

Climate ethics at a multidisciplinary crossroads: four directions for future scholarship

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Abstract In recent years, the field of climate ethics has grown into a truly multidisciplinary endeavor. Climate ethics scholars are pursuing both normative and positive questions about climate change using many different approaches drawn from a wide diversity of disciplinary and theoretical perspectives. Now, the field stands at a multidisciplinary crossroads, delineated in large part by two interrelated considerations: what are the key research questions most in need of multidisciplinary attention and what can be done to move the insights and implications of climate ethics scholarship into real-world climate decision-making. Here, we identify four directions for near-future climate ethics research that we believe are both in need of further examination and likely to be of interest to a diverse coalition of decision-makers working “on the ground”: geoengineering; scope of ethical consideration; responsibility of actors; and, hazards, vulnerabilities and impacts. Regardless of the specific questions they choose to pursue, multidisciplinary climate ethics researchers should strive to conduct accessible and actionable research that both answers the questions decision-makers are already asking as well as helps shape those questions to make decision-making processes more inclusive and ethically-grounded.

1 Introduction

Over the past 25 years a robust literature has developed around the concept of climate ethics. Primarily driven by normative considerations of justice and harm,

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scholars have raised and addressed numerous interwoven questions: Who is responsible for climate change? What is owed to whom? Does the present generation owe future generations a stable climate system (i.e., one that looks and behaves much as it does today)? Do developed nations owe developing nations for historical emissions and harm? Who should shoulder the costs—financial or otherwise—of confronting and/or preparing for climate change impacts? What principles should underlie international burden-sharing treaties or regimes? How can policymakers make ethically defensible decisions under conditions of great uncertainty? Given limited resources, how should priorities be set between reducing emissions versus increasing resilience?

As these and other normative questions have seeped into broader conversations around possible societal responses to climate change (including in the fifth Intergovernmental Panel on Climate Change, IPCC, Working Group 3 report), the field of climate ethics has broadened and become truly multidisciplinary. In recent years, researchers from many areas, and in particular the social sciences, have begun to address these questions (as well as raise many others) from a descriptive (positive) rather than purely normative perspective. This growing literature includes:

- Public opinion research on individuals' perceptions of climate change as an ethical issue (e.g., Markowitz 2012);
- Psychological work on the role of perceived fairness, social norms and contextual factors on climate decision-making under uncertainty (e.g., Graham et al. 2015; Wade-Benzoni et al. 2010);
- Economic research examining justice implications of different burden-sharing regimes (e.g., Böhringer and Helm 2008; Ciscar et al. 2013);
- Sociological and political science work on intra- and inter-national issues around vulnerability and adaptation to climate change (e.g., Tschakert and Machado 2012);
- Legal analysis on the implications of past climate change treaty language (e.g., UNFCCC) for burden-sharing responsibilities and obligations (e.g., Mayer 2015).

The growth of climate ethics has also expanded with respect to topics considered by philosophers and others thinking about normative issues, from advocating for new metrics to measure climate impacts (see Nolt 2015) to developing guidelines for future deployment of different geoengineering technologies (see Preston 2015; also Burns and Strauss' edited volume, 2013) to identifying normative ethical constraints on persuasive climate communication efforts (Lamb and Lane *Forthcoming*). These recent efforts, of course, stand on the shoulders of a deep and diverse set of foundational texts in this area, many of which speak directly to the issues we raise below. Because a review of the relevant literatures is not appropriate for the present paper, we refer interested readers to explore some or all of the following topics and their key respective texts: geoengineering (e.g., Gardiner 2010; Hamilton 2013; Jamieson 1996; Preston 2012); targets of ethical consideration (e.g., Palmer 2011); responsibility for response (e.g., Cripps 2013; Jamieson 2014; Nolt 2011) and, vulnerability and impacts (e.g., Grasso 2010, Nelson et al. 2007).

We are encouraged by and encouraging of these developments, as they portend a bright future for the field of climate ethics. In part this sense of optimism derives from the (demonstrated) potential that a multidisciplinary approach to applied climate

ethics has to aid the development and refinement of theory and practice across a diversity of fields, both directly and indirectly related to the issue of climate change. In addition, we see the growth of the field both in depth and breadth as critical, if excellent normative and positive scholarship on the ethical implications of climate change (writ large) is to be both useful and actually used in real-world climate change decision-making contexts (e.g., policymaking, corporate sustainability, climate communication).

