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Fossil Fuels

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1. Introduction

Fossil fuels are the accretions of unimaginably vast generations of algae and plankton (mostly not dinosaurs, despite what some might believe) that slowly settled on ocean beds, compacting and sedimenting over geological timescales. Under intense heat and pressure, the solar energy stored in those microscopic beings has been condensed into fossil fuels. They are fossil in at least two senses: they are extracted from the earth and they belong to a previous era. When we burn oil today, we are burning this long-contained accumulation of solar energy. One estimate is that it took 23 metric tons of ancient plant matter to produce one liter of gasoline (Dukes 2003). Think how quickly one can burn through that liter.

Not only has the volume of energy contained in fossil fuels been released in a short period of time, the number of firms that have facilitated the bulk of this extraction is also surprisingly small. Richard Heede (2013) traced the emissions catalogued in the historical record of 90 large fossil fuel producers, both public and private and reflecting both mergers and acquisitions. His conclusion was that, up until 2010, 63% of *all* estimated anthropogenic, or human-caused, historical emissions could be traced to these 90 producers (also cf. Frumhoff et al. 2015, Ekwurzel et al. 2017 and Shue 2017). He called these producers ‘carbon majors’, and they span

well-known brands all the way to petrostates (Collins 2020, Grasso and Vladimirova 2019, Hormio 2017, Moss 2020). In short, thinking about fossil fuels reveals two kinds of compression: temporal, from the development of these fuels to the speed of their use; and distribution, from the variety of ways we all use fossil fuels to the relatively few entities that bring the majority of them out of the ground.

Our relationships with fossil fuels likewise span a variety of scales. To give a sense of these, this chapter discusses a range of relationships with fossil fuels. The purpose of this chapter is to show a range of debates that environmental ethicists have engaged with regarding fossil fuels.

First, with respect to our personal relationship to fossil fuels, it introduces arguments about whether we should or even can address our own usage of fossil fuels. This involves determining whether offsetting emissions is morally required and practically possible. Second, with respect to our relationship with fossil fuels at the national level, it discusses forms of local resistance, especially divestment and pipeline protesting. Finally, with respect to our relationship with fossil fuels at the international level, it considers two types of policy. On the one hand, some have argued that we should stop most trade in oil, on the basis that most oil that is traded is not subject to the control of citizens. On the other hand, some have argued that we should price the costs of fossil fuels so that there are market incentives to avoid digging them out of the ground. The chapter ends with a short conclusion.

2. On Our Personal Relationship to Fossil Fuels

Every one of our lives is entwined with fossil fuel emissions. Besides direct fuel use, necessary for activities like driving or flying, our choices of energy have significant consequences for our emissions and we also consume vast number of oil-produced products every day. If you are at

the computer, most likely your keyboard and monitor are made of plastic produced by oil. Your food containers and cell phone are made from oil. It's likely in your lip balm and your luggage. You walked home on sidewalks made from it. And the list goes on. Most of our lives, especially in the wealthy, industrialized world, depend on fossil fuel emissions. [Average people in lower-income countries use considerably fewer fossil fuels, meaning that they could scale up fossil fuel use significantly and still generate fewer emissions than average people in high-income countries (Chakravarty et al. 2009.)] These emissions together with those of many others will lead to major harms to current and future people. Should we reduce, or *mitigate*, our personal emissions by reducing the amount of fossil fuels we, directly and indirectly, consume?

On the one hand, it is very unlikely that any given person's emissions will make a recognizable or morally important contribution to climate change (Sinnott-Armstrong 2005; Nefsky 2011; Cripps 2013; Maltais 2013; Kingston and Sinnott-Armstrong 2018; Budolfson 2019). After all, even if one's emissions are significant for an individual, they are part of massive systems including the emissions of many others. If one individual changed their own emissions, it might seem to make no difference with respect to climate outcomes. One important point to keep in mind is that we have to carefully distinguish claims that individual emissions make no difference *at all* and that they make negligible or *very small* differences. In order for this to be a special problem, it has to be the case that each individual's emissions make no difference at all.

On the other hand, if all the emissions make a difference, within those emissions *some* of them had to be the ones that led to the difference. If so, there must be some likelihood that any given person will make a difference by producing those relevant emissions. For any given individual, that difference may be unlikely to occur at her hand, or hard to attribute to her, but if the value of the difference is great enough, a relatively low likelihood of making a difference might still make

a significant difference in expectation (Hiller 2011; Kagan 2011; Nolt 2011; Broome 2019). This is because even a small likelihood of making a difference could be highly relevant if the size of that difference is large enough. For instance, it might be very unlikely that the emissions from my plane ride cause the strengthening of a heatwave from climate change, but if it did, the harm from that slightly more intense heatwave could be very large so the product of the likelihood and the disvalue of the outcome could be significant. It could also be that one's difference could be magnified by demonstrating integrity between one's political ideals and personal actions, as Marion Hourdequin (2010) argues.

