

Mitigation Duties

Michel Bourban, University of Twente

Draft – the final version is available here: https://doi.org/10.1007/978-3-030-16960-2_52-1

Abstract

To avoid dangerous anthropogenic interference with the climate system, drastic mitigation measures have become necessary. But who should do what and how much of it should they do to help the global effort to reduce global greenhouse gas emissions? This chapter addresses this question by specifying the identity of duty-bearers, the content of their mitigation duties, and how demanding these duties are. It identifies five families of agents and explains that each individual and collective agent has specific duties to contribute to mitigation measures: individual agents, nation-states, subnational jurisdictions, supranational formations, and economic corporations. For each family of agents, arguments for and against mitigation duties are scrutinized, with the objective of presenting a detailed account of burden-sharing climate justice. In addition to investigating the duties held by individual agents and nation-states, the two families of agents that have attracted most attention from climate justice scholars so far, this chapter also proposes to focus on three new agents in order to turn philosophical discussions on climate change in new directions: cities, the World Trade Organization, and carbon majors. The polycentric approach to climate change governance and the related normative framework of multiscale justice seem particularly promising in terms of finding new ways to promote climate justice in a context of failure to bring climate change under political control at the national and international levels.

Keywords: climate justice; ethics; mitigation; duties; responsibility; nation-states; corporations; cities; trade

Index terms: carbon footprint; carbon majors; CBDR-RC; CDR; cities; climate justice; climate negotiations; consequentialism; demandingness; duties; energy; feasibility; global justice; innovation; institutional reform; mitigation; population control; principles; states; responsibility; social justice; trade; virtue

Introduction

The topic of climate change mitigation has been discussed in academic and political circles for more than three decades. At least since the publication of the first IPCC Assessment Report in 1990, it has become clear that substantial and rapid mitigation measures are necessary to avoid dangerous anthropogenic interference with the climate system. However, over the last few decades, global greenhouse gas (GHG) emissions have not only continued to grow, but have done so at an increased rate. As a result, what is left of the global carbon budget is now very meager.

If we are to comply with the overall goal of the Paris Agreement to limit global warming to “well below 2°C” while “pursuing efforts to limit the temperature increase to 1.5°C” (UNFCCC, 2015, p. art. 2.1), the remaining budget is indeed small and rapidly shrinking. For instance, the IPCC (2022, p. 10) warns that the remaining carbon budget is no more than 500 GtCO₂ for a 50% probability of limiting global warming to 1.5°C, and no more than 1150 GtCO₂ for a 67% probability of limiting global warming to 2°C. To get an estimate of how little this represents, cumulative net CO₂ emissions for the 2010–2019 decade would exhaust about

four-fifths of the totality of the remaining carbon budget for a 50% probability of limiting global warming to 1.5°C, and about one-third of the remaining budget for a 67% probability of limiting global warming to 2°C (IPCC, 2022, p. 10).

What mitigation measures should be implemented in the coming years and decades to avoid overshooting the global carbon budget? This chapter specifies what kind of agents (the *identity* of duty-bearers) owe what kind of mitigation duties (the *content* of duties of climate justice) and to what extent (the *demandingness* of duties of climate justice). It starts with a distinction between two mitigation measures and then explains the context in which the idea of mitigation duties emerged, who talked about it first, and how the topic evolved in the literature over time. Next, the chapter explores the different kinds of mitigation duties owed by five different families of agents. In each case, it also presents major objections that have been voiced against mitigation duties and proposes possible responses to these challenges.

Since the lion's share of the literature on climate justice addresses the mitigation duties of individuals and nation-states, this chapter focuses most heavily on these two families of agents. However, it also highlights three other duty-bearers that have been relatively neglected so far: subnational jurisdictions, supranational formations, and economic corporations. Outlining the responsibilities of these collective agents leads to exploring new avenues in research on climate justice, which so far remains essentially state-centric. The point is not to question the responsibilities of states or individuals, who do owe major mitigation duties, but rather to highlight that other families of agents also have significant responsibilities when it comes to addressing climate change.

1. Definitions

1.1. Two Mitigation Measures

According to the IPCC (2014b, p. 4), mitigation is “a human intervention to reduce the sources or enhance the sinks of greenhouse gases.” In other words, there are two possible options to mitigate climate change: reducing GHG emissions and enhancing the sinks in which GHGs are stored. The first option directly cuts GHG emissions at their source. Replacing fossil fuels with renewable energies fits into this category. The second option relies on carbon dioxide removal (CDR), that is, the removal of CO₂ from the atmosphere to store it in geological, terrestrial, or ocean reservoirs, or in products. Negative emission technologies (NETs), such as bio-energy with carbon capture and storage (BECCS), fit into this second category.

Both emissions reductions and CDR have the same objective: to avoid a dangerous level of atmospheric GHG concentration. They do so, however, by pursuing two different strategies with different levels of effectiveness. While emissions reductions ensure that GHGs remain sequestered in stable geological formations, enhancing sinks takes place after those GHGs have already been emitted. Due to reversal risks (human actions and natural forces disturbing reservoirs of carbon) and/or irreversible climate impacts that would cause additional warming during the carbon budget overshoot period (such as permafrost thawing, weakening of land and ocean carbon sinks, and Amazon forest dieback), sink enhancement might well prove less effective than it would otherwise have been (Dooley & Kartha, 2018, pp. 82–83).

When climate justice scholars discuss mitigation duties, most of them have in mind duties to reduce GHG emissions. There are however two exceptions. The first can be found in discussions on the ethics of geoengineering (See Callies, “The Ethics of Geoengineering,” this volume). John Shepherd et al. (2009, p. 1) define geoengineering as “the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change.” Geoengineering methods include both solar radiation management (SRM) and CDR techniques. According to Peter Singer (2016, p. 66), “Despite the very significant known and

unknown risks of geoengineering, there is some plausibility to the idea that we ought to have it in our back pocket as a Plan B in case we fail to reduce greenhouse gas emissions sufficiently to prevent catastrophic climate change.” To make this “Plan B” plausible, “we would need to start doing research directed at finding out what might work and how to reduce the risks” (Singer, 2016, p. 66). How would this research be financed? Singer (2015, p. 199 n113) points out that the meta-charity GiveWell “has reviewed geoengineering as an opportunity for effective altruism.” This suggests that individuals could (at least partially) discharge their mitigation duties by giving money to CDR projects. Singer stresses that climate engineering technologies are risky and only represent a “Plan B” in case we fail to avoid catastrophic climate change. That being said, he believes that geoengineering represents a solution to climate change and that individuals could financially support research into CDR and/or SRM projects if they wish to fulfil their individual climate duties.

The second exception can be found in debates on the ethics of offsetting. Carbon offsetting allows individuals to pay for projects that either remove carbon dioxide from the atmosphere or support mitigation measures elsewhere: forestry projects, wind farms, and the distribution of efficient cooking stoves in the developing world all represent offsetting schemes (Hyams & Fawcett, 2013). William MacAskill is a supporter of this option: “rather than reducing your own greenhouse gas emissions, you pay for projects that reduce or avoid greenhouse gas emissions elsewhere” (MacAskill, 2015, p. 137). Thanks to meta-charities that have compared numerous offsetting companies, according to MacAskill, it is possible to find effective ways of offsetting personal emissions. People can for instance give money to Cool Earth, a charity that protects rainforests, a major carbon sink. According to MacAskill’s calculations, \$105 per year would be enough for the average American to fully offset their carbon emissions (MacAskill, 2015, p. 140). He concludes, “offsetting might be an easier and more effective way of reducing your carbon footprint than making large lifestyle changes” (MacAskill, 2015, pp. 142-143).

Since most philosophers are not advocating duties to support CDR and/or offsetting, and since they tend to consider “mitigation” and “emissions reductions” as synonymous, the rest of the chapter will focus on this kind of mitigation (for a critical analysis of the approaches to individual climate ethics supported by Singer and MacAskill, see Bourban and Broussois (2020a)). For the sake of simplicity, it will also use “emissions reductions” as being synonymous with “mitigation”.

1.2. Five Kinds of Agents

Dale Jamieson and Henry Shue were among the first to stress the new philosophical challenges posed by climate change. Adopting an ethical approach focused on the individual level, Jamieson stressed that to reach the desired level of mitigation (based on the First IPCC Assessment Report, “60% reductions in net emissions in order to stabilize at a carbon dioxide doubling by the end of the next century” (Jamieson, 1992, p. 140)), management approaches based on cost-benefits analyses prove to be unhelpful. What is instead required are “radical revisions in lifestyles” (Jamieson, 1992, p. 141), based on a transformation of our value system away from the calculation of probable outcomes and towards the promotion of character traits, such as humility, courage, and moderation (Jamieson, 1992, pp. 150-151). From a political theory perspective focused on the national and international levels, Shue (1993, p. 43) stressed that “the CO₂ emissions of the wealthy nations must be reduced by more than the amount by which the emissions of the poor nations increase.” He explained that common-sense principles of justice—greater contribution to the problem, greater ability to pay, and guaranteed minimum—all lead to the same conclusion: the allocation of the costs of addressing climate change “should initially be borne by the wealthy industrialized states” (Shue, 1999, p. 545).

Jamieson's and Shue's early contributions have largely shaped the development of the philosophical literature on climate change. In a critical discussion of Shue's approach to climate justice, especially his principle of justice based on contribution to the problem, Simon Caney (2005, p. 751) explains that in addition to states, other ethically relevant units could bear "mitigation burdens," understood as the costs of avoiding activities that contribute to global climate change (in addition to mitigation burdens, individual and collective agents could also bear adaptation and compensation burdens: see Grasso, "Adaptation Duties," this volume; Mintz-Woo, "Compensation Duties," this volume). Caney agrees with Jamieson that individuals could also be considered responsible to a certain extent, since they also emit GHGs when they consume fossil fuels and can reduce those emissions by changing their "energy-intensive lifestyles" (Caney, 2005, p. 754). He adds two possible duty-bearers: economic corporations, which "consume vast amounts of fossil fuels and/or bring about deforestation" and international regimes and institutions, such as the World Trade Organization (WTO) and the International Monetary Fund (IMF), which "encourage countries to engage in deforestation and the high use of fossil fuels" by promoting economic growth (Caney, 2005, p. 755). We can adapt this taxonomy and identify five main families of agents that owe mitigation duties (see also Caney, 2010, p. 219; Jamieson, 2015, pp. 38-41):

1. Individual agents
2. Nation-states
3. Subnational jurisdictions
4. Supranational formations
5. Economic corporations

This typology raises the following questions: What *kinds* and *degrees* of mitigation responsibilities can be attributed to these different agents? And what is the *relation* between these different mitigation responsibilities: are they independent, mutually exclusive, or complementary?

1.3. Responsibility and Duty

Before we turn to these points, a couple of preliminary remarks on the two related notions of "responsibility" and "duty" are in order. The use of the notion of responsibility in the case of climate change poses serious challenges (Gardiner, 2011; Jamieson, 2015; Jamieson & Di Paola, 2016). To identify and properly define mitigation duties, it is necessary to rely both on outcome responsibility, which attributes responsibility based on previous actions and behaviors, and remedial responsibility, which attributes responsibility based on what difference an agent can make in addressing climate change. Both concepts are normatively connected. As David Miller (2007, p. 108) points out, "outcome responsibility provides us with one important way of identifying remedial responsibility." However, as we will see in the case of individual agents with the problem of inconsequentialism and in the case of collective agents with the ability to pay principle, remedial responsibility can also be based on other relevant considerations, such as agents' financial and/or technological capacity to address climate change or agents' ability to successfully influence other people to reduce their carbon footprint. This chapter, refers mostly to remedial responsibility, except when speaking in terms of "causal responsibility."

Another important distinction is that between individual and collective responsibility. Here again, climate change poses important challenges. A major reason for this is "*fragmentation of agency*" (Gardiner, 2011, p. 24 – emphasis original), or "causal fragmentation" (Jamieson & Di Paola, 2016, p. 264), that is, the fact that climate change is

caused by multiple individual and collective agents that often act in isolation by pursuing different purposes, but whose GHG emissions, taken together, contribute to the rise in global temperatures, which in turn contribute to harmful climate impacts. Climate change represents a “new harm” (Lichtenberg, 2010), an aggregative harm generated by a complex causal chain of a vast plurality of agents’ actions. Aggregative harms are “structural injustices” (Young, 2006) resulting from structural processes participated in by many people all pursuing individual goals, often without intending to contribute to harming others.