Yet, the newly multidisciplinary field also stands at a crossroads of sorts, delineated in large part by two major sets of questions that must be confronted head on if the field is to have a meaningful impact moving forward. First and most centrally, where should (and does) the field go from here? What are the key questions that need to be examined over the next 5 to 10 years? With respect to international cooperation, what will be the core challenges and opportunities in a post-Kyoto international climate regime? How can the multidisciplinary field of climate ethics become more cohesive (and thus likely more impactful)? And, which directions for future scholarship are most likely to provide fertile test beds for innovative multidisciplinary theoretical and/or methodological developments? Second, and closely related, what can researchers in the field do to help move their work into the multi-faceted world of climate change decision-making? How can researchers increase the odds that both normative and descriptive work will be considered and incorporated into real-world decisions about emissions pathways, building cross-sector resilience, and climate communications efforts?

In the remainder of this article, we sketch some initial answers to the first set of questions above (“where do we go from here”) by identifying four key areas for near-term research on climate ethics. We focus in particular on topics and issues that cross disciplinary boundaries, as these coincide with the most pressing issues policymakers, negotiators, regulators, managers, non-profit organizations, climate communicators and others involved in responding to climate change will face in the coming years; these are also areas of inquiry likely to produce innovative theoretical and methodological advances. As described in more detail below, these four promising areas of research include: geoengineering; scope of ethical consideration; responsibility of actors; and, hazards, vulnerabilities and impacts. We end with a brief and necessarily incomplete response to the second set of questions (“how do we move climate ethics into practice”).

2 Four areas for near-future research in climate ethics

The four topics we identify below are all, to varying degrees, already active areas of research within the growing field of climate ethics. That being said, we see clear room for further, multidisciplinary growth in all four and hope to encourage such development by highlighting some key considerations still in need of further examination.

2.1 The ethics of a “geoengineered” world

Over the past 10 years, geoengineering—the “deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change” (Shepherd 2009)—has

moved from the fringes to the mainstream.¹ This has been the case amongst climate change scholars (see for example the edited volume by Burns and Strauss 2013 or the special issue of *Climatic Change* edited by Wood et al. 2013), the broader public (e.g., as evidenced by the increasing search frequency for the term “geoengineering” on Google over the past 5–7 years) and some policymakers and climate negotiators. As attention to, familiarity with and consideration of geoengineering continue to grow, so too does the need for multidisciplinary research that examines the ethical implications of a “geoengineered world.” Indeed, we believe work that identifies and examines the key ethical and moral aspects of decision-making with respect to geoengineering will play an increasingly important and central role in the broader field of climate ethics over the next few years. This is particularly likely to be the case if negotiators are unable to produce a meaningful new emissions control regime at the Paris Conference of the Parties (COP 21) in 2015.

What issues or questions should the field of multidisciplinary climate ethics tackle with respect to geoengineering in the near term? First and perhaps most obviously, there are important normative and descriptive questions pertaining to how decisions will be made regarding the timing, intensity and scale (scope) of efforts to intentionally engineer the climate system. Unlike the other conventional responses to climate change (i.e., mitigation and adaptation), geoengineering the climate will almost certainly occur while or after severe impacts are well underway, thus while communities are under duress. How will this influence the decisions that are made by those communities? For example, will ethical considerations (e.g., long-term impacts of local, regional or global-scale geoengineering activities) simply be thrown out the window in the name of short-term necessity? What would an ethical framework for making such decisions about implementation look like and how might it be enforced?

Along similar lines, there will be technical, political and ethical questions that will need to be answered with respect to when, if ever, geoengineered stop-gap measures or solutions are implemented, how much or little geoengineering should be done (e.g., which negative events or hazards must be avoided and which will future generations be able to manage), and at what scale those projects should be implemented, assuming there are options on the table. Moreover, as has long been the case with other response options (e.g., mitigation, adaptation), there will be important practical and ethical questions about who should (or will) shoulder the costs of geoengineering, particularly given that the worst consequences of climate change are projected to impact communities least capable of implementing large-scale climate engineering projects (IPCC 2014). Such work will require input from political scientists, economists, ethicists and others if it is to play an active role in policy decision-making.