But even if that were right, how could one person reduce their emissions? We might think that it is inevitable that the fossil fuels will be dug up and used (Hale 2011). After all, they are there in the ground, we know where many of them lie, and they are valuable in the marketplace. Also, it might seem we cannot live our lives without being responsible for some emissions, so why does it matter if it is somewhat more or somewhat less?

In response to this challenge, John Broome (2012) makes a surprising argument which relies on a distinction between *net* emissions and emissions *simpliciter*. To begin, he says that it does make a difference if you make more or less of a contribution of emissions; his claim is that it makes a difference in terms of what he calls your *duties of justice*. If your emissions will lead to some harms and you owe it—as a matter of justice—not to harm others, then you owe it to others not to emit at all! But this leads to a problem. Let us grant that you cannot live at all while reducing your emissions to zero. Broome's claim is that, while you cannot reduce your emissions to zero *simpliciter*, you can reduce your *net* emissions to zero.

How could you reduce your net emissions to zero? If you have positive emissions, then to get to net zero you have to *offset* these emissions, usually by paying others to emit less or to pursue

projects that involve fewer emissions than there would have been otherwise. This is very difficult to verify; in particular, it is difficult to determine whether those emissions reductions really change the outcome relative to some baseline (this issue is called *additionality*).

If these challenges can be met and there are reliable offsetting schemes, Broome claims that you can make zero net emissions by using such schemes. Given that greenhouse gases are to a first approximation global, meaning that they quickly mix well throughout the atmosphere, it does not matter whether you personally were the source (in whatever region you are in) as opposed to the offsetting project (in whatever region it is in). Economists might say emissions appear to be *fungible*, meaning that there is no change associated with replacing one set of emissions with a different set of emissions of the same quantity.

Will this defense work? Can we reduce our emissions to net zero via offsetting, even if we cannot reduce them to zero simpliciter? Dale Jamieson (2014) denies that this line of reasoning succeeds; he thinks that replacing some emissions with others *does* make a difference. If we think again about the formation of the fossil fuels from which those emissions come, we recall that this involves a long slow physical and chemical process. Clearly the offsetting schemes do not *reverse* that process. One of the original suggestions for offsetting, for instance, was planting trees. First of all, while this would sequester some carbon in the wood, it would take a very long time so there is a temporal mismatch between your emissions today and those sequestered emissions over the coming decades. Second, while it might sequester carbon, it is very different from the carbon that was stored in fossil fuels. One important way that these differ is that the carbon stored in fossil fuels underground is physically stable and unlikely to re-enter the atmosphere. However, carbon stored in trees is only retained there for the life of the tree. So

there is a second sense in which there is a temporal mismatch. These objections might not apply to other forms of offsetting, but they demonstrate how difficult it is to truly offset any emissions.

There are good reasons to be suspicious of offsetting. However, there are companies that are trying to provide offsets which attempt to satisfy additionality (e.g., atmosfair, myclimate and Cool Effect) and their offsets are certified via various standards.

In this section, we considered arguments about whether you should offset and whether your emissions matter. Some authors claim that individual emissions do not matter; some claim that they do. If they do, it could be because you owe it as a duty to reduce your net emissions to zero. But it's not clear whether this is possible. If you try to do so, make sure to read widely and choose carefully. But everyone can be mindful of their emissions and try to reduce their personal unnecessary uses of fossil fuels. For some, that might be enough. For others, more significant actions are called for; we turn to these in the next section.

3. On Our National Relationship to Fossil Fuels

While the harms of burning fossil fuels are, to a first approximation, global in that they have far more global effects than domestic, there are several important ways that we interact with the fossil fuels that are in our own countries or local regions. In this section, I will discuss two. First, we have the ability to politically affect fossil fuels by acting locally. Here, we can consider, for instance, protest and divestment movements that have arisen in North America. These can complement more familiar (but not unimportant) voting and letter-writing contributions to political discourse. Second, burning fossil fuels is not only relevant in terms of climate change; over closer spatial scales, we also face co-harms involving local pollutants and their effects on, inter alia, human health. This is important for many reasons, but one is political: governments

can claim credit for improving local health much more easily than for preventing harms either internationally or in the future. Let us consider these in turn.