How should responsibility be assigned in such circumstances (see Obst, “Responsibility for Climate Harms,” this volume)? First, despite these difficulties, it still makes sense to speak in terms of individual responsibility. It is true that the classical conception of the harm principle—discrete, individual actions with observable and measurable harmful impacts on particular persons—no longer suffices to explain how our individual conduct may harm other people. It remains possible however to assign responsibility by avoiding the use of the harm principle, just as it is possible to revise the harm principle so as to include responsibility for new harms and structural injustices. Those who participate in the social structures that systematically produce harm bear some responsibility for challenging, debating, and transforming those structures to reduce their harmful impacts. Second, it is also possible to assign collective responsibility to groups of individuals, especially because collective agents such as states, subnational entities, and supranational entities control the background conditions that will greatly influence individuals’ opportunities to reduce their carbon footprint. Collective agents can promote climate justice in municipal, national, and international policies.

Both individual and collective responsibility for addressing climate change lead to mitigation duties. Duties of justice are a special kind of moral duties. Unlike duties of friendship or duties of charity, they establish “*rightfully enforceable entitlements*” (Valentini, 2013, p. 94 – emphasis original). This means that if an agent fails to fulfill their duties of justice, their autonomy can be rightfully limited by obliging them to comply with such duties. Negative duties, that is, duties to refrain from acting in a certain way (mostly to refrain from harming other people), are intuitively more stringent than positive duties, that is, duties to act in a specific way (mostly to aid those in need). Agents have a special responsibility for what they themselves do, as opposed to what they merely fail to prevent: “[h]owever strong the reasons to alleviate a person’s suffering, a person has an additional reason to do so if she has had some role in bringing that suffering about” (Lichtenberg, 2010, p. 563). However, in the context of new harms, positive duties can sometimes take priority. While the effects of an individual alone refraining from contributing to new harms can be negligible, actively providing aid can make a significant difference to other people’s well-being: “it seems likely that, per unit of human effort (measured in dollars, or some other way), we are more likely to make a difference by giving aid than we are by refraining from contributing to harm” (Lichtenberg, 2010, p. 567). Negative duties have also become more demanding, as refraining from contributing to aggregative harms implies radical changes in lifestyle for individuals and substantial reforms for institutions. In this respect, negative duties increasingly resemble positive duties: to refrain from causing harm, for instance by refraining from emitting a certain amount of GHGs, it is often necessary to take positive action, for instance by replacing fossil fuels with renewable energy. For the sake of analytical clarity, we will sometimes refer to “negative duties” and to “positive duties,” but it is important to keep in mind that this distinction has its limits in practice, where the two kinds of duty tend to overlap.

Duties of justice are most commonly defined as duties owed by human beings to other human beings. According to Rawls (1999, p. 446), for instance, justice is owed only to those who have the cognitive and moral capacities to consider, accept, and abide by principles of justice. He wrote very little on nonhuman animals and other species, but enough to stress that although “it is wrong to be cruel to animals and the destruction of a whole species can be a

great evil,” such wrongs are beyond “the limits of a theory of justice,” and we do not have duties of justice towards creatures lacking the capacity for a sense of justice (Rawls, 1999, p. 448). Even with such a restrictive view, many duties of climate justice can be justified, for instance on the grounds of the human rights threatened by climate change (Caney, 2009). Although most of the literature on climate justice has been influenced by this Rawlsian account of duties of justice, there is a growing literature that aims at expanding the scope of climate justice beyond anthropocentrism (Bourban & Broussois, 2020b; Cripps, 2013, pp. 85-111; McShane, 2016; Palmer, 2011). As Clare Palmer (2011, pp. 288-289) explains, “[i]f climate change seriously harms animals – as it plausibly does – and humans are responsible for it, then those chiefly responsible are wronging animals.” She mentions the rights view, according to which animals are rights-holders, and highlights that climate change can infringe animals’ basic rights. Although Palmer does not speak in terms of (in)justice, Katie McShane (2016, p. 201) points out that “[i]f animals should be counted as bearers of rights or objects of direct duties, then claims about justice straightforwardly apply to them.” Even without taking a position in the debate between anthropocentric and non-anthropocentric approaches to climate justice, there are in any case multiple ways to ground mitigation duties.

2. Individual Climate Duties

2.1. Two Individual Duties of Climate Justice

We can distinguish between two main types of mitigation duties in the literature on individual climate ethics (Fragnière, 2016, p. 799): the duty to reduce one’s carbon footprint, and the duty to promote and support collective action against climate change. When Jamieson (1992, p. 141) and Caney (2005, p. 754) stress that individuals have a responsibility to change their lifestyle to reduce their emissions, they support the first kind of duty. Baylor Johnson (2003) and Walter Sinnott-Armstrong (2005) were among the first to support the second kind of duty. Interestingly, their argumentative strategy is to reject the duty to reduce one’s carbon footprint in order to stress the duty to contribute to climate action at the collective level. Supporting what has become known in the literature as “the problem of inconsequentialism” (Sandler, 2009), they argue that since individual emissions do not cause harm in any relevant sense, especially because they are too small to be morally significant, fighting climate change is not the responsibility of individuals, but of collective agents, especially governments. Climate change is a collective action problem, and individuals have no obligation to unilaterally reduce their personal emissions. However, they have an obligation to work toward collective agreements and policies that would contribute to mitigation at the national and international levels. Sinnott-Armstrong (2005, p. 344) illustrates this position with his (in)famous example of driving for pleasure in a gas-guzzling SUV: “[i]t is better to enjoy your Sunday driving while working to change the law so as to make it illegal for you to enjoy your Sunday driving.”

This would seem to suggest that the two kinds of duties are independent, or even mutually exclusive. But this would be too hasty a conclusion. Climate justice scholars have developed two main lines of argument to reply to the problem of inconsequentialism. A first argumentative strategy is to remain on consequentialist ground. Some authors have challenged the empirical claim that individual emissions only cause indiscernibly small effects. For instance, John Broome (2012, p. 224) calculates that the lifetime emissions of a westerner would cause the loss of six months of healthy life, or cost between \$19,000 and \$65,000. The problem with this line of argument is that these figures are rough estimates and, more seriously, there is a debate on the very relevance of such calculations, which are based on controversial cost-benefit analyses (Fragnière, 2016, p. 801).

Elizabeth Cripps (2013, pp. 140-166) proposes an alternative consequentialist approach to Nolt's and Broome's. In reply to Sinnott-Armstrong, she stresses the distinction between individuals taken in isolation and individuals taken in combination, and she argues that, as members of a group contributing to an aggregative harm, citizens have first and foremost a duty to promote collective action in cases where collective responsibility remains unfulfilled. Promotional duties to help bring about collective action through active citizenship or advocacy work take precedence, but direct duties to reduce one's emissions are still relevant, provided that reducing one's carbon footprint can promote collective action, and that alternative promotional options are exhausted. In other words, actions to mitigate one's own emissions represent "second-best responses" in cases where individuals cannot bring about collective action (Cripps, 2013, p. 150). However, given the large range of available promotional actions, in most cases there is actually no duty to reduce one's carbon footprint (Cripps, 2013, p. 151). Even though Cripps develops a more nuanced consequentialist approach, her conclusion remains therefore similar to that of Sinnott-Armstrong and Johnson: the duty to contribute to collective action against climate change (mostly) works as a substitute for the duty to reduce one's carbon footprint.

A second, more promising strategy to address the problem of inconsequentialism is to develop noncausation-based arguments. We can distinguish here between virtue ethics approaches and deontological approaches. In what is perhaps the most systematic reply to Sinnott-Armstrong and Johnson, Marion Hourdequin (2010) stresses that the virtue of integrity requires moral agents to harmonize their values and actions at the collective and the individual levels. A person who is ethically committed to combatting climate change at the collective level should also commit themselves to act on a personal level: "even if it is sometimes the case that one's personal actions to reduce climate change have little to no effect on the course of climate change, integrity nevertheless requires a kind of synchrony between personal and political action that Johnson and Sinnott-Armstrong fail to acknowledge" (Hourdequin, 2010, p. 449). Lichtenberg (2010, pp. 567-571) also uses an argument from integrity to bypass questions of efficacy: A person should do the right thing even if it has no discernible effect in the world because they are especially responsible for what they do, no matter what others do, and they have a duty to refrain from acts complicit in aggregative harms such as climate change by reducing their carbon footprint, even if others choose to keep their high-emitting lifestyles. Hourdequin also stresses in her analysis that thanks to the communicative power of individual actions, efforts to reduce personal emissions can have an amplifying effect and lead other individuals to do the same, thereby contributing to more substantial emission reductions. The decision to change one's lifestyle might inspire others to make similar changes and contribute to a collective shift: "individual consumer decision, personal communication about such decisions, and similar small-scale, local actions may turn out to be important catalysts for emerging collective agreements" (Hourdequin, 2010, p. 457).

Other virtues have been stressed in the literature to develop this kind of noncausation-based argument. Defining virtues as "non-calculative generators of behaviors," Jamieson (2007, p. 167) proposes a list of green virtues, such as humility, that should lead people to a love of nature, temperance, which promotes self-restraint and moderation, and mindfulness, an awareness of our environmentally destructive activities and a willingness to improve our behavior (Jamieson, 2007, pp. 181-182). Defining virtues as character traits that help promote human and nonhuman flourishing, both individually and collectively, Gambrel and Cafaro (2009) have put forward simplicity, understood as an attitude toward material goods that typically includes decreased consumption. To this list, we can add energy sobriety, understood as a self-imposed behavior to reduce one's overall energy use in order to reduce one's carbon footprint as much as possible (Bourban, 2022). Integrity, humility, temperance, mindfulness, simplicity, and energy sobriety are all based on an ethical principle of self-limitation that guides

individuals' everyday choices. They are not a matter of sacrifice, or heroic morality, or asceticism, but rather an acquired and stable set of dispositions that leads to a fulfilled life through enjoying a new relationship with oneself, with others, and with the natural world.

Developing a more deontological noncausation-based argument, Christian Baatz argues that regardless of whether individual emissions are harmful or not, we all have a duty to do our fair share in the fight against climate change (Baatz, 2014). Baatz defines an agent's fair share as the entitlement to a certain share of the overall remaining carbon budget. Individuals emitting more than their entitlement are illegitimately depriving others of part of their fair share. To do their part, most affluent citizens in developed countries should reduce their carbon footprints, especially by stopping easily avoidable high-emitting activities such as driving for pleasure. Even if controversy surrounds the calculation of what a sustainable carbon footprint would look like, average per capita emissions in developed countries are too high according to any reasonable standard, especially in light of the small and rapidly decreasing remaining global carbon budget. Since most affluent and rich people are plausibly overshooting their fair share by a large margin, such empirical worries are no excuse to avoid reducing one's carbon footprint.

2.2. Options to Fulfill Individual Climate Duties

In response to the problem of inconsequentialism, the virtue ethics and the deontological approaches show that the duty to reduce one's carbon footprint and the duty to promote and support collective action against climate change are both relevant. As the argument from integrity stresses, they are not mutually exclusive, but rather complementary, and even mutually require each other. Responsible individuals should both reduce their carbon footprint and contribute to collective action against climate change. But how might individuals fulfill such duties?

Regarding the duty to promote and support collective action against climate change, a further distinction can be drawn between two subcategories of duties: a duty to change and create institutions, and a duty to change and create social norms. To realize their institutional duty, individuals have at their disposal a large range of possibilities, from voting green (Maltais, 2013) to civil disobedience as a way of responding to government failure and pushing for more ambitious climate policies (Caney, 2014, p. 138). To change policies and reform institutions, people can write blogs and articles, petition their local government, email their representatives or executives, organize and/or attend demonstrations, and donate to organizations (Cripps, 2013, p. 143). To fulfill their duty to change and create social norms, they can, for instance, adapt their lifestyles and develop communication strategies to amplify the effects of their green behaviors (Fraginière, 2016, p. 808). They can also frame greener lifestyles as appealing so as to influence other people to reduce their own carbon footprint. Abandoning the rhetoric of self-sacrifice and explaining the different ways in which more virtuous lifestyles can be self-rewarding and contribute to happiness and well-being is a powerful tool to push other people to go green (Prinzing, 2020).

Importantly, different actors bear different responsibilities (Caney, 2014, pp. 139-140). While politicians are more likely to successfully influence other people's behaviors and to change institutions, journalists, poets, novelists, researchers, and gifted communicators are more likely to successfully promote green lifestyles. Lawyers can contribute to climate litigation and help those who engage in lawsuits against states, corporations, and other entities by providing legal expertise. Climate scientists can play a part in undermining resistance to effective climate policies by rebutting factual errors and misleading statements by climate deniers. Engineers can design more sustainable power plants, buildings, and infrastructures. A

wide range of actions is available to different kinds of actors, but it is possible for most individuals to contribute, in their own way, to collective efforts to mitigate climate change.

