratory diseases developed by exposed children. It has also been shown that children from poor families are more likely to be born with poor health because of the polluted environment experienced by their mothers during pregnancy (Currie 2011).[18] This, in turn, results in poor educational attainment and eventually lower income and lower social status. The question for decision makers interested in social justice is thus clear: how should the reality of environmental inequality inform public policy? The European Environment Agency, for the first time in 2018 (EEA 2018), has proposed an inventory of these inequalities in the European Union, recognizing that better harmonization of social and environmental policies and better local action are necessary in order to successfully address environmental justice issues.

Indeed, because of the growingly intertwined nature of theses twin crises, only a social-ecological policy would be sufficient to address the sustainability-inequality nexus (see Laurent 2020 and chapter 15).

Notes

1 This chapter draws from several papers and books written in the last 10 years.
2 The authors mentioned the existence of a nexus between "sustainability, environmental justice and equity."
3 This section is adapted from Laurent 2020.
4 See recent reports from the IPCC, IPBES, and UN Resource Panel.
5 This section is adapted from Laurent 2015.
6 Absolute decoupling of GDP growth and CO_2 emissions has actually been achieved in a number of countries over certain periods of time, but only on the basis of production or territorial emissions. Once the global ecological impact of their economic development is taken into account (i.e. "net decoupling"), only relative decoupling remains.

7 Richard Wilkinson and Michael Marmot can be credited for opening this avenue of research, now widely pursued in governmental and international institutions.
8 Some portions of this section are taken from Laurent 2020.
9 For more on the capabilities approach applied to environmental justice, see Schlosberg (2007).
10 Households in the top 10% in the US have a carbon footprint three times higher than that of households in the bottom 10% (Laurent 2020).
11 For more on this see www.cancer-environnement.fr/
12 UNDRR: www.undrr.org/about-undrr
13 Despite this, the Americas reported the highest economic losses, representing 88% of the total cost from 93 disasters. China, US, and India were the hardest hit countries in terms of occurrence with 25, 20, and 15 events respectively.
14 Blaikie et al. (2004) made the case for the need to set apart "natural events" and "natural disasters."
15 On those two points, see Pastor et al. (2006).
16 The authors are able to determine that in Italy, three earthquakes prior to 1915 claimed over 120,000 lives, and since then there have been fewer than 10,000 deaths. In California, since the 1906 San Francisco earthquake that killed 3,000 people, there have been only 350 deaths. In Japan, since the 1923 earthquake that left nearly 120,000 dead, there have been only 30,000 deaths despite a very high number of earthquakes (190 earthquakes of magnitude greater than 6).
17 African-Americans are 52% more likely than whites to live in exposed neighbourhoods, Asians 32%, and Hispanics 21%, see Jesdale, Morello-Frosch and Cushing (2013).
18 "Individuals may start with very different endowments at birth because of events that happened to them during a critical period: The nine months that they were in utero. In turn, endowments at birth have been shown to be predictive of adult outcomes and of the outcomes of the next generation." Currie adds, "Mechanisms underlying the perpetuation of lower socioeconomic status: Poor and minority children are more likely to be in poor health at birth, partly because their mothers are less able to provide a healthy fetal environment. Poor health at birth is associated with poorer adult outcomes, which in turn provide less than optimal conditions for the children of the poor" (p. 6). Toxicologists refer to the first 1,000 days in the life of a child (gestation and the first two years of life) as the period when he or she is critically exposed or protected from environmental nuisances and pollution that can impact her or his life for decades.

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