Popularizing work done by the group Carbon Tracker (Gunningham 2017), the journalist and environmentalist Bill McKibben (2012) drew a large amount of attention to the impact of proven fossil fuel reserves, or reserves which were expected to be burned and catalogued as assets for the companies that control them. In short, the carbon contained in fossil fuels that firms intended to extract and burn was far more than was consistent with keeping climate change to two degrees Celsius, an internationally recognized limitation. That means that our best science tells us we cannot extract and burn the fossil fuels that companies and countries expect to.

In 2012, McKibben reported that the carbon contained within proven fossil fuel reserves, 2,795GtC (gigatons of carbon), was more than five times the amount estimated in the carbon budget. The carbon budget to maintain two degrees Celsius was estimated at 565GtC. This implies that, if we do manage to keep to this budget, we need to keep the vast majority of already proven fossil fuels in the ground. (A more recent scientific study found more tolerance than McKibben estimated; consistent with the two degree warming guideline, the study found that a third of oil reserves could be burned (McGlade and Ekins 2015).)

This point helped galvanize significant political opposition, especially in North America. Using slogans like “Keep it in the ground”, many activists became concerned about the potential for all of this stored carbon to blow past the two degree target. Although other chapters address lawbreaking and civil disobedience (Garcia-Gibson forthcoming), two particular forms of opposition are worth noting because they have to do with local control (Kyllönen 2014). While these can complement more familiar ways of registered political positions, such as voting, they

deserve extra attention here precisely because they are less familiar and have been influential with respect to fossil fuels.

One innovation of the group that McKibben founded, 350.org, was in specifying the importance of fighting fossil fuel companies—and drawing attention to them via the tactic of *divestment* (Gunningham 2017). The idea here is that individuals can challenge fossil fuel companies by getting large local institutions to divest (un-invest) from these energy companies, regardless of where those companies or fossil fuels are physically located. In this way, individuals can send a signal about their engagement with fossil fuels from within their local organizations, such as universities and religious institutions. While divestment has limited direct financial impact on fossil fuel companies, it can be valuable in signaling moral disapproval and drawing attention to the potential for climate damages (Ansar et al. 2013). This tactic should be contrasted with activist shareholding, where one retains investment in companies and generates coalitions to shift firm behavior. Using terms popularized by Hirschman, the former is a form of *exit*; the latter is a form of *voice*.

The other type of opposition that has received attention in North America is protesting pipelines. This is a classic case where local action has global effects; the theory of change is that, without ways to get energy products to global markets, the fossil fuels will not be extracted. Many of these protests have been led or supported by Indigenous or First Nations people (for instance, see Whyte 2017, Tallbear 2019). Once again, this is possible only when the extraction or transportation takes place within one's state or country.

Another important local aspect of fossil fuel extraction—an aspect which has not received as much attention as it deserves by the philosophical community—is the role of local co-harms that accompany fossil fuel extraction and emissions. Globally, and over time, the major impact of

fossil fuel use is climate change. Stephen Gardiner calls the *dispersion of causes and effects* the phenomenon that the effects of climate change are remote in time and space (Gardiner 2006). This makes climate effects more difficult to address.

However, climate change is not the only effect of extracting and burning fossil fuels. Furthermore, if we can prevent these additional effects, which are more local, this can be politically beneficial as well as important in changing the narratives we might expect about fossil fuels (Bain et al. 2016).

These other effects are called *co-harms* (and *co-benefits*), since they accompany the effects of emissions that are usually considered (i.e., climate change). However, co-harms and co-benefits of fossil fuel reductions are important because they can greatly strengthen the case for limiting fossil fuel use. For instance, when they are incorporated into models measuring the costs of climate change, emissions reductions have net benefits immediately (as opposed to when delayed climate benefits occur) and these immediate benefits can be very significant (Ürge-Vorsatz et al. 2014, Scovronick et al. 2019, Karlsson et al. 2020).

This is a powerful narrative; the health co-harms from fossil fuel use are more temporally and regionally immediate than climate harms. Furthermore, these benefits are politically useful because they mostly occur within the country which is emitting, instead of being felt internationally. Governments that encourage reduction of fossil fuel use can claim immediate health benefits (assuming we count avoided health costs). Since we do not have direct control over the actions of governments in different countries, this is an important connection to fossil fuel use in one's own country. As for our connections to fossil fuels internationally, there are many other policy options, some of which are considered in the next section.