Regarding the duty to reduce one's carbon footprint, the most relevant course of action is to adopt so-called "high-impact actions," that is, actions that reduce one's GHG emissions by at least 0.8 tons CO₂-equivalent (tCO₂e) per year (Wynes & Nicholas, 2017), for instance by adopting a plant-based diet (0.8 tCO₂e saved per year on average), buying green energy (1.5 tCO₂e) avoiding one transatlantic flight (1.6 tCO₂e), living car free (2.4 tCO₂e), and having one less child (58 tCO₂e). Although here again controversy surrounds the empirical calculations on which these estimates are based, these actions remain on average the most effective. There is one particular category of people who are in a privileged position to reduce their ecological footprint: affluent people, especially very rich people. The reason for this is that economic and environmental inequalities are strongly correlated. According to Oxfam (2015), while the richest 10% of the world's population are responsible for around 50% of global emissions, the poorest 50% are responsible for only around 10% of global emissions. Someone in the richest 10% emits on average 60 times more than someone in the poorest 10%, and the richest 1% emits 175 times more than the poorest 10%. These findings indicate that the richer people are, the greater their overall carbon footprint. At the same time, since the lifestyles of wealthy citizens are characterized by an abundance of choice, they are in the best position to reduce or avoid consuming the goods and services that contribute the most to environmental degradation (Wiedmann, Lenzen, Keyßer, & Steinberger, 2020). This is why, as Baatz (2014, p. 12) stresses, "the duty of the very wealthy is much greater than the duty of an ordinary worker or middle-class person." Each person trying to reduce their carbon footprint must assess where their efforts can be best spent, but surely many opportunities are available to many people, especially affluent people in developed countries (Bourban, 2022).

2.3. Are Mitigation Duties Too Demanding?

A possible challenge to both kinds of individual climate duties is that they can potentially be too demanding. According to the objection that mitigations are overly demanding, morality cannot require individuals to make very large sacrifices to their well-being, since such requirements infringe on their autonomy and their ability to pursue their life plans (Lichtenberg, 2010, p. 558). At what point do mitigation duties become too demanding to be expected of individuals?

Regarding the duty to promote and support collective action against climate change, this objection has little relevance. It is true that it is difficult to measure the extent to which this duty of climate justice is fulfilled, since there is no way to calculate the impact of participating in demonstrations, of voting for a green political party, or of publishing an article to promote greener lifestyles. However, with the exception of some extreme cases, such as citizens living in authoritarian regimes that severely sanction criticism of government policy, most individuals can do a lot at relatively little cost to themselves (Cripps, 2013, p. 151). Since affluent citizens living in developed countries take precedence among those who should fulfill promotional duties, in most cases contributing to collective action against climate change is not overly demanding. It is however important to stress that how demanding this duty is varies from individual to individual: those who have more power to influence other people to change their lifestyles and to push for more ambitious climate policies have a higher degree of responsibility to do so. Caney (2014, p. 141) stresses this point through the "Power/Responsibility Principle," according to which "those with the power to compel or induce or enable others to act in climate-friendly ways have a responsibility to do so."

The objection that mitigation duties are too demanding has more relevance when applied to the duty to reduce one's carbon footprint. Since there are many carbon-dependent structures

in industrialized countries, living a low-carbon lifestyle can be quite demanding, and in some cases indeed overly demanding. To ensure that this mitigation duty is not economically, psychologically or socially too burdensome for individuals, its scope should be limited. A general ethical principle here is the Kantian rule “ought implies can”: people should not be required to do things that are not in their power (Baatz, 2014, pp. 9-10; Fragnière, 2016, pp. 806-807). The options and possibilities open to particular agents differ considerably, depending on their respective geographical, economic, and social situation. This means that individuals are morally required to reduce their emissions only as far as can reasonably be demanded of them.

That being said, it is important not to concede too much to this objection. As Ann Schwenkenbecher (2014, p. 180) argues, “being demanding is by itself no reason against a particular moral theory or a particular moral duty.” After all, the whole point of ethics is to push us to question what we take for granted in our everyday behavior, and to change our lifestyles according to the demands of what is just, right, or good. Such changes are usually demanding and can be uncomfortable in that they require us to question ourselves, but that is not an objection against ethics or morality, especially when what is at stake are urgent and severe climate injustices. Another important point is that reductions in one’s carbon footprint are not always very demanding: “[m]any actions we can take would merely require us to change our habits, to make a bigger effort and to accept a little more inconvenience” (Schwenkenbecher, 2014, p. 180). Put in perspective with the severe climate impacts vulnerable people have to face when GHG emissions are not mitigated, most moderate- and high-impact actions are actually quite reasonable.

In contrast with promotional duties, the degree of fulfillment of the duty to reduce one’s carbon footprint can more easily be measured. In the climate change literature, the sustainable carbon footprint is set at approximately 2 tons of CO₂ per person and per year (Fragnière, 2016, p. 806; Wynes & Nicholas, 2017, p. 1). Most affluent people have a carbon footprint that is several times higher than that. It is true that in most developed countries, it would be overly demanding to require individuals to reach a sustainable carbon footprint overnight, since the possibility of implementing high-impact actions partially relies on the infrastructures provided by local and national governments. For instance, for individuals to have the opportunity to buy green energy (1.5 tCO₂e saved per year), to avoid air travel (1.6 tCO₂e saved per roundtrip transatlantic flight), and to live car-free (2.4 tCO₂e saved per year on average) (Wynes & Nicholas, 2017), governments should guarantee an efficient and effective public transportation network as well as available and affordable renewable energies. However, if the 2 tons of CO₂ per person and per year limit is taken as an aspirational goal (very much like the 1.5°C limit at the global level), and if the duty to reduce one’s carbon footprint is interpreted as a duty to get as close as reasonably possible to this limit, the objection that mitigation duties are overly demanding has much less bite. In virtually all developed countries, most individuals still have a wide range of high-impact actions available, such as adopting a plant-based diet, avoiding long-distance flights for their holidays, and having smaller families, even if they do not have full control over their carbon footprint.

3. The Mitigation Duties of States

How can the background conditions on which a substantial part of individuals’ carbon footprints depend be changed? This is where considerations on the duties of collective agents become relevant, especially nation-states, which design and control many of the policies in the sectors of energy and of agriculture, forestry, and other land use. In contrast with individual climate duties, collective climate duties are not affected by the problem of inconsequentialism. Most nation-states’ emissions contribute to climate harms in a non-negligible way, and nation-

states can mitigate their emissions so as to reduce their contribution to such harms. States are the primary agents responsible for developing the adequate legislative and political framework that would enable individual and other collective agents, such as cities and corporations, to substantially reduce their carbon footprint. They can make it easier for other agents to fulfill their mitigation duties, just as they can make it much harder and sometimes impossible. This is why the bulk of the literature on climate justice has focused on this particular agent.

3.1. PPP, APP, BPP

How can the burdens of climate change be fairly allocated, particularly mitigation burdens? This question has led to the search for the most relevant principle of distributive justice or for some combination of such principles, for instance to create a “hybrid model” (Caney, 2010). The three most important principles of climate justice that have emerged from these discussions are the following (Bourban, 2018, pp. 101-118):

- The *polluter pays principle* (PPP): the burdens of climate change should be borne by those agents that have the most important historical and current levels of GHG emissions. The more an agent has contributed to climate change, the more that agent should pay to address climate change.
- The *ability to pay principle* (APP): the burdens of climate change should be borne by those agents that have the greatest financial and technological capacities, regardless of their historical and present contribution to climate change.
- The *beneficiary pays principle* (BPP): the burdens of climate change should be borne by those agents that have benefitted most from past and present GHG emitting activities.

These principles make it possible to differentiate the degree of responsibilities that can be attributed to different states in the fight against climate change. Despite historical and ongoing disputes on the best (set of) principles to determine how best to allocate mitigation burdens, there is, as Stephen Gardiner (2004, p. 579) highlighted in an early review of the literature, “a surprising convergence of philosophical writers on the subject: they are virtually unanimous in their conclusion that the developed countries should take the lead role in bearing the costs of climate change.” In a more recent contribution, Shue (2015, p. 8) confirmed this by explaining that “even though some may diverge at the theoretical periphery,” key principles of climate justice “converge at the practical core”: as the main historical and often the main current emitters, as the most capable of addressing climate change, and as the main beneficiaries of past emitting activities, developed countries have the greatest responsibility to act to slow climate change. Shue (1999, p. 545) had already reached this conclusion in the late 1990s when he wrote:

[I]n spite of the different content of these three principles of equity [greater contribution to the problem, greater ability to pay, guaranteed minimum], and in spite of the different kinds of grounds upon which they rest, they all converge upon the same practical conclusion: whatever needs to be done by wealthy industrialized states or by poor non-industrialized states about global environmental problems like ozone destruction and global warming, the costs should initially be borne by the wealthy industrialized states.

In general terms, these principles therefore point in the same direction: affluent countries should bear most of the burden and play a leadership role. However, if we apply the principles in detail, they can start to diverge. For instance, in the case of high emitting but poor countries, just as in the case of low emitting but rich countries, the polluter pays principle and the ability

to pay principle lead to different results. It all depends on the level of specificity: the principles tend to converge at the general level, but the more we compare specific cases, the more divergences will appear.

Here again, objections were voiced against mitigation duties. Eric Posner and David Weisbach have launched a radical attack against principles of climate justice and their use in international law. On the grounds that philosophers lack understanding of the realities of international relations, they “reject the claim that certain intuitive ideas about justice should play a major role in the design of a climate agreement” (Posner & Weisbach, 2010, p. 5). Such ideas are problematic because “they fail to consider basic pragmatic or feasibility constraints” (Posner & Weisbach, 2010, p. 4). Posner and Weisbach argue that the only feasible climate treaty is one that is in the short-term domestic self-interest of developed countries, particularly the US. In doing so, they dismiss most mitigation duties as unfeasible because they would be too costly for rich countries, among other reasons.

The key feasibility constraint isolated by Posner and Weisbach (2010, p. 6) is International Paretianism, according to which “treaties are not possible unless they have the consent of all states, and states only enter treaties that serve their interests.” Caney (2014, p. 128) breaks down their argument the following way:

(P1) It is necessary to have a climate treaty with which major emitters comply.

(P2) To be feasible an effective climate treaty must serve the interests of high emitting states (from ‘Feasibility’ to ‘Pareto Superiority’). Therefore,

(C) A climate treaty must serve the interests of high emitting states.

Three main responses can be made to this attack on climate justice. First, it can be argued that principles of justice and feasibility operate on two different levels (Bell, 2013; Roser, 2015). While normative considerations determine the goals of climate policy, feasibility considerations merely delineate the space within which these goals can be pursued. Feasibility considerations do not impose limits on moral and political theorizing; they simply highlight the degree of (political, cultural, social) feasibility of institutional reform proposals. This reply is similar to the counter-objection to the problem of mitigations being overly demanding: there is nothing intrinsically problematic with demanding ethical duties. Individual and collective agents should comply with the demands of ethics or justice, even if they are demanding, as long as they are reasonable. The human rights approach to climate justice illustrates this point very well: “[i]f emitting greenhouse gases (GHGs) results in rights violations it should stop, and the fact that it is expensive does not tell against that claim” (Caney, 2009, p. 87). Claiming that principles of distributive climate justice are unfeasible just because some states are not willing to implement them due to their cost is not an objection against such principles. It is just a reminder of the importance of discussing how ideal theory can be slotted into the non-ideal circumstance of the real world (see, e.g., Heyward and Roser (2016)).

Second, with its overly narrow assumption that to be feasible, any climate treaty must necessarily be in the short-term, self-perceived economic interest of developed states, Posner and Weisbach support an inaccurate picture of the feasible set. Based on this overly restrictive conception of the feasible set, not only do they exclude just and feasible solutions, but they also support unjust solutions by claiming that “an optimal climate treaty would probably not require side payments to poor countries. It could well require side payments to rich countries like the United States and rising countries like China, and indeed possibly from very poor countries which are extremely vulnerable to climate change – such as Bangladesh” (Posner & Weisbach, 2010, p. 86). This statement, which strikes many as intuitively unfair, shows that there is something wrong with their definition of feasibility, as well as the priority they give to their problematic feasibility considerations over normative considerations.

A third possible response is that philosophers do not bring in normative considerations from outside the framework of climate negotiations in a top-down or ad hoc fashion: considerations of equity, responsibility, capacity, justice, and other normative notions play an important role in international law. From the start of climate negotiations, the Parties to the United Nations Framework Convention on Climate Change (UNFCCC, 1992, p. art. 3.1) agreed that their core objective is to “protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities [CBDR-RC].” This norm of CBDR-RC plays a major role in all the main outcomes of climate negotiations, including in the Paris Agreement, the most recent and perhaps most significant outcome of the climate regime, which also mentions the notions of “climate justice,” “intergenerational equity,” and “human rights” (UNFCCC, 2015). This shows that, contra Posner and Weisbach, ethical arguments and normative beliefs are not irrelevant in international relations.

