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Upending Climate Violence Research: Fossil Fuel Corporations and the Structural Violence of Climate Change

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Abstract

There is a high-profile body of work asserting a link between anthropogenic climate change and increased rates of violence. There is also an expanding literature that is highly skeptical of this research. Critics point out that (1) this research has so far produced widely divergent findings, and that there is no consensus on a causal link between climate and the incidence of conflict. Critics also argue that much climate violence research (2) draws upon a long-discredited environmental determinism, (3) rehashes colonial stereotypes of the global South, (4) naturalizes and depoliticizes inequalities within and between nations, and (5) potentially creates new rationales for militarism and intervention from more powerful states. In the following essay, I build on these critiques, arguing that orthodox climate conflict research also focuses unduly on the *potential* climate-related violence of the poor, overlooking the violence of the powerful. Drawing from a climate justice perspective, I advocate for more study on the structural violence of climate change. To make this case, I focus on the world's largest publicly traded fossil fuel companies.

Keywords: climate conflict, climate justice, fossil fuel corporations, fossil fuel divestment, structural violence

Introduction

Will climate change make the world a more violent place? This is one of the more important questions of our time. There are a growing number of warnings coming from influential places about the relationship between climate change and violence. The United States government, for instance, has increasingly labeled global warming a "threat multiplier" (Banusiewicz, 2014; CNA, 2007).

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Additionally, prominent journalists and policy analysts at important think tanks and advocacy groups have worked to highlight potential connections between global warming and conflict (see for instance EJF, 2014; Friedman, 2013; Werrell & Fernia, 2013). And headlines at major newspapers, for example in the *Washington Post*, report "there's a surprisingly strong link between climate change and violence" (Mooney, 2014).

But how we answer the question—"will climate change create a more violent future?"—has much to do with the definitions we use. On one hand, the jury is very much out in terms of proving a causal relationship between climate change and increasing conflict. While some research, published in some of the world's most prestigious journals, has found what the authors describe as a strong link between climatic changes and rates of violence (see Burke et al., 2009; Hsiang et al., 2013), other research, sometimes published in the same journals, has found no such correlation (Buhaug, 2010a, 2010b; Wischnath & Buhaug, 2014). There is, in fact, no consensus among quantitative researchers about the existence of a causal link between changes in temperature and rainfall and increasing violence (Buhaug, 2015; Selby, 2014). As the body of research on a potential climate violence relationship has grown, so too has the number of its critics.

An increasing number of authors worry that quantitative climate conflict research, as the next reincarnation of a long-discredited environmental determinism, is simply old wine in a new bottle (Hartmann, 2014; Raleigh et al., 2014). Moreover, according to critics, this research draws upon colonial stereotypes of the global South, implying that its peoples are somehow more predisposed to violence than those of European ancestry (Livingstone, 2015; Raleigh et al., 2014; Selby, 2014; Verhoeven, 2014). Finally, this research implies that the violence of poor people in the most peripheral areas of the global economy is "natural," hiding from view the ways that histories of colonialism and the contemporary global political economy have conditioned and produced violent conflict (Hartmann, 2010, 2014; Verhoeven, 2011, 2014). Why, given all these problems, has orthodox climate conflict research continued to flourish, and to enjoy such a high public profile? Critics warn that this is because the perspective so closely matches, and is so useful to, governments that are securitizing the issue of climate change and using it as a means to legitimate militarism and ongoing interventions in the global South (Hartmann, 2010, 2014; Selby, 2014; Verhoeven, 2014).

Given all the problems with orthodox climate violence research, does this mean that it is safe to say that climate change will not make the world a more violent place? Hardly. I advance instead that anthropogenic climate change is itself a kind of violence (Solnit, 2014). After all, it will certainly cause early deaths and it will drive people from their homes and homelands, all of which will cause untold suffering. Drawing upon a climate justice perspective, I provide here a brief overview of orthodox climate conflict research and further describe its

critics' concerns. I add to their critique by arguing that this body of research, as a whole, focuses almost exclusively on the *potential* violence of the poor, overlooking the violence of the wealthy and powerful groups who benefit most from, and actively work to sustain, a fossil fuel–dependent neoliberal capitalism. To begin amending this bias in the climate violence literature, I draw upon work in sociology, green criminology, and geography to argue that major fossil fuel companies are disproportionately responsible for, and have disproportionately benefited from, the structural violence of climate change.

Orthodox climate violence research and its critics

There is a long line of argumentation in social/environmental research, going back to Malthus (1798), making a link between environmental scarcity and violent conflict. Many contemporary investigators looking at climate change are doing work that is largely in alignment with this long-standing research trend. The argument is basically that climate change will act as a stressor in the larger environment that, along with other important conditions, will make large-scale violence more likely. It is important to note that most analysts are not alleging that there is a direct causal relationship between climate change and violence, but that climate change is an important background force that heightens other risk factors associated with conflict (Homer-Dixon, 1999). Some studies in this body of research simply try to make the point that the relationship exists, without going into depth to examine particular causal mechanisms (Burke et al., 2014; Hsiang et al., 2013).

Other studies try to look deeper into potential causal factors, arguing that weather aberrations—such as prolonged dry seasons, droughts, abnormally high temperatures, or excessive rainfall—are associated with increased levels of conflict (Burke et al., 2009; Hendrix & Saleyhan, 2012; Hsiang et al., 2011; Kelley et al., 2015; Landis, 2012; Raleigh & Kniveton, 2012). Such weather abnormalities, according to these researchers' arguments, are consistent with climate change models and could become the "new normal" in years ahead. These changes in the weather might drive conflict, they explain, by negatively impacting crop production and reducing food availability, thereby triggering migration or catalyzing resentments against governments or other ethnic groups. Or in another line of thinking, researchers argue that unusually hot and dry weather associated with climate change could drive pastoralists out of their traditional homelands and into conflict over land and water resources with agricultural communities.

While a large number of studies posit a link between climate change and violence, there is by no means a consensus among researchers. For one, several notable studies find little-to-no support for the relationship when other standard predictors for the onset of violence are factored in, such as (1) levels of economic development, (2) ethno-political exclusion practiced by governments, (3) time period (for instance, accounting for the end of the Cold War), and (4) levels of conflict in nearby countries (Buhaug, 2010a; Wischnath & Buhaug, 2014). Other studies find a limited relationship between weather and conflict, but it is very weak compared to those associated with more conventional variables (Klomp & Bulte, 2013; O'Loughlin et al., 2014).

In fact, some research finds the opposite. Gartzke (2012, p. 177) analyzed global temperature trends in relation to rates of conflict over the past 200 years and found that "global warming is associated with a *reduction* in interstate conflict." Humans have, after all, been warming the climate since the beginning of the Industrial Revolution, but during this time per capita rates of violence have been declining (see Pinker, 2011). Of course, Gartzke does not actually believe that a warming planet necessarily increases harmony between nations, but rather that industrialization—achieved by burning fossil fuels and inadvertently warming the planet—has brought about greater prosperity and a decreasing tendency for governments to go to war. Buhaug (2010b) comes to a similar conclusion when comparing the increasing temperature trends in Africa over the past 30 years in relation to the diminishing frequency of both large and small civil wars (in which the numbers of fatalities have also been diminishing).

These findings illustrate that there is no clear consensus that a relationship exists between climate change and rates of violence, as both Buhaug (2015) and Selby (2014) confirm in separate reviews of the literature. To Buhaug (2015, p. 269), this has much to do with the fact that "climate and conflict are not connected in the simple and direct manner as sometimes portrayed," and that therefore climate conflict researchers need to do a better job of attending to how political and economic forces mitigate or increase climate vulnerability (see also Raleigh, 2010). Buhaug also explains that the widely divergent, and often contradictory, findings in orthodox climate violence research are often caused by analysts' tendency to universalize potential variables, neglecting for instance how changes in rainfall or temperature patterns could have very different effects depending upon the geography and political economy of particular regions. Similarly, Raleigh and her co-authors (2014, p. 76) point out that orthodox climate violence researchers often fail to specify what exactly constitutes conflict in the first place, writing that, "if the social setting that engenders conflict is ignored, there is also danger that multiple types of conflict become conflated. Conflict in wealthy areas can be reduced to the level of baseball skirmishes instead of large-scale societal violence." While Buhaug (2015) and others think

that orthodox climate violence research can be rescued by better use of theory and more fine-grained analysis, other critics argue that its problems run much deeper, and that looking at climate variability as a potential driver of conflict is a project that is best abandoned.

As one of these critics, Hartmann (2010, p. 237) argues that "a certain exceptionalism is at work" in much orthodox climate conflict research, in which "it is commonly assumed that scarcity can lead to institutional and technological innovation in more affluent countries, [while] just the opposite is assumed for poor people in less affluent countries." In this research narrative, according to Hartmann, scarcity renders people in poorer nations "into victims/villains, incapable of innovation or livelihood diversification and naturally prone to violence" (ibid.). Contrary to the orthodox climate violence narrative, Raleigh and her colleagues (2014, p. 77) write that the reality is typically quite the opposite. "People in poor countries do not respond to bad weather by attacking each other," they contend. Rather, "on the ground in developing countries, climate change and ecological stress is treated as a problem to be solved, not a harbinger of apocalyptic violence" (ibid.). To these critics, this "research programme reflects and reproduces an ensemble of Northern stereotypes, ideologies and policy agendas" (Selby, 2014, p. 830).

Livingstone (2015) finds that such notions are not new. He looked back to the historical origins of today's orthodox climate violence research and found that there are very old Northern ideas that people in more southerly latitudes are more predisposed to violence. This discourse, of course, is rooted in histories of racism and colonialism. And it was a very useful discourse indeed to colonial authorities who had to legitimate their undemocratic rule of foreign lands (Verhoeven, 2014). Similarly, according to critics, orthodox climate violence research is ideologically useful today because it tends to gloss over or hide how histories of colonialism, along with the operation of the contemporary global political economy, have created tremendous global inequalities and made some people much more vulnerable to the impacts of climate change. According to Verhoeven (2011, p. 685), orthodox climate violence research:

> Essentially absolves political actors from their responsibility in creating and sustaining the conditions that make people vulnerable to crises. It ignores the fact that a drought might push communities over the edge, but isn't a real cause … it only triggers the final stage of a complex, drawn-out process of violent marginalization that benefits local, national and/or global elites.

In consequence, orthodox climate violence research depoliticizes global inequalities and their resulting climate vulnerabilities, making the potential violence of actors in the global South seem "natural" (Raleigh et al., 2014; Selby, 2014; Verhoeven, 2014).

But, according to critics, the orthodox climate violence narrative has other ideological implications. Hartmann (2014, p. 775), for instance, worries that the "depiction of Africa as a continent under severe demographic, climate and security stresses helps to legitimise the intensification of monitoring and surveillance by the US intelligence community." Hartmann also warns that the discourse could be used as a means to further militarize United States foreign aid. Moreover, the prospect of ever-unfolding disasters and climate strife in the global South could be used as a rationale among more powerful nations in the global North to continue, or even increase, their high rates of spending on military equipment, rather than spending more money on climate mitigation to actually get at the root of the problem (Bonds, 2015).

Taken as a whole, then, while orthodox climate violence research is a growing area of study that has attracted a great deal of public attention, it has also been greeted by a growing number of critics who claim that it is beset by methodological, epistemological, and political/ethical problems. Beyond outlining these criticisms, the goal of this essay is to add one more concern: while orthodox climate violence research focuses on the *potential* violence of those in the global South whose lives will be most harmed by climate change, it overlooks the potentially climate-related violence of the powerful. If a speedy transition to a less carbon-intensive economy could slow rates of global warming, which would have the ultimate effect of saving lives and reducing the extent of climatic displacement, are deliberate efforts to prevent or slow this transition a kind of violence? Maintaining our current rates of emissions, after all, threatens human communities across the world. While orthodox climate violence research does not ask such questions, a climate justice perspective, drawing on the concept of structural violence, insists that we should.

