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**Abstract** This article outlines key developments in the philosophical literature on climate change. The allocation of the costs and benefits of greenhouse gas emissions between states and individual duties of climate justice are two major topics that climate ethics scholars have discussed by drawing on deontological theory, consequentialism, and virtue ethics. This article explores the connections between ethics and climate justice to present these two topics. In addition, it introduces three emerging sub-fields in climate ethics: the ethics of climate engineering, non-anthropocentric climate ethics, and the ethics of procreation. It concludes that as the remaining global carbon budget dwindles, radical lifestyle changes become more and more pressing and should move to the forefront of the debate.

Climate ethics is a field of research in applied ethics and political theory. It started to develop in the early 1990s with Dale Jamieson's reflection on the inadequacy of our conventional value system to deal with global environmental problems (Jamieson, 1992) and Henry Shue's distinction between subsistence emissions and luxury emissions (Shue, 1993). Since then, climate ethics has followed two main objectives: justifying collective agents' duties of climate justice (burden-sharing justice) and clarifying individual agents' responsibilities in the fight against climate change (individual climate ethics).

A first major branch of climate ethics is burden-sharing justice. It arises out of analytical political philosophy and focuses on principles of distributive justice, more specifically on the fair allocation of the costs and benefits of greenhouse gas (GHG) emissions between states. The three main normative ethics (deontological theory, consequentialism, and virtue ethics) have been used to justify the three major duties of climate justice held by states: reduce their GHG emissions, help vulnerable populations to adapt to adverse climate impacts, and compensate – as far as possible – for losses and damages (Bourban, 2018).

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Since principles of climate justice generally come from Kantian-Rawlsian-inspired theories, deontological ethics is very influential in climate ethics. In this perspective, Simon Caney (2009, 2010) has developed a human-rights approach complemented by a “hybrid view” that reconciles the polluter pays principle (major historical and current GHG emitters ought to pay) with the ability to pay principle (the wealthiest ought to pay) in order to justify the obligation for developed countries to take the lead in the fight against climate change.

Consequentialism has also greatly influenced climate justice scholars. Since the disruption of the climate system has adverse effects on vulnerable people and populations, such as sea-level rise, more frequent and intense storms and hurricanes, and severe droughts and forest fires, it is possible to morally assess the consequences of state actions (and inaction). In relation to this, Peter Singer (2016) explains that the polluter pays principle and the principle of equal distribution of emission rights can be based on a calculation of utility that aims to ensure the greatest net happiness for the greatest number.

Turning now to virtue ethics, Stephen Gardiner (2011) explains that political inertia in the face of climate change is an ethical failure resulting, in particular, from the problem of “moral corruption”. Moral and political agents are subverting moral language and arguments to serve their own interests, leading to attitudes of complacency and procrastination. Climate change also challenges our traditional normative categories, such as harm and responsibility. Dale Jamieson (2007) therefore calls for a shift in the value system of Western societies through an educational program that promotes “green virtues”, such as humility, temperance, and respect for nature.

Considerations on attitudes, values, and character traits lead us to individual climate ethics, the second major branch of climate ethics, which arises out of applied ethics and environmental ethics. Here, the focus is more on individual behaviour and values and what individuals can do in the absence of ambitious and effective climate policies. Faced with the cumulative delay of decades of political inertia, individual climate ethics has taken off since 2010. In particular, it seeks to instil a sense of duty to reduce one’s individual carbon footprint and to promote and support collective action against climate change (Fraginière, 2016).

Climate change is the result of the actions of a very large number of agents who are dispersed in both space and time. Although individual emissions are virtually harmless taken separately, once they are added to past and present anthropogenic emissions into the atmosphere, they can contribute to causing harm to people living far away, and to creating harmful circumstances for people who will live in the future. No individual action is the sole cause of harm; however, each high-emitting activity potentially contributes to the emergence of a harmful effect. This is the reason why Dale Jamieson (1992) observes that “Today we face the possibility that the global environment may be destroyed, yet no one will be responsible”. In such circumstances, how can we assign responsibility for fighting climate change to individuals?

A first line of argument avoids relying on consequences by focusing on intentions. It rests on the integrity of moral agents (Hourdequin, 2010), which is morally relevant both for deontological theorists and virtue ethicists. Even if the effects of a

reduction in individual GHG emissions are imperceptible, acting virtuously still matters. An action with a low or imperceptible impact but arising from virtuous motives, such as temperance or benevolence, should be pursued, because it reveals something about our integrity as moral agents, about the coherence between our ethical commitments and our behaviour. Integrity contributes to reducing the moral dissociation between what we should do and our everyday actions (Bourban & Broussois, 2020a).

