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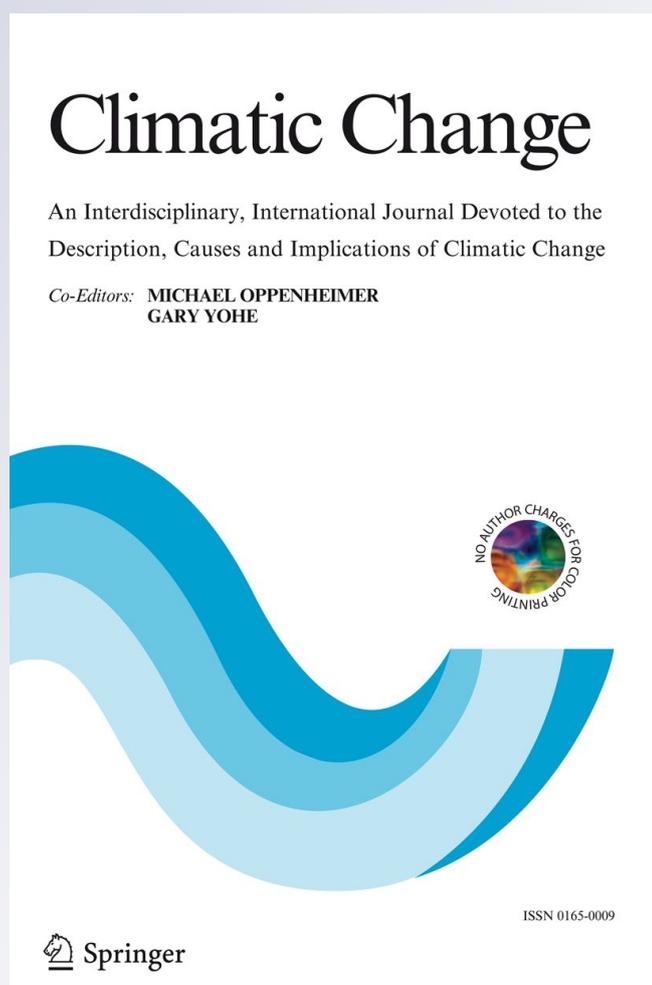
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# Is climate change an ethical issue? Examining young adults' beliefs about climate and morality

Ezra M. Markowitz

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**Abstract** Moral philosophers argue that climate change poses an 'ethical problem' for humanity and thus that humans have moral obligations to respond. Little empirical research has explored whether non-philosophers agree with these conclusions. This is unfortunate, because non-experts' moral intuitions (or lack thereof) about climate change likely hold important implications for willingness to engage cognitively, emotionally and behaviorally with the issue. After reviewing the moral philosophical position on climate change, I present results of two studies conducted with a total of 922 U.S. undergraduate students that explored beliefs about the 'ethics of climate change.' Forty-five percent of the students sampled stated unequivocally that climate change represents a moral or ethical issue; a full quarter of students said it was not an ethical issue and roughly 30% were unsure. Participants' beliefs regarding the causes of climate change were predictive of intentions to perform pro-environmental actions, and this relationship was fully mediated by ascriptions of personal moral obligation to respond. Implications and directions for future research are discussed.

## 1 Introduction

Extant scholarship on the moral and ethical dimensions of climate change (cf., Broome 2008; Butler 2010; Davidson 2008; Gardiner 2006; Hourdequin 2010; Jamieson 2007, 2009; Singer 2006) potentially holds important implications for how both individuals and communities will respond to climate change in the near future (in particular via democratically driven changes in public policy; Jamieson 2007). However, the present body of (published) research is incomplete. Specifically, nearly all work completed to date on the 'ethics of climate change' has approached the issue from a *normative* perspective, relying primarily on philosophical claims about harms, rights and duties held by various stakeholders (e.g., rich

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E. M. Markowitz (✉)  
Environmental Studies Program, Department of Psychology, University of Oregon, Eugene,  
OR 97403-1227, USA  
e-mail: emarkowi@uoregon.edu

individuals, future generations) to make the case that climate change is indeed an ethical issue (see below). This approach can provide useful insights, e.g., about why we might very well fail to act before it is 'too late' (Gardiner 2006), but it fails to ask whether, how and to what extent non-experts (i.e., members of the general public) understand<sup>1</sup> climate change in ethical terms.

The purpose of the present research is twofold: first, to explore whether or not non-experts' own moral judgments of climate change align with the moral philosophical position taken up by Jamieson, Gardiner, Hourdequin, Singer and others; and second, to examine the upstream etiology and downstream implications (e.g., behavioral intentions) of those judgments. Such moral judgments may have an important, perhaps fundamental, role to play in shaping responses to climate change in the coming years, yet we know little about the incidence and nature of such beliefs among various sectors of the public. Ultimately, non-experts' beliefs about climate change, including whether or not it poses a moral imperative, are likely to be at least as important in shaping our response to the issue as are expert declarations regarding the ethical, economic, social and technical aspects of climate change. After briefly exploring the moral philosophical position on climate change, I report the results of two recently conducted empirical studies in which I explored college students' beliefs about the ethical dimensions of climate change. I conclude the paper with a brief discussion and call for future research.

## 2 Why climate change is an ethical issue (and why we care if it is)

Over the past twenty years, a number of moral philosophers (among others) have explored whether anthropogenic climate change involves questions of good and bad, right and wrong, responsibility and blame (e.g., Davidson 2008; Gardiner 2006; Jamieson 2007, 2009; Shue 1993; Singer 2006). Taking a normative approach, these researchers have attempted to lay out how and why climate change poses an ethical problem for policymakers, economists and laypersons alike and thus why confronting climate change should be treated as a moral imperative (Broome 2008; Stern 2006).

Interest in the ethical dimensions of climate change stems, at least in part, from the fact that morality is a key driver of human (social) behavior (Haidt 2008). Both as individual actors and as collectives (families, communities, nations), we care deeply about right and wrong, about the intentions we see in others' actions (Guglielmo et al. 2009), and about the implications of our and others' behavior with respect to questions of justice and harm (in addition to other concerns, e.g., loyalty, purity, respect for authority; see Haidt and Graham 2007). Thus, if climate change is recognized as an ethically significant issue, there may be reason to believe that people will be motivated to effectively confront the causes of the problem (i.e., emission of greenhouse gases, consumption; see Shwom et al. 2010 for initial supporting evidence, but see Gardiner 2006 for a more pessimistic outlook); on the other hand, if many individuals fail to identify climate change as a moral imperative, this may pose a significant barrier to effectively responding to the issue (individually and collectively).