The structural violence of climate change

Martin Luther King Jr. stated in a sermon he delivered in 1956 that "peace is not merely the absence of some negative force—war, tension, confusion, but it is the presence of some positive force—justice" (King, 1956). Both before and since King made this eloquent statement, philosophers and social activists have critiqued narrow conceptualizations of peace as the lack of armed hostilities and active fighting. Narrow definitions of peace, after all, overlook other more prevalent causes of death and suffering in the world. Johan Galtung (1969) brought this critique into the social sciences in a now classic essay in which he introduced the concept of "structural violence," which he defined as the existence of suffering and death in the world that might otherwise be prevented. Structural violence, he argues, is caused when "resources are unevenly distributed, as when income distributions are heavily skewed, literacy/education unevenly distributed,

medical services existent in some districts and for some groups only, and so on'' (Galtung, 1969, p. 171). As Soron (2007) further explains, it is ''the normal, unexceptional, anonymous, and often unscrutinized violence woven into the routine workings of prevailing power structures.''

While death is inevitable and suffering for all people who live long enough is unavoidable, Galtung (1969, p. 168) focuses on preventable deaths and degrees of suffering as manifestations of structural inequalities, writing that, for instance, ''if a person died from tuberculosis in the eighteenth century it would be hard to conceive of this as violence since it might have been quite unavoidable, but if he dies from it today, despite all the medical resources in the world, then violence is present according to our definition.'' Anthropologist and medical doctor Paul Farmer has put the concept to good use to study the tuberculosis and HIV/AIDS epidemics that needlessly kill millions of persons every year. Farmer's (2003, 2004) own focus is on Haiti, and the ways that its historical domination within the global political economy and its own internal inequalities—based on divisions of race, class, and gender—create a society that is ravaged by these diseases, which could be largely averted or at least made much less severe.

Both Galtung and Farmer insist that social scientists are introducing an important kind of bias in their research by focusing only on forms of violence that are intentionally and directly carried out. Certainly direct forms of violence are more immediately visible. Warfare, with its bombs and explosions and all the terrible wounds it creates, is often spectacular. It embodies a certain kind of drama that often draws and holds our attention (Galtung, 1969). Even so, both theorists warn that narrowly focusing on dramatic forms of direct violence will let the biggest killers in contemporary global society go free, and mostly unnoticed.

Typically, orthodox climate conflict research measures violence in terms of the numbers of persons killed in hostilities. There is no doubt that such killings are troubling, and any connection between climate change and the onset of violent clashes in the global South should be studied. But the almost exclusive focus on this potential connection in regard to climate-related violence is also disconcerting. After all, can we say that, if global warming continues unabated, the increasing numbers of children who will die from waterborne diseases is somehow peaceful, even if it does not trigger armed combat? Can we say that the millions of persons who will be forced to leave their homes and homelands due to rising ocean levels are going in peace, even if their migrations do not lead to war? And what about the growing rates of people expected to be killed or displaced by the increasing numbers of severe tropical storms? While they might suffer silently without raising arms, is this peace? Clearly not. But current

research on climate-related violence is unmindful of the likelihood of such suffering and death. It misses the mark by failing to acknowledge that climate change is itself violent (Solnit, 2014).

Dennis Soron (2007), for one, has advocated for the study of the structural violence of climate change. Such violence is not committed with malice and intent. And its impacts will not be felt immediately, but only over the decades to come. The World Health Organization, for instance, predicts that 250,000 excess deaths per year will be indirectly caused by climate change between the years 2030 and 2050 (through, for example, increased childhood malnutrition, heat waves, and the spread of tropical diseases) (Hales et al., 2014). Obviously, these deaths will pale in comparison to those that will be linked to climate change beyond 2050 if current rates of warming continue. And, needless to say, the bulk of these deaths will be experienced in the global South, among groups who contributed least to global warming but are also most vulnerable to its effects (Parr, 2014; Roberts & Parks, 2006).

To Soron (2007), the structural violence of climate change is created by the normal operation of global capitalism, in which corporate profits and economic growth have been prioritized over environmental well-being and justice (see also Klein, 2014; Lynch et al., 2013; Parr, 2014). For this reason, Soron (2007) argues:

> Responding effectively to the structural violence of climate change will require a correspondingly *structural* program of social change, oriented not simply towards technological fixes, but towards achieving a greater degree of democratic control over economic life, refitting the scale of production and consumption to respect environmental limits.

There is a large body of work within both environmental sociology and green criminology that supports Soron's approach: the inequalities necessarily part of capitalism and its emphasis upon economic growth regardless of environmental consequences mean that it is an unsustainable system that is imperiling whole ecosystems and entire human communities (see Foster, 2002; Gould et al., 2008; Lynch et al., 2013; Stretesky et al., 2013). At the same time, the climate crisis requires immediate action, and meaningful carbon reductions could technically be possible even within the social organization of capitalism (Parenti, 2013). For this reason, it is important to look for potential opportunities to intervene within this system to push it toward less carbon dependency.

Downey and Strife (2010) provide some important insights on how this goal might be achieved. While capitalism as a whole is unsustainable, they also explain that certain groups and institutions benefit disproportionately from environmentally degrading behaviors (e.g., resource extraction, the production of toxic pollution and carbon emissions). Downey and Strife therefore argue that social scientists should study how these groups and institutions organize

themselves within capitalism to protect and promote their ability to profit from environmental degradation. Following their lead, I apply the concept of structural violence to large publicly traded corporations in the next section. While I acknowledge that capitalism itself produces structural violence through climate change and other environmental harms, I also make the case that these large corporations disproportionately benefit from, and are disproportionately responsible for, our contemporary inability to achieve more significant carbon reductions.

Structural violence and fossil fuel corporations

Social sustainability science is typically the result of cross-pollination between environmental justice movements and academics, as each group draws upon and elaborates ideas and strategies used by the other (Martinez-Alier et al., 2014). Climate justice activists, earth scientists, and, most unexpectedly, financial analysts have similarly co-developed a shared way of understanding the perilous nature of our climate's future and the difficulties humanity faces in achieving a political solution to the crisis of climate change. Central here are the carbon reserves held by the world's largest fossil fuel companies, along with the political power that they wield.

In 2009, Malte Meinshausen and his colleagues published an article in the prestigious journal *Nature* that attempted to calculate a "carbon budget" based upon the international consensus that global atmospheric temperatures should be kept below 2 degrees Celsius of warming. While, the authors noted, this is not a "safe" level of warming because it will still create profound impacts on ecosystems and human communities, it nonetheless had "gained increasing prominence in science and policy circles as a goal to prevent dangerous climate change" (Meinshausen et al., 2009, p. 1159). Based on extensive climate modeling, the authors determined that human societies have only a limited ceiling on the gigatons of carbon that they can emit into the atmosphere without soon exceeding the 2 degrees of warming level. In fact, at current rates of emissions, these researchers determined that we are well on our way to exceed these levels within the next few decades. Most importantly, these scientists also ran models that included the potential emissions from economically viable reserves in oil, gas, and coal around the world. They found that emissions from burning these underground reserves would "vastly exceed the allowable CO_2 emission budget for staying below 2 °C" (ibid., p. 1160).

The paper gained a great deal of attention among climate scientists, but was also popularized outside academic audiences when its findings were discussed in the International Energy Agency's *World Energy Outlook 2009* report, which

summed up the findings by stating that "we are currently eating into these CO_2 budgets at a disproportionate rate" (IEA, 2009, p. 193). A main reason for the delay in bringing carbon emissions in line with the internationally agreed upon carbon budget is, according to the IEA report, capital that is sunk into carbon-intensive technologies, effectively "locking in" companies to high-carbon futures.

A group of environmentally minded financial analysts at Carbon Tracker grabbed hold of this perspective in 2011. They scoured public records to determine the size of the proven oil, gas, and coal reserves claimed by the world's largest publicly traded fossil fuel corporations. They then calculated the carbon equivalents of the reserves held by the 200 largest of these companies. The researchers found that these companies alone held five times more carbon in their reserves than could be emitted without pushing beyond the "carbon budget" that would keep warming below 2 degrees Celsius. The Carbon Tracker report concluded therefore that at least 80% of these fossil fuels are "unburnable carbon," or that they are at least unburnable if governments hope to keep warming below catastrophic levels (Leaton, 2011). As financial specialists, the analysts were therefore concerned that contemporary financial markets have a "carbon bubble" because they accord value to energy companies based on reported fossil fuel reserves that must be left in the ground, rendering them valueless or at least worth far less than that which the market currently accords them.

Climate leader Bill McKibben drew attention to this report, however, as a means to both understand the dynamics of our environmental crisis and to propose a citizens' movement that could push for solutions. In his widely read 2012 article in *Rolling Stone*, McKibben argued that coal, oil, and gas companies have a business model that commits them to bringing all the world's fossil fuels onto the market, which will result in the production of carbon emissions that will radically transform the climate and threaten human existence. And while these publicly traded companies already claim ownership of fossil fuel reserves that far exceed the world's carbon budget, these companies' business model also brings them into partnerships with governments—such as Saudi Arabia, Iraq, and Iran—that hold even greater reserves of fossil fuels.

To McKibben (2012), these are businesses whose activities are incompatible with life as we know it on Earth. Despite a decades-old scientific consensus on anthropogenic global warming, the world's largest fossil fuel companies are nonetheless committed to a business model of unrestrained, or only weakly restrained, fossil fuel extraction and combustion. Their profitably depends upon it. They have sunk capital into exploration and into the development of their fossil fuel reserves. And their shareholder value would plummet if they were forced to leave much of their carbon reserves underground. Consequently, they

are fighting to protect their continued ability to transform the climate, which their business model demands, in ways that will result in profound, and otherwise avoidable, human suffering. In so doing, major fossil fuel companies are disproportionately contributing to the structural violence of climate change.

According to the Intergovernmental Panel on Climate Change (IPCC, 2014), pushing beyond 2 degrees Celsius of warming creates "considerable" risk that people will die, be injured, or have their livelihoods disrupted due to increasing coastal and inland flooding. Likewise, there are considerable risks of "extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services" (ibid., p. 13). Moreover, food insecurity is predicted to increase, along with death and sickness from increasing periods of extreme heat. While such impacts will happen even by keeping within the 2 degrees Celsius threshold, they will become more extensive as the atmosphere is warmed beyond this level. To put this more bluntly, the lives of hundreds of millions of people—in some cases whole societies—will be impacted.

Despite these consequences, major fossil fuel companies are fighting hard to preserve their business model, and have exerted considerable political influence to defeat or weaken efforts to limit carbon emissions around the world. Within the United States alone, oil, gas, and coal mining companies spent more than US$141 million on lobbying to influence Congress and federal agencies in 2014, which works out to more than US$386,000 per day, according to the Center for Responsive Politics (2016). This figure does not include the federal lobbying of electricity utilities, which in the United States have also vigorously opposed carbon emission limits. This figure also leaves out the vast amounts of money these companies have paid to promote oil, gas, and coal extraction at the state level of government.

Beyond lobbying to fight carbon emissions, large oil, gas, and coal companies are major campaign contributors to United States elections. The Center for Responsive Politics estimates that these companies gave close to US$74 million to bankroll the campaigns of political candidates in the 2014 election. Clearly, large fossil fuel companies give contributions for a number of reasons. An empirical investigation by Long et al. (2012) for instance finds that coal companies increase political donations to weaken or avoid enforcement of environmental laws. It also stands to reason that they spend large sums to decrease political support for climate change legislation. This would certainly go a long way to help explain the United States Congress's recalcitrance on the issue, despite public support for steeper emissions reductions.