3.2. CBDR-RC

Some climate justice scholars have proposed operationalizing the norm of CBDR-RC to measure each country’s degree of responsibility and capacity more precisely (for a synthesis of burden-sharing frameworks in the literature, see IPCC, 2014a, pp. 315-321). This branch of burden-sharing climate justice can be seen as a way to interpret the implications of the PPP, the APP, and the BPP in more concrete terms. Arguably, CBDR-RC does not perfectly align with these principles, but for several authors, the notion of “common but differentiated responsibilities” is a possible interpretation of the PPP, while the idea of “respective capabilities” can be captured by the APP and the BPP (Baer, 2013, p. 62; Bourban, 2018, pp. 101-127; Moellendorf, 2009, p. 255; Page, 2008, p. 557).

One proposal to translate CBDR-RC into a burden-sharing formula that is among the most influential is the Greenhouse Development Rights Framework (GDR), a climate justice index composed of a responsibility indicator (cumulative national emissions since 1990) and a capacity indicator (per capita annual income above a development threshold of \$8,500). This responsibility–capacity index determines the percentage of total global obligation for each country by giving each indicator the same weight. As a result, in 2010, the US held 29.4% of global obligation, the EU 26%, Japan 7.6%, Russia 5.8%, China 5.1%, Brazil 2.8%, and India and South Africa 0.9% each. In total, high-income countries held 73.7% of global obligation, the least developed countries (LDCs) 0.3%, and the remaining 26% fell to new emitting countries, such as countries from the Brazil, South Africa, India, and China (BASIC) group (Baer, 2013) (see Table 1).

Country	Percentage of Global Population	Per Capita Income (\$US2010, MER)	Per Capita Income (\$US2010, PPP)	Percentage of Global Capacity	Percentage of Global Responsibility	RCI (Percentage of Global Obligation)	RCI (Percentage of Global Obligation)	RCI (Percentage of Global Obligation)
	2010	2010	2010	2010	2010	2010	2010	2010
United States	4.6%	4922	4922	29.7%	29.2%	29.4%	26.4%	21.6%
EU27	7.3%	33040	32101	30.9%	21.2%	26.0%	22.3%	17.4%
EU15	5.8%	38419	35407	29.1%	17.8%	23.4%	19.9%	15.4%
EU12+	1.5%	12122	19243	1.8%	3.4%	2.6%	2.3%	2.1%
Japan	1.8%	42985	33874	10.2%	5.0%	7.6%	6.3%	4.7%
Russia	2.0%	10543	20036	2.3%	9.4%	5.8%	5.4%	5.1%
China	19.6%	4542	7794	4.8%	5.4%	5.1%	12.2%	21.8%
India	17.6%	1422	3454	0.2%	0.3%	0.3%	0.9%	2.9%
Brazil	2.8%	10684	11183	2.6%	3.1%	2.8%	2.8%	2.7%
South Africa	0.7%	7203	10465	0.4%	1.3%	0.9%	0.9%	0.9%
High Income	15.1%	40317	38970	81.9%	65.5%	73.7%	65.6%	53.4%
LDCs	11.4%	767	1585	0.1%	0.5%	0.3%	0.3%	0.3%
World	100.0%	9088	11086	100.0%	100.0%	100.0%	100.0%	100.0%

Table 1 – The GDR Climate Justice Index. Demographics (share of population and per capita income, market exchange rates (MER) and purchasing power parity (PPP) adjusted) in 2010, along with share of capacity for 2010, share of responsibility for

2010, and Responsibility and Capacity Indicator (RCI) for selected countries and regions for 2010, 2020, and 2030. With permission of John Wiley and Sons (Baer, 2013, p. 66).

This climate justice index makes three important contributions to the literature on burden-sharing justice. First, it confirms the outcome of the more abstract debates on distributive principles of climate justice, which converge, at the practical level, to identify developed countries as being most responsible for addressing climate change. Second, it makes it possible to precisely differentiate each country's degree of responsibility and to establish a list to compare them. Third, it stresses that, in addition to developed countries, there are a growing number of new countries that have increasingly contributed to global GHG emissions over the last few years and will in all likelihood continue to do so in the coming decades. This list of new emitting countries is constantly evolving, but it includes BASIC countries, Russia, Indonesia, South Korea, and Mexico.

Recognizing that their choice of indicators is debatable according to different countries' interpretation of CBDR-RC, advocates of the GDR framework have recently created the Climate Equity Reference Framework (CERF), which offers a climate equity reference calculator to assign each country and region its fair share of mitigation efforts (Holz, Kartha, & Athanasiou, 2018). In contrast to the GDR, the CERF includes an equity band that allows more or less demanding effort-sharing parameters to be chosen, giving countries more flexibility in calculating their respective level of responsibility and capacity. Three key parameters are flexible: the level of global ambition, with three possible mitigation pathways (66% chance of remaining below 1.5°C in 2100; greater than or equal to 50% chance of staying within 1.5°C; or greater than 66% chance of staying within 2°C); the historical responsibility parameter (with possible start dates ranging from 1850 to 2010); and the capacity parameter (with the option to set the development threshold between \$0 and \$20,000).

For a 1.5°C-compliant global mitigation effort (>66% chance of remaining below 1.5°C), a responsibility indicator with a start date ranging from 1850 to 1990 (the equity band for the responsibility parameter), and a development threshold ranging from \$2,500 to \$7,500 (the equity band for the capacity parameter), the CERF authors made the following findings. The nationally determined contributions (NDCs) of most high-capacity and high-responsibility countries, such as the US, EU members, and Japan, "fall far short of the fair-share contributions as bounded by the equity band" (Holz et al., 2018, p. 127). This means, whatever the choice of parameters, these countries fail to assume their global responsibilities. The US pledged only 16–24% of its fair-share contributions, the EU 21–23%, and Japan about 10% (see Figure 1).

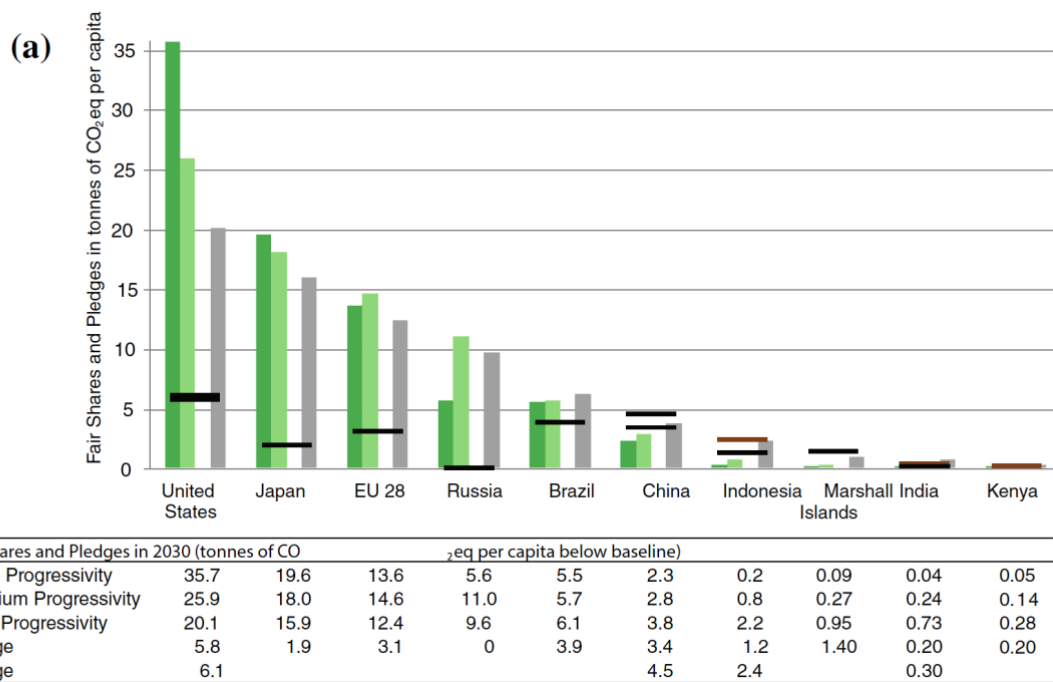


Figure 1 – Fair Shares of the Global Mitigation Effort in 2030. Expressed in tons of CO₂e per capita of mitigation in 2030 for selected countries, showing the amount that would be required for each equity benchmark (green bars) and the additional reference benchmarks (gray bars), as well as the actual mitigation pledged in the country’s NDC (unconditional in black, conditional in brown). With permission of Springer Nature (Holz et al., 2018, p. 126).

In addition, fair shares of the global effort to mitigate emissions are higher than plausible domestic reductions in developed countries (Holz et al., 2018, p. 128). This means that, to fulfill their mitigation efforts, developed countries must contribute, through climate finance, to mitigation opportunities in other countries where mitigation potential exceeds domestic obligations. Developed countries therefore have a dual mitigation duty. In addition to domestic emissions reductions, they are also obligated to engage in international mitigation cooperation.

Since CBDR-RC represents the cornerstone of the climate regime, working as “the pivot of most equity debates within the climate negotiations” (Holz et al., 2018, p. 119), this kind of proposal to operationalize CBDR-RC can be seen as a promising and feasible way to move forward in climate negotiations. Mitigation pledges are currently provided by countries as part of their NDC. While no country is legally required by the Paris Agreement to follow its mitigation commitments, each party is legally required to provide a new, more ambitious commitment every five years, based on CBDR-RC (UNFCCC, 2015, p. art. 4.3). This five-year cycle of reevaluating NDC could be used as an opportunity to include a normative framework such as the one provided by the CERF within the international climate regime (Bourban, 2021).

3.3. IPAT

The PPP, the APP, and the BPP, each on its own and especially in combination, provide a strong justification for attributing more demanding mitigation duties to developed states and new emitting countries. Operationalizing CBDR-RC is a relevant way to measure and compare the different degrees of responsibility of the states. But how might those states fulfill their responsibilities? Introducing the IPAT equation to discussions on climate justice, as Clare Heyward (2012, p. 706) and Simon Caney (2020, pp. 355-356) have proposed, is a helpful way to reply to this more practical question. According to this equation, environmental impact (I) equals population (P), multiplied by affluence (A), multiplied in turn by technology (T):

$$\text{Impact} = \text{Population} \times \text{Affluence} \times \text{Technology}$$

In their discussion of the IPAT equation, both Heyward and Caney tend to focus on the potential of technology to mitigate global GHG emissions. They especially stress two key measures that states could implement to fulfill their mitigation responsibilities: energy efficiency and the expansion of renewables in their energy mix (Caney, 2020, p. 357; Heyward, 2012, p. 721). These two measures are two major pillars of the energy transition, which relies on progressively replacing fossil fuels with renewables (Bourban, 2022). Rapidly phasing fossil fuels out of the global energy mix can only be achieved through massive public investment in renewables to make this alternative source of energy both available and affordable for most consumers and producers, in developed and developing countries alike.

Fossil fuels should be subject to incremental price increases through carbon taxes and carbon markets to ensure that they lose their competitive advantage, but to avoid a trade-off between climate justice and social justice by driving additional people into energy poverty, two complementary measures are necessary. First, public subsidies in renewables and technology transfers should make energy affordable for poor people, wherever they live. Second, measures ought to be implemented to compensate for the temporary increase in the cost of fossil fuels, such as subsidies to improve energy efficiency in poor households, subsidies to extend networks, improve efficiency and reduce the price of public transportation, or redistribute part of the revenue collected through carbon pricing schemes in the form of an energy dividend. Developed states therefore have two negative duties: a duty not to continue to undermine the climate by burning excessive amounts of fossil fuels and a duty not to increase the obstacles to development for the global poor. Shue (2013, p. 400) adds, “[t]he two duties are additive, but the beauty of fulfilling them by developing affordable, renewable energy is that such measures would fulfill both at once.”

But technological innovation to implement the energy transition from fossil fuels to renewables is not sufficient on its own. There are too many economic, political and infrastructural obstacles in the way, especially the scale and influence of the fossil fuel industry, the problem of technological and infrastructural lock-in, and the high metal requirements of low-carbon power generations (Bourban, 2022). This means that additional measures should be taken by states to reduce their emissions. This leads us to the two remaining elements in the IPAT equation.