Many of the arguments put forth by moral philosophers in support of the claim that climate change poses an ethical problem rest on two seemingly reasonable premises. The first is that the Earth's atmosphere, which provides significant life-sustaining services to humans and all other life on the planet, can be considered a public good, a piece of the global

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<sup>1</sup> I use the term 'understand' to broadly include not only highly reasoned, cognitive mental representations but affective reactions as well.

'commons' (Hardin 1968). The second is that Earth's life-sustaining atmosphere is in fact a limited resource, subject to depletion and/or degradation under certain conditions. This second claim is especially important because, as Peter Singer (2006) clarifies, 'Climate change is an ethical issue, because it involves the distribution of a scarce resource—the capacity of the atmosphere to absorb our waste gases without producing consequences that no one wants' (Singer 2006: 415).

In a closely related vein, Jamieson (2009) argues that climate change is a moral issue because it involves 'rich people appropriating more than their share of a global public good and, in addition, harming poor people by causally contributing to extreme climatic events such as droughts, hurricanes and heat waves' (Jamieson 2009: 5). Thus, Jamieson slightly extends Singer's argument by suggesting that past and present distributions of 'atmospheric use' are in fact unjust for two intertwined reasons. First, some people (i.e., rich individuals who primarily, but not exclusively, live in developed nations) have used and continue to self-appropriate more of the atmospheric commons than have others (i.e., poor individuals living primarily in developing nations). Second, such 'atmosphere grabbing' has the very real potential to cause physical (and psychological; see Doherty and Clayton 2011) harm to many people (Broome 2008), including those who are not yet born. Additionally, the problem is compounded by the fact that the perpetrators of harm (i.e., those who emit greenhouse gases at levels far above what could reasonably be considered equitable; see Singer 2006) have not compensated those who are harmed by their actions. Critically, these arguments (as well as others made by moral philosophers on this topic) appear to rely on the (scientifically valid) assumption that climate change is anthropogenic in origin; I return to this critical question of 'causality' below.

To the extent that the points discussed above reflect an accurate representation of the causes and consequences of climate change, the case for considering climate change an ethical issue seems clear-cut. Indeed, in light of recent evidence suggesting that negative consequences of climate change are already occurring (e.g., the 2003 heat waves in Europe that caused over 70,000 premature deaths; World Health Organization 2010), many of the 'complications' that have been discussed at length in the (moral philosophical) literature on climate change (e.g., Parfit's 'non-identity' problem and the question of harm to future generations; see Davidson 2008) seem moot. Thus, climate change is an ethical issue involving morally reprehensible behavior perpetrated by billions of individuals living now and in the past (Gardiner 2006; Jamieson 2009). But if we accept this conclusion, we are faced with a more troubling and difficult question: why do we, as individuals and as communities, continue to emit greenhouse gases at levels that are already causing harm to human and non-human life (IPCC 2007; World Health Organization 2010) if doing so is morally reprehensible?

### 3 Possible explanations of continued greenhouse gas emissions

There are likely many plausible, if partial, explanations we could employ to explain why we continue to dangerously emit greenhouse gases (Dessai et al. 2004), despite the plea from various moral philosophers and others (including some politicians, activists, economists and religious leaders, e.g., Benedict XVI 2009; Moore and Nelson 2010; Stern 2006) that we understand climate change as a moral issue that *requires* ameliorative action. Perhaps most non-experts and policymakers agree with Singer, Jamieson and others that climate change is an ethical issue, but they simply are unwilling to reduce their own consumption or to vote for policies that redistribute and restrain access to the atmospheric commons. An economically-minded analysis of individual and collective non-response might suggest that inaction arises (in part) due to the fact that climate change mitigation efforts involve a massively multi-

player prisoner's dilemma situation, in which each individual (household, community, country, etc.) has a strong incentive *not* to reduce greenhouse gas emissions personally (Helm 2008); through this lens, non-action might well be viewed as highly rational at the individual-actor level, regardless of any potential ethical concerns that might exist.

Alternatively, people may believe that the harms done to others via climate change were in fact perpetrated by past generations or by those living elsewhere, and thus while climate change does pose a moral problem, it is not *our* moral problem. Indeed, recent findings suggest that individuals actively work to avoid feeling responsible for climate change, in part by blaming others for their inaction and contributions to the problem (Stoll-Kleemann et al. 2001). Along related lines, Norgaard (2006, 2011) has argued that entire communities may engage in a motivated (if not necessarily conscious) process of socially constructed and reinforced climate change denial and avoidance, which allows daily life to proceed as normal despite knowledge of the harms one's actions impose on others. Diffusion of responsibility, feelings of inefficacy, motivated reasoning and information processing, and myriad other psychological and sociological mechanisms may also be at play (see Gardiner 2006; Kunda 1990; Lord et al. 1979; Swim et al. 2009). Of course, we know that a substantial number of individuals do not believe that climate change is even happening (cf., Yeager et al. 2011; Leiserowitz et al. 2011), and there is little reason to expect these individuals to take the ethical ramifications of the issue seriously.

There is another possibility as well, namely, that we are not responding to climate change in a significant way because our moral intuitions do not match up with the position(s) staked out by the moral philosophers. That is, perhaps many or even most individuals *do not* have a clear sense that climate change is a moral imperative, or are at best unsure whether the 'rules' of morality apply in the case of (anthropogenic) climate change. If this is the case, then there is no reason to expect normative considerations of morality to be an effective motivator of ameliorative action regarding climate change<sup>2</sup>, despite the urgings of moral philosophers, religious figures and others, in part because we tend to trust our own gut instincts regarding issues of morality more than we do the reasoned arguments provided by others (Haidt 2008). But what do we know about the moral intuitions of non-experts with respect to climate change, and what role, if any, do such intuitions play in driving individuals' behavioral responses to the problem?

### 3.1 Moral intuitions and climate change

Jamieson, Gardiner, Davidson and others suggest there is reason to believe that many people, including some of those who believe climate change is indeed happening and is a problem, may *not* understand climate change in ethical terms. For example, Gardiner (2006) suggests that climate change poses a 'perfect moral storm,' leaving us 'extremely vulnerable to moral corruption' (397). According to Gardiner, both at the individual, psychological level as well as at the institutional, political level, certain features of climate change converge to 'exacerbate and obscure a lurking problem of moral corruption' (399). Specifically, Gardiner discusses three features of climate change that he believes may 'cause problems for ethical behavior' (398): temporal and spatial dispersion of causes and effects, the multiply determined nature of climate change ('fragmentation of agency'), and 'institutional inadequacy' (problems of the commons). Of course, other features of the problem,

<sup>2</sup> Of course, there are certainly other grounds besides moral ones for justifying climate change mitigation and adaptation efforts, including self-preservation/national defense, economic opportunity and generating positive affect (e.g., 'warm glow').

including uncertainty about the timing and magnitude of potential consequences and discounting the value of future versus present consumption (see also Weber 2006) also play a role. Gardiner argues that even if people recognize climate change as an ethical issue, these features of climate change may militate in favor of unethical behavior (i.e., a failure to reduce emissions adequately).