Importantly, lobbying and campaign finance also help secure tens of billions of dollars in subsidies every year for major fossil fuel companies. To be exact, governments around the world spent a total of US$88 billion to subsidize exploration for new oil, gas, and coal reserves in 2013 (Bast et al., 2014). But this is only a portion of the total amount of capital that fossil fuel companies invest to search out new reserves. In 2012 alone, the world's largest 200 fossil fuel companies spent US$674 billion to hunt for new sources of oil, gas, and coal (Carbon Tracker, 2013). In other words, even as the largest fossil fuel companies in the world possess more than enough carbon underground to push atmospheric temperatures far beyond 2 degrees Celsius—which will result in death, displacement, and suffering—they are making huge investments to find yet more reserves.

In addition to lobbying and providing campaign contributions to help defeat or weaken climate change legislation, fossil fuel companies and their individual owners/shareholders have played a major role in funding think tank–driven climate change denialism. In the United States, think tanks have mounted years-long campaigns to convince the public that the science on global warming is unsettled or wrong (Freudenburg et al., 2008; Jacques et al., 2008; McCright & Dunlap, 2000). Elite-drive climate denialists further argue that, even if the science is correct, efforts to reduce carbon emissions would do more harm than good in terms of economic well-being (McCright & Dunlap, 2000). Climate change denialism has had the effect of "institutionalizing delay" on climate change mitigation by effectively polarizing the issue of climate change and by giving elected officials the political cover they need to vote against emission-reduction legislation (Brulle, 2014; McCright & Dunlap, 2011).

In summary then, major oil, gas, and coal corporations have played, and continue to play, a critical role in the unfolding crisis of climate change by both extracting and selling the fossil fuels that are driving global warming, but also by successfully working to defeat or water down public efforts to reduce fossil fuel dependency. Because this behavior will contribute to the deaths, displacement, and untold suffering climate change will ultimately cause, it can be seen as a form of structural violence. Of course, none of this is to say that major publicly traded fossil fuel companies are the only powerful organizations responsible for the structural violence of climate change. For instance, state-owned oil, gas, and coal companies—such as Saudi Aramco and major Chinese-controlled coal enterprises—and the governments of wealthy nations that are leading producers of fossil fuels—like Saudi Arabia, Canada, the United States, and Australia—play a role in contributing to climate violence as well (see for instance Mulvaney et al., 2015).

In making the link to structural violence, I also want to stress that large publicly traded fossil fuel companies are not intentionally working to cause harm and suffering. In fact, given the prevailing legal, political, and economic structure of neoliberal capitalism, it would be extremely difficult—if not impossible—for them to act otherwise. These companies' efforts to extract the fullest amount of fossil fuels that technological and market conditions will allow is economically rational, at least in the short term. If any large oil, gas, or coal company failed to do so, it would, after all, be outcompeted by other companies in cut-throat global markets. And given that it is legal to fund elections in order to influence law-making, in this case to defeat or weaken climate change legislation, it again is rational for these companies to take advantage of such opportunities. Clearly then, these companies have limited agency within the prevailing political economy. Getting different outcomes will require systemic changes. But this is a very large goal, and it is difficult to know where to begin.

One starting place is to simply point out the ways that fossil fuel companies have disproportionately benefited from a carbon-intensive capitalism, and how they have led the largely effective opposition against efforts to diminish fossil fuel dependency. The overall point is that responsibility for the structural violence of climate change is not shared evenly. Unveiling the climate violence of powerful organizations, like major fossil fuel corporations, is important in order to counter biases in orthodox climate violence research. More importantly, it might have some resonance in larger political debates.

Politics, social science, and climate violence

There is a long-standing bias in the social sciences: the violence of the poor is subjected to intense scrutiny, while the violence of the powerful often evades attention. For example, it is well known to criminologists that white-collar crime—including corporate crime—is just as costly, in terms of financial losses and losses in human lives, as the crimes of the poor, but it receives only a tiny fraction of researchers' attention (Stretesky et al., 2013). Likewise, in making a case for a new green criminology, Lynch and his co-authors (2013, p. 998) write that, "green harm and [environmental] crime are more widespread, have more victims and produce more damage than crimes that 'occur on the streets'." Even so, green crime has been largely neglected by most criminologists. And scholars of state crime similarly point out that when governments make decisions to violate international laws in the process of invading other nations, such as the United States's decision to invade Iraq in 2003, it results in the deaths of thousands of people and imposes heavy costs on public treasuries (Kramer et al., 2005). But again, for the most part state crime goes relatively understudied compared to the violence of the poor (see Rothe, 2009).

These kinds of biases mean that the social sciences often misread the world. Conversely, focusing greater attention on the violence of the powerful would produce a social science that is more reflective of the most prevalent forms of harm in contemporary society. But more importantly, white-collar criminologists, state-crime criminologists, and green criminologists also point out that the biases of orthodox criminology have ideological implications: by focusing only on the poor, the harm caused by the very powerful goes mostly unnoticed, and is therefore more easily reproduced. These radical criminologists are, in other words, trying to flip the script in traditional social science to work for a more sustainable and peaceful future (Lynch et al., 2013).

Similarly, I have argued for the need to upend climate violence research. While orthodox climate conflict researchers have produced a high-profile literature that links climate change with increased violence in the global South, there is also a growing body of work that challenges such claims. Critics have conducted their own empirical tests, casting doubt on any strong climate change/conflict relationship. Critics also argue that orthodox climate violence researchers rely on a long-discredited environmental determinism, which largely reproduces colonial stereotypes about the ways that warmer climates supposedly influence behavior. According to critics, this research perspective is also ideological in its effect, as it "naturalizes" conflict in the global South while giving governments in the global North new justifications for militarism and foreign surveillance. I add to these criticisms by arguing that traditional climate violence research unduly focuses on the potential violence of the poor (those most vulnerable to global warming impacts) while ignoring the violence of powerful organizations that disproportionately benefit from, and have disproportionately sought to preserve, a carbon-dependent economy.

The world's largest publicly traded fossil fuel companies have more than enough carbon reserves to push the climate into extremely dangerous levels of warming. These companies nonetheless remain committed to extracting their reserves, and are influencing public policy in order to protect their ability to do so. While fossil fuel companies are spending large amounts of money to influence politics, they are spending even larger sums on exploration in order to find yet more carbon reserves to add to those they already hold.

Ultimately, the consequences of this situation will be felt through rising sea levels, increasingly severe storms, heat waves, and droughts, all of which will harm people and cause suffering. As such, it constitutes a kind of violence, albeit one that is not caused by malevolence, nor with intent. It is instead an unintended violence that will be increasingly felt over generations to come. Any sense of proportion insists that attention to the potential climate violence of the poor should not overshadow the preventable harm created through climate change itself. But attending to the structural violence of climate

change is not purely a scholarly issue, and naming those organizations most responsible for global warming could help advance political campaigns to reduce carbon emissions.

A carbon divestment movement is mobilizing based on both awareness of the limited nature of the world's remaining "carbon budget" and awareness that publicly traded fossil fuel companies hold enough carbon reserves to far surpass this threshold and push Earth's climate into uncharted territory. Members of this movement are working to encourage their city governments, churches, and universities to pull their investments from the world's largest fossil fuel companies, and they have had some notable successes so far (see Divestment Commitments, 2015). Members of this movement understand full well that their strategy will not bankrupt these very large and very profitable corporations. Their strategy instead is to tarnish the public image of fossil fuel companies, and by so doing diminish their political power. If these companies are successfully stigmatized, so the hope goes, they may not have the same capacity to successfully push back on carbon emission limits and other needed environmental reforms. The strategy is imperfect, but many important environmental thinkers today argue that it is the best hope we have of creating the climate justice movement necessary to achieve a less disastrous environmental future. Naming the climate violence produced by these companies for what it is might further this cause, and might be one small contribution from the social sciences to the divestment movement.

The larger point is that, while the structural violence of global warming might be felt through changes in the weather, it is not like the weather itself, in the sense that it is outside human control. Researchers studying the potential climate-related violence of the poor often presume that, because a certain amount of climate change is "locked in" due to the carbon emissions already in the atmosphere, increasing conflict is inevitable. But this does not need to be the case. Governments and publics can respond to changing atmospheric conditions in numerous ways, some of which are more or less just, some of which are more or less likely to further enflame tensions in potential conflict zones. But just as importantly, governments and publics can put an end to the structural violence of climate change by moving to aggressively cut carbon emissions and by making the monumental investments in a green infrastructure necessary to achieve a less carbon-intensive economy. Naming the violence of climate change as such might be helpful in this difficult work ahead.

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The Biohistorical Paradigm: The Early Days of Human Ecology at The Australian National University[1]

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Human ecology at The Australian National University (ANU) goes back to 1965 when a small group came into existence that was initially known as the Biology and Human Affairs Group. It was concerned with the constant interplay between human society and the processes of life that underpin our existence. This interplay is of immense consequence for us all.

It was not long before the Biology and Human Affairs Group became known as the Human Ecology Group.

In 1971, the Human Ecology Group came up with the proposal to carry out a study of the ecology of the city of Hong Kong. This idea was canvassed around the university, and initially met with either stony silence or open ridicule. Just about everybody thought it was a crazy idea. Everybody, that is, except Frank Fenner, who was director of the John Curtin School of Medical Research at the time. He made crucial funding available that made it all possible. Later, further substantial financial support was provided by other sources, including the Nuffield Foundation and UNESCO (United Nations Educational, Scientific and Cultural Organization).

Eventually, the Hong Kong Human Ecology Program became a cooperative effort between the ANU group and CSIRO,[3] the University of Hong Kong, the Chinese University of Hong Kong, and the Hong Kong Government. It was eventually adopted by UNESCO as the first project in the urban settlements section of the Man and the Biosphere Program.

1 The concepts discussed in this essay have been further developed in Dyball and Newell (2015) and Boyden (in press).

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3 Commonwealth Scientific and Industrial Research Organisation, Australia's national science agency.

The Hong Kong study involved describing:

1. important aspects of the metabolism of Hong Kong, with special emphasis on flows of energy, carbon, water, and phosphorus in the system
2. the environments and conditions of life of different sections of the human population (e.g., housing, commuting and working patterns, population density, noise levels, diet)
3. patterns of health and disease in the human population.

The findings were published in numerous scientific papers and in a book titled *The Ecology of a City and Its People: The Case of Hong Kong* (Boyden et al., 1981).

The Hong Kong project was followed by a study, on a smaller scale, of the human ecology of the city of Lae and its hinterland in Papua New Guinea. This project was directed by Ken Newcombe.

This was all taking place in the ANU Institute of Advanced Studies, which was not involved with undergraduate education. However, in 1972, the Human Ecology Group proposed that an undergraduate program be introduced at ANU which would offer a series of integrative transdisciplinary courses on the human condition. Human ecology was to be a major component of this program. There was an interesting and amazingly vehement opposition to this idea from some quarters in the university. The proposed courses were simply not recognized as subjects worthy of academic pursuit.

However, approval for the program was eventually forthcoming. It was known as the Human Sciences Program and it lasted some 25 years, due to the efforts of people like Val Brown, Ian Hughes, David Dumaresq, and Rob Dyball. After that time its courses were largely taken over by the Fenner School of Environment and Society.

Something needs to be said about our theoretical approach. When I say "our," I am referring to a band of some 25 to 30 enthusiastic individuals who made up the Human Ecology Group in the John Curtin School, and later in the Centre for Resource and Environmental Studies, over the 25 years from 1965—too many to mention by name.