To reduce levels of affluence, states can target “luxury emissions” (Shue, 1993), or “unnecessary carbon emissions” (Cafaro, 2011), through two political measures: taxation and prohibition. Through carbon price policies such as taxes on flights, vehicles, electricity consumption, and meat consumption, governments can incentivize consumers and producers to reduce their carbon footprint. To avoid regressive effects on the poorer, for whom the increase in prices is more difficult or impossible to afford, these taxes should be progressive: they should start relatively low and then increase for each new flight ticket, for bigger cars, for bigger houses, and so on. It is also possible for states to prohibit consumption goods that are causing the highest levels of luxury emissions, for instance by banning the use of private jets, yachts, SUVs, and the construction of ridiculously large houses. This measure is of course more controversial, but it has the merit of helping wealthy citizens to do their fair share, instead of just giving them the option of buying their way out of doing so by paying more taxes. As Philip Cafaro (2011, p. 206) highlights, “from a fairness perspective, from a wide buy-in perspective, and from a maximal emissions reductions perspective, it makes sense to consider the absolute prohibition of some high-energy, luxury consumption.”

The last component of the IPAT equation is also relevant in terms of outlining the content of states’ mitigation duties. Population growth is indeed more substantial in developing countries than in developed ones, but the contribution of the demographic factor to climate change does not depend only on the number of people: income, wealth, diets, education,

household size, and geographical location all lead to substantial variations in individual GHG emissions (Jiang & Hardee, 2011). A child born in a developed country will have a much larger carbon footprint than a child born in a developing country. For instance, the total carbon footprint of a child born in the US is more than 160 times greater than the footprint of a child born in Bangladesh (Murtaugh & Schlax, 2009, p. 18). This is why population control policies represent an effective measure for many developed countries to mitigate their emissions.

Three public policies are possible in this context: education, coercion, and incentivization. Philip Cafaro (2011, 2012) supports mainly choice-enhancing measures. There are numerous possible options here: improving education; promoting female literacy; improving women's economic opportunities; providing cheap, reliable contraception; and helping individuals to become aware of the environmental impacts of their reproductive choices. These measures are "win/win:" they not only reduce global GHG emissions, but also contribute to other sustainable development goals (SDGs), such as improving maternal health and increasing the percentage of children receiving a full primary school education (Cafaro, 2011, p. 209). The limitation of this type of measure is that it has more impact in developing countries than in developed countries: fertility rate and family planning needs are higher in Asia and Africa than in the EU and the US (Hickey, Rieder, & Earl, 2016, p. 855).

At the other end of the population growth reduction policy spectrum, we find coercive measures. Based on the idea that it is justifiable to reduce the autonomy of individuals in situations where they significantly harm others, Sarah Conly (2016) argues that in a context of global overpopulation and climate emergency, the state can legitimately restrict individual reproductive choices. A system of legal sanctions for couples who have more than one child would reduce this problem of motivation not only by changing individual behaviors, but also by changing attitudes, since legal sanctions communicate communal moral judgments. A progressive system of fines, based on household income, could bring about cultural change by making small families the norm and large families the exception. The limitation of this kind of policy is that it raises substantial ethical and political issues. A one-child policy carries enormous potential moral costs, particularly in terms of possible human rights violations, such as sterilizations and forced abortions. Conly obviously does not advocate such measures, but they are much more likely to occur in the context of coercive policies than in the context of educational and empowerment policies.

Other policies with much lower potential moral costs and more effectiveness in developed countries are available and probably more feasible, using positive and negative incentives. While education allows parents to make voluntary reproductive choices and coercion deters parents from having more than a fixed number of children by legally sanctioning those who have too many, incentives encourage those who have few children and discourage those who would like to have many. A possible positive incentive would be to reduce taxes for households with small families. The idea is to reverse the incentive structure set by the pro-natalist culture in many countries by encouraging couples to have fewer, rather than more children. Making sterilization free for both men and women is also among the options to be considered. Giving a financial reward for sterilization would also be a possibility, but it is important not to set the amount of the reward too high, in order to avoid disadvantaged people reluctantly using it as an opportunity to obtain money. A possible negative incentive would be a tax increase for families with too many children – although this would have to be carefully handled to ensure taxes remained fair across income brackets.

These different measures to fulfill states' mitigation duties are articulated in the literature on deep decarbonization pathways. Such pathways rely on three main scenarios, each reflecting a component of the IPAT equation (van Vuuren et al., 2018): a lifestyle change scenario, with radical shifts toward more environmentally friendly behaviors such as plant-based diets, changes in transport habits, and reductions of heating and cooling levels; a

renewable electricity scenario, with the substantial expansion of solar and wind technologies, based on the encouraging progress over the last few years; and a low-population scenario, based on population control policies that would decrease birth rates around the world, with the objective of reducing the global population to 6.9 billion by 2100. None of these alternative scenarios is, on its own, sufficient, but implemented together, they are probably our best hope of avoiding dangerous climate change.

4. Subnational Jurisdictions, Supranational Organizations, and Corporations

Given the failure of international climate policies to bring climate change under effective political control, there is a growing momentum in the literature to develop climate justice approaches that go beyond state-centrism. The development of individual climate ethics investigated above is a good illustration of this. Another branch of climate justice, which is still minor but rapidly growing, is exploring the responsibilities of other collective agents at the subnational and supranational levels. A relevant framework to bring together these recent contributions is the polycentric approach to climate change (André, 2020; Ostrom, 2010). This approach stresses that in the absence of an international treaty that would effectively reduce global GHG emissions, many mitigation measures can be undertaken by multiple entities at diverse scales that, cumulatively, can make a difference. In a polycentric system, each unit enjoys sufficient independence to make norms and rules to mitigate GHG emissions at the local, regional, and subnational levels. Local governments, firms, international regimes can all encourage polycentric efforts to reduce the risks associated with climate change, even in the absence of an effective concerted framework at the global level.

4.1. Cities

More than half of humanity and more than three quarters of Europeans live in cities (EEA, 2015). Cities represent concentrations of economic and industrial activity and contribute to approximately 70% of energy-related CO₂ emissions (IEA, 2016). At the same time, in most developed nations, there is already far more climate action at the municipal level than at the national level (Forman, Solomon, Morello-Frosch, & Pezzoli, 2016). Cities are increasingly important actors in global climate governance (see Nictolis, “Climate Change and Urban Studies,” this volume). They are adopting mitigation plans, experimenting with climate policy solutions that could be transferred to other local governments or scaled nationally, and building local capacity to address climate change (Hsu et al., 2020). They often participate in transnational municipal networks, such as Cities for Climate Protection, Climate Alliance, Energy Cities, the C40 Cities Climate Leadership Group, and the Rockefeller Foundation Climate Change Initiative (Kern & Bulkeley, 2009). All these polycentric systems tend to enhance innovation, cooperation, learning, and trustworthiness, and also tend to lead to the achievement of more effective, equitable, and sustainable outcomes (Ostrom, 2010, p. 552).

Cities are taking part in transnational climate change governance by promoting mitigation and adaptation policies, setting standards, and calling for action, both with and without the cooperation of states (Dietzel, 2018, pp. 95-97). Transnational networks of cities are not focused on the single outcome of reaching a climate treaty, but are rather based on individual, decentralized, and self-organized initiatives, such as information sharing, voluntary goal-setting, and experimental policies. Municipal networks such as the C40 motivate cities to take climate action they likely otherwise would not have implemented and create a context within which GHG emissions can be reduced (Dietzel, 2018, pp. 171-172). Although it is not possible to measure the impact of these networks on global emissions precisely, they include a broad range of the global population and encompass thousands of projects.

Given the increased initiatives to contribute to mitigation efforts at municipal level over the past two decades, as well as the influence of the cosmopolitan framework in the literature on global justice which aims at moving beyond state-centrism, it is surprising that there has been little investigation into the role that cities can play as actors of climate justice. Major cities such as Philadelphia, Toronto, or Quito have already integrated distributive and procedural justice considerations into their mitigation plans (Bulkeley, Carmin, Castán Broto, Edwards, & Fuller, 2013, pp. 923-924). Chicago, Birmingham (England), and Vancouver have made notable attempts to reduce GHG emissions by integrating climate justice and social justice considerations (McKendry, 2016). Bristol was the first city in the UK to declare a climate emergency in April 2019 (one month ahead of the UK government) and adopted the ambitious “One City Climate Change Plan” that pledged to make the city carbon neutral by 2030, which goes beyond what is required by the national government (the UK has committed to cutting emissions by 78%, compared to 1990 levels, by 2035) (Dietzel, 2022). A just urban response to climate change at the municipal level allocates mitigation duties according to the city’s proportionate responsibility for climate change in comparison with other cities, but also according to the degree of responsibility of individuals, communities, and corporations within the city, as well as their degree of capacity (Bulkeley et al., 2013, p. 918).

The promising framework of a “multiscalar justice” (André, 2020; Barrett, 2013; McKendry, 2016) could contribute to reframing research on climate justice by integrating this new kind of actor into philosophical discussions on climate change. Just like states, municipal governments have a relatively high level of control over GHG emissions through their choices of energy supply and management, transport, land-use planning, and waste management. As the political level closest to people, they are also potentially more receptive to the climate justice demands of citizens. The major mitigation duty in this context is that of developing an urban design that contributes as much as possible, and in a fair way, to the reduction of emissions at the municipal level. The “in a fair way” proviso is especially important to avoid trade-offs between climate justice and social justice. Just as mitigation measures at the international level should avoid contributing to energy poverty in developing countries, and just as mitigation measures at the national level should avoid putting additional burdens onto poorer people at the domestic level, mitigation measures at the municipal level should avoid regressive effects on the most vulnerable members of the community.

Three examples can serve to illustrate the possible relations between social and climate justice (McKendry, 2016). While the closure of two coal-fired plants in Chicago clearly represented a victory both from the climate justice (reduction of GHG emissions) and social justice (reduction of air pollution), in Vancouver, the development of hydroelectric power and a dense and transit-oriented downtown reached its climate justice goal (a decrease in GHG emissions, despite a 27% increase in population), but missed its social justice objective (housing prices skyrocketed and urban density increased). Finally, Birmingham’s efforts to increase local energy efficiency missed both its climate justice goals (GHG emissions reductions were much smaller than anticipated) and its social justice goals (the average energy bill increased by 75% between 2004 and 2014).

Through a polycentric approach, cities can learn from others that are also engaged in trial-and-error learning processes, experiment, develop methods for assessing the costs and benefits of particular strategies, and build settings in which trust and reciprocity can emerge, grow, and be sustained over time. As Elinor Ostrom (2010, p. 556) stresses, “[a] strong commitment to finding ways of reducing individual emissions is an important element for coping with climate change. Building such a commitment, and trusting that others are also taking responsibility, can be more effectively undertaken in small- to medium-scale units that are linked together through diverse information networks.”

4.2. *Reforming the WTO*

Without an institutional framework to promote technological innovation, consumption reduction, and population control, avoiding dangerous anthropogenic interference with the climate system will become very difficult, if not impossible. While states are the most relevant collective agents to implement such a framework, international organizations such as the UN, the WTO, and the IMF also play an important role, not only in making it possible, but also in promoting it. In other words, international institutions have a negative duty not to interfere with the mitigation duties of states, cities, corporations, and individuals, as well as a positive duty to bring about a framework that encourages these agents to comply with their mitigation duties.

The WTO can be considered as an agent of justice. Trade laws can bring about justice but are, in their current form, one of the major causes of global injustices such as world poverty—take for instance tariffs on agricultural, textile, and footwear imports faced by poor countries, or intellectual property rights denying millions of patients access to generic versions of medicines. In a similar way, it is also possible to conceive the WTO as an agent of climate (in)justice, and, as such, a duty-bearer that ought to provide an adequate setting within which states can fulfill their mitigation duties. The international climate regime and the international trade regime are directly linked. The UNFCCC (1992, p. art. 3.5) holds a compliance clause regarding international trade: “[m]easures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.” In other words, in their current form, both regimes are encouraging the overexploitation of fossil fuels by mentioning no specific limitation to their use. The EU–Canada Comprehensive Economic and Trade Agreement (CETA) and the EU–US Transatlantic Trade and Investment Partnership (TTIP) are two of the most recent outcomes of this international framework. In both cases, trade rules guarantee unrestricted access to fossil energy sources and even restrict the possibilities to develop renewables and low-carbon economies (GRAIN, 2015). Current trade rules are therefore not only inadequate, but also unjust, and should thus be reformed to make possible and promote states’ mitigation opportunities. The current “trade compliance” clause should be removed from the climate regime, and a “climate compliance” clause should be added to the trade regime, demanding that any trade agreement should include environmental conditions, such as limitations on the use and exchange of fossil fuels, and encouragements for the development and exchange of low-carbon energy technology.