Jamieson (2007) is even more direct in making the claim that individuals fail to recognize climate change as a moral imperative: 'We tend not to see climate change as a moral problem...[because it] is not a matter of a clearly identifiable individual acting intentionally so as to inflict an identifiable harm on another identifiable individual' (Jamieson 2007: 477). That is to say, no one *wants* climate change to occur and is intentionally trying to bring about harm to future generations. As a result, 'It [climate change] does not motivate us to act with the urgency characteristic of our responses to moral challenges' (ibid.). Essentially, Jamieson argues that climate change does not fit the 'paradigm[atic] moral problem' in which one individual directly and causally harms another and thus that our moral intuitions regarding the issue may be relatively weak.

Recent work in the field of moral psychology appears to provide important, if indirect, support for both Jamieson's and Gardiner's (among others') contentions. For example, research shows that actors who intentionally perform harmful acts are considered more blameworthy and punishable than are actors who unintentionally bring about the same consequences (Guglielmo et al. 2009). Moreover, recognizing harmful events as the result of intentional action is a highly motivating cue for ameliorative action (Cushman 2008); at the same time, people tend to treat acts of omission (e.g., failing to reduce emissions) as less morally repugnant than they do acts of commission (e.g., actively harming someone), at least with respect to the treatment of out-group members (e.g., people living far away in time or space; Baron 2012). Additionally, recent research finds that individuals feel guiltier about climate change (and subsequently want to do more to combat it) after reading that it is anthropogenic rather than naturally occurring (Ferguson and Branscombe 2010). Markowitz and Shariff (2012) review these and other psychological factors that likely act to weaken individuals' moral intuitions about climate change, concluding that various features of the issue itself (e.g., uncertain outcomes; long time horizons) pose significant challenges to the human moral judgment system. Given these findings, individuals' beliefs about both the causes of climate change (e.g., whether it is purely anthropogenic, purely a natural phenomenon, or some mix of the two) as well as its consequences (e.g., harm to poor individuals or other species) may play an important role in shaping both perceptions of moral obligation to respond and subsequent intentions to actually change one's behavior.

#### 4 Present research

The findings discussed above suggest that there may indeed, as Jamieson has argued, be good reason to expect that many non-experts simply do not perceive climate change in ethical terms; moreover, moral judgments about the issue likely play an important role in motivating (or demotivating, in their absence) ameliorative behavior (cf., Shwom et al. 2010). Indeed, in some of the only empirical research to examine this question, Leiserowitz et al. (2009) found that between 15–30% of Americans surveyed indicated that moral considerations were a motivating factor in their performance of various energy saving actions (depending on the behavior); somewhat more indirectly, public polling data consistently reveals relatively strong support for climate change mitigation policies aimed at improving corporate behavior but weak support for policies that hurt individuals'

pocketbooks directly (e.g., gas taxes; Leiserowitz et al. 2009), pointing, perhaps, to the weakness or absence of moral resolve regarding the problem. Despite this and some other recent work (e.g., Butler 2010; Shwom et al. 2010), it appears that very little research has empirically examined the extent to which non-experts perceive climate change as an ethical issue, nor what the etiology and implications of such beliefs might be. In an effort to begin filling in this critical gap, I conducted two studies with undergraduate students in the U.S. in which I explicitly explored beliefs about the 'ethics of climate change.' In the remainder of this paper I briefly report the results of this research.

## 5 Methods

### 5.1 Participants and procedure

Study 1 was conducted between January and March, 2010 and Study 2 was conducted between March and June, 2011. Participants were undergraduate students attending a large public university in the Northwestern U.S.; Study 1 had 606 participants and Study 2 had 316 participants. Participants in both studies were enrolled in introductory Psychology courses at the time, but were not all Psychology majors. Both samples over-represented females (58% in Study 1, 64% in Study 2) and were predominately white/Caucasian (78% and 75% respectively) and young (mean age=20 in both samples). Clearly, the data reported on below are not representative of the general U.S. public. Thus, making generalizations from the present samples to other populations regarding the prevalence of various climate change beliefs (e.g., morality beliefs) would be inappropriate. However, this research was primarily intended to provide initial empirical insights into the etiology and implications of beliefs non-experts hold regarding climate change as a moral imperative; that is to say, the focus of the research presented below is on why participants either do or do not identify climate change as an ethical issue and how such beliefs relate to other constructs of interest, e.g., behavioral intentions. It seems reasonable to suggest that the manner in which such beliefs relate to one another should be relatively robust across different subpopulations (including college students); regardless, readers should keep in mind the population being studied when interpreting results.

The measures used in the present studies were embedded within larger omnibus surveys that the participants took via the internet, under no time constraints. All measures relevant to the present research were presented in a single block to participants; however, the location of the block within the broader omnibus survey was fully randomized across participants. Other constructs measured in the Study 1 omnibus survey included: Big Five personality; numeracy; maximizing; betrayal emotion and appraisal; perspective taking; need for cognition and closure; and, various other social psychological measures. The Study 2 survey also included measures of: general social attitudes; self-other overlap; betrayal trauma; and subjective well-being. On average, students spent 45 min filling out the survey in Study 1 and 32 min in Study 2; given the length of the omnibus surveys, participants who took less than 15 min to complete either survey were eliminated from analyses presented below.

### 5.2 Materials

Across both studies, participants were asked a variety of questions regarding their beliefs about climate change. Table 1 shows question wording and response categories of items

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**Table 1** Shows item wording and response categories for measures used in Studies 1 and 2