We refer to our conceptual approach as "biohistory," which we define as the study of human situations against the background of the story of life on Earth. Biohistory is, of course, a big subject. Here I will confine my comments to five themes that have been of special interest to us. I will discuss them under the following headings:

- Conceptual approach
- Cultural maladaptation and reform
- Watersheds in biological and cultural evolution
- Biometabolism and technometabolism
- Evolution and human health
- Hope for the future.

Conceptual approach

Biohistory takes, as its starting point, the history of life on Earth.

In the beginning there was no life. Only the physical world existed—called the "Physical environment" in Figure 1. Then, perhaps around 4.5 billion years ago, the first living organisms came into being.

Eventually, over many hundreds of millions of years there evolved an amazing array of different life forms. Among these, emerging some 200,000 years ago, was *Homo sapiens*. Because of this animal's special relevance to our studies, it is separated from other living organisms in our conceptual scheme ("Human species" in Figure 1).

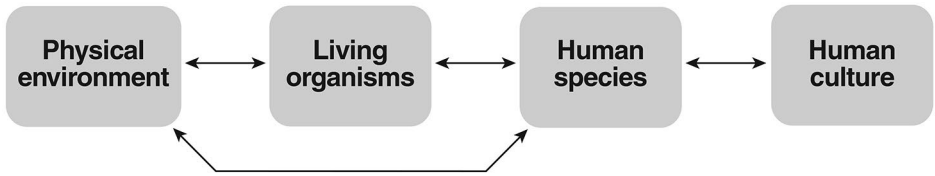

Figure 1. Conceptual starting point
Source: Stephen Boyden

Through the processes of biological evolution, humans had acquired a distinctive and extraordinarily significant biological attribute—the ability to invent and learn a symbolic spoken language, and to use it for communicating among themselves.

This aptitude for language led to the accumulation of shared knowledge, beliefs, and attitudes in human groups. That is, it led to human culture.[4]

Humans are also adept at inventing and applying new technologies, and knowledge of these technologies is a crucial component of culture.

4 The word culture is used here to mean the world view and accumulated knowledge, assumptions, beliefs, priorities, and values of a human population. It includes knowledge of language and technologies.

As soon as human culture came into existence it began, through its influence on people's behavior, to have impacts not only on humans themselves but also on other living systems. It evolved as a new kind of force in the biosphere, destined eventually to bring about profound and far-reaching changes across the whole planet.

For the purposes of this discussion, it is useful to complicate the scheme a little. Because we are especially interested in the impacts on humankind and on the environment of what people actually do, it is useful to split humans into human population and human activities (Figure 2).

Human culture is also divided into two parts.

The first part is culture itself, which is the information stored in human brains and transmitted through language. The focus in our work has often been on the dominant culture of a society—that is, the culture that largely determines the patterns of human activity in that society.

The second part is designated societal arrangements, which includes society's economic, regulatory, political, and educational arrangements, and its institutional structure. Societal arrangements are largely determined by, and to some extent determine, the characteristics of the dominant culture.

In Figure 2 we have added another set of variables—namely artefacts, by which we mean "things made by humans," including buildings, roads, all kinds of machines and electronic devices, as well as clothes, utensils, and works of art.

Although this conceptual framework is based on the sequence of happenings in the history of life on Earth, it can also be applied to the here and now. The same sets of variables are involved. Located at the base of the model are the physical environment and living organisms—underpinning and supporting the human population, which in turn creates and maintains human culture.

We have found this conceptual framework useful for thinking and communicating about the human place in nature.

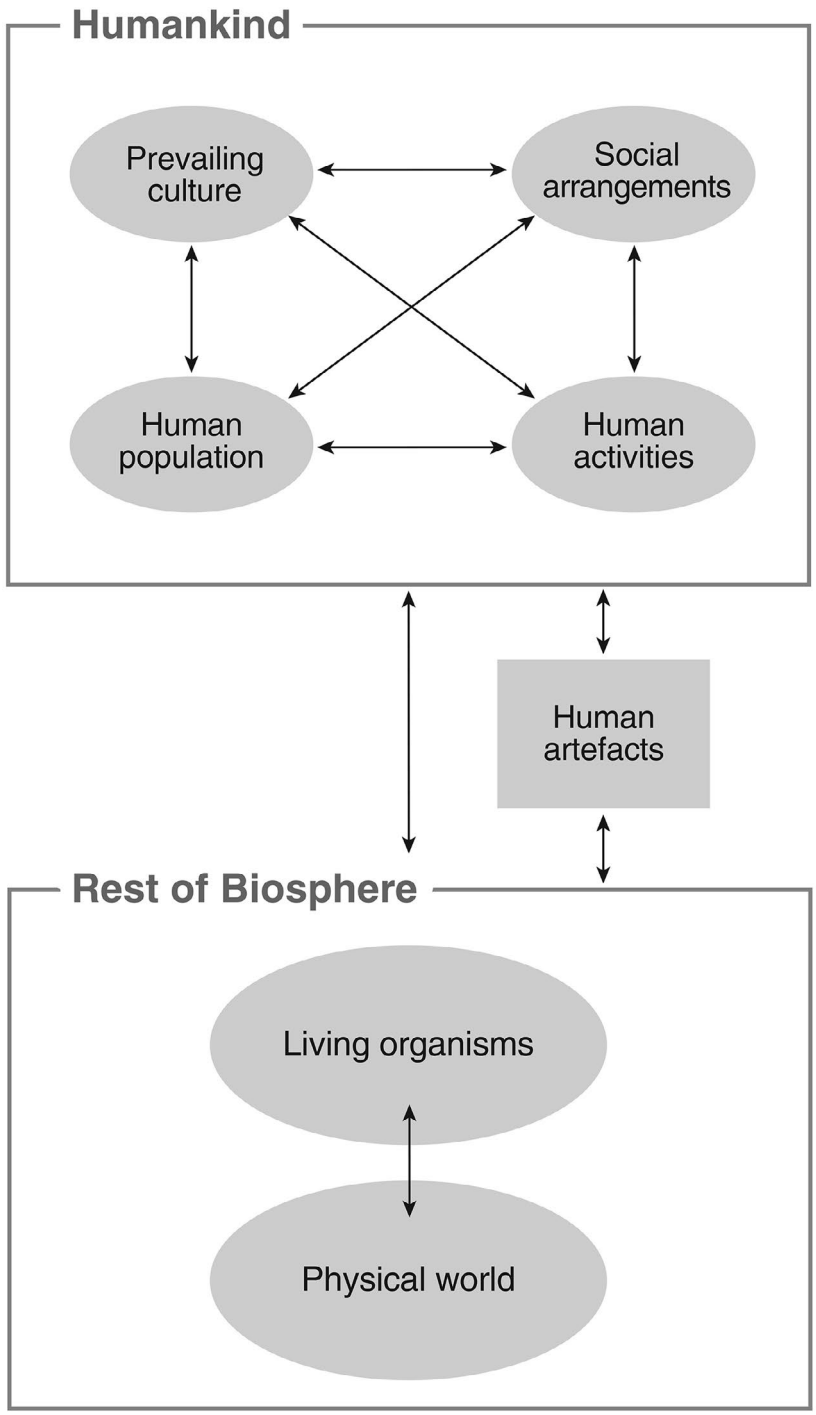

Figure 2. Conceptual framework
Source: Stephen Boyden

I would like to emphasize three points:

1. Including the cultural dimension in this framework is critically important. Cultural factors are of vital importance as powerful forces in the living systems of our planet today. It is unscientific to ignore them simply because they are difficult to quantify—or because culture is the domain of the humanities. To do so can only lead to an incomplete and therefore misleading picture.
2. The historical perspective is crucially important for understanding the human ecological situation today.
3. The study of the interplay between human culture and living systems brings to mind fundamental principles that are important for the understanding of human situations and problems in the modern world. Some of these principles will be discussed below.

Cultural maladaptation and reform

Cultural maladaptation

The rapidity of the evolutionary development of the capacity for culture indicates that, once a rudimentary ability to invent and use symbolic spoken language emerged, it was at once of major biological advantage under the prevailing conditions.

In my view, its chief advantage lay in its role in the exchange and storage of useful information about the environment. This information was not only communicated within the group, but was also passed on to members of subsequent generations, increasing the likelihood of their good health and successful reproduction.[5]

Apart from its practical advantages, culture adds richness to human experience. It did so in the days of our hunter–gatherer ancestors—as in storytelling, musical traditions, dancing, and other forms of artistic expression. And it does so today in so many ways. It makes a huge contribution to the sheer enjoyment of life.

However, especially under conditions of civilization, cultural evolution has often resulted in activities that have caused a great deal of unnecessary distress to humans or damage to ecosystems. Such undesirable culturally inspired activities are referred to as cultural maladaptations.

5 The fact that the capacity for culture was of biological advantage during the tens of thousands of generations of our species before the advent of agriculture does not mean, of course, that it will necessarily be an advantage under conditions quite different from those of the evolutionary habitat.

A particularly tragic example of cultural maladaptation was the ancient Chinese custom of foot-binding, which prevented the normal growth of the feet of young girls and caused them excruciating pain. This extraordinary practice well illustrates the propensity of culture to influence people's mind-sets in ways that result in activities that are not only nonsensical in the extreme, but also sometimes very cruel and destructive and contrary to nature. This particular cultural maladaptation was mutely accepted by the mass of the Chinese population for 40 or more generations.

Throughout the history of civilization, different cultures, including our own, have come up with a fascinating range of delusions about how social well-being, or prosperity, can best be achieved, and some of these delusions have led to blatant examples of cultural maladaptation. Here I will mention only one instance.

According to the dominant culture of the Mayan civilization, prosperity could best be achieved by pleasing the gods, and the best way to please the gods was to torture, mutilate, and then sacrifice human beings. This behavior can be regarded as a cultural maladaptation because it caused a great deal of unnecessary human suffering.

Again, the point to be emphasized is the fact that while there may well have been a handful of skeptics among the Mayans, the great majority of them really believed that the torture and sacrifice of humans was an entirely appropriate behavior.

Cultural gullibility is indeed a fundamental characteristic of our species.

Biohistory thus alerts us to the need for us to be constantly vigilant—checking that the assumptions of our society's dominant culture are in tune with the processes of life—and that they are not leading us to behave in ways that are against nature or causing unnecessary human distress.

Cultural reform

Our species shares with all other animals a series of adaptive mechanisms, which include genetic adaptation through natural selection (adaptation of populations over many generations), many kinds of physiological adaptation, and adaptation through learning.

Humans, however, have an extra string to their bow—namely cultural adaptation, which is defined as adaptation through cultural processes.

In the present context we are especially interested in cultural adaptation aimed at overcoming the undesirable consequences of culture itself—that is, adaptation to cultural maladaptations. We refer to this as cultural reform.

The processes of cultural reform are often quite complicated, involving prolonged interactions between different interest groups in society. A key role is often played initially by minority groups, occasionally by single individuals, who start the ball rolling by drawing attention to an unsatisfactory state of affairs. We can refer to these people as first-order reformers. A prime example of a first-order reformer is Rachel Carson who, in her ground-breaking book *Silent Spring*, drew attention to the insidious and destructive ecological impacts of certain synthetic pesticides (Carson, 1962).

Almost invariably, the expressions of concern coming from first-order reformers are promptly contradicted by others, the counter-reformers. This backlash often involves representatives of vested interests who fear that the proposed reforms will be to their disadvantage. They are likely to argue that the problem does not exist or that it has been grossly exaggerated, and they try to ridicule the reformers by calling them alarmists, fanatics, scaremongers, and prophets of doom. It is noteworthy that there is often a smattering of scientists among the counter-reformers (Oreskes & Conway, 2010). Nowadays some of these counter-reform forces are extraordinarily powerful.

The first-order reformers are, in time, joined by second-order reformers who also take up the cause. Eventually, if they are successful, a change comes about in the dominant culture and members of government bureaucracies and other organizations set about working out ways and means to achieve the necessary changes. Their efforts may still be hindered to some extent by the stalling tactics of counter-reformers.