Such institutional reforms could not only lead the WTO to refrain from contributing to global injustices, as it currently does, but also make it an agent that can bring about justice. Instead of encouraging countries to relentlessly burn and trade their remaining reserves of fossil fuels, it can encourage them to refrain from overexploiting these resources by keeping a substantial part of oil, gas, and coal reserves in the ground. A new climate code within the WTO could for instance allow border adjustment measures in the form of carbon tariff imports to raise the price of imports from countries with low or non-existent carbon price measures. Border adjustment measures would send a signal to exporting countries to reduce the embodied carbon in their products to avoid the impost and generate a revenue that could be invested in the development of low-carbon technologies.

Another possible institutional reform takes the form of a Clean Trade Act that would make it illegal for any corporation or country to buy oil, gas, and coal from authoritarian countries that violate the right of peoples to control their resources, with legal penalties for those who make purchases or facilitate imports from a disqualified country (Wenar, 2016, pp. 283-312). While the first objective of this clean trade policy is to promote global justice by protecting the human rights of peoples suffering from the resource curse and its associated political pathologies (authoritarianism, corruption, violence), it would also promote climate

justice by contributing to the decarbonization of energy supplies. Today, over half of the global oil production and reserves cannot be exported without violating popular sovereignty over resources. For instance, to comply with the Clean Trade Act, the EU would have to reduce its importation of oil by half, of gas by one-third, and of coal by one quarter, which would significantly increase its mitigation targets (Wenar, 2016, p. 305).

A first challenge here is that there are concerns over whether this kind of measure to promote global justice and climate justice is compatible with WTO rules. According to Joseph Stiglitz (2007, pp. 176-178), such border measures are actually WTO compatible, since this regime established the principle that maintaining the global environment is important enough for normal access to markets to be suspended when a country's export industries endanger it. As long as countries like the US do not implement serious mitigation policies, European and other countries could levy a tax on energy-intensive products like steel and aluminum, which would provide a strong incentive for the US to implement mitigation policies: "[e]ven widespread discussion of the possibility of imposing these tariffs might induce the United States to act" (Stiglitz, 2007, p. 177). Robyn Eckersley (2010, p. 377) confirms this by observing that "the balance of legal opinion suggests that appropriately designed, nondiscriminatory unilateral border measures are most likely to be WTO compatible as an environmental exemption under Article 20 of the General Agreement on Tariffs and Trade (GATT)." Clean trade policies are also compatible with WTO rules: "WTO rules apply to trade, not to stolen goods, Clean Trade does not restrict free trade – rather, it enables free trade by enforcing property rights" (Wenar, 2016, p. 297). To rule against clean trade, the WTO would have to state that seizing a country's natural resources by force and violence creates property rights and thus allow democratic countries to trade in violation of their own principle of popular sovereignty.

A second challenge is that international organizations cannot be much more effective than their member parties want them to be (Jamieson, 2015, p. 39). The UNFCCC cannot impose binding emissions limits on countries that do not accept being bound. Likewise, the WTO would have difficulty imposing sanctions on countries that do not agree to be sanctioned. In response to this, it is worth stressing that international organizations are major actors in the international legal process (Ratner, 2020, pp. 364-366). They reflect the interests of their member states in many ways, but they also make claims generated by their own secretariat officials that need not be in accordance with the views of all of their members. For instance, the UN can advance the claims of individuals and peoples, if necessary, against the claim of states, based on international human rights law. Likewise, the WTO can sanction some states by authorizing border adjustments, even if not all countries consent to such sanctions. International organizations contribute to the creation of legal norms in the form of international rules, and as such they can push states to comply with their own mitigation duties. One core international norm is that states must avoid environmental harms that extend beyond their jurisdiction and take precautionary actions regarding measures whose environmental impact is uncertain (Ratner, 2020, p. 369). In contrast with domestic law, international law does not rely primarily on vertical enforcement, but on non-coercive means, such as dialogue, capacity-building, diplomatic protest, incentives, and sanctions. Through such means, the WTO and the UNFCCC can help to ensure states' compliance with international environmental law.

One reason why so little has been written by climate justice scholars on international organizations is the domination of ideal theory in contemporary analytical political philosophy. Under the influence of John Rawls (1999), many philosophers have engaged with climate change by avoiding practical questions, such as feasible institutional reforms in the international climate and trade regimes. Many climate justice scholars have so far avoided engaging with legal rules and institutions, and the result is a failure to engage in institutional moral reasoning, that is, "reasoning that takes into account existing international institutions (including the lack thereof) in justifying, criticizing, or theorizing about the international political order" (Ratner,

2020, p. 380). Steven Ratner (2020, p. 370) explains that international law scholars are also partially responsible for this, since “most international law scholarship is empty or thin on questions of moral reasoning or ethical theory” (interestingly, he identifies the “environmental law concept of common but differentiated responsibilities” (Ratner, 2020, p. 384) as a potential ground on which normative political theorists and international law scholars could work together to get a more accurate account of the allocation of global responsibilities). To promote climate justice in the non-ideal circumstances of the real world, it is crucial to move from ideal theories of climate justice to more interdisciplinary approaches on how to concretely change and improve the world by reforming existing institutions in the international climate and trade regimes.

4.3. Carbon Majors

One last family of agents that owes mitigation duties are corporations, among which carbon majors, such as Chevron, Saudi Aramco, and BP stand out as significant actors (to these fossil fuel corporations, we can add meat and dairy corporations, such as JBS, Tyson Foods, and Cargill: together, the top five meat and dairy companies emit more GHGs than ExxonMobil, Shell or BP; the top 20 emit more than whole countries, such as Germany, Canada, Australia, the UK, or France (GRAIN & ITAP, 2018)). Carbon majors are the world’s largest public and private investor-owned, state-owned and government-run oil, gas, coal, and cement producers. According to Richard Heede’s calculations, 90 carbon majors were responsible for 63% of cumulative worldwide emissions of industrial CO₂ and methane from 1751 to 2010 (Heede, 2014, p. 234). Of these emissions, half has been emitted since 1986. Just like the operationalization of CBRD-RC explored above, this approach also leads to a very informative table which allows us to compare how much causal responsibility is borne by different firms in terms of their contribution to climate change (see Table 2).

Entity	2010 emissions MtCO ₂ e	Cumulative 1854–2010 MtCO ₂ e	Percent of global 1751–2010
1. Chevron, USA	423	51,096	3.52 %
2. ExxonMobil, USA	655	46,672	3.22 %
3. Saudi Aramco, Saudi Arabia	1,550	46,033	3.17 %
4. BP, UK	554	35,837	2.47 %
5. Gazprom, Russian Federation	1,371	32,136	2.22 %
6. Royal Dutch/Shell, Netherlands	478	30,751	2.12 %
7. National Iranian Oil Company	867	29,084	2.01 %
8. Pemex, Mexico	602	20,025	1.38 %
9. ConocoPhillips, USA	359	16,866	1.16 %
10. Petroleos de Venezuela	485	16,157	1.11 %
11. Coal India	830	15,493	1.07 %
12. Peabody Energy, USA	519	12,432	0.86 %
13. Total, France	398	11,911	0.82 %
14. PetroChina, China	614	10,564	0.73 %
15. Kuwait Petroleum Corp.	323	10,503	0.73 %
16. Abu Dhabi NOC, UAE	387	9,672	0.67 %
17. Sonatrach, Algeria	386	9,263	0.64 %
18. Consol Energy, Inc., USA	160	9,096	0.63 %
19. BHP-Billiton, Australia	320	7,606	0.52 %
20. Anglo American, United Kingdom	242	7,242	0.50 %
Top 20 IOCs & SOEs	11,523	428,439	29.54 %
Top 40 IOCs & SOEs		546,767	37.70 %
All 81 IOCs & SOEs	18,524	602,491	41.54 %
Total 90 carbon majors	27,946	914,251	63.04 %
Total global emissions	36,026	1,450,332	100.00 %

Table 2 – Carbon Majors’ Cumulative Emissions. Top 20 investor-owned companies (IOCs) and state-owned entities (SOEs). Attributed GHG emissions in million tons of CO₂-equivalent (MtCO₂e) in 2010 (left column), between 1854 and 2010 in absolute terms (middle column), and between 1751 and 2010 in relative terms. With permission of Springer Nature (Heede, 2014, p. 237).

This empirical picture has important normative implications. It provides a different way to consider collective responsibility for climate change by moving beyond the state-centric perspective that dominates the literature on burden-sharing justice. Just like subnational and supranational entities can be considered as possible agents of justice, carbon majors can be seen as moral agents—a shift in perspective that can also represent a way forward in political and philosophical debates on the attribution of responsibility to address climate change (Grasso & Vladimirova, 2020; Heede, 2014, pp. 235-236). The climate ethics literature has indeed focused predominantly on the emissions side, with little research on the “extraction side” or the “supply side” (Grasso & Vladimirova, 2020; Kartha, Caney, Dubash, & Muttitt, 2018).

Under any principle of distributive climate justice—the PPP, the APP, and/or the BPP—carbon majors have a special responsibility to address climate change. They have historically contributed to destabilizing the climate system, and they continue to do so today on a massive scale, even though the harms and dangers of doing so have been clear for at least three decades (Shue, 2017). They have the financial and technological capacity to develop substantial mitigation measures. They have benefitted considerably from past emitting activities, since most of their capital is based on the exploitation of fossil fuels. Although they could have invested massively in alternative sources of energy such as renewables, so far none of the major corporations, such as Chevron, ExxonMobil, Shell, and BP, have changed their business plans. Quite the contrary: they all argue that the world needs more fossil fuels rather than less (Frumhoff, Heede, & Oreskes, 2015, p. 166).

One additional reason why carbon majors have a special kind of responsibility is that they have systematically worked to prevent political action to reduce global emissions,

especially through lobbying activities to ensure fossil fuels were favored over other sources of energy and through disinformation campaigns (Oreskes & Conway, 2010). For instance, between 1988 and 2005, ExxonMobil spent over \$16 million to spread misleading claims about climate science and worked with the Bush administration to try to remove top scientists from leadership roles in the IPCC and the US National Climate Assessment (Frumhoff et al., 2015, p. 164).

The most obvious responsibility of carbon majors is a negative duty to stop financing misinformation campaigns about climate change and lobbying campaigns to slow down or stop political progress in the fight against climate change. But they also have a more positive duty of decarbonization: they ought to implement large-scale transformation in order to reduce and, eventually, eliminate GHG emissions from their business model (Grasso & Vladimirova, 2020; Shue, 2017). The contribution of carbon majors is also significant enough to avoid the problem of inconsequentialism: “By continuing major contributions to harm, the major carbon producers have for decades knowingly and flagrantly persisted in violating the bedrock principle: do no harm” (Shue, 2017, p. 593). If they have been able to impose a harmful carbon-intensive model of development at the global level by providing fossil fuels to the global socio-economic system, carbon majors have the economic and political power to promote low-carbon sources of energy. They can invest massively in the research, development, and deployment of renewables. To fulfill their duty to decarbonize, they have to progressively phase out fossil fuels from their businesses by transitioning to a distribution of low-carbon sources of energy. The financial burden of this energy transition should be differentiated according to the PPP, the APP and the BPP, but on any reasonable interpretation of these principles, big oil, gas and/or coal companies such as Chevron, ExxonMobil, Shell, and BP have to bear most of the burden.

The obvious challenge to mitigation duties in this context is that the fossil fuel industry has tremendous economic power and a strong interest in fossil energy continuing to be exploited. Individual corporations will probably not drastically change their business models on their own. But other agents can push them to do so. Governments can “level the playing field” by changing the incentive structure (Jamieson & Di Paola, 2016, p. 268). Political measures that increase the prices of fossil fuels, such as carbon taxes and carbon markets, as well as measures that decrease the prices of renewables, such as public subsidies, would create the background conditions that would push carbon majors to comply with their mitigation duties. Likewise, offering carbon majors reductions in royalty rates relative to how much low-carbon energy they provide would produce a strong positive incentive for engaging in the development and deployment of alternative technology (Maltais, 2016, p. 57).

Another possible response to this challenge is for institutions to divest from owning shares in publicly traded fossil fuel companies. The fossil fuel divestment movement aims to reduce the flow of investment into the companies that own the highest amount of reported carbon reserves and increase the flow of investment in companies promoting low-carbon sources of energy. Taking part in this movement could even represent an opportunity for individuals to discharge their duty to help promote climate action at the collective level by contributing to changing moral, political, cultural norms, and shifting capital out of the fossil fuel industry and into low-carbon energy (Lenferna, 2019, pp. 148-150). Here again, it is possible to incentivize carbon majors to comply with their mitigation duties.