4. On our International Relationship to Fossil Fuels

Fossil fuels are extracted and sold across global borders—indeed, oil is perhaps first among equals as the most geopolitically important commodity sold. Blood and treasure are spent on control and access to it. Given this background, how should those of us in the wealthy, industrialized world relate to fossil fuels and the governments and regimes that sell it to us? There is a wide array of policy options in response to this question, but they are anchored on both sides by the question of whether such buying and selling is impermissible or permissible. If it is impermissible, then the question is on what grounds it would be impermissible and what practically could be done to put an end to it. This could involve bans and injunctions. If it is permissible, then the question is under which conditions it would be permissible and how to impose those conditions. This could involve carbon pricing and compensation. Consider these in turn.

The first answer, as argued by Leif Wenar (2016), is that, when faced with the prospect of buying oil from certain kinds of repressive states, we should simply refrain from buying it. In particular, his claim is that countries that support rule of law should not purchase natural resources like oil from regimes that prevent citizens from discovering, controlling and authorizing the sales of these resources. This *popular resource sovereignty* holds that the resources belong to the citizens. It requires that there is press freedom and other access to information about resource management, that there is the ability for citizens to intervene and object to various uses of resources, and a situation where the government does not manipulate public opinion by, for instance, making objecting dangerous or unduly costly. Given that many resources are extracted and sold in ways that are inconsistent with the citizens' endorsement or even knowledge, Wenar concludes that these resources are, morally speaking, stolen. He allows

that they may not be *legally* stolen, since the legal regime that governs natural resources is governed by "effectiveness" or the idea that whoever controls the resources owns them. Wenar summarizes this doctrine as "might makes right". Just as we would not traffic in stolen goods or in any other way legitimize the ownership of thieves, Wenar argues we should not engage in trade for oil and other natural resources under these conditions.

How could this look in policy terms? Wenar proposes a Clean Trade Act which makes purchase of such resources illegal and prevents regimes that trade in such goods from benefitting from commerce within the borders of the Act's state. He points out that, while a strong response, it need not involve any interference with the regimes' sovereignty and so involves far less intrusion than options such as military action. Which states are excluded from trade could be governed by non-governmental organization indices.

Recall that the question is how to respond to the international usage and sale of fossil fuels. While Wenar thinks that the appropriate response to trade is to stop it, one might think that the problem is not that fossil fuels are being traded simpliciter, but that they are being traded *without reflecting the real costs to society*. This *externalization* of the social costs (not being borne by those making the trade) could ground a new approach to climate ethics (Mintz-Woo and Leroux 2021). The issue is that, when a transaction can affect a third party, and those effects are not priced into the transaction, we expect the number of transactions to be non-optimal from the social point of view. In this case, extraction and purchase of fossil fuels involves harms from climate change as well as co-harms from local air pollution. Perhaps the appropriate policy would be to price carbon, with the appropriate price leading to the socially optimal level of use. When things are more expensive, on the margin, people will consume less of them.

Three important things are worth noting up front. First, there are many methods for pricing carbon: the most common are a carbon tax that imposes a set cost per unit of emission and a cap-and-trade system that divides a target amount of total emissions into *emissions allowances* to be traded amongst emitters (Mintz-Woo, 2022). In principle, with sufficient information these options are in most cases equivalent even though there may be significant differences with respect to political or social acceptance of the respective methods (Klenert et al. 2018).

Second, almost all fossil fuel policies will engender a price on carbon; the issue is how transparent those prices are to consumers. For instance, a portfolio standard policy which requires a certain percentage of state energy to be generated by renewables will demand some renewables when they are not the least cost energy option. That will lead to a greater cost for energy, some of which will fall on the consumers. The point is not that this is necessarily unjustified; it is that energy policies, even those without obvious price introductions, ultimately make energy more expensive. So the question is not whether to adopt policies that increase the price of carbon-intensive activities or those which do not—it is whether to adopt ones that price carbon explicitly or those that price it implicitly (Mintz-Woo, 2022).

Finally, people do respond to price signals with respect to fossil fuels (Mintz-Woo 2021c). For instance, Murray and Rivers (2015) analyzed the impact of a carbon tax that was introduced in British Columbia in 2008. The carbon tax went to \$30CAD/tCO_2. They found the tax reduced carbon emissions relative to expectations (by roughly 5-15%), was politically popular, and had not disadvantaged British Columbia economically relative to other provinces in general. More generally, while many people find it counterintuitive, carbon taxes do shift behavior (for a similar case, raising taxes on tobacco robustly decreases the number of cigarettes purchased on the margin) (Klenert et al. 2018).