A well-documented instance of cultural reform from the past is the Public Health Movement of the later part of the nineteenth century (Flinn, 1965; Frazer, 1950). Other more recent examples include the anti-smoking campaign and the current debates about climate change. In the latter case, the counter-reformers are often referred to as climate change deniers.

Watersheds in biological and cultural evolution

It is well recognized that biological evolution has been marked by a series of highly significant watersheds—after each of which a new situation emerged and nothing was ever the same again.

Especially important among these watersheds were the development of photosynthesis, the appearance of cells with nuclei, the advent of multicellularity, and the invasion of land by life forms.

The most recent all-important watershed in biological evolution was the evolutionary emergence of the human capacity for language and culture. As discussed above, human culture eventually developed into a new and extremely powerful force in the biosphere, with far-reaching ecological consequences.

Cultural evolution, like biological evolution, has been marked by a series of watersheds, each of which ushered in a new ecological phase of human existence.[6]

The first of these cultural watersheds was the shared knowledge of how to make use of and, up to a point, control fire. The deliberate and regular use of fire was an important feature of Ecological Phase 1 of human history, the Hunter–Gatherer Phase (Figure 3). This phase lasted for some 200,000 years. During this time *Homo sapiens* spread from Africa, and by 11,000 years ago, possibly much earlier, our species had reached all five habitable continents.

Cultural watershed and approximate starting date	Followed by
Use and control of fire 200,000 years before present?	Ecological Phase 1 Hunter–Gatherer Phase
Farming 12,000 years before present	Ecological Phase 2 Early Farming Phase
Urbanization 8,000 years before present	Ecological Phase 3 Early Urban Phase
"Enlightenment" and Industrial Revolution 250 years before present	Ecological Phase 4 Exponential Phase or Anthropocene Unsustainable ecologically, leading to the collapse of civilization, with great loss of life—**unless** humankind moves to Ecological Phase 5.
Biorenaissance	Ecological Phase 5 Biosensitive Phase Based on understanding the human place in nature. In tune with, sensitive to, and respectful of the processes of life.

Figure 3. Watersheds in cultural evolution

Source: Stephen Boyden

6 The emphasis here is in ecologically significant watersheds. There were also cultural watersheds affecting other aspects of human society. For example, in the sphere of the communication and storage of information, the introduction of writing and recently of information technology were hugely significant watersheds.

The second crucial watershed was the advent of farming. It led to Ecological Phase 2, the Early Farming Phase, which began around 480 generations ago. This was indeed a turning point in cultural evolution. Without it, the spectacular developments in human history since that time would not have been possible.

The third crucial watershed in cultural evolution was the advent of urbanization—beginning around 300 generations ago, but really getting under way about 250 generations ago when fully fledged cities with populations of tens of thousands were in existence in Mesopotamia. And there were cities with populations of a few thousand in Peru at this time. This was the beginning of Ecological Phase 3—the Early Urban Phase. For the first time in human history, very large numbers of people were separated from the natural environment and played no role in the acquisition of food, and urban cultures evolved that regarded the natural world as alien and threatening.

The ecology of these urban dwellers was very different from that of hunter–gatherers or early farmers.

The fourth cultural watershed consisted of the philosophical movement referred to, misguidedly, as the Enlightenment, and the subsequent Industrial Revolution. We say misguidedly because a more appropriate term would be Partial Enlightenment. Its great weakness lay in its association with the idea that nature is out there to be conquered.

This fourth cultural watershed led to Ecological Phase 4, the Exponential Phase. This phase has also been dubbed 'the Anthropocene' (Crutzen & Stoermer, 2000).

Ecological Phase 4 has been characterized by huge changes in the ecological relationships between human populations and the rest of the living world. There are now about 1,500 times as many people alive as there were when farming began. Seventy-five percent of this increase has occurred over the past 80 years.

Not only are there 1,500 times as many humans in existence, but these people are using vastly more resources and energy per capita. The human species as a whole is now using about 20,000 times as much energy per day as was the case when farming began. This is equivalent to the difference in weight between a small apple and a couple of tonnes of bricks. And well over 90% of this increase has occurred over the past 80 years.

The human population is now responsible for the emission of about 10,000 times as much carbon dioxide every day as was the case when farming began (Figure 4). Again, 90% of this increase has occurred over the past 80 years.

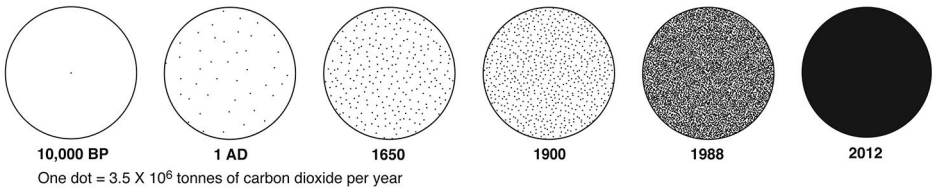

Figure 4. Carbon dioxide production by the human species

Source: Calculations by the author.

We don't have to be ecologists to appreciate that the living systems of our planet that support humankind will not be able to tolerate this onslaught forever. At present, anthropogenic climate change is the most critical result of cultural maladaptation. It may well be that the average temperature across the planet will be 4 degrees Celsius above the preindustrial level by the end of this century, with devastating consequences for humanity. But there are many other serious ecological threats to sustainability (Box 1).

Box 1. Some recent consequences of cultural maladaptation

- A steady and continuing increase in the atmospheric concentration of the greenhouse gas carbon dioxide, from the pre-industrial level of 280 parts per million by volume to 392 parts per million in 2011. There is strong evidence that this change is leading to increases in temperatures across the globe and other climatic changes.
- Destruction of 80% of the world's original forests. At present trees are felled in the Amazonian forests at the rate of 2,000 a minute.
- Severe land degradation (e.g., loss of organic matter, soil erosion, salinization).
- Worldwide loss of biodiversity—on land and in the oceans.
- Major interference with the natural nutrient cycles on which life depends.
- Persistent organic pollutants, which are synthetic compounds used as pesticides and for other purposes, now found in the tissues of humans and other animals all over the world, including oceanic species. They can cause ill health or death and they interfere with reproductive processes.
- Acidification of the oceans resulting from the uptake of anthropogenic carbon dioxide from the atmosphere.
- Thousands of weapons of mass destruction stored in the arsenals of the world—many times more than necessary to bring an end to the human species.
- Extreme disparities in health and material wealth among human populations (not the case for the first 190,000 years of our species).

Humans are overstepping the mark in a big way. If present trends continue unabated the collapse of civilization is inevitable. The days of Ecological Phase 4 are numbered.

The most disturbing feature of the present situation is the fact that the dominant cultures of the world today are blissfully unaware of these ecological realities. They have lost sight of our total dependence on the processes of life in and around us, and they have no grasp of the nature, magnitude, and seriousness of current human impacts on the ecosystems of our planet. The world views, assumptions, and priorities of these cultures are totally incompatible with the achievement of ecological sustainability, and hence the survival of civilization.

Biometabolism and technometabolism

An important theme in biohistory is the changing patterns of metabolism of human populations.

Every population of living organisms takes up nutrients and energy from its environment, makes use of them in the processes of life and then discharges wastes and gives off the energy in the form of heat.

In the case of the human species, cultural evolution has led to an extra dimension to population metabolism. In addition to a population's biometabolism, which consists of the inputs, throughputs, and outputs of energy and materials involved in physiological processes within human bodies, there is also a significant technometabolism. This consists of the inputs, uses, and outputs of energy and materials involved in technological processes taking place outside human bodies. Technometabolism is a new phenomenon in the history of life on Earth and is of tremendous ecological significance.

Already in the Hunter–Gatherer Phase of human existence, technometabolism became important through the regular use of fire. This resulted in significant changes in the life conditions of humans by providing them with warmth and leading to the consumption of cooked foods. In some regions, the use of fire by hunter–gatherers sometimes resulted in important ecological changes in the local environment, leading to the replacement of large areas of woodland with grassland and resulting in big increases in the size of herds of grazing animals, and consequently in the supply of animal protein for humans. Fires resulting from human activities had a major impact on vegetation in parts of Australia long before the European invasion of the continent (Jones, 1969).

In Ecological Phase 4, industrialization has led to a massive increase in the intensity of the technometabolism of human populations. The most evident manifestation of this at present is anthropogenic climate change—but there are many others.

Technometabolic inputs

Energy use is an important measure for a number of reasons. First, the rate of use of energy is probably the best single indicator of the overall intensity of human activity on the planet, since everything that we do involves, or requires, a throughput of energy. However, its impact depends a great deal, of course, on the particular use to which the energy is put. It also depends on the source of the energy, since some energy sources have by-products that have biological impacts of various kinds. These impacts include carbon dioxide, oxides of sulfur and nitrogen from fossil fuels, and radioactive by-products from nuclear power plants.

The main sources of extrasomatic energy throughout the industrial phase of society have been fossil fuels, although the relative contributions of coal, oil, and natural gas have changed over the past 60 years. In some countries, nuclear power has made a significant contribution to the generation of electricity.

Hydroelectricity, unlike fossil fuels and nuclear power, does not produce undesirable by-products, and it makes a significant contribution in regions where topography allows it. Use of other clean, non-polluting energy sources, such as wind and solar power, is also on the increase; but at present they contribute only a small fraction of the total energy budget.

Other technometabolic inputs into human societies today include a vast range of materials used in construction of buildings and roads and for the manufacture of machines and utensils as well as electronic devices. To take just one example, the per capita consumption of iron in Australia today, excluding the iron in manufactured goods imported from overseas, is around 1.3 kilograms per day. In Shakespeare's time it was probably about 1 gram per day.

Technometabolic outputs

Human activities in Ecological Phase 4 have resulted in the production of massive quantities of by-products of industrial processes, many of which have very serious ecological and health consequences. They include the chlorofluorocarbons (CFCs) that result in damage to the ozone layer, and the persistent organic pollutants that have spread into ecosystems right across the globe and that can cause serious ill health in many animal species, including humans.

At present the most critical output is carbon dioxide, which comes from the use of fossil fuels and as a result of deforestation.

In 1965, Abel Wolman introduced the concept of urban metabolism and described the metabolism of a hypothetical city of one million inhabitants (Wolman, 1965). In 1975 and 1976, the Human Ecology Group at ANU and colleagues from CSIRO carried out an analysis of aspects of both biometabolism and technometabolism of Hong Kong, focusing on energy, carbon dioxide, water, and phosphorus (Newcombe et al., 1978).

In the final report of this work on Hong Kong, attention was drawn to the long-term unsustainability of the ever-increasing intensity of resource and energy use and waste production in this city (Boyden et al., 1981). This conclusion is shared by the authors of a more recent study of the metabolism of Hong Kong (Warren-Rhodes & Koenig, 2001).

Since the 1970s there has been much work on urban metabolism, all of it indicating progressive increase in the intensity of resource and energy use and waste production (Kennedy et al., 2007).

Evolution and human health

Biohistory reminds us that our species has been in existence for some 8,000 generations and that we are basically the same animal as our ancestors who lived long before the advent of farming—that is, an animal genetically adapted through natural selection to the life of the hunter–gatherer.[7] This fact has important implications for understanding ourselves and our problems.

One of the outcomes of the processes of evolution is the fact that animals become well adapted in their biological characteristics to the habitat in which they are evolving. In other words, the genetically determined characteristics of any species are such that the individual animals are likely to experience good health in their natural environment.

If an animal is removed from its natural environment, or if its environment changes significantly, then it is likely to be less well adapted to the new conditions, and consequently some signs of physiological or behavioral maladjustment can be expected. This evolutionary health principle is a fundamental law of nature (Boyden, 1973, 1987, 2004).