Another cross-cutting issue in need of further examination revolves around the consideration and treatment of future, unintended consequences that will emerge from geoengineered “solutions.” As we move from unintentional to intentional tinkering with the climate system, how will our moral perceptions (and legally-binding claims) of blame and responsibility shift if and when things go wrong (e.g., if introducing sulfate aerosols in one region by one set of actors causes unintentional harm in another region to other actors)? A rich and growing psychological literature on blame suggests that unintended side-effects are treated differently than actions that intentionally cause harm (e.g., Guglielmo et al. 2009), but it remains to be

¹ We use the term “geoengineering” as a shorthand to refer to the diverse and ever-growing suite of technologies and other approaches to intentional climate system management that climate scientists, engineers, policymakers and others have begun considering in earnest over the past decade. These include both so-called “solar radiation management” (SRM) and “carbon drawdown and removal” (CDR) strategies. For further discussion see Jamieson (2013).

seen how such issues will play out in the legal realm, especially if the distinction between intentional and unintentional actions becomes blurred, as may well be the case with geoen지니어ing.

Finally, geoen지니어ing involves many other rapidly emerging issues as well, all of which will be ripe topics for multidisciplinary climate ethics scholarship. One topic that has already received some attention (Comer and Pidgeon 2015) is how non-experts respond to different geoen지니어ing options, partly as a function of how those technologies are framed (e.g., as extensions of natural processes versus human-made innovations). Along similar lines, there is likely to be continued and increasing debate over the “proper language” that scientists, engineers, policymakers, journalists, ethicists and others should use to talk about geoen지니어ing. This work will have important normative and descriptive (and perhaps prescriptive) dimensions, given the role that frames, metaphors and terminology play in shaping broader debate amongst the public (and thus acceptance and adoption).

2.2 Identifying the targets of ethical consideration

A long-standing concern amongst normative climate ethicists has revolved around the question of “who counts”—that is, who are the appropriate targets of ethical consideration in the context of long-term, global climate change (see Jamieson 2014, Chapter 5)? Because responding to climate change may involve making trade-offs between “present, near, similar” decision-makers’ consumption (loosely defined) and “future, far, dissimilar” others’ well-being, this question of “who counts” plays a critical role in shaping broader discussions of the timing and extent of societal (and individuals’) responses to climate change. For example, if ethical analysis suggests that we don’t have to care about future others because they are outside the scope of ethical consideration, it makes less sense to act on their behalf to the extent that doing so places burdens on present actors.

What has been relatively unexplored to date, however, is how this question of “who counts” plays out in the real-world—that is, what individuals and groups actually *do* and *believe* when it comes to considering others (including non-human species) as potential targets for ethical consideration in the context of climate change. This gap in our descriptive understanding of ethical consideration is problematic because people’s beliefs about who (or what) should be considered as morally significant are likely to play an important role in shaping our individual and collective responses to climate change. Although some recent polling and experimental studies have begun to examine related constructs (e.g., concern about climate change, perceptions of who will be affected and how badly), if anything these initial, indirect findings only highlight the need for further research by psychologists, sociologists, political scientists and others in this domain.

For example, work by Leiserowitz et al. (2014a, b) finds that Americans believe that they personally are not as vulnerable to climate change as non-human species, people who live in other countries, and people who will be alive in the future. Combined with the finding that most Americans (and others) perceive climate change as a relatively low-level concern (see, for instance, PewResearchCenter 2014), this suggests that many people may tend to discount the importance of responding to climate change, as distant others are less likely to be seen as deserving of full ethical consideration (e.g., due to their out-group status; see Harris and Fiske 2006; Markowitz and Shariff 2012). However, it may also be the case that certain features or characteristics of the perceived victims of climate change (e.g., future generations, non-human species), such as their innocence or inability to defend themselves against anthropogenic

climate impacts, could work to increase the likelihood of viewing such distant others as appropriate targets of ethical consideration.