Having made those initial points, we can turn to the question of how to set the price. Economists have the concept of the *social cost of carbon*, or the cost to society of a marginal increase of a ton of CO_2. If the carbon price that policy sets matches the social cost of carbon, then the appropriate amount of fossil fuels will be burned under ideal circumstances. Note that the appropriate amount might not be zero—for instance, the emissions needed to rush a person to hospital might outweigh the harms that the fossil fuel extraction is associated with. Note also that many of our targets are in terms of *net*-zero, not zero anthropocentric emissions simpliciter, since there are very substantial carbon sinks in the system—on the order of a third of anthropocentric emissions (Keenan & Williams 2018). However, estimating the social cost of carbon requires taking a stand on both difficult empirical questions as well as a number of morally contested questions (Mintz-Woo 2021b). While the empirical questions include how the overall warming is driven by additional emissions and how society would respond to new warmer conditions, the moral questions include how to compare harms over time, what scope of harms is covered, which population ethics assumptions to adopt, and whether to include non-human impacts. One overall conclusion about these considerations is that the standard tools for estimating the social cost of carbon are more flexible than is often assumed (Fleurbaey et al. 2019). This section will focus on these moral considerations.

The consideration that has received the most philosophical attention is how to compare costs and benefits over time, which we call the *discounting problem* (Broome 1994; Davidson 2006; Kelleher 2017a,b; Rendall 2019; Mintz-Woo 2019). Greaves (2017) and Mintz-Woo (2021a) provide introductions and overviews of this problem. The issue is how to compare both pure goods (like utility or welfare) and impure goods (like money and material things) across times. This difference matters because the benefits of selling fossil fuels are mostly immediate, whereas

the costs can stretch far into the future. In short, the question is how to compare future people and future things with their current present counterparts.

Another consideration concerns which *present* people we are including. Do we include all the global impacts or just our local or national impacts? There is a case to be made that it is more consistent with other types of policies to consider only national impacts. In response, Mintz-Woo (2018) argues that climate change is special in a couple of ways which justify considering global effects: the climate problem is predominantly global and the mechanisms which govern it are well-understood.

Other considerations have to do with *population ethics*, the moral positions that we make about the evaluative importance of comparing outcomes with different people with different levels of welfare. So, for instance, a standard way of aggregating pure values like utility or welfare is simply to sum them. This type of *total utilitarianism* is morally objectionable to some because it could be that an exceedingly large population with very low average level of welfare could be valuable (if we had a choice between creating a populous world with very low levels of welfare this would be better than a less populous world with high levels of welfare). These worries have led some to an alternative, the *average utilitarian* view, where the value of a world is given by the average pure value. This abstract population ethics assumption can have major effects on the appropriate carbon price, as significant as which answer one gives to the discounting problem (Scovronick et al. 2017). Another population ethics alternative would be to weight the utility of those with lower utility more heavily, yielding some form of prioritarianism with respect to risk (Adler et al. 2017, Fleurbaey et al. 2019). These abstract moral positions could make significant differences with respect to the ideal carbon price (although Arrhenius, Budolfson, and Spears (2021) argue that there may be more agreement than initially appears).

Finally, with respect to a consideration of especial interest to environmental ethicists, we have the question of what to value: just humans, which is the default in these analyses (*anthropocentrism*); all beings with the capacity to suffer (*sentientism*); all living beings (*biocentrism*); or ecosystems themselves (*ecocentrism*) (Jamieson 2008). As incorporating non-humans into such social costs of carbon is an emerging topic, the space is ripe for possible methods of comparing impacts across species (Fleurbaey et al. 2019).

While we have focused on the moral aspects involved in estimating the level of the carbon price, it is also worth noting that there are distributive justice considerations involved in dealing with the *revenue*. Most forms of carbon pricing involve tax revenue, which can be used for one of several purposes, or even a combination of purposes (Gajevic Sayegh 2019; Singer and Mintz-Woo 2020, Mintz-Woo et al. 2021). For instance, if revenue is distributed as equal per capita lump-sum payments, it will actually be net progressive in most places (meaning more than the poorest half of society will end up overall paying less taxes and some of the wealthiest will end up overall paying more taxes) (Mintz-Woo 2022). An alternative purpose is to remove burdensome distortionary taxes like labor taxes. Yet another purpose is to spent revenue on public and green priorities. Economists call the two effects (incentivizing less pollution and reducing harmful taxes) the *double dividend hypothesis*. It shows that there can be multiple advantages to pricing carbon.

5. Conclusion

While we engage with fossil fuels on a daily basis in myriad ways, recognizing those relationships can reveal the opportunity for more conscious actions. These can involve trying to restrict or offset our own fossil fuel use; engaging in voting, protest, or other political activities

to keep fossil fuels in the ground; and considering global policies that would limit our impact on the environment. This is by no means an exhaustive list, but it provides some idea of the discussions that environmental ethicists have been and could be engaging with on the topic of this buried fossil energy.