7 This does not mean that evolutionary change in the human species has come to a halt. There has been a relaxation of some selection pressures that were powerful in the hunter–gatherer environment and in the long term this will result in genetic changes in human populations (Rendel, 1970). There have also been some new selection pressures associated with the advent of farming that have produced changes in some populations. A well-known example of this is the emergence and spread in European populations of lactase production into adulthood in response to the availability of bovine milk as a food source. For discussion of this change and for other examples, see Cochran and Harpending (2009).

Changes in conditions of life from the natural situation that are likely to cause maladjustment have been called evodeviations. Recent evodeviations in human populations include the consumption of refined carbohydrates and the practice of cigarette smoking.

It follows from the evolutionary health principle that if we wish to identify the health needs of any particular kind of animal, the first thing to do is to examine the conditions under which it evolved, because we can be sure that these conditions are capable of providing all the essential ingredients for maintaining and promoting health in that species.

In the case of our own species, for example, there is no diet better for us than the typical diet of our hunter–gatherer ancestors; if we take much more or much less physical exercise than a typical hunter–gatherer, or if we inhale chemical fumes that were not present in the evolutionary environment, then we are likely to experience signs of maladjustment.

There are good reasons for believing that the evolutionary health principle applies not only to such physical health needs as clean air and the need for physical exercise, but also to psychosocial aspects of life conditions. For example, the lives of hunter–gatherers are usually characterized by the experience of conviviality, effective emotional support networks, incentives and opportunities for creative behavior, and a sense of personal involvement in daily activities. Most of us would agree that such conditions are likely to promote health and well-being in our own society. It is important that we take them into account in assessing the quality of life today and in considering options for the future.

Taking our knowledge of the conditions of life of hunter–gatherers as a starting point, we can put together a working list of physical and psychosocial conditions likely to promote health and well-being in our species (Box 2). They are referred to as universal health needs because they apply to all members of the human species wherever or whenever they may be living.

Box 2. Universal human health needs

Physical needs

- Clean air (not contaminated with hydrocarbons, sulfur oxides, etc.).
- A natural diet, that is, foods containing the full range of nutritional requirements, as provided by a diverse range of different plant foods and a small amount of cooked lean meat and offal; foods devoid of noxious contaminants or additives.
- Clean water (free of contamination with chemicals or pathogenic organisms).
- Electromagnetic radiation within the natural range.
- Minimal contact with parasites and pathogenic organisms.
- Natural contact with non-pathogenic microorganisms in the environment.
- Adequate protection from extremes of climate.
- Noise levels within the natural range.
- A pattern of physical exercise that involves some short periods of vigorous muscular work and longer periods of medium and varied muscular work, but also frequent periods of rest.

Psychosocial needs

- An emotional support network, providing a framework for care-giving and care-receiving behavior.
- The experience of conviviality.
- Levels of sensory stimulation neither much lower nor much higher than those of the natural habitat.
- Variety in daily experience.
- Opportunities and incentives for creative behavior and practicing manual skills.
- Opportunities and incentives for active involvement in recreational activities (e.g., dancing, making music).
- An environment and lifestyle conducive to a sense of belonging, challenge, self-fulfillment, comradeship, love, purpose, and personal involvement in daily activities.
- An environment and lifestyle that do not promote a sense of alienation, anomie, deprivation, boredom, loneliness, or chronic frustration.

Most of the items on the list of postulated psychosocial health needs, like creative behavior and sense of personal involvement, cannot be defined and measured as easily as the physical health needs; but this does not mean they are less important.

The evolutionary health principle is of enormous relevance to the health professions, public health policies, and personal lifestyle choices. However, it is seldom mentioned in the medical literature.[8]

8 An exception is Cleave and Campbell (1966), who drew attention to the fact that diets containing refined carbohydrates deviated from the natural diet of the human species and consequently gave rise to various forms of maladjustment.

Cultural evolution has led to numerous instances of cultural maladaptation resulting in ill health in human populations throughout the history of civilization. Many forms of ill health in our society today are the result of evodeviations including most cases of lung cancer, coronary heart disease, obesity, and probably much mental depression.

In this context, something must be said about the concept of stressors and meliors. The term "stressor" is commonly used for an experience that causes anxiety and distress. When stressors are excessive and persistent they can interfere seriously with both mental and physical health. During our work on the ecology of Hong Kong, we became aware of the immense importance of experiences that have the opposite effect to stressors, and which are associated with a sense of enjoyment. We decided to call such experiences "meliors."

The well-being of individuals at any particular time can be seen to be largely a function of their position on a hypothetical continuum between a state of distress at one extreme and a sense of well-being at the other. While stressors tend to push the individual toward a state of distress, meliors push in the opposite direction. A person's position on the continuum is thus the outcome of the balance between stressors and meliors. Social changes that result in the erosion of meliors are just as undesirable as those that result in an increase in stressors.

There is nothing particularly original about the melior–stressor concept. It is no more than everyday common sense. However, in academic discussion and research much more emphasis has been placed on stressors than on the opposite kinds of experience. Giving them the name meliors serves to remind us to take them properly into account in assessing existing conditions or options for the future.

One of the features of Ecological Phase 4 society today is the fact that the achievement of meliors is frequently much more costly, in terms of energy and resources, than it was in the past. The pursuit of meliors makes a substantial contribution to a society's technometabolism.

Hope for the future: A fifth watershed in cultural evolution

Cultural maladaptations in Ecological Phase 4 are manifold and some of them are on a scale unprecedented in the history of our species. The ecological unsustainability of the current patterns of human activity is now well appreciated. Our hope for the survival of civilization and the future well-being

of humankind lies in the possibility that processes of cultural reform might lead us to an ecologically sustainable and healthy Phase 5 of human existence. It will be a phase in which our society is truly in tune with, sensitive to, and respectful of the processes of life that underpin our existence. We call this a biosensitive society. A biosensitive society will promote health and well-being in all sections of the human population and in the ecosystems of the biosphere (Figure 5).

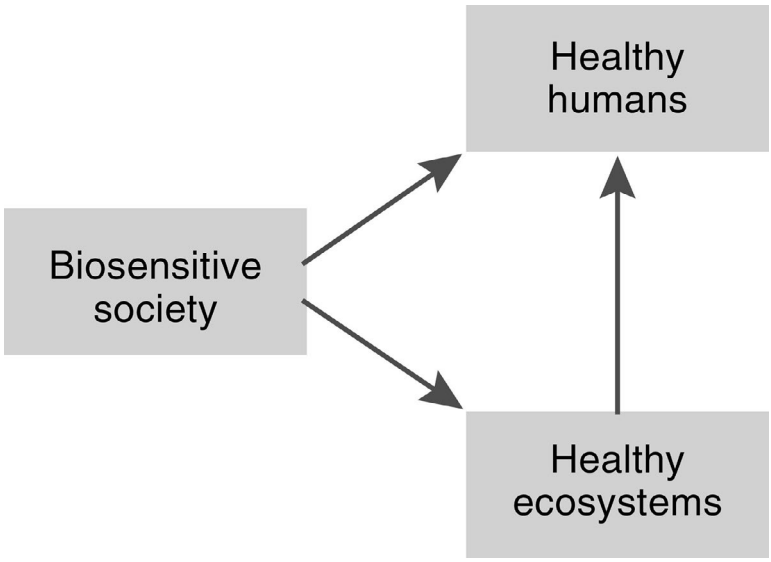

Figure 5. A biosensitive society
Source: Stephen Boyden

The transition to a biosensitive society will involve sweeping changes in the intensity and nature of human activities. It will require a major scaling down of resource and energy use and the eradication of all practices and technologies that interfere with or threaten human or ecosystem health. It will require revolutionary changes in societal arrangements, including the economic system and the occupational structure of society.

Biosensitivity will be the guiding principle in all spheres of human activity—individual and collective. This will mean biosensitive governments, biosensitive technologies, biosensitive transport systems, biosensitive industries, biosensitive farms, biosensitive forests, biosensitive cities, biosensitive buildings, and biosensitive lifestyles—and a biosensitive economy.

But there can be no shift to a biosensitive Phase 5 society until there comes about a radical transformation in the world views and priorities of the dominant cultures of the world. It will need a fifth watershed in cultural evolution (Figure 3), based on a shared understanding of the story of life on Earth and the human place in nature. We call this biounderstanding.

Cultures that embrace biounderstanding will share a profound respect for the processes of life and will place the achievement of biosensitivity at the top of the social agenda—reflecting the reality that keeping the processes of life healthy is what matters most, because everything else depends on them.

We can call this cultural transformation a "cultural renaissance"—or perhaps "biorenaissance"—because many hunter–gatherer and early farming cultures in the past were characterized by a profound respect for the living world and an understanding that humans are part of nature and completely dependent on other life forms for their well-being and survival.

Of course, the social reform movement is well under way. There are countless individuals, community organizations, and nongovernmental organizations (NGOs) putting a great deal of effort into activities aimed at the achievement of ecological sustainability. But so far they represent only a small section of the community and their overall effect has been minimal. The juggernaut rolls on.

The most critical need right now is therefore for an international campaign to spread this biounderstanding globally. United Nations agencies have the means and the obligation to play a key role in this movement. In the meantime, individuals, community groups, and NGOs can start the ball rolling by promoting this kind of understanding right across the community, especially among those in positions of power and influence.

Professional human ecologists also have a pivotal role to play in bringing about the fifth watershed in cultural evolution. Their task is to spread this understanding across the disciplines within the academic world and to the community at large.

The survival of civilization—and perhaps of the human species—will depend on whether this fifth watershed in cultural evolution takes place.

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Our Heritage Is Already Broken: Meditations on a Regenerative Conservation for Cultural and Natural Heritage[1]

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> They must find a way to love the sublime presence of waste and garbage in our world. Love … is not an abstract idealization but it is an acceptance of the world with all its failures and flaws—a way of seeing perfection in imperfection itself—a parallax view of something where flaw and virtue are one and the same. (Russell, 2012, p. 260)

Consider the following story:

> In 2001, several months before the September 11 attacks on the World Trade Center, the Taliban regime ordered the destruction of all "shrines of infidels" (Manhart, 2009, p. 38), including two colossal 6th–7th century CE statues of the Buddha carved into cliff faces in central Afghanistan's Bamiyan Valley during this region's heyday as a Silk Road hub. The demolition of the Bamiyan Buddhas (Figure 1), executed with mortar fire and dynamite and filmed by the Taliban, incited international shock and outrage. How could this destruction have been allowed to happen to such an invaluable historical treasure? These statues had existed for more than 1,400 years and now, in the space of a few weeks, were all but completely erased. In 2003, the United Nations Educational, Scientific and Cultural Organization (UNESCO) responded by designating the cultural landscape and archaeological remains of the Bamiyan Valley as a World Heritage site and adding them to the World Heritage in Danger List, thereby authorizing their "Outstanding Universal Value" and need for protection (UNESCO, n.d.). Since then, experts have journeyed to Bamiyan to conduct archaeological excavations and shore up

1 I presented a schematic of this paper, entitled "Which Heritage, for Whom?" at the Society for Human Ecology XX International Conference, Bar Harbor, Maine, October 2014. I wish to thank members of the audience and two anonymous reviewers of this paper's original manuscript whose comments led to clarifications on and improvements of the ideas and arguments in this essay.
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the niches in which the Buddha statues once stood. Thanks to UNESCO and the efforts of heritage professionals, what remains of Bamiyan's cultural heritage will be protected, interpreted and preserved for future generations.