Domain	Question	Response Categories	Study 1	Study 2
Ethics	Do you consider 'climate change' to be an ethical or moral issue?	Yes; No; Not sure	X	X
	Please explain your answer.	Open-ended	X	X
	Do you personally feel a moral obligation to respond to climate change?	Not at all; A little bit; Somewhat; Very much		X
	Do you feel personal responsibility for dealing with climate change?	Not at all; A little bit; Somewhat; Definitely	X	
Certainty	How sure are you that climate change (global warming) is already taking place?	Not at all sure; A little unsure; Somewhat sure; Very sure	X	
	You may have noticed that climate change has been getting some attention in the news. What do you think? Do you think that climate change is happening?	Yes; No; Don't know		X
Causes	Assuming climate change is happening, do you think it is...Caused mostly by humans; Caused mostly by natural changes in the environment; Caused by both human activities and natural changes; None of the above because climate change isn't happening	(see left)		X
Efficacy	How much influence do you think you personally can have on limiting climate change?	None; Some; A little; Large	X	
	The actions of a single individual, including myself, won't make any difference in climate change	Strongly disagree; Somewhat disagree; Unsure; Somewhat agree; Strongly agree		X
Risk	How much of a risk do you feel global warming poses to you personally?	Very little (1) to A lot of risk (7)	X	
	How much do you think climate change will harm people living in poor countries, either now or in the future?	Not at all; Only a little; A moderate amount; A lot; Extremely		X
Concern (3 items)	How important is the issue of global warming to you personally? If nothing is done to reduce global warming, how serious of a problem do you think it will be? How concerned are you about the possible effects of global warming?	Not at all; Not too; Somewhat; Very; Extremely	X	
Affect	How strongly do you feel each of the following emotions when you think about the issue of climate change? Worry; Guilt	Not at all; A little bit; Somewhat; Very		X
Scientific Consensus	To what extent do environmental scientists agree among themselves about the existence and causes of global warming?	No agreement at all (1) to Near complete agreement (5)	X	
Behavioral Intentions (5 items)	I intend to...use only recyclable and reusable products from now on; join and provide financial support to pro-environmental organizations in the near future; actively rally for policies that are good for the environment; cut down on using electricity and driving by at least 50%; devote more money to purchase products that are environmentally friendly	Strongly disagree (1) to Strongly agree (9)		X

discussed in the analyses below and indicates which questions were asked in which study. Beliefs about the ethical dimensions of climate change were measured using two items in Study 1, including one open-ended item that asked participants to explain why they had said that climate change either was or was not an ethical/moral issue. Responses to the open-ended question were coded (see below). In Study 2, participants were also asked whether they felt a 'moral obligation' to respond to the issue; in addition, Study 2 participants responded to a challenging five-item environmental behavior intentions scale ( $\alpha = .89$ ). Political ideology was assessed with a single item that asked participants to self-identify as conservative, moderate or liberal. Additionally, participants were asked basic demographic data (age, gender, ethnicity).

## 6 Study 1 results and discussion

The primary aims of Study 1 were to: a) identify the proportion of respondents who believed climate change to be an ethical issue or not; b) explore participants' open-ended responses explaining their 'ethics' responses in order to develop a clearer understanding of the moral reasoning underlying such beliefs; and c) preliminarily examine relations between 'climate ethics' beliefs and other constructs (e.g., concern, efficacy). 592 participants responded to the question, 'Do you consider "climate change" to be an ethical or moral issue?' Forty-two percent of the students responded affirmatively (referred to as 'ethicists'), 23% said 'no' ('non-ethicists'), and 36% said they were unsure either way ('unsures'). Among those participants who were somewhat or very sure that climate change is occurring (80% of the sample), 48% believed it was an ethical issue, 18% said it was not and 34% were unsure. These initial results suggest that, unlike many other hot-button social issues (e.g., capital punishment; abortion), individuals may lack clear moral intuitions regarding climate change, as predicted.

I next examined participants' open-ended responses explaining their perceptions of climate change as an ethical issue (or not); 475 responses were coded. To do so in a systematic manner, I first developed three content-driven coding schemes, one for each of the three groups of respondents<sup>3</sup>. Next, I trained two research assistants blind to the overarching aims of the research project on the use of the coding schemes. After a training period, inter-rater agreement stabilized around 73% across the three sets of responses. Disagreements were resolved by the author<sup>4</sup>. Further details regarding the coding process and instructions provided to coders are described in the [Appendix](#).

'Ethicists' provided four substantive response types as explanation: 1) humans have a positive stewardship duty and should protect others (including future persons and other species) from the harms of climate change (33.8% of all responses); 2) climate change is anthropogenic (20.4%); 3) climate change will cause harm to others (without explicit indication of duty to protect those others; 19%); and, 4) humans can do something about climate (references to efficacy; 6.5%). The remaining respondents either restated their belief that climate change represents a moral issue or else provided uncodeable or idiosyncratic responses.

<sup>3</sup> Different coding schemes were necessary for the three groups given the nearly non-overlapping nature and content of the responses provided by respondents.

<sup>4</sup> Secondary analyses confirmed that the substantive results of the open-ended coding were unaffected by the author's involvement in resolution of inter-coder disagreements.

Unsurprisingly, responses were extremely different among 'non-ethicists.' This group also demonstrated four substantive categories of response: 1) climate change is an environmental, scientific or technical problem (20% of respondents); 2) it is a naturally occurring phenomenon (16.4%); 3) humans cannot do anything about the problem (references to inefficacy; 10.9%); and, 4) climate change is simply not happening (9.1%). Additionally, a full 12% of respondents simply restated their response to the 'ethics' item and 5.5% said they "didn't care" about the issue. Finally, among participants who were unsure regarding the ethical nature of climate change ('unsures'), a full 27.5% indicated that they lacked enough knowledge to make up their minds, 5.4% were unsure about the causal nature of the issue (e.g., anthropogenic vs. naturally occurring) and more than half simply provided an uncodeable or blank response to the follow-up question.

In order to further explore the implications of 'climate change ethics' beliefs in this first sample, I next turned to the other measures listed in Table 1 and examined how each of these constructs (e.g., concern, perceived efficacy) related to 'ethics' beliefs. As shown in Table 2, compared to 'non-ethicists' and 'unsures,' 'ethicists' reported significantly higher levels of concern over climate change, greater risk perceptions, and stronger perceptions of scientific consensus on the issue. Importantly, when looking at conservatives, liberals and moderates separately (results not shown), all of these group differences (e.g., 'ethicists' vs. 'non-ethicists') were in the predicted direction (and nearly all were statistically significant). In addition, 'ethicists' perceived themselves to possess greater efficacy to do something about climate change than non-ethicists and similarly were more likely to ascribe personal responsibility to themselves than were participants who did not clearly identify the issue as an ethical one.