6. Related Topics

Property;

Moral Basis of Responses to Climate Change;

Mitigation;

Climate Justice and Equity;

Skepticism and Denialism;

Renewables;

Energy Poverty;

Pollution and Polluter Pays;

Environmental Justice

7. References

Adler, M.D., Anthoff, D., Bosetti, V., Garner, G., Keller, K., and Treich, N. (2017) "Priority for the worse-off and the social cost of carbon," *Nature Climate Change*, 7(6), pp. 443–449.

Ansar, A., Caldecott, B. and Tilbury, J. (2013) "Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets?" Technical

report, Oxford: Smith School. Available at: https://www.smithschool.ox.ac.uk/publications/reports/SAP-divestment-report-final.pdf.

Arrhenius, G., Budolfson, M. and Spears, D. (2021) "Does Climate Change Policy Depend Importantly on Population Ethics?" in T. McPherson, M. Budolfson and D. Plunkett (eds.) *Philosophy and Climate Change*, Oxford: Oxford University Press.

Baatz, C. (2014) "Climate Change and Individual Duties to Reduce GHG Emissions," *Ethics, Policy & Environment*, 17(1), pp. 1–19.

Bain, P. G., Milfont, T. L., Kashima, Y., Bilewicz, M., Doron, G., Garðarsdóttir, R. B., et al. (2016) "Co-benefits of addressing climate change can motivate action around the world," *Nature Climate Change*, 6(2), 154–157. http://doi.org/doi:10.1038/nclimate2814

Broome, J. (1994) "Discounting the Future," *Philosophy and Public Affairs*, 23(2), pp. 128–156.

--- (2012) *Climate Matters: Ethics in a Warming World*, New York: W. W. Norton.

--- (2019) "Against Denialism," *The Monist*, 102(1), pp. 110–129.

Budolfson, M.B. (2018) "The inefficacy objection to consequentialism and the problem with the expected consequences response," *Philosophical Studies*, 176(7), pp. 1711–1724.

Chakravarty, S., Chikkatur, A., de Coninck, H., Pacala, S., Socolow, R. and Tavoni, M. (2009) "Sharing global CO_2 emission reductions among one billion high emitters," *Proceedings of the National Academy of Sciences of the United States of America*, 106(29), pp. 11884–11888.

Collins, Stephanie (2020) "Corporations' duties in a changing climate," in J. Moss and L. Umbers (eds.) *Climate Justice and Non-State Actors: Corporations, Regions, Cities, and Individuals*, Oxford: Routledge.

Cripps, E. (2013) *Climate Change and the Individual Agent*, Oxford: Oxford University Press. doi:10.1093/acprof:oso/9780199665655.001.0001

Davidson, M.D. (2006) "A Social Discount Rate for Climate Damage to Future Generations Based on Regulatory Law," *Climatic Change*, 76(1), pp. 55–72.

Fleurbaey, M., Ferranna, M., Budolfson, M.B., Dennig, F., Mintz-Woo, K., Socolow, R., Spears, D. and Zuber, S. (2019) "The Social Cost of Carbon: Valuing Inequality, Risk, and Population for Climate Policy," *The Monist*, 102(1), pp. 84–109. Available at: https://academic.oup.com/monist/article/102/1/84/5255707.

Gajevic Sayegh, A. (2019) "Pricing Carbon for Climate Justice," *Ethics, Policy & Environment*, 22(2), pp. 109–130. Available at: https://www.tandfonline.com/doi/full/10.1080/21550085.2019.1625532.

Garcia-Gibson, F. (forthcoming) "Undemocratic Climate Protests," *Journal of Applied Philosophy*. Available at: https://doi.org/10.1111/japp.12548.

Greaves, H. (2017) "Discounting for Public Policy: A Survey," *Economics and Philosophy*, 33(3), pp. 391–339. Available at: https://doi.org/10.1017/S0266267117000062.

Gunningham, N. (2017) "Building Norms from the Grassroots Up: Divestment, Expressive Politics, and Climate Change," *Law & Policy*, 39(4), pp. 372–392.

Davidson, M.D. (2006) "A Social Discount Rate for Climate Damage to Future Generations Based on Regulatory Law," *Climatic Change*, 76(1), pp. 55–72.

Dukes, J.S. (2003) "Burning buried sunshine: Human consumption of ancient solar energy," *Climatic Change*, 61(1-2), pp. 31–44.

Ekwurzel, B., Boneham, J., Dalton, M.W., Heede, R., Mera, R.J., Allen, M.R. and Frumhoff, P.C. (2017) "The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers," *Climatic Change*, 144(4), pp. 579–590. Available at: http://doi.org/10.1007/s10584-017-1978-0 .