Following a consequentialist logic based on the harm principle, other climate ethics theorists have tried to calculate the concrete impact of individual emissions. While John Nolt (2011) estimates that the lifetime emissions of an average American would result in the serious suffering and/or death of two people over the next millennium, John Broome (2012) calculates that the monetary value of the harm caused by the lifetime emissions of a westerner ranges between \$19,000 and \$65,000. While these figures are still debated, they show that one possible way to justify the duty to reduce one's individual carbon footprint is that it prevents harm to others.

Even if individual emissions have harmful impacts, the victims of these impacts remain so distant in space and/or time that it is difficult for the person contributing to the harm to realize it. It is indeed quite counter-intuitive to feel responsible for a state of the world to which one contributes in an infinitesimal way, or to which one contributes without knowing it. Anthropology challenges ethics on this point. We tend to be concerned only with the effects of our actions that are close and visible, and to ignore those that are dispersed in space and time and beyond our perception. What kind of measure would be suited to a situation where everyone contributes to disrupting the climate system, without anyone feeling responsible for it?

In such a situation, it may be tempting to bypass individual behavioural changes and focus instead on technological innovation. Indeed, climate engineering is an increasingly favoured measure in scientific, economic, and political circles. It represents an intentional and large-scale manipulation of the climate system designed to counter global warming or offset some of its effects. There are two main climate engineering methods: carbon dioxide removal techniques, the purpose of which is to reduce the levels of already emitted carbon dioxide in the atmosphere, and solar radiation management techniques, which endeavour to reduce the solar radiation reaching the Earth's surface.

The emerging sub-field of the ethics of climate engineering is rapidly expanding in critical response to the popularity of climate engineering projects (Gardiner, 2010; Preston, 2013). Its main purpose is to highlight the issues of justice, ethics, and governance raised by climate engineering projects. Because of their potential side effects on poor and marginalized populations, these projects could exacerbate the climate injustices that the global poor are already suffering. Another challenge is to find institutions adapted to the complex task of governing climate engineering. Can a governance system ensure that once in place, a climate engineering program is not suddenly stopped due to political unrest or technological malfunction, leading to a quick increase in global temperatures (the 'termination problem')? Or can it ensure that once in place, a climate engineering program would stop once it has achieved its end, despite the risks of sociotechnical lock-in (the 'phasedown

problem')? Another and perhaps even more important problem is ethical. Climate engineering is based on a Promethean logic of controlling and dominating nature through technical means, a logic which is itself at the root of the climate problem. It would be more virtuous, if not wiser, to change our relationship to others and to the natural world, rather than trying to adapt planetary boundaries to our high-emitting lifestyles (Bourban & Rochel, 2021).

Changing our relationship to the world would mean changing our habits in terms of mobility, diet, and family size. Since its emergence in the early 1990s, climate ethics has focused on transforming our lifestyles through rehabilitated old values, such as temperance, and through finding new values, such as mindfulness (Jamieson, 1992, 2007). In addition to technological innovations and institutional reforms, adopting more sustainable individual behaviours that respect our natural environment, other human beings, and other living beings is crucial to contributing to the fight against climate change.

How can we change our ways of thinking, acting, and consuming? Two other emerging sub-fields of climate ethics are particularly relevant here. The first is non-anthropocentric climate ethics. Although most climate ethicists adopt an anthropocentric approach, Clare Palmer (2011), Elizabeth Cripps (2013) and Katie McShane (2016) have recently highlighted our responsibility for climate impacts on ecosystems, other species, and non-human animals. This approach could be further extended by moving from the consequences of climate change to its causes, especially industrial livestock farming. Such an approach to climate ethics would converge with animal ethics and environmental ethics to encourage individuals to reduce or simply stop their consumption of animal-based products (Bourban & Broussois, 2020b).

Another new sub-field of climate ethics deals with individuals' procreative choices, which also have a significant carbon footprint (or a 'carbon legacy'). Philosophers have explored three types of population growth reduction measures to help combat climate change: education and empowerment, which lead to voluntary measures to reduce family size (Cafaro, 2012); negative and positive incentives, which encourage individuals to have small families (Hickey et al., 2016); and coercive measures, which legally sanction parents who have too many children (Conly, 2016). These political measures have varying degrees of effectiveness, feasibility, and ethical acceptability, but in our context of scarce global carbon budget and overpopulation, a small family ethics becomes more and more compelling (Rieder, 2016; Bourban, 2019).

Today, we have to philosophize in a context of climate emergency. The carbon budget left to humanity before triggering tipping points and crossing critical thresholds in the climate system is scarce and rapidly shrinking. Since betting on climate engineering projects in the future may turn out to lead to a dangerous anthropogenic interference with the climate system, the very situation we should try to avoid, a crucial task is to focus on education, communication, and incentivization to convince or at least 'nudge' individuals to adopt low-emitting lifestyles. Ethical and democratic debates on controversial solutions, such as changing our diets, banning

ridiculously large houses, yachts, and cars, and having fewer children should therefore gain momentum in the coming years in order to help avoid the worst-case scenarios.

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