The results of Study 1 suggest that believing climate change to be an ethical issue is closely associated with the general perception that the issue is a serious problem in need of ameliorative action. More specifically, 'ethicists' appeared to make connections between the etiology of the problem (it is human caused), humans' responsibility to protect others from harm (stewardship), and personal ascriptions of responsibility. Thus, this group of respondents appeared to focus both on the causal structure of the problem as well as on downstream consequences. In contrast, 'non-ethicists' appeared to focus their attention almost exclusively on the causes and nature of climate change and not very much, if at all, on its downstream implications; it is also of interest to note that relatively few (less than 10%) 'non-ethicists' explicitly stated that climate change simply was not happening (perhaps unsurprising given the make up of the population from which the sample was drawn). Taken together, these

**Table 2** Shows mean scores of 'ethicists' ( $n=131$ ), 'non-ethicists' ( $n=242$ ), and 'unsures' ( $n=204$ ) in Study 1 on five domains of climate change belief. All  $F$  tests have  $df=2, 574$ . Last two columns show results of post-hoc pairwise comparisons using Bonferroni corrections: \* indicates a significant pairwise difference. Concern and scientific consensus were measured using 5-pt scales, risk perceptions with a 7-pt scale, and efficacy and responsibility with 4-pt scales

Measure	Ethicists (1)	Non-ethicists (2)	Unsures (3)	$F$	$p$	1 vs. 2	1 vs. 3
Concern	3.89	2.62	3.29	102.52	<.001	*	*
Risk	4.37	2.70	3.88	51.68	<.001	*	*
Consensus	3.74	3.02	3.17	26.83	<.001	*	*
Efficacy	2.57	1.89	2.25	34.67	<.001	*	*
Responsibility	2.68	1.73	1.99	69.41	<.001	*	*

results point to the potentially critical role that beliefs about the causes of climate change play in shaping moral judgments, perceptions of moral obligation and subsequent motivation to take action on the issue. I explore these possibilities in more detail in Study 2.

## 7 Study 2 results and discussion

The results of Study 1 raise a number of important and interesting questions: Are responses to the 'ethics' question simply a proxy for beliefs regarding either (or both) the causes of or the potential harms caused by climate change? How are perceptions of moral obligation to respond in the face of climate change affected by beliefs about the causal structure of the problem? Do such 'etiology' beliefs affect intentions to respond behaviorally to the problem, and if so, is this effect mediated by perceptions of moral obligation or efficacy? Moreover, is there a difference (e.g., in perceptions of obligation and efficacy) between people who believe climate change is exclusively anthropogenic and those who see both human and natural forces at work? Study 2 was designed to provide at least initial answers to these questions.

As in Study 1, participants in Study 2 disagreed with one another regarding the ethical nature of climate change: 51% were 'ethicists,' 29% were 'non-ethicists' and 20% were 'unsures.' Moreover, while the vast majority of participants believed climate change was happening (85%), there was significant variation among these respondents regarding beliefs about the causes of climate change: 34% believed that the problem is exclusively caused by human actions, 61% believed that both humans and natural variation are causing it, and 5% said that climate change is a naturally occurring phenomenon with no anthropogenic contribution (these numbers highlight significant differences in opinion between the population sampled and the general U.S. public, see Leiserowitz et al. 2011).

To begin answering the questions raised by Study 1, I first examined the distribution of responses to the 'ethics' item as a function of 'causation' beliefs. (In these and all subsequent analyses described below, I included only those individuals who said that climate change is indeed happening). As expected, among the few individuals ( $n=14$ ) who stated that climate change is a naturally occurring phenomenon, 64% responded 'no' to the ethics item (14% said yes, 21% said 'unsure'); in contrast, only 14% of participants who believed climate change to be exclusively anthropogenic (total  $n=87$ ) were 'non-ethicists.' Perhaps more surprisingly, compared to the 'anthropogenic' group, twice as many individuals who viewed climate change as both anthropogenic *and* natural ('mixed causation' group; total  $n=163$ ) were 'non-ethicists' (28%).

These initial results suggest that simply holding the belief that climate change is not *exclusively* anthropogenic (let alone exclusively natural) might be related to understanding the issue in fundamentally different terms with respect to considerations of morality. Because the 'naturally caused' group was so small in this sample, I focused the remainder of my analysis on comparisons between the 'anthropogenic' and 'mixed causation' groups.

Further supporting the contention that the 'anthropogenic' and 'mixed causation' groups perceived the moral implications of climate change differently, the former group reported stronger perceptions of personal moral obligation to respond than did the latter group,  $t(248)=2.4$ ,  $p=.02$ ,  $d=.32^5$ ; individuals in the 'anthropogenic' group also reported feeling significantly more guilty when thinking about climate change,  $t(249)=2.5$ ,  $p=.01$ ,  $d=.33$ . One simple explanation for these findings could be differences between the

<sup>5</sup> This is considered a small-to-moderate effect size in the psychological literature.

two groups with respect to perceptions of harm caused to innocent others (e.g., poor individuals, future generations), although it is unclear exactly why beliefs about the etiology of the problem would affect perceptions of harm. However, although the 'anthropogenic' group did have a higher mean score on the harm item than the 'mixed causation' group, the effect was only marginally significant by traditional standards,  $t(248)=1.8$ ,  $p=.07$ . Moreover, the two groups did not differ significantly in terms of perceived personal self-efficacy,  $t(251)=1.5$ ,  $p=.13$ .

Further analysis revealed that individuals in the 'anthropogenic' group reported stronger intentions to perform pro-environmental actions than did 'mixed causation' individuals,  $t(251)=2.1$ ,  $p=.04$ ,  $d=.28$ , and across both groups there was a moderate-to-strong correlation between ascriptions of personal moral obligation and intentions to perform pro-environment acts,  $r(250)=.47$ ,  $p<.001$ <sup>6</sup>. These findings suggest that understanding climate change to be caused primarily or exclusively by humans may increase intentions to respond by increasing feelings of moral obligation, apart from considerations of harm or efficacy.

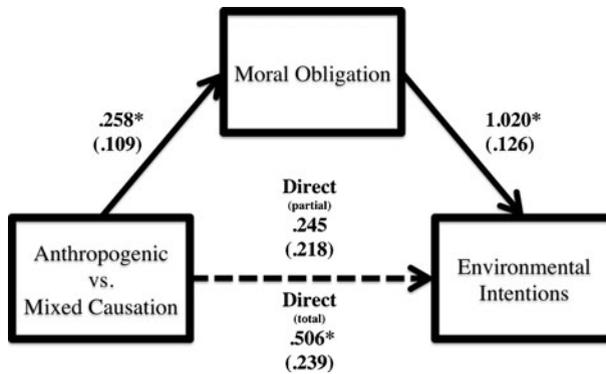
To test this proposition formally, I conducted a mediation analysis using Preacher and Hayes' (2008) bootstrapping method (with 5000 resamples), which generates a data driven sampling distribution that can be used to robustly estimate the statistical significance of the indirect effect. As suggested by the pattern of results presented above, the 95% confidence interval for the indirect effect of causation beliefs (anthropogenic vs. mixed) on behavioral intentions via perceptions of moral obligation did *not* include zero ( $CI_{95}=.05$ ,  $.50$ ), indicating the existence of a robust and significant mediation effect, as predicted (point estimate=.23, Sobel  $z=2.25$ ,  $p=.02$ ); after accounting for perceptions of moral obligation, the direct effect of causation beliefs on environmental intentions was no longer significant (Fig. 1). (It must be noted that in theory the causal pathway could be reversed, i.e., moral obligation predicts etiology beliefs; the observational nature of the data do not allow us to conclusively determine which variable is the mediator and which is the more distal independent variable; see below for further discussion.)