In a related vein, rhetoric about moral duties to future generations appears frequently in political debates over climate change (e.g., President Obama's 2014 State of the Union address), yet it remains unclear how such frames interact with people's perceptions of moral inclusion to shape behavioral responses (including policy support). Such statements are often made in debates over fiscal policy. But do people really believe they have such duties towards future others? And if they do, what is the shape (nature) of those duties? How far do they extend in time? Does their strength change through time (e.g., do we discount future generations at a constant rate or hyperbolically)? Are these duties mainly construed as duties to progeny or are they impersonal as well? Similar questions can also be asked about duties to those who are not part of one's own political community.

We see considerable merit in further research that examines these questions of ethical consideration from a wide variety of perspectives and using a diversity of approaches. This includes further normative research as well as descriptive and experimental work. This work should also explore how people's perceptions of ethical consideration possibly differ across groups (within and across nations) and of course whether such differences potentially help explain different responses to date (and potentially in the future) to climate change. Similarly, researchers should examine how different forms of moral distance (e.g., spatial, temporal, relatedness) interact with one another to influence our ethical considerations. Such work seems particularly well poised to contribute to multidisciplinary theory building, including at the nexus of applied ethics, psychology, political science and sociology.

2.3 Whose responsibility to respond?

One of the most challenging and persistent problems in addressing climate change involves the assignment of responsibility in ways that are simultaneously ethically, legally, economically, politically, socially and psychologically acceptable to policymakers and the broader public. The United Nations Framework Convention on Climate Change (UNFCCC) has relied on the language of "common but differentiated responsibilities" to define, albeit poorly, who has responsibility for confronting the problem. Although this phrase can be given good definition in diplomatic parlance (and perhaps in normative ethical terms), the implication that all actors have responsibilities (ill-defined though they may be) has also been blamed for creating a "you first" attitude amongst policymakers and international negotiators (Aldy and Stavins 2012). Even worse, it is entirely unclear what the psychological and social resonance of the term may be: the two terms (common, differentiated) seem to push against each other in colloquial use (and this is perhaps particularly the case in Western societies that tend to strongly distinguish between individual and group responsibilities). Indeed, American political rhetoric seems to largely mirror the purported concern (at the international negotiations level) over "being taken advantage of" for taking the first action (the so-called "sucker" effect; but see Leiserowitz et al. 2014a, b for evidence that Americans believe the U.S. should act even if other countries fail to do so.).

Once we look beyond the state-centric view of the international system, there is a spirited ongoing debate about who is responsible for addressing climate change and it is in this debate that we see significant opportunities for a multidisciplinary climate ethics to contribute (keeping in mind that the contributions in this area may be more relevant for issues of local decision-making and scholarly innovation rather than for international policymaking). For

example, much environmentalist rhetoric focuses on personal responsibility, both in terms of reducing ones' own emissions and for advocating larger-scale change (see, for example, the messaging of advocacy groups such as 350.org). Although this perspective may have gained some traction in recent years, there are also important questions about how such frames actually influence individuals' and communities' moral engagement with the issue. Even amongst people who are identified as high-emitters (e.g., upper middle class Westerners), it is unclear how much people feel responsible for the emissions with which they are associated. Intersecting with these psychological questions are ongoing normative ethical questions about how much responsibility individuals actually do have for the harms caused by their (in the grand scheme, miniscule) greenhouse gas emissions as well as positive ethical questions regarding individual responsibility given political economic constraints on action. For example, a recent article in *Climatic Change* finds (roughly) that 90 firms are responsible for 63 % of worldwide emissions (Heede 2014), complicating the view that individuals themselves are responsible for causing and/or confronting climate change.

Perhaps the core challenge that multidisciplinary climate ethicists can help address in this arena is that there is no single, salient, widely agreed-upon locus of responsibility when it comes to carbon emissions (which separates the issue from some other societal problems, e.g., individual acts of violence). As a result, there is a great deal of flexibility and variability as to how the issue is perceived by different individuals, groups and organizations. We see work that aims to develop a cohesive, ethically-defensible framework for assigning and understanding responsibility in contexts that lack a single, widely accepted locus of responsibility—e.g., where decisions must be made across scales and by actors or groups of actors that may have little capacity for coordinating action—as fertile ground for future multidisciplinary research.