Frumhoff, P.C., Heede, R. and Oreskes, N. (2015) "The climate responsibilities of industrial carbon producers," *Climatic Change*, 132(2), pp. 157–171. Available at: https://link.springer.com/article/10.1007/s10584-015-1472-5 .

Gardiner, S.M. (2006) "A perfect moral storm: climate change, intergenerational ethics and the problem of moral corruption," *Environmental Values*, 15(3), pp. 397–413. Available at: http://www.jstor.org/stable/30302196.

Grasso, M. and Vladimirova, K. (2020). A Moral Analysis of Carbon Majors' Role in Climate Change. *Environmental Values* 29(2), pp. 175–195. Available at: https://doi.org/10.3197/096327119X15579936382626.

Hale, B. (2011) "Nonrenewable Resources and the Inevitability of Outcomes," *The Monist*, 94(3), pp. 369–390. Available at: https://doi.org/10.5840/monist201194319.

Heede, R. (2014) "Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010," *Climatic Change*, 122(1-2), pp. 229–241. Available at: http://link.springer.com/10.1007/s10584-013-0986-y.

Hiller, A. (2011) "Climate Change and Individual Responsibility," *The Monist*, 94(3), pp. 349–368.

Hormio, S. (2017) "Can Corporations Have (Moral) Responsibility Regarding Climate Change Mitigation?" *Ethics, Policy & Environment*, 20(3), 314–332. http://doi.org/10.1080/21550085.2017.1374015

Hourdequin, M. (2010) "Climate, Collective Action and Individual Ethical Obligations," *Environmental Values*, 19(4), pp. 443–464.

Jamieson, D. (2008) *Ethics and the Environment: An Introduction*, Cambridge: Cambridge University Press.

--- (2014) "*Climate Matters: Ethics in a Warming World* Book Review," *Ethics & International Affairs*, 28(2), pp. 263–265. Available at: https://www.ethicsandinternationalaffairs.org/2014/climate-matters-ethics-in-a-warming-world-by-john-broome/.

Kagan, S. (2011) "Do I Make a Difference?" *Philosophy and Public Affairs*, 39(2), pp. 105–141.

Karlsson, M., Alfredsson, E., & Westling, N. (2020) "Climate policy co-benefits: a review," *Climate Policy*, 20(3), 292–316. Available at: http://doi.org/10.1080/14693062.2020.1724070

Keenan, T. F., & Williams, C. A. (2018) "The terrestrial carbon sink," *Annual Review of Environment and Resources*, 43, 219–243. Available at: http://doi.org/10.1146/annurev-environ-102017-030204

Kelleher, J.P. (2017a) "Descriptive Versus Prescriptive Discounting in Climate Change Policy Analysis," *Georgetown Journal of Law & Public Policy*, 15, pp. 957–977.

--- (2017b) "Pure Time Preference in Intertemporal Welfare Economics," *Economics and Philosophy*, 33(3), pp. 441–473. Available at: https://doi.org/10.1017/S0266267117000074.

Kingston, E. and Sinnott-Amstrong, W. (2018) "What's Wrong with Joyguzzling?" *Ethical Theory and Moral Practice*, 21(1), pp. 169–186.

Klenert, D., Mattauch, L., Combet, E., Edenhofer, O., Hepburn, C., Rafaty, R. and Stern, N. (2018) "Making carbon pricing work for citizens," *Nature Climate Change*, 8(8), pp. 669–677.

Kyllönen, S. (2014) "Civil Disobedience, Climate Protests and a Rawlsian Argument for 'Atmospheric' Fairness," *Environmental Values*, 23(5), pp. 593–613.

Maltais, A. (2013) "Radically Non-Ideal Climate Politics and the Obligation to at Least Vote Green," *Environmental Values*, 22(5), pp. 589–608.

McGlade, C. and Ekins, P. (2015) "The geographical distribution of fossil fuels unused when limiting global warming to 2 °C," *Nature*, 517(7533), pp. 187–190.

McKibben, B. (2012) "The Reckoning," *Rolling Stone*, 1162, pp. 52, 54–58, 60. Available at: https://www.rollingstone.com/politics/politics-news/global-warmings-terrifying-new-math-188550/.

Mintz-Woo, K. (2018) "Two Moral Arguments for a Global Social Cost of Carbon," *Ethics, Policy & Environment*, 21(1), pp. 60–63. Available at: https://www.tandfonline.com/doi/full/10.1080/21550085.2018.1448038.

--- (2019) "Principled Utility Discounting Under Risk," *Moral Philosophy and Politics*, 6(1), pp. 89–112. Available at: http://www.degruyter.com/view/j/mopp.2019.6.issue-1/mopp-2018-0060/mopp-2018-0060.xml .