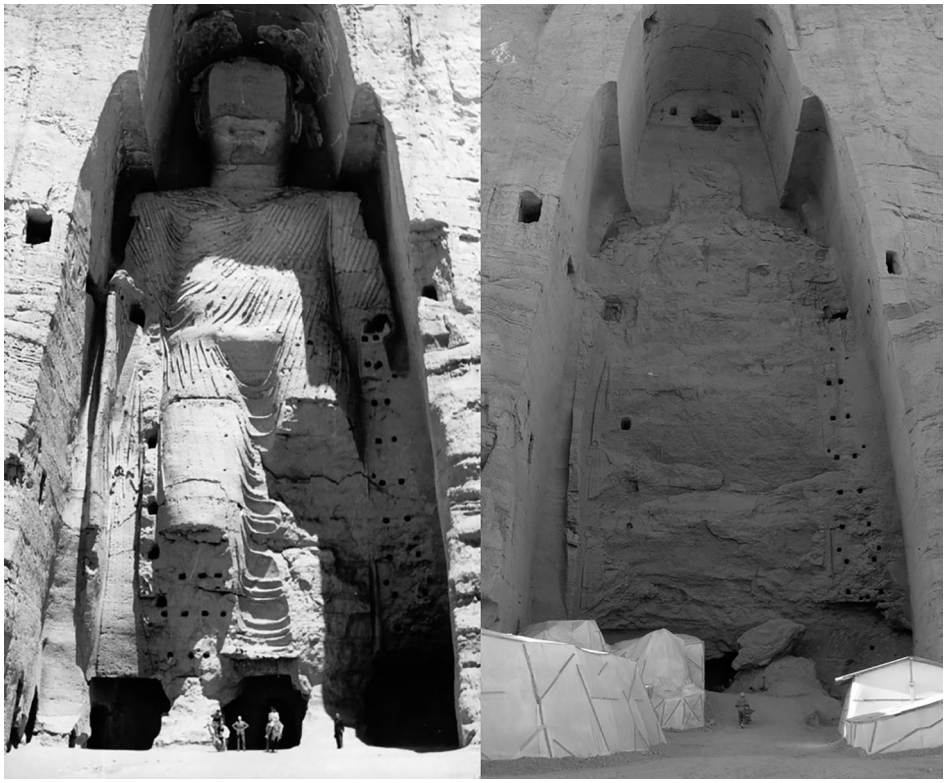

Figure 1. One of the Bamiyan Buddhas before and after destruction by the Taliban in 2001

Source: Wikimedia Commons, commons.wikimedia.org/wiki/File:Taller_Buddha_of_Bamiyan_before_and_after_destruction.jpg. This image is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

This story, also told by other heritage scholars (e.g., Blänsdorf and Petzet, 2009; Holtorf, 2006; Jokilehto, 2006; Karlström, 2009; Peleggi, 2012) in different ways and for their own rhetorical reasons, seems to capture some of the essence of heritage—its fragility, our fear and sense of its loss, and our powerful drive to conserve it. Perhaps it is also a heroic tale, at least from a European/American-centric world view, in which the forces of good do battle with the destructive (evil) forces of violence, ignorance, time, and entropy to save something of universal value. For some of us, this reading of the story is the only one that can or should be made. For others, however, there are different renditions that need to be heard, ones that are based on different world views and lived experience. For example, how would the Hazara—an ethnic group of Shia Muslims whose

heritage includes deep roots in the Bamiyan Valley—tell this story? Who has listened deeply to their own stories and experience? How might the Hazara understand and care for their Bamiyan heritage?

This essay is about the interdependence of story and action with respect to cultural and natural heritage. It is also about the inexorability of change and its relationship to heritage conservation. In the following paragraphs, I share several stories and excerpts, some heroic, others less so (I leave it to the reader to decide which is which), to make the case that the traditional, Western perspective on heritage does not hold up well under scrutiny—there is now an emerging paradigm for heritage conservation, one that both realizes its "empty" nature and guides us in developing a conservation approach that aligns with this recognition.

To accomplish this, I have divided this essay into several parts. First, I define and critique the Western heritage conservation paradigm, which I call "postcard heritage," by exploring an archaeological example from Nepal's Mustang Valley and the theoretical example of the "postcard Indian." Second, I critically examine four axioms of postcard heritage via insights arising from an alternative heritage paradigm, one I term "empty heritage," inspired by Buddhist teachings and practice. Third, I cross an arbitrary boundary between cultural and natural heritage by briefly exploring the controversial and instructive case of the "postcard red wolf" and its alternative, the "empty red wolf." I conclude these meditations on a theme by contemplating the implications of an empty approach to cultural and natural heritage conservation—one that, to paraphrase the Thai Forest Tradition Buddhist monk, Ajahn Chah (2007), understands heritage to be "already broken" and concentrates on the transformative merit in a "regenerative conservation" of living, as opposed to fixed and essentialized, heritage.

Postcard heritage

The roots of my notion of postcard heritage extend into urban heritage conservation, specifically the ideas of urban designer, Rahul Mehrotra (2004).[3] In his critical examination of the concept of cultural significance as it pertains to Mumbai's historic fort area, Mehrotra quotes a passage from Italo Calvino's novel, *Invisible Cities* (1974, p. 30), in which a city named Maurilia is described by the fictional character, Marco Polo:

3 My inquiries into Mehrotra's work began when I found a reference to it in Ioannis Poulios's thought-provoking book, *The Past in the Present: A Living Heritage Approach—Meteora, Greece* (2014, p. 127).

> In Maurilia, the traveler is invited to visit the city and, at the same time, to examine some old postcards that show it as it used to be … If the traveler does not wish to disappoint the inhabitants, he must praise the postcard city and prefer it to the present one …

Mehrotra (2004, p. 26) compares this "postcard city" theme to the attitudes of many conservation activists in Mumbai:

> Unfortunately, most conservation debates discuss change in terms of the loss of something, as opposed to new possibilities, mostly because people … will easily react to any sort of new condition as worse than some "magic moment" in the past … the issue is how to simultaneously identify new typologies and work with them rather than dwell in the "postcard city," a city that only flights of nostalgia momentarily recreates.

Thus, postcard heritage conjures up an inaccessible past comprising lost "magic moments"—static snapshots of imagined places, landscapes, and peoples that we prefer over those existing in the present, which are always more complicated, if not contaminated, by their own histories and agency.

Consider the following story, inspired by one I heard from heritage scholar Neel Kamal Chapagain (2013a) in his presentation at the 7th World Archaeological Congress in Jordan:

> In 2009 the National Geographic Society released a documentary, evocatively entitled *Secrets of Shangri-La*. This particular Shangri-La consists of more than 10,000 human-built caves in the cliff faces of Mustang Valley in northern Nepal. In the documentary's preview,[4] we accompany scholars and explorers as they rappel from the top of a cliff down to the alcove entrances, kicking off large chunks of the cliff face as they do so and shouting "rock!" to their colleagues down below. They express disbelief and wonder at their discovery of stunning 15th century murals, manuscripts and burials representing the valley's indigenous Bön and Buddhist heritage. Their next step is to figure out a way to rescue some of these unprotected masterpieces.

I conducted a simple content analysis of the documentary's preview and identified several key words and phrases used in the video's narrative, namely: *priceless*, *hidden*, *masterpiece*, *discovery*, *unprotected*, *rescue*, *finds*, *mysterious*, *beckon*, *lost world*, *first time*, *secrets*. This kind of language, of course, can be attributed in part to savvy marketing for Western viewers, but such a suspicion only underscores the fact that there's something deeper going on here. Words and phrases such as these are part of a powerful Western "authorized heritage

4 I recommend that readers watch the preview, available at www.youtube.com/watch?v=IRLyJbt6wvs.

discourse'' (Smith, 2006, p. 29) that dictates the meaning, value, and purpose of cultural heritage. Chapagain (in press) summarizes and critiques this Mustang Valley heritage narrative as follows:

> To me there appeared to be a fundamental misunderstanding of the notion of heritage in such contexts. Many of the Buddhist (and for that matter, even pre-Buddhist) sites contain objects or texts that are not supposed to be taken out of their respective places … In attempting to ''discover'' and claim our ''authority'' over this heritage through documentation and preservation efforts, we may be crossing cultural boundaries of respect for the underlying concepts behind the materiality and spirituality contained therein.

Indeed, these artifacts and features were not calling out for recognition and protection by Western scholars; they had been stewarded by their environmental context and the custodial oversight of local people and had endured as an integral part of landscape and culture for centuries. It is also interesting to point out that the caves, equally sacred to the local community, were treated by the scholars and explorers as a disposable backdrop, likely because they were perceived by them as merely value-neutral containers for highly valued cultural heritage artifacts.

Another example of this paradigm can be found in what I refer to as the theoretical ''postcard Indian'' (Figure 2) who regards us from the safe (that is, for non–Native Americans) confines of a nostalgic, two-dimensional tableau. But as archaeologist Matthew Liebmann (2008, pp. 76–77) writes,

> Popular portrayals of … fictionalized Native Americans in the mass media have lent credence to the romantic fantasy that these so-called ''real Indians'' still exist somewhere, unaffected by colonization. These imaginary Indians ultimately prove more desirable to mainstream society than modern Native Americans, who suffer by comparison and are often ignored or marginalized when they attempt to explain their differences through *complex histories of dynamic adaptation* [emphasis added].

Figure 2. Chief Standing Deer, Cherokee Indian Reservation, North Carolina. This vintage postcard exemplifies the fantasized Indian who replaces "modern Native Americans, who suffer by comparison" (Liebmann, 2008, pp. 76–77).

Source: Wikimedia Commons, commons.wikimedia.org/wiki/File:Chief_Standing_Deer_-_Cherokee_Indian_Reservation,_North_Carolina_(5756035888).jpg. This image is licensed under the Creative Commons Attribution 2.0 Generic license.

The postcard Indian is the fixed, fantasized and essentialized Native American, whose real existence is replaced by an imagined one, which, as it is colonized, sanitized, and commodified, becomes increasingly alienated from its referent. This relegation—indeed, expulsion—of peoples and their histories from their living contexts to the literal and figurative cardboard context of postcards brings to mind French sociologist Jean Baudrillard's (1994, p. 8) notion of "referential simulacra"—replicas that we conjure up and sever from their referents, a "real without origin or reality" (ibid., p. 1). For example, Baudrillard examines the case of the Tasaday people of the Philippines, a putatively uncontacted "stone age" culture "discovered" in the 1960s. In the early 1970s, the Philippine government relocated the Tasaday to a reserve and effectively sealed them away from anthropological investigation, allegedly to protect them from harm.[5] Baudrillard (1994, p. 8) writes with respect to the role of science—in this case, ethnology—in creating simulacra:

> The Indian … in the glass coffin of the virgin forest, again becomes the model of simulation of all the possible Indians from before ethnology. This model thus grants itself the luxury to incarnate itself beyond itself in the "brute" reality of these Indians it has entirely reinvented—Savages who are indebted to ethnology for still being Savages … Of course, these savages are posthumous: frozen, cryogenized, sterilized *to death*, they have become referential simulacra, and science itself has become pure simulation.

This "sterilization," the product of a collusion, Baudrillard argues, between science and mass media, is not a harmless act—it distracts and prevents us from recognizing the actual heritage, comprising Liebmann's (2008) complex histories of dynamic adaptation, which is manifest in the minds, hearts, bodies and culture of living Native Americans.