2.4 Hazards, vulnerabilities and impacts

Emissions abatements and adaptation are intertwined responses to climate change, even though the scientific and policy debate has tended to consider them separately (Klein et al. 2005; Pielke et al. 2007; Wilbanks et al. 2003). Despite the prominent role that mitigation has played thus far (both in the field of climate ethics and, more generally, in climate negotiations), these two main strategies should be carried forward together, since they reinforce each other (Grasso 2010). However, whether or not future climate negotiations consider adaptation more closely and/or jointly with mitigation, countries, institutions and people around the world will inevitably have to adapt to climate impacts and incorporate adaptation of natural and human systems into their regular policies, plans and activities. In fact, the recent IPCC AR5 report places a great emphasis on the potential for and limits to adaptation, and on the elements that ultimately shape adaptation activities and effectiveness (including vulnerability, exposure, impacts and risks).

Such elements bring about profound and largely unexplored moral questions that will surely be at the forefront of the disparate multidisciplinary field of climate ethics in the near future. These include questions of responsibility at both the individual/household level and at community and larger scales as well; both descriptive and normative questions that will focus on how people think about vulnerability, exposure and imposition of risks on others (including future others); and, questions regarding socio-cultural issues around responses to previous experiences with hazards, responsibilities and obligations.

At the very heart of the ethics of adaptation, though, lie two general moral claims: 1) more advantaged subjects should bear the burden of adaptation; and, 2) less advantaged subjects

should be well-supported in accessing adaptation opportunities (Grasso and Feola 2012). These moral arguments will very likely drive much future research and scholarship on adaptation and its determinants. In general terms, the first claim entails moral arguments related to the *ability* of subjects to shoulder the burdens of adaptations. This is a forward-looking approach grounded in no-fault forms of prospective responsibility (Shue 1993) based on the capacity (in terms of institutions, technology, infrastructures, skills) and the wealth (in terms of welfare levels) of subjects, which ultimately may also justify remedial duties. In practice, such a moral approach to adaptation decision-making requires that the most advantaged subjects bear the largest share of adaptation burdens because of their greater wealth and capacities.

The second claim (privileging those who are most in need of adaptation) refers instead to a moral argument grounded by and large in some recognition of *lack of adaptive capacity*. This perspective requires identifying, on the one hand, a minimum level of adaptive capacity, likely operationalized as some combination of vulnerability, exposure, impacts and risk (IPCC 2014). From a moral perspective, this level serves as a threshold between those who have sufficient and those who have insufficient adaptive capacity to perform the basic adaptation activities to ensure a decent life (which of course must also be defined—normatively and descriptively). This moral purview ultimately allows those subjects of justice below the moral threshold of adaptive capacity to be supported in carrying out the adaptations necessary to pursue a decent life.

Taken together, we believe that the burgeoning work on the ethics of adaptation, largely structured along the two main avenues of research delineated above, holds the potential to substantially contribute to solving some of the core moral puzzles raised by the multifaceted nature of climate change. Given a future world in which adaptation and, perhaps, geoengineering will be required to support human survival and flourishing, examining the moral underpinning and implications of such decisions could and should play an important role in shaping how successfully humanity responds to its self-induced challenges.

3 Concluding remarks: bringing multidisciplinary climate ethics into the “real world”

As the multidisciplinary field of climate ethics moves forward over the coming years, the inclusion of its findings, insights and implications in real-world decision-making will rest in large part on the relevance of the work to the questions being asked by negotiators, policymakers, citizens and institutions. Critical in supporting the inclusion of climate ethics in decision-making, then, is pursuing research questions that are meaningful given current institutional and political understandings and constraints. To be useful, such work must provide accessible (understandable), stable (maintainable) and actionable insight into the problems faced by decision-makers, rather than providing answers to questions no one is asking at the negotiating table. At the same time, this emerging field has the potential to help shape the very questions that are asked “at the table,” and in so doing help make climate change decision-making at various scales a more inclusive and ethically-grounded process.