--- (2021a) "A Philosopher's Guide to Discounting," in T. McPherson, M. Budolfson and D. Plunkett (eds.) *Philosophy and Climate Change*, Oxford: Oxford University Press.

--- (2021b) "The ethics of measuring climate change impacts," in T. Letcher (ed.) *The Impacts of Climate Change*, Ch. 23, Oxford: Elsevier. Available at: https://doi.org/10.1016/B978-0-12-822373-4.00023-9

--- (2021c) "Will Carbon Taxes Help Address Climate Change?" *Les ateliers de l'éthique/The Ethics Forum*, 16(1), pp. 57–67. Available at: https://doi.org/10.7202/1083645ar.

--- (2022) "Carbon Pricing Ethics," *Philosophy Compass*, 17(1), e12803. Available at: https://doi.org/10.1111/phc3.12803.

Mintz-Woo, K., Dennig, F., Liu, H., and Schinko, T. (2021) "Carbon Pricing and COVID-19," *Climate Policy* 21(10), pp. 1272–1280. Available at: https://doi.org/10.1080/14693062.2020.1831432.

Mintz-Woo, K., & Leroux, J. (2021) "What do climate change winners owe, and to whom?" *Economics and Philosophy* 37(3), pp. 462–483. Available at: http://doi.org/10.1017/S0266267120000449.

Moss, J. (2020) "Carbon majors and corporate responsibility for climate change," in J. Moss and L. Umbers (eds.) *Climate Justice and Non-State Actors: Corporations, Regions, Cities, and Individuals*, Oxford: Routledge.

Murray, B. and Rivers, N. (2015) "British Columbia's revenue-neutral carbon tax: A review of the latest 'grand experiment' in environmental policy," *Energy Policy*, 86(C), pp. 674–683.

Nefsky, J. (2011) "Consequentialism and the Problem of Collective Harm: A reply to Kagan," *Philosophy and Public Affairs*, 39(4), pp. 364–395.

Nolt, J. (2011) "How harmful are the average American's greenhouse gas emissions?" *Ethics, Policy & Environment*, 14(1), pp. 3–10.

Rendall, M. (2019) "Discounting, Climate Change, and the Ecological Fallacy," *Ethics*, 129(3), pp. 441–463.

Scovronick, N., Budolfson, M.B., Dennig, F., Errickson, F., Fleurbaey, M., Peng, W., Socolow, R., Spears, D., and Wagner, F. (2019) "The impact of human health co-benefits on evaluations of global climate policy," *Nature Communications*, 10(1), p. e126.

Scovronick, N., Budolfson, M.B., Dennig, F., Fleurbaey, M., Siebert, A., Socolow, R., Spears, D., and Wagner, F. (2017) "Impact of population growth and population ethics on climate

change mitigation policy," *Proceedings of the National Academy of Sciences of the United States of America*, 114(46), pp. 12338–12343.

Shue, H. (2017) "Responsible for what? Carbon producer CO_2 contributions and the energy transition," *Climatic Change*, 144(4), pp. 591–596. Available at: https://link.springer.com/article/10.1007/s10584-017-2042-9.

Singer, P. and Mintz-Woo, K. (2020) "Put a Price on Carbon Now!" *Project Syndicate*. Available at: https://www.project-syndicate.org/commentary/low-oil-prices-ideal-time-for-carbon-tax-by-peter-singer-and-kian-mintz-woo-2020-05 [Accessed May 25, 2020].

Sinnott-Armstrong. W. (2005) "It's Not My Fault: Global Warming and Individual Obligations," in W. Sinnott-Armstrong and R. Howarth (eds.) *Perspectives on Climate Change* (pp. 285–307), Oxford: Elsevier.

Tallbear, K. (2019) "Badass Indigenous Women Caretake Relations," in N. Estes and J. Dhillon (eds.) *Standing with Standing Rock* (pp. 13–18), Minneapolis: University of Minnesota Press.

Ürge-Vorsatz, D., Herrero, S. T., Dubash, N. K., & Lecocq, F. (2014) "Measuring the Co-Benefits of Climate Change Mitigation," *Annual Review of Environment and Resources*, 39(1), 549–582. http://doi.org/10.1146/annurev-environ-031312-125456

Wenar, L. (2016) *Blood Oil: Tyrants, Violence, and the Rules that Run the World*, Oxford: Oxford University Press.

Whyte, K.P. (2017) "The Dakota Access Pipeline, Environmental Injustice, and U.S. Colonialism," *Red Ink*, 19(1), pp. 154–169.

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