One last response is that the renewable energy market is now a profitable option for multiple investors and industrialists. In many parts of the world, wind and solar energy have become competitive with fossil fuels in terms of cost. Today, choosing to divest from fossil fuels to invest in renewables instead has no influence on the total financial risk for the investor: divesting from fossil fuel stocks has no negative impact on investment returns (Plantinga & Scholtens, 2021). Shifting from fossil fuels to renewables also brings a range of co-benefits: for instance, providing 139 countries with electricity generated using 100% wind, water, and solar

power by 2050 would avoid millions of deaths from air pollution annually, create 24.3 million net new long-term, full-time jobs, reduce energy costs, reduce power requirements by 42.5%, reduce power disruption, and increase worldwide access to energy (Jacobson et al., 2017).

A final challenge here is that many communities and workers are economically dependent on fossil fuel extraction (Kartha et al., 2018). Renewable energy delivers more jobs per unit of energy delivered than fossil fuels, but the transition from fossil fuels to renewables will unavoidably lead to job losses in the sector of fossil fuel extraction. People who lose their jobs because of the energy transition will need to find a new foundation for livelihoods and revenue. Once again, to avoid a possible clash between climate justice and social justice, compensatory measures are necessary here as well, such as making alternative jobs available, securing access to the necessary skills building to shift into these alternative positions, and ensuring social protection. According to Sivan Kartha et al. (2018, p. 127), this challenge is important, but not insurmountable: “[i]n principle, societies could undertake a decarbonization transition in which they anticipate, prepare, cooperate, and contribute fairly to minimize and alleviate the transitional disruption.”

Conclusion

The remaining global carbon budget to avoid dangerous anthropogenic interference with the climate system is scarce and rapidly decreasing. Transgressing the planetary boundary of the climate system by greatly overshooting the global carbon budget will probably result in other planetary boundaries being crossed, which would lead the whole Earth system toward a new state that would be much less hospitable. Crossing the 2°C threshold is likely to trigger a “hothouse Earth” pathway characterized by a cascade of tipping points in the climate system, with no possibility of coming back to stringent warming targets, even with substantial amounts of negative emissions (Steffen et al., 2018). According to Timothy Lenton et al. (2019, p. 595), “the evidence from tipping points alone suggests that we are in a state of planetary emergency: both the risk and urgency of the situation are acute.”

In such a context of climate emergency, each actor at each level has a compelling responsibility to implement ambitious mitigation measures. Different actors have different responsibilities with variations in how demanding those responsibilities are and different options available to fulfill them, but most individual and collective agents can and should contribute to mitigation efforts (see Table 3).

Agents	Duties	Options (Examples)	Major Duty-bearers
Individuals	<ol style="list-style-type: none"> 1. A duty to reduce one's carbon footprint; 2. a duty to promote and support collective action against climate change. 	<ol style="list-style-type: none"> 1. Consumption choices and lifestyle changes (reducing consumption of animal-based products, reducing car and air travel, having fewer children); 2. contributing to changing policies and reforming institutions (voting green, organizing and attending demonstrations, participating in civil disobedience) and/or contributing to changing or creating social norms (influencing other people to reduce their carbon footprints, making greener lifestyles more appealing, taking part in the fossil fuel divestment movement). 	<ol style="list-style-type: none"> 1. Rich and affluent people; 2. those who can influence other people to change their lifestyles and to push for more ambitious climate policies (politicians, lawyers, researchers, journalists, poets, novelists).
Nation-states	<ol style="list-style-type: none"> 1. A duty to mitigate domestic GHG emissions; 2. a duty to engage in international mitigation cooperation to help other states to mitigate their own emissions. 	<ol style="list-style-type: none"> 1. Technological innovation (energy efficiency and the expansion of renewables); progressive carbon pricing policies (taxes on flights, vehicles, electricity consumption, meat consumption); prohibition (private jets, yachts, SUVs, and very large houses); population control policies (tax reduction for households with small families and tax increases (where affordable) for families with too many children); 2. clean technology and financial transfers. 	Developed states and new emitting countries (BASIC, Russia, Indonesia, South Korea Mexico). Each state's degree of responsibility can be measured through the operationalizing of CBDR-RC offered by the climate equity calculator.
Sub-national jurisdictions	A duty to develop an urban design that mitigates emissions at the municipal, local and regional levels in a fair way.	Design and apply mitigation policies in the most polluting sectors by conciliating climate justice goals with social justice goals (energy supply and management, transport, land-use planning, waste management).	Cities, counties, provinces, individual states
Supra-national formations	<ol style="list-style-type: none"> 1. A duty not to interfere with states', corporations' and individuals' mitigation duties; 2. a duty to bring about a framework that promotes compliance with these entities' mitigation duties. 	<ol style="list-style-type: none"> 1. Remove the trade compliance clause from the climate regime; 2. create a climate compliance clause in the trade regime, a new climate code to allow border adjustment measures, and a Clean Trade Act to promote global justice and climate justice goals. 	UNFCCC, WTO, IMF
Economic corporations	<ol style="list-style-type: none"> 1. A duty not to interfere with domestic and international mitigation measures; 2. a duty of decarbonization. 	<ol style="list-style-type: none"> 1. Stop financing misinformation campaigns about climate change and lobbying campaigns against mitigation policies; 2. redesign business plans to replace fossil fuels with renewables, stop contributing to deforestation, stop intensive animal livestock farming. 	Carbon majors, meat and dairy corporations

Table 3 – Summary of Mitigation Duties

These various mitigation duties have been identified by drawing on the literature on climate justice, global ethics, and global justice. Climate justice scholars have so far focused most heavily on nation-states, but other families of agents are starting to emerge in the philosophical literature, especially individuals. A further inclusion of other collective agents, such as cities, the WTO, and carbon majors could move the discussion forward by investigating new mitigation duties. If climate justice scholarship moves away from its predominantly state-centric perspective, additional agents and mitigation duties will probably be identified; if it moves away from its predominantly anthropocentric perspective, new grounds for justifying mitigation duties will probably be found. Moving towards a more polycentric approach and less anthropocentric ethics through the use of new ideas such as multiscale justice and interspecies justice would allow the philosophical literature on climate change to explore new avenues and could contribute to further promoting climate justice in climate action at all levels.

Acknowledgements: I am grateful to Lisa Broussois, Simon Caney, Kian Mintz-Woo, and Gianfranco Pellegrino for their helpful feedback on this chapter.

References

- André, P. (2020). *La justice climatique. Idéal philosophique, échec international et métamorphoses cosmopolitiques*. (PhD Dissertation in Philosophy). Paris-Sorbonne University, Paris.
- Baatz, C. (2014). Climate Change and Individual Duties to Reduce GHG Emissions. *Ethics, Policy & Environment*, 17(1), 1-19. doi:10.1080/21550085.2014.885406
- Baer, P. (2013). The greenhouse development rights framework for global burden sharing: reflection on principles and prospects. *Wiley Interdisciplinary Reviews: Climate Change*, 4(1), 61-71. doi:10.1002/wcc.201
- Barrett, S. (2013). The necessity of a multiscale analysis of climate justice. *Progress in Human Geography*, 37(2), 215-233. doi:10.1177/0309132512448270
- Bell, D. (2013). How Should We Think about Climate Justice? *Environmental Ethics*, 35(2), 189-208. doi:10.5840/enviroethics201335217
- Bourban, M. (2018). *Penser la justice climatique. Devoirs et politiques*. Paris: PUF.
- Bourban, M. (2021). Climate Justice in the Non-Ideal Circumstances of International Negotiations. In S. Kenenhan & C. Katz (Eds.), *Principles of Justice and Real-World Climate Politics* (pp. 59–88). London: Rowman & Littlefield.
- Bourban, M. (2022). Ethics, Energy Transition, and Ecological Citizenship. In T. M. Letcher (Ed.), *Comprehensive Renewable Energy (Second Edition)* (pp. 204-220). Oxford: Elsevier.
- Bourban, M., & Broussois, L. (2020a). The Most Good We Can Do or the Best Person We Can Be? *Ethics, Policy & Environment*, 23(2), 159-179. doi:10.1080/21550085.2020.1848175
- Bourban, M., & Broussois, L. (2020b). Nouvelles convergences entre éthique environnementale et éthique animale : vers une éthique climatique non anthropocentriste. *VertigO - la revue électronique en sciences de l'environnement*, 32, 1-29. doi:10.4000/vertigo.26893
- Broome, J. (2012). *Climate Matters: Ethics in a Warming World*. New York: W. W. Norton.
- Bulkeley, H., Carmin, J., Castán Broto, V., Edwards, G. A. S., & Fuller, S. (2013). Climate justice and global cities: Mapping the emerging discourses. *Global Environmental Change*, 23(5), 914-925. doi:10.1016/j.gloenvcha.2013.05.010

- Cafaro, P. (2011). Beyond business as usual: alternative wedges to avoid catastrophic climate change and create sustainable societies. In D. G. Arnold (Ed.), *The Ethics of Global Climate Change* (pp. 192-215). Cambridge: Cambridge University Press.
- Cafaro, P. (2012). Climate ethics and population policy. *WIREs Climate Change*, 3(1), 45-61. doi:10.1002/wcc.153
- Caney, S. (2005). Cosmopolitan Justice, Responsibility, and Global Climate Change. *Leiden Journal of International Law*, 18(4), 747-775. doi:10.1017/S0922156505002992
- Caney, S. (2009). Climate change, human rights and moral thresholds. In S. Humphreys (Ed.), *Human Rights and Climate Change* (pp. 69-90). Cambridge: Cambridge University Press.
- Caney, S. (2010). Climate change and the duties of the advantaged. *Critical Review of International Social and Political Philosophy*, 13(1), 203-228. doi:10.1080/13698230903326331
- Caney, S. (2014). Two Kinds of Climate Justice: Avoiding Harm and Sharing Burdens. *Journal of Political Philosophy*, 22(2), 125-149. doi:10.1111/jopp.12030
- Caney, S. (2020). Human Rights, Population, and Climate Change. In D. Akande, J. Kuosmanen, & D. Roser (Eds.), *Human Rights and 21st Century Challenges: Poverty, Conflict, and the Environment* (pp. 348-369). Oxford: Oxford University Press.
- Conly, S. (2016). *One Child: Do We Have a Right to More?* Oxford: Oxford University Press.
- Cripps, E. (2013). *Climate Change and the Moral Agent: Individual Duties in an Interdependent World*. Oxford: Oxford University Press.
- Dietzel, A. (2018). *Global Justice and Climate Governance: Bridging Theory and Practice*. Edinburgh: Edinburgh University Press.
- Dietzel, A. (2022). Non-state climate change action: Hope for just response to climate change? *Environmental Science & Policy*, 131, 128-134. doi:<https://doi.org/10.1016/j.envsci.2022.01.023>
- Dooley, K., & Kartha, S. (2018). Land-based negative emissions: risks for climate mitigation and impacts on sustainable development. *International Environmental Agreements: Politics, Law and Economics*, 18(1), 79-98. doi:10.1007/s10784-017-9382-9
- Eckersley, R. (2010). The Politics of Carbon Leakage and the Fairness of Border Measures. *Ethics & International Affairs*, 24(4), 367-393. doi:10.1111/j.1747-7093.2010.00277.x
- EEA. (2015). *How Vulnerable Are Cities to Climate Change?* Retrieved from Copenhagen: <https://www.eea.europa.eu/highlights/how-vulnerable-are-cities-to>
- Forman, F., Solomon, G., Morello-Frosch, R., & Pezzoli, K. (2016). Bending the Curve and Closing the Gap: Climate Justice and Public Health. *Collabra*, 2(1), 1-17. doi:10.1525/collabra.67
- Fraginière, A. (2016). Climate change and individual duties. *WIREs Climate Change*, 7(6), 798-814. doi:10.1002/wcc.422
- Frumhoff, P. C., Heede, R., & Oreskes, N. (2015). The climate responsibilities of industrial carbon producers. *Climatic Change*, 132(2), 157-171. doi:10.1007/s10584-015-1472-5
- Gambrel, J. C., & Cafaro, P. (2009). The Virtue of Simplicity. *Journal of Agricultural and Environmental Ethics*, 23(1), 85-108. doi:10.1007/s10806-009-9187-0
- Gardiner, S. M. (2004). Ethics and Global Climate Change. *Ethics*, 114(3), 555-600. doi:10.1086/382247
- Gardiner, S. M. (2011). *A Perfect Moral Storm : The Ethical Tragedy of Climate Change*. Oxford: Oxford University Press.
- GRAIN. (2015). *Trade Deals Boosting Climate Change: The Food Factor*. Retrieved from Barcelona: <https://www.grain.org/article/entries/5317-trade-deals-boosting-climate-change-the-food-factor>