It is for both of these reasons (among others, including the development of theoretical and methodological innovations in multidisciplinary scholarship) that we believe an agenda for near-term research in this field—such as the one we offer here—is particularly important and useful. The four directions for future research we lay out above do not encompass the only

questions multidisciplinary climate ethicists should or will pursue in the coming years, but we believe all four have—if to differing extents—the potential both to support improved climate-related decision-making at multiple scales *and* to promote and build a more cohesive and innovative multidisciplinary field of climate ethics.

As we write this call for further multidisciplinary research and analysis on the ethical implications and considerations involved in responding to climate change, we are heartened by the rapid developments already in progress. Climate ethics has not lost its roots in solid normative analysis, but rather has begun to build from that foundation and expand in new, exciting and ultimately necessary directions. In so doing, the new and as-of-yet amorphous field of multidisciplinary climate ethics is poised to make important and impactful contributions both to real-world decision-making regarding climate change and to scholarship on this topic. Our hope is that our brief analysis of the “state of the future” of this fledgling field spurs even more innovative, multidisciplinary scholarship and practice in the years to come.

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References

- Aldy JE, Stavins RN (2012) Climate negotiators create an opportunity for scholars. *Science* 337:1043–1044. doi:10.1126/science.1223836
- Böhringer C, Helm C (2008) On the fair division of greenhouse gas abatement cost. *Resour Energy Econ* 30: 260–276
- Burns WCG, Strauss L (2013) *Climate change geoengineering*. Cambridge Univ Press, Cambridge
- Ciscar JC, Saveyn B, Soria A, Szabo L, Van Regemorter D, Van Ierland T (2013) A comparability analysis of global burden sharing GHG reduction scenarios. *Energ Policy* 55:73–81. doi:10.1016/j.enpol.2012.10.044
- Corner A, Pidgeon N (2015) Like artificial trees? The effect of framing by natural analogy on public perceptions of geoengineering. *Clim Chang* (this issue). doi:10.1007/s10584-014-1148-6
- Cripps E (2013) *Climate change and the moral agent: individual duties in an interdependent world*. Oxford Univ Press, Oxford
- Gardiner SM (2010) Is ‘arming the future’ with geoengineering really the lesser evil? Some doubts about the ethics of intentionally manipulating the climate system. In: Gardiner SM, Caney S, Jamieson D, Shue H (eds) *Climate ethics. Essential readings*. Oxford Univ Press, New York, pp 284–314
- Graham S, Barnett J, Fincher R, Mortreux C, Hurlimann A (2015) Towards fair local outcomes in adaptation to sea-level rise. *Clim Chang* (this issue). doi:10.1007/s10584-014-1171-7
- Grasso M (2010) *Justice in Funding adaptation to climate change under the international climate change regime*. Springer, Dordrecht
- Grasso M, Feola G (2012) Mediterranean agriculture under climate change: adaptive capacity, adaptation, and ethics. *Reg Environ Chang* 12:607–618. doi:10.1007/s10113-011-0274-1
- Guglielmo S, Monroe A, Malle B (2009) At the heart of morality lies folk psychology. *Inquiry* 52:449–466. doi: 10.1080/00201740903302600
- Hamilton C (2013) *Earthmasters: the dawn of the age of climate engineering*. Yale Univ Press, New Haven
- Harris LT, Fiske LT (2006) Dehumanizing the lowest of the low: neuroimaging responses to extreme outgroups. *Psychol Sci* 17:847–853. doi:10.1111/j.1467-9280.2006.01793.x
- Heede R (2014) Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers. *Clim Chang* 122(1–2):229–241. doi:10.1007/s10584-013-0986-y
- Intergovernmental Panel on Climate Change (IPCC) (2014). *Climate change 2014: Impacts, adaptation, and vulnerability. Contribution of working group II to the intergovernmental panel on climate change fifth assessment report*. <http://www.ipcc.ch/report/ar5/wg2/>. Accessed 22 Nov 2014
- Jamieson D (1996) Ethics and intentional climate change. *Clim Chang* 33(3):323–336