Further explicating the initial results from Study 1, these findings suggest that individuals' perceptions of climate change as a moral issue, and subsequent feelings of moral obligation to respond (and intentions to do so), are significantly related to beliefs about the etiology of the issue and the role not only of humans but also natural variation in shaping our changing climate. Although the results above (and particularly the mediation analysis) should be treated with caution given their correlational nature and the restricted population sampled (see below), they appear to fall closely in line with other recent experimental research which shows that individuals who are exposed to messages blaming humans for causing the problem (as opposed to it being naturally occurring) report greater feelings of guilt, which in turn mediate stronger intentions to act in the interests of the environment (Ferguson and Branscombe 2010). Moreover, Study 2 results appear to fit nicely with past findings highlighting the central role of agency and intentionality in judgments of morality (Cushman 2008; Guglielmo et al. 2009).

## 8 General discussion

Although it is important to keep in mind that the empirical results presented above reflect the beliefs of a very specific subgroup of the American public (i.e., college students), the

<sup>6</sup> This correlation is attenuated by the exclusion of the rest of the sample; when all participants are included, which is reasonable given that one does not need to believe climate change is happening or anthropogenic to meaningfully respond to either of the two items in question, the correlation is even stronger,  $r(312)=.50$ ,  $p<.001$



**Fig. 1** Presents results of a mediation analysis showing that the effect of causation beliefs on environmental behavior intentions is fully mediated by perceptions of moral obligation; note that the significant direct path between causation beliefs and behavioral intentions becomes non-significant once moral obligation is entered into the regression equation; unstandardized regression coefficients are shown with standard errors in parentheses; \* indicates a significant path,  $p < .05$

findings hold important implications for both the study of climate change ethics and the use of morality and ethics frames (Nisbet 2009) for communicating about climate change. Specifically, the present research suggests that while many individuals do believe that climate change poses an ‘ethical problem’ (Jamieson 2007), there may be just as many if not more who are either unsure or who do not believe the issue falls under the domain of moral consideration. What is more, the results of two studies reveal that moral judgments regarding climate change cannot simply be explained by an individual’s belief regarding the existence of climate change. Rather, a majority of the roughly 20% of participants who fell into the ‘non-ethicists’ group appeared to hold that position in significant part due to a belief that climate change is not anthropogenic; moreover, significant differences between those who view climate change as anthropogenic and those who understand it to be a result of both human and natural forces arose with respect to perceptions of moral obligation, and subsequent intentions to act on those obligations, despite similar levels of perceived harm and efficacy. This latter result suggests that individuals may be particularly sensitive to, and perhaps overly oriented towards, the etiology of the problem as opposed to the downstream consequences that climate change poses for many communities and non-human species.

The present findings appear to fit well with recent research demonstrating a causal relationship between perceived causes of climate change, moral emotions (e.g., guilt), and motivation to respond behaviorally (Ferguson and Branscombe 2010) as well as with the rapidly growing literature on moral intuition and judgment (Haidt 2007). Moreover, the results provide some support for Jamieson’s (2007) contention that we do not see climate change as a ‘paradigm[atic] moral problem,’ one which motivates immediate and decisive action. They also suggest that the situation may be even worse than Gardiner (2006) assumes, because it may not be the case that most (or even very many) non-experts and non-philosophers understand climate change in ethical terms (much less that they fall prey to ‘moral corruption’). At the same time, it seems important not to lose sight of the fact that the largest subgroup (with respect to ‘climate ethics’ beliefs) in the present samples did indeed consist of individuals who responded affirmatively to the ethics question. Moreover, many of the open-ended responses provided by the participants in Study 1 belied deeply rooted and powerfully felt moral intuitions regarding climate change.

Perhaps more substantively, the results of Study 2 in particular suggest that individuals who identify climate change as a moral imperative also demonstrate a greater willingness to engage in a positive manner with the issue—emotionally, cognitively and perhaps behaviorally—than those who do not understand the issue in ethical terms, even when taking into account groups differences in perceptions of harm and efficacy (which are also known motivators of altruism under some conditions). Put slightly differently, these results indicate that individuals' expressions of their altruistic tendencies are shaped by perceptions of an issue as morally relevant or not; to the extent that these results generalize to the broader population (which remains to be seen), this finding potentially holds important implications for our broader understanding of the underlying drivers of prosocial action in situations that theoretically should push individuals to act selfishly.

Additionally, these results would seem to be good news for those climate change advocates who have tried to use morality frames to communicate about climate change with traditionally unreceptive segments of the population (e.g., attempts to increase concern among Evangelical Christians in the U.S. by framing the issue as one about stewardship and personal responsibility; see, e.g., Wardekker et al. 2009). Even more encouraging in this respect, perhaps, is the fact that morality beliefs in the climate context do not seem to be completely wrapped up in (that is to say, confounded with) the public 'debate' over the very existence of climate change; on the other hand, given the present results, the widespread belief among the U.S. public (and others) that climate change is a result of natural forces (Leiserowitz et al. 2011) suggests a potentially significant barrier to recognition of the issue as a moral imperative. Finding ways to effectively communicate the 'moral position' on climate change with individuals who currently believe climate change is happening but who do not see it as an ethical issue may indeed have significant impacts on those people's other beliefs about the issue, and perhaps even their willingness and eagerness to confront the issue in meaningful ways.

## 9 Limitations and future directions

The present research is limited in a number of respects, first, and most obviously, by the use of convenience samples. Future research should continue to explore beliefs about the ethical dimensions of climate change among representative samples of the general public. Of course, this work should be cross-cultural, as there may very well be significant differences between nations (and certainly between groups within nations) with respect to how and why individuals understand climate change as a moral imperative (or not). At the most basic level, this research should establish the extent to which members of the general public(s) do or do not view climate change in ethical terms. Moving forward, it will also be critical to utilize experimental designs that allow researchers to examine the relative efficacy of climate change messages that use or do not use morality frames, or that use different types of morality frames (see Feinberg and Willer [under review](#)). Only carefully designed experimental or quasi-experimental designs will allow us to determine the extent to which 'ethics' beliefs are indeed predictive of, and not simply coexistent with, concern over climate change, feelings of responsibility and efficacy and, ultimately, willingness to engage in greenhouse gas-reducing actions (including political ones, e.g., 'green' voting).