- GRAIN, & ITAP. (2018). *Emissions Impossible: How Big Meat and Dairy Are Heating up the Planet*. Retrieved from Barcelona: <https://www.grain.org/article/entries/5976-emissions-impossible-how-big-meat-and-dairy-are-heating-up-the-planet>
- Grasso, M., & Vladimirova, K. (2020). A Moral Analysis of Carbon Majors' Role in Climate Change. *Environmental Values*, 29(2), 175-195.
- Heede, R. (2014). Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Climatic Change*, 122(1), 229-241. doi:10.1007/s10584-013-0986-y
- Heyward, C. (2012). A Growing Problem? Dealing with Population Increases in Climate Justice. *Ethical Perspectives*, 19(4), 703-732.
- Heyward, C., & Roser, D. (2016). *Climate Justice in a Non-Ideal World* (C. Heyward & D. Roser Eds.). Oxford: Oxford University Press.
- Hickey, C., Rieder, T. N., & Earl, J. (2016). Population Engineering and the Fight against Climate Change. *Social Theory and Practice*, 42(4), 845-870. doi:10.5840/soctheorpract201642430
- Holz, C., Kartha, S., & Athanasiou, T. (2018). Fairly sharing 1.5: national fair shares of a 1.5 °C-compliant global mitigation effort. *International Environmental Agreements: Politics, Law and Economics*, 18(1), 117-134. doi:10.1007/s10784-017-9371-z
- Hourdequin, M. (2010). Climate, Collective Action and Individual Ethical Obligations. *Environmental Values*, 19(4), 443-464. doi:10.3197/096327110X531552
- Hsu, A., Tan, J., Ng, Y. M., Toh, W., Vanda, R., & Goyal, N. (2020). Performance determinants show European cities are delivering on climate mitigation. *Nature Climate Change*, 10(11), 1015-1022. doi:10.1038/s41558-020-0879-9
- Hyams, K., & Fawcett, T. (2013). The ethics of carbon offsetting. *WIREs Climate Change*, 4(2), 91-98. doi:<https://doi.org/10.1002/wcc.207>
- IEA. (2016, 07.09.2016). Cities are at the frontline of the energy transition. Retrieved from <https://www.iea.org/news/cities-are-at-the-frontline-of-the-energy-transition>
- IPCC. (2014a). *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, MA: Cambridge University Press.
- IPCC. (2014b). Summary for Policymakers. In O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (Ed.), *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1–30). Cambridge: Cambridge University Press.
- IPCC. (2022). Summary for Policymakers. In P. R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, & J. Malley (Eds.), *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 7–53). Cambridge: Cambridge University Press.
- Jacobson, M. Z., Delucchi, M. A., Bauer, Z. A. F., Goodman, S. C., Chapman, W. E., Cameron, M. A., . . . Yachanin, A. S. (2017). 100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World. *Joule*, 1(1), 108-121. doi:10.1016/j.joule.2017.07.005
- Jamieson, D. (1992). Ethics, Public Policy, and Global Warming. *Science, Technology, & Human Values*, 17(2), 139-153. doi:10.1177/016224399201700201
- Jamieson, D. (2007). When Utilitarians Should Be Virtue Theorists. *Utilitas*, 19(2), 160-183. doi:10.1017/S0953820807002452

- Jamieson, D. (2015). Responsibility and Climate Change. *Global Justice: Theory Practice Rhetoric*, 8(2), 23-42. doi:10.21248/gjn.8.2.86
- Jamieson, D., & Di Paola, M. (2016). Political Theory for the Anthropocene. In D. Held & P. Maffettone (Eds.), *Global Political Theory* (pp. 254-280). Oxford: Polity Press.
- Jiang, L., & Hardee, K. (2011). How do Recent Population Trends Matter to Climate Change? *Population Research and Policy Review*, 30(2), 287-312. doi:10.1007/s11113-010-9189-7
- Johnson, B. L. (2003). Ethical Obligations in a Tragedy of the Commons. *Environmental Values*, 12(3), 271-287. doi:10.3197/096327103129341324
- Kartha, S., Caney, S., Dubash, N. K., & Muttitt, G. (2018). Whose carbon is burnable? Equity considerations in the allocation of a “right to extract”. *Climatic Change*, 150(1), 117-129. doi:10.1007/s10584-018-2209-z
- Kern, K., & Bulkeley, H. (2009). Cities, Europeanization and Multi-level Governance: Governing Climate Change through Transnational Municipal Networks. *JCMS: Journal of Common Market Studies*, 47(2), 309-332. doi:10.1111/j.1468-5965.2009.00806.x
- Lenferna, A. (2019). Divest-Invest: A Moral Case for Fossil Fuel Divestment. In R. Kanbur & H. Shue (Eds.), *Climate Justice: Integrating Economics and Philosophy* (pp. 139-156). Oxford: Oxford University Press.
- Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen, W., & Schellnhuber, H. J. (2019). Climate tipping points — too risky to bet against. *Nature*, 575, 592-595. doi:10.1038/d41586-019-03595-0
- Lichtenberg, J. (2010). Negative Duties, Positive Duties, and the “New Harms”. *Ethics*, 120(3), 557-578. doi:10.1086/652294
- MacAskill, W. (2015). *Doing Good Better: How Effective Altruism can Help You Make a Difference*. New York: Gotham Book.
- Maltais, A. (2013). Radically Non-Ideal Climate Politics and the Obligation to at Least Vote Green. *Environmental Values*, 22(5), 589-608. doi:10.3197/096327113X13745164553798
- Maltais, A. (2016). A Climate of Disorder: What to Do About the Obstacles to Effective Climate Politics. In C. Heyward & D. Roser (Eds.), *Climate Justice in a Non-Ideal World* (pp. 43-63). Oxford: Oxford University Press.
- McKendry, C. (2016). Cities and the challenge of multiscale climate justice: climate governance and social equity in Chicago, Birmingham, and Vancouver. *Local Environment*, 21(11), 1354-1371. doi:10.1080/13549839.2015.1116064
- McShane, K. (2016). Anthropocentrism in Climate Ethics and Policy. *Midwest Studies In Philosophy*, 40(1), 189–204. doi:10.1111/misp.12055
- Miller, D. (2007). *National Responsibility and Global Justice*. Oxford: Oxford University Press.
- Moellendorf, D. (2009). Treaty Norms and Climate Change Mitigation. *Ethics & International Affairs*, 23(3), 247-265. doi:10.1111/j.1747-7093.2009.00216.x
- Murtaugh, P. A., & Schlax, M. G. (2009). Reproduction and the carbon legacies of individuals. *Global Environmental Change*, 19(1), 14-20. doi:10.1016/j.gloenvcha.2008.10.007
- Oreskes, N., & Conway, E. M. (2010). *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. New York: Bloomsbury Press.
- Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, 20(4), 550-557. doi:10.1016/j.gloenvcha.2010.07.004
- Oxfam. (2015). *Extreme Carbon Inequality*. Retrieved from Oxford: <https://www.oxfam.org/en/research/extreme-carbon-inequality>

- Page, E. A. (2008). Distributing the burdens of climate change. *Environmental Politics*, 17(4), 556-575. doi:10.1080/09644010802193419
- Palmer, C. (2011). Does nature matter? The place of the nonhuman in the ethics of climate change. In D. G. Arnold (Ed.), *The Ethics of Global Climate Change* (pp. 272-291). Cambridge: Cambridge University Press.
- Plantinga, A., & Scholtens, B. (2021). The financial impact of fossil fuel divestment. *Climate Policy*, 21(1), 107-119. doi:10.1080/14693062.2020.1806020
- Posner, E. A., & Weisbach, D. (2010). *Climate Change Justice*. Princeton: Princeton University Press.
- Prinzing, M. (2020). Going Green Is Good for You: Why We Need to Change the Way We Think about Pro-environmental Behavior. *Ethics, Policy & Environment*, 1-18. doi:10.1080/21550085.2020.1848192
- Ratner, S. R. (2020). International Law. In T. Brooks (Ed.), *The Oxford Handbook of Global Justice* (pp. 362-392). Oxford: Oxford University Press.
- Rawls, J. (1999). *A Theory of Justice: Revised Edition*. Cambridge: The Belknap Press of Harvard University Press.
- Roser, D. (2015). Climate Justice in the Straightjacket of Feasibility. In D. Birnbacher & M. Thorseth (Eds.), *The Politics of Sustainability: Philosophical Perspectives* (pp. 71-91). New York/London: Routledge.
- Sandler, R. (2009). Ethical Theory and the Problem of Inconsequentialism: Why Environmental Ethicists Should be Virtue-Oriented Ethicists. *Journal of Agricultural and Environmental Ethics*, 23(1), 167. doi:10.1007/s10806-009-9203-4
- Schwenkenbecher, A. (2014). Is there an obligation to reduce one's individual carbon footprint? *Critical Review of International Social and Political Philosophy*, 17(2), 168-188. doi:10.1080/13698230.2012.692984
- Shepherd, J., Caldeira, K., Haigh, J., Keith, D., Launder, B., Mace, G., . . . Watson, A. (2009). *Geoengineering the Climate: Science, Governance and Uncertainty*. Retrieved from London: http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/publications/2009/8693.pdf
- Shue, H. (1993). Subsistence Emissions and Luxury Emissions. *Law & Policy*, 15(1), 39-60. doi:10.1111/j.1467-9930.1993.tb00093.x
- Shue, H. (1999). Global Environment and International Inequality. *International Affairs*, 75(3), 531-545. doi:10.1111/1468-2346.00092
- Shue, H. (2013). Climate Hope: Implementing the Exit Strategy. *Chicago Journal of International Law*, 13(2), 381-402.
- Shue, H. (2015). Historical Responsibility, Harm Prohibition, and Preservation Requirement: Core Practical Convergence on Climate Change. *Moral Philosophy and Politics*, 2(1), 7-31. doi:10.1515/mopp-2013-0009
- Shue, H. (2017). Responsible for what? Carbon producer CO2 contributions and the energy transition. *Climatic Change*, 144(4), 591-596. doi:10.1007/s10584-017-2042-9
- Singer, P. (2015). *The Most Good You Can Do: How Effective Altruism Is Changing Ideas About Living Ethically*. Yale: Yale University Press.
- Singer, P. (2016). *One World Now: The Ethics of Globalization*. New Haven/London: Yale University Press.
- Sinnott-Armstrong, W. (2005). It's Not My Fault: Global Warming and Individual Moral Obligations. In W. Sinnott-Armstrong & R. Howarth (Eds.), *Perspectives on Climate Change* (pp. 221-253). Amsterdam: Elsevier.
- Steffen, W., Rockström, J., Richardson, K., Lenton, T. M., Folke, C., Liverman, D., . . . Schellnhuber, H. J. (2018). Trajectories of the Earth System in the Anthropocene.

- Proceedings of the National Academy of Sciences*, 115(33), 8252-8259.
doi:10.1073/pnas.1810141115
- Stiglitz, J. (2007). *Making Globalization Work*. New York: W. W. Norton & Company.
- UNFCCC. (1992). *United Nations Framework Convention on Climate Change. Document FCCC/INFORMAL/84*. New York
- UNFCCC. (2015). *Adoption of the Paris Agreement. Decision 1/CP.21. Document FCCC/CP/2015/10/Add.1*. Paris
- Valentini, L. (2013). Cosmopolitan Justice and Rightful Enforceability. In G. Brock (Ed.), *Cosmopolitanism versus Non-Cosmopolitanism: Critiques, Defenses, Reconceptualizations* (pp. 92-107). Oxford: Oxford University Press.
- van Vuuren, D. P., Stehfest, E., Gernaat, D. E. H. J., van den Berg, M., Bijl, D. L., de Boer, H. S., . . . van Sluisveld, M. A. E. (2018). Alternative pathways to the 1.5 °C target reduce the need for negative emission technologies. *Nature Climate Change*, 8(5), 391-397. doi:10.1038/s41558-018-0119-8
- Wenar, L. (2016). *Blood Oil: Tyrants, Violence, and the Rules that Run the World*. Oxford: Oxford University Press.
- Wiedmann, T., Lenzen, M., Keyßer, L. T., & Steinberger, J. K. (2020). Scientists' warning on affluence. *Nature Communications*, 11(1), 3107. doi:10.1038/s41467-020-16941-y
- Wynes, S., & Nicholas, K. A. (2017). The climate mitigation gap: education and government recommendations miss the most effective individual actions. *Environmental Research Letters*, 12(7), 1-9.
- Young, I. M. (2006). Responsibility and Global Justice: A Social Connection Model. *Social Philosophy and Policy*, 23(1), 102-130. doi:10.1017/S0265052506060043