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- Jamieson D (2013) Some whats, whys and worries of geoengineering. *Clim Chang* 121(3):527–537. doi:10.1007/s10584-013-0862-9
- Jamieson D (2014) Reason in a dark time: why the struggle to stop climate change failed, and what it means for our future. Oxford Univ Press, New York
- Klein RJT, Schipper EL, Dessai S (2005) Integrating mitigation and adaptation into climate and development policy: three research questions. *Environ Sci Pol* 8(6):579–588. doi:10.1016/j.envsci.2005.06.010
- Lamb M, Lane M (Forthcoming) Aristotle on the ethics of communicating climate change. In: Heyward C, Reser D (Eds) *Climate justice in a non-ideal world*. Oxford Univ Press, Oxford
- Leiserowitz A, Maibach E, Roser-Renouf C, Feinberg G, Rosenthal S, Marlon J (2014a) Climate change in the American mind: Americans' global warming beliefs and attitudes in November, 2013. Yale University and George Mason University. Yale Project on Climate Change Communication, New Haven
- Leiserowitz A, Maibach E, Roser-Renouf C, Feinberg G, Rosenthal S (2014b) Public support for climate and energy policies in November 2013. Yale University and George Mason University. Yale Project on Climate Change Communication, New Haven
- Markowitz EM (2012) Is climate change an ethical issue? Exploring young adults' beliefs about climate and morality. *Clim Chang* 114(3–4):479–495. doi:10.1007/s10584-012-0422-8
- Markowitz EM, Shariff A (2012) Climate change and moral judgment. *Nat Clim Chang* 2:243–247. doi:10.1038/nclimate1378
- Mayer B (2015) Conceiving the rationale for international climate law. *Clim Chang* (this issue). doi:10.1007/s10584-014-1271-4
- Nelson DR, Adger WN, Brown K (2007) Adaptation to environmental change: contributions of a resilience framework. *Annu Rev Environ Resour* 32:395–419
- Nolt J (2011) How harmful are the average American's greenhouse gas emissions? *Ethics Policy and Environ* 14(1):3–10. doi:10.1080/21550085.2011.561584
- Nolt J (2015) Casualties as a moral measure of climate change. *Clim Chang*. doi:10.1007/s10584-014-1131-2
- Palmer C (2011) Does nature matter? The place of nonhuman in the ethics of climate change. In: Arnold DG (ed) *The ethics of global climate change*. Cambridge Univ Press, Cambridge, pp 272–291
- Pielke RA Jr, Prins G, Rayner S, Sarewitz D (2007) Climate change 2007: lifting the taboo on adaptation. *Nature* 445:597–598. doi:10.1038/445597a
- Polling data available at www.pewresearch.org
- Preston CJ (ed) (2012) *Engineering the climate. The ethics of solar radiation management*. Lexington Books, Plymouth
- Preston CJ (2015) Framing an ethics of climate management for the anthropocene. *Clim Chang* (this issue). doi:10.1007/s10584-014-1182-4
- Shepherd J (2009) *Geoengineering the climate: science, governance and uncertainty*. The Royal Society, London
- Shue H (1993) Subsistence emissions and luxury emissions. *Law Policy* 15(1):39–59. doi:10.1111/j.1467-9930.1993.tb00093.x
- Tschakert P, Machado M (2012) Gender justice and rights in climate change adaptation: opportunities and pitfalls. *Ethics Soc Welf* 6(3):275–289. doi:10.1080/17496535.2012.704929
- Wade-Benzoni KA, Sondak H, Galinsky AD (2010) Leaving a legacy: intergenerational allocations of benefits and burdens. *Bus Ethics Q* 20(1):7–34. doi:10.5840/beq20102013
- Wilbanks TJ, Kane SM, Leiby PN, Perlack RD, Settle C, Shogren JF, Smith JB (2003) Integrating mitigation and adaptation: possible responses to global climate change. *Environ: Sci Policy Sustain Dev*. doi:10.1080/00139150309604547
- Wood R, Gardiner S, Hartzell-Nichols L (2013) Climatic change special issue: geoengineering research and its limitations. *Clim Chang* 121(3):427–430. doi:10.1007/s10584-013-1000-4