Additionally, the research reported here is limited by the measures I used in this particular study. Future research should attempt to employ even more robust measures, especially with respect to the most critical constructs. For example, although both the open-ended item as well as some of the close-ended questions included in Study 2 provide some insights into

what the terms ‘ethical’ and ‘moral’ meant to my participants, future research would do well to more thoroughly examine how different individuals (and perhaps groups) understand and use those terms; in addition, asking participants to classify a number of different social and environmental issues as moral or not would help contextualize responses regarding any one issue. It seems clear that we should be able to delve more deeply into the nuances of individuals’ beliefs in this domain without having to lose the robustness and potential for representative coverage of study populations gained by use of wide scale survey and public polling methodologies. Indeed, one of the strengths of the present research is that the findings reflect the thoughts and feelings of over 900 individuals, albeit individuals from a very specific subpopulation. There is clearly also a need for focus group and in-depth interviewing on this topic (e.g., Butler 2010; Stoll-Kleemann et al. 2001), as these methods can provide rich narratives and deep insights into individuals’ beliefs. At the same time, such methods provide a fundamentally different, and complementary, perspective relative to large-scale survey research methods.

Future research should also seek to further exploit recent insights coming out of the fields of moral, political and social psychologies in order to both better explicate the etiology of ‘climate ethics’ beliefs as well as, and perhaps more importantly, to uncover barriers to and facilitators of understanding climate change as a moral imperative. Just as the research on perceptions of intentionality can perhaps help us to explain some of the present results, other recent theories and findings are already being used to explain and predict other, related aspects of non-experts’ climate change (moral) belief systems (cf., Feinberg and Willer 2011; Feygina et al. 2010; Markowitz and Shariff 2012).

Two other closely related points should be noted. I have argued throughout this paper that ‘etiology beliefs’ and ‘morality beliefs’ are distinct, yet related, constructs; moreover, I have also proposed a specific causal relationship between the two constructs (i.e., beliefs about the causes of climate change shape morality beliefs, including perceptions of moral obligation). However, it is important to note that both of these assertions could be challenged, particularly on empirical grounds. First, it is possible that the measures of morality beliefs and etiology beliefs used in these studies are simply different measures of the same underlying latent construct; for example, stating that climate change is anthropogenic and that it is a moral issue (or that one has a moral obligation to respond) may just reflect one’s underlying beliefs about the harms caused by climate change. However, the fact that perceptions of harm did not differ significantly between the ‘anthropogenic’ and ‘mixed causation’ groups, whereas moral obligation did, would seem to argue against this interpretation; moreover, from a theoretical perspective, morality beliefs appear to be broader in scope than etiology beliefs, and there is only partial overlap between the two constructs.

Second, as indicated in the Results above, it is plausible that the direction of causality between these two constructs is reversed from the one assumed throughout this paper. For example, people may first develop the belief that climate change either is or is not a moral issue and then shape their understanding of the causes of the phenomenon to fit and support those preexisting beliefs (this may especially be the case among people who want to deny or avoid personal culpability); such ‘motivated moral reasoning’ is a well-documented and regular occurrence in daily life (see Ditto et al. 2009; Kunda 1990). However, it seems likely that the considerably more common “causal story” to which people are exposed (e.g., via mass media) regarding climate change as a moral issue involves climate change being described as moral in part *because* it is caused by humans, not that it is caused by humans *because* it is a moral issue (which makes little sense). To the extent that individuals develop beliefs about climate change primarily as a result of exposure to mass media coverage of the topic, then, the original proposed causal relationship seems reasonable.

Finally, there are important aspects of this general topic that I have almost entirely ignored in the present paper, and these should be addressed in future work. Foremost amongst these are the intertwined issues of environmental justice, racism and sustainability. A key component of much messaging on climate change is the issue of harm to future generations caused by our greenhouse gas emitting behaviors performed now. Much less prevalent, but just as important, are questions of climate justice in the here-and-now. The open-ended responses of 'ethicists' described briefly above suggest that to the extent that justice issues are present in people's minds, these concerns are predominantly focused on intergenerational considerations (which seems to indicate that they are tracking how the issue is often portrayed in the media). Various researchers are actively engaged in expanding the universe of ethical concerns in the climate change context (e.g., Moore and Nelson 2010; Singer 2006), and it will be important to explore the public's beliefs about *all* dimensions of the 'ethics of climate change.'

## 10 Conclusion

The present research examined non-experts' beliefs about climate change and morality. The findings provide novel insights into how a relatively large group of individuals thinks about the ethical dimensions of global climate change, showing that self-ascriptions of moral obligation and intentions to perform ameliorative actions are related in important ways to how individuals understand the causes of the phenomenon. This work builds off of and, I think, begins to expand the extant literature on the ethical dimensions of climate change. While moral philosophical treatises laying out well-reasoned arguments in favor of recognizing climate change as a moral imperative are clearly important (especially, I think, in motivating and guiding policymaking), it is clear that non-experts' beliefs about all aspects of the climate issue, including ethics, are key ultimate drivers of public policy (Bord et al. 1998; Krosnick et al. 2006). Understanding how, why and to what extent members of the general public think about and respond to climate change as an ethical issue, and not solely as an environmental, scientific, technological or physical one, can only improve our chances of finding meaningful and (politically) workable solutions moving forward.

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## Appendix

### Development of coding schemes

As described in the paper, three distinct coding schemes were deemed necessary for 'ethicists,' 'non-ethicists,' and 'unsures' given the essentially non-overlapping nature of the content produced across the three groups. The coding scheme(s) were entirely data-driven: working with a collaborator (not one of the two coders), I examined participants' open-ended responses and generated an initial coding scheme for each of the three groups. For 'ethicists,' the codes were as follows: 'stewardship/responsibility towards others/'should" do something'; 'anthropogenic/human caused/human problem'; 'harm caused'; 'efficacy'; 'restated'; 'other/uncodeable.'

For 'non-ethicists,' the codes were: 'not happening'; 'naturally occurring'; 'environmental/technical/scientific issue'; 'lack of control/inefficacy'; 'restated'; 'other/uncodeable.' For 'unsures,' the codes were: 'lack of knowledge'; 'unclear causation'; 'restated'; 'other/uncodeable.' Given the data-based nature of the coding schemes that were used, future research using similar open-ended response methods will necessarily have to develop study-specific coding schemes.

#### Instructions to coders and coding procedure

Once the initial coding schemes were developed, I introduced the two coders (both of whom were blind to the hypotheses and aims of the present research) to the dataset and the coding schemes; we then went through a small number of open-ended responses (<5%) together as a group. Coders were then given approximately 20% of the data (proportionally split across the three participant groups/types) and instructed to code only the first codeable statement provided by respondents; in the vast majority of cases, only one codeable statement was provided. I then met with the coders again to discuss any disagreements. After establishing conventions for common responses, I gave coders another 25% of the data. Coding was again completed independently. I met one more time with the coders to discuss any remaining disagreements on a case-by-case basis. At that point, I provided coders with the remaining 50% of the open-ended data. I resolved all remaining disagreements between the coders.

#### References

- Baron J (2012) Parochialism as a result of cognitive biases. In: Woods AK, Goodman R, Jinks D (eds) *Understanding social action, promoting human rights*. Oxford University Press, Oxford
- Benedict XVI (2009) *Caritas in veritate: encyclical letter on integral human development in charity and truth*. St. Pauls Publications, Vatican
- Bord RJ, Fisher A, O'Connor RE (1998) Public perceptions of global warming: United States and international perspectives. *Clim Res* 11:75–84
- Broome J (2008) The ethics of climate change: pay now or pay more later? *Sci Am* 298:96–102
- Butler C (2010) Morality and climate change: is leaving your TV on standby a risky behaviour? *Environ Val* 19:169–192
- Cushman F (2008) Crime and punishment: distinguishing the roles of causal and intentional analyses in moral judgment. *Cognition* 108:353–380
- Davidson MD (2008) Wrongful harm to future generations: the case of climate change. *Environ Val* 17:471–488
- Dessai S, Adger WN, Hulme M, Turnpenney J, Kohler J, Warren R (2004) Defining and experiencing dangerous climate change. *Clim Change* 64:11–25
- Ditto PH, Pizarro DA, Tannenbaum D (2009) Motivated moral reasoning. *Psychol Learn Motiv* 50:307–338
- Doherty TJ, Clayton S (2011) The psychological impacts of global climate change. *Am Psychol* 66:265–276
- Feinberg M, Willer R (2011) Apocalypse soon? Dire messages reduce belief in global warming by contradicting just-world beliefs. *Psychol Science* 22:34–38
- Feinberg M, Willer R (Under review) The moral roots of environmental attitudes
- Ferguson MA, Branscombe NR (2010) Collective guilt mediates the effect of beliefs about global warming on willingness to engage in mitigation behavior. *J Environ Psychol* 30:135–142
- Feygina I, Jost JT, Goldsmith RE (2010) System justification, the denial of global warming, and the possibility of "system-sanctioned change. *Per Soc Psychol Bull* 36:326–338
- Gardiner SM (2006) A perfect moral storm: climate change, intergenerational ethics and the problem of moral corruption. *Environ Val* 15:397–413
- Guglielmo S, Monroe AE, Malle BF (2009) At the heart of morality lies folk psychology. *Inquiry* 52:449–466
- Haidt J (2007) The new synthesis in moral psychology. *Science* 316:998–1002
- Haidt J (2008) Morality. *Perspect Psychol Sci* 3:65–72

- Haidt J, Graham J (2007) When morality opposes justice: conservatives have moral intuitions that liberals may not recognize. *Soc Justice Res* 20:98–116
- Hardin G (1968) Tragedy of the commons. *Science* 162:1243–1248
- Helm D (2008) Climate-change policy: why has so little been achieved? *Oxf Rev Econ Pol* 24:211–238
- Hourdequin M (2010) Climate, collective action and individual ethical obligations. *Environ Val* 19:443–464
- IPCC (2007) Summary for Policymakers, Synthesis Report. In: Bernstein L et al (eds) Cambridge University Press, Cambridge
- Jamieson D (2007) The moral and political challenges of climate change. In: Moser S, Dilling L (eds) *Creating a climate for change. Communicating climate change and facilitating social change*. Cambridge University Press, Cambridge, pp 119–138
- Jamieson D (2009) Climate change, responsibility, and justice. *Sci Eng Ethics* 16:431–445
- Krosnick JA, Holbrook AL, Lowe L, Visser PS (2006) The origins and consequences of democratic citizens' policy agendas: a study of popular concern about global warming. *Clim Change* 77:7–43
- Kunda Z (1990) The case for motivated reasoning. *Psychol Bull* 108:480–498
- Leiserowitz A, Maibach E, Roser-Renouf C (2009) Climate change in the American mind: Americans' climate change beliefs, attitudes, policy preferences, and actions. New Haven, Yale Project On Climate Change, <http://environment.yale.edu/climate/>
- Leiserowitz A, Maibach E, Roser-Renouf C, Smith N (2011) Climate change in the American mind: Americans' global warming beliefs and attitudes in May 2011. New Haven, Yale Project on Climate Change, <http://environment.yale.edu/climate/>
- Lord CG, Ross L, Lepper MR (1979) Biased assimilation and attitude polarization: the effects of prior theories on subsequently considered evidence. *J Pers Soc Psychol* 37:2098–2109
- Markowitz EM, Shariff AF (2012) Climate change and moral judgement. *Nature Climate Change*. doi:10.1038/NCLIMATE1378
- Moore KD, Nelson MP (2010) *Moral ground: Ethical action for a planet in Peril*. Trinity University Press, San Antonio
- Nisbet MC (2009) Communicating climate change: why frames matter for public engagement. *Environment* 51:12–23
- Norgaard KM (2006) "People just want to protect themselves a little bit": Emotions, denial, and social movement nonparticipation. *Sociol Inq* 76:372–396
- Norgaard KM (2011) *Living in denial: Climate change, emotions and everyday life*. MIT, Cambridge
- Preacher KJ, Hayes AF (2008) Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Meth* 40:879–891
- Shue H (1993) Subsistence emissions and luxury emissions. *Law Pol* 15:39–60
- Shwom R, Bidwell D, Dan A, Dietz T (2010) Understanding U.S. public support for domestic climate change policies. *Glob Environ Change* 20:472–482
- Singer P (2006) Ethics and climate change: a commentary on MacCracken, Toman, and Gardiner. *Environ Val* 15:415–422
- Stern N (2006) *Stern review on the economics of climate change*. HM Treasury, London
- Stoll-Kleemann S, O'Riordan T, Jaeger CC (2001) The psychology of denial concerning climate mitigation measures: evidence from Swiss focus groups. *Glob Environ Change* 11:107–117
- Swim J et al (2009) *Psychology and global climate change: Addressing a multi-faceted phenomenon and set of challenges*. American Psychological Association, Washington
- Wardekker A, Petersen AC, van der Sluijs JP (2009) Ethics and public perception of climate change: exploring the Christian voices in the U.S. public debate. *Glob Environ Change* 19:512–521
- Weber E (2006) Experience-based and description-based perceptions of long-term risk: why global warming does not scare us (yet). *Clim Change* 77:103–120
- World Health Organization (2010) *The solid facts on climate change and health*. WHO, Copenhagen
- Yeager DS, Larson SB, Krosnick J, Tompson T (2011) Measuring Americans' issue priorities: a new version of the most important problem question reveals more concern about global warming and the environment. *Pub Opin Q* 75:125–138