By imagining the postcard Indian into being, we assign his or her people a kind of contingent merit, which rises or falls in accordance with the value of a heritage authorized by managers, scholars, stakeholders, other delineated groups (e.g., Americans, Europeans, global citizens, tourists), or a generic humanity—that is, what heritage scholar Laurajane Smith (2006, p. 29) refers to as our "nebulous future generations." Heritage scholar Ioannis Poulios (2010) points to this idea in his critique of a values-based approach to heritage conservation, one in which authorized stakeholders of one kind or another disproportionately influence the interpretation and management of heritage places. Likewise, Sullivan (2004, p. 53) cites the example of Australia's Kakadu National Park, in which contingent merit is assigned to a postcard Aboriginal community:

5 This is a controversial and convoluted case that features a long-term debate over whether the Tasaday represented a "real" or fabricated cultural group and whether, as linguist Lawrence Reid claims (1993, p. 2), the "hoax proponents were themselves the hoax makers." Although Baudrillard does not discuss this debate, it fits neatly into his thesis on the nature of referential simulacra.

> Members of a World Heritage delegation who visited the Kakadu National Park on a mission to assess whether it was endangered by uranium mining found in their report that the one small modern settlement in an area the size of Belgium, which provided health, modern housing, education and transport facilities for the indigenous owners of the Park, as well as tourism revenue and mining royalties, was undesirable and a threat to the area's World Heritage values because it was seen as a blot on the pristine landscape and also as inimical to the traditional lifestyle of the owners.

In sum, postcard heritage possesses a set of core perspectives, which I summarize here via four axioms: (1) heritage contains *essential* qualities; (2) many of these qualities have or should have *fixed* manifestations (objects, places, traditional lifeways, etc.) that, when possible, should be rendered *permanent* against the passage of time; (3) these manifestations are *independent* of and *discontinuous* with contemporary cultural contexts; and (4) they possess *contingent merit* that must be assessed and authorized by experts and stakeholders.

Empty heritage

I begin this section with an author's disclosure and disclaimer. Among other things and in different contexts, I identify as a Euro-American heterosexual male, an archaeologist trained within a Western positivist tradition, a human ecologist and engaged anthropologist, and a practitioner of Buddhist teachings. I am not a scholar of Buddhism. What follows includes my own distillation, synthesis, and application of others' scholarship of Buddhist philosophy, culture, and heritage. Buddhism is not monolithic; it comprises a rich diversity of interpretations and practices within and across a vast array of Asian cultures and societies and broad traditions (Theravadan, Mahayana, Vajrayana).[6] Further, Buddhism's much more recent introduction into relatively affluent Western societies has spawned a new wave of interpretations and practices befitting their own respective and varying orientations toward scientific inquiry, secularism, democracy, individualism, psychotherapy ("self help"), and so forth. This latter phenomenon and my own background influence my analyses and flavor my conclusions in ways that likely both help and hinder them.

Moreover, any project of this kind necessarily privileges generalization over particularization, which means that counterpoints to my claims about "a Buddhist perspective" on cultural heritage can (and should) undoubtedly be found in the particulars of philosophy, culture, and socioeconomics/politics

6 The Theravadan Buddhist Tradition is associated with South Asian and Southeast Asian cultures; the Mahayana Tradition is rooted in Tibetan, Japanese, and Chinese cultural heritage; the Vajrayana Tradition is found in Tibetan Buddhist culture.

at certain spatio-temporal intersections within the so-called Buddhist world. Nevertheless, I believe my generalizations are useful in drawing attention to and articulating differences between a dominant heritage world view and a much-needed alternative.

Although the postcard heritage paradigm exerts a hegemonic force on our conception and perception of heritage, it is possible to discern an opposing paradigm that is inseparable, as it were, from the sacred caves of Mustang Valley and Native Americans' complex histories of dynamic adaptation. In this paradigm, heritage lives in the minds, hearts, and practice of what my place-building colleagues and I call heritage "placekeepers" (Kimball et al., 2013) and what Poulios (2010, p. 176) calls the "core community," that is, those who consider a heritage place to be "an integral part of [their] contemporary life" (Poulios, 2014, p. 115). This paradigm recognizes that, rather than a fixed, fantasized, and essentialized product, heritage is actually a *process*, through which, as Smith (2006, p. 75) puts it, we "express, facilitate and construct a sense of identity, self and belonging." In deference to Buddhism, whose world view is consistent with this perspective, I refer to this paradigm as "empty heritage."[7]

Empty heritage offers insights into each of the postcard heritage paradigm's four axioms: (1) heritage is, upon closer inspection, *empty* of any essential qualities; (2) the qualities we conceive and perceive are, instead, *impermanent* and inevitably change with the passage of time, despite our best efforts to freeze them in place; (3) heritage arises, changes, and passes away dependent on its causes and conditions—it is therefore *interdependent* and *continuous* in its relation to the past, present, and future; thus, (4) the merit of heritage can be *transformative* when its stewards aren't attached to static conceptions and rigid expectations. In the remainder of this section I expand upon these insights.

Essentialism versus emptiness

Below is an English translation of part of a Tibetan Buddhist version of the *Prajnaparamita* (or Heart) *Sutra*, in which the Buddha instructs his disciples on the inherent emptiness of all phenomena (FPMT, 2008):

> all phenomena are emptiness; without characteristic; unproduced, unceased; stainless, not without stain; not deficient, not fulfilled … therefore, in emptiness there is no form, no feeling, no discrimination, no compositional factors, no consciousness … There is no ignorance, no extinction of ignorance,

7 I must distinguish my use of the term "empty heritage" from that appearing elsewhere. In the literature on heritage scholarship it is not uncommon to find the term "empty heritage" equated with the notion of "lost heritage," that is, an ethnic group's cultural or religious heritage that is forgotten, marginalized, or erased.

> and so on up to and including no aging and death and no extinction of aging and death. Similarly, there is no suffering, origination, cessation, and path; there is no exalted wisdom, no attainment, and also no non-attainment.

Where the postcard heritage paradigm is fundamentally essentialist, the empty heritage paradigm is rooted in this Buddhist realization of emptiness. As Khisty (2006, p. 302) writes of the *Heart Sutra*:

> This text says that when one considers a particular object to be empty, it means it is empty of a separate, independent existence, because everything in this world has to inter-be with everything else, including the mind. It is empty of a separate self; but empty of a separate self means it is full of everything.

This perspective challenges an implicit assumption of postcard heritage—that heritage actually possesses authentic qualities, those that are intrinsically, objectively, and demonstrably genuine and which can (and must) be discovered, rescued, and preserved. A Buddhist investigation would ask, if authentic qualities exist, where can they be found? Are they in the material—the structure, the substance, the DNA of an object? Alternatively, can these qualities be found in the mind of the heritage maker or heritage observer? Is there a substance in/to memory, experience, insight that can be apprehended as heritage? For example, where is the heritage in Mustang Valley? Can it be extracted from the manuscripts, the ink, the pigments? Is it in the skeletons of the people who wrote or illuminated the texts? Is it in their minds? Is it in the mind of placekeepers, the explorer, the scholar, the viewer of the *Shangri-La* documentary?

Consider the following paradox related by heritage scholar Jukka Jokilehto (2006, pp. 2–3):

> A well-known case is the debate about the ship of Theseus, as told by Plutarch … The ship was kept by the Athenians as a memorial for a long time. Due to gradual replacement of rotten planks, the ship retained its original form but its material was entirely renewed. The question was then raised: was it still the ship of Theseus?

The same question might be asked about restoration of art works, archaeological sites, and perhaps ecosystems. But this is only a conundrum for the postcard heritage paradigm. From an empty heritage perspective, the answer is to use a well-known Zen retort: *mu*.[8] That is to say, not yes and not no. In the words of the *Prajnaparamita Sutra*, there is no attainment and also no non-attainment. This is because the ship's authenticity, its "shipness," is a dynamic, interdependent

8 From a Western perspective, Jokilehto's question demands a resolution to the conundrum. From a Zen perspective, it may be read as a koan, the deep contemplation of which might allow one to short-circuit one's habitual conceptions and perceptions of heritage.

conception, not a fixed and essential quality residing somewhere within the phenomenon itself. Jokilehto (2006, p. 3) goes on to wonder, "one could imagine that the materials that were removed would have been reassembled elsewhere in another ship. What would then be the significance of this other ship?" *Mu*, once again.

Fixity/permanence versus change/impermanence

A correlate of the principle of emptiness—and one continuously performed through interactions between many Buddhist placekeepers and their heritage—is that all phenomena are impermanent and always changing. This insight is manifested in the heritage that embodies and enacts cultural history. For example, there is Tibet's traditional butter-sculpture festival, which, prior to the Chinese invasion,[9] was held annually in the monastery of Kumbum in eastern Tibet. This festival was the result of many months of work by monks who sculpted hardened butter into statues of abbots, teachers, bodhisattvas, and other figures, which were then publicly displayed on one day and destroyed before the dawn of the next. As Tibetan Buddhism scholar John Powers (1995, p. 196) writes, "this provided the audience with a graphic reminder that all mundane human activities pass away, leaving nothing behind."

A perhaps more familiar example for some might be the Tibetan sand mandala ritual (Figure 3) in which monks spend weeks painstakingly constructing out of colored sand an elaborate and finely crafted mandala—a highly stylized model of a sacred realm, which "represents both the nature of reality and the order of an enlightened mind" (Powers, 1995, p. 227). When the mandala is complete, it is swept up into piles, which are then removed and ceremoniously dumped into a nearby body of water. Some years ago, I visited the North Carolina Museum of Art while a group of visiting Tibetan monks was creating a sand mandala. I observed other visitors like myself manically snapping photos of the scene and couldn't help reflecting on the "moods and motivations" (to paraphrase Geertz, 1973)[10] behind taking the pictures and the reality of their impermanence as either prints or pixels.

9 In 1950, during Mao Zedong's Cultural Revolution, the Chinese army invaded Tibet, destroying and looting monasteries, temples, and schools; killing and imprisoning thousands of people; and partitioning Tibet into Chinese provinces (Powers, 1995). The ebb and flow of China's influence in and on Tibet, as well as the cultural heritage of China and Tibet, which both suffered great losses during the Cultural Revolution, are themselves lessons in impermanence and interdependence.

10 Clifford Geertz used the term "moods and motivations" in his formulation of an anthropological definition of religion. According to Geertz (1973, p. 97), "motivations are 'made meaningful' with reference to the ends toward which they are conceived to conduce, whereas moods are 'made meaningful' with reference to the conditions from which they are conceived to spring."

Figure 3. Tibetan Buddhist Green Tara sand mandala creation, Moscow

Source: Wikimedia Commons, commons.wikimedia.org/wiki/File:Mandala_zel-tary.jpg. This image is made available under the Creative Commons CC0 1.0 Universal Public Domain Dedication.

These examples not only show how Buddhist philosophy is manifested and taught through intangible (e.g., rituals) and tangible (butter and sand) cultural heritage, they also present heritage as synecdoche—a compression in time and space of a grand, inexorable, and cyclical process of birth, death, and decay for living beings, inanimate objects, places, and mental and social constructs alike.

Independence/discontinuity versus interdependence/continuity

The postcard heritage paradigm views heritage as a discrete set of objects, places, and practices that, essentially, belong to the past and are discontinuous with the present (Poulios, 2010). As such, these objects, places, and practices can be delineated and abstracted from their cultural and environmental contexts and preserved in isolation as cultures (e.g., the Tasaday), skeletal remains, sites, artifacts, and so forth. The *Shangri-La* manuscripts, for example, are seen by Western scholars as possessing an existence independent of their contexts because they are apprehended as separate and separable—from the sacred caves, from their placekeepers—objects possessing their own inherent and fixed qualities. Thus, from this perspective it is possible, indeed justified

and necessary, to collect and remove them from the caves and attempt to freeze them in their current state or restore them to a semblance befitting a previous and preferred condition and snapshot of time.

Through the lens of empty heritage, however, this construct dissolves. Fundamental to this kind of understanding of phenomena is the recognition of dependent arising (from the Sanskrit, *pratityasamutpada*), which holds that everything arises, persists, and passes away because its temporary existence depends on whatever lineages of phenomena brought it into being, whatever phenomena hold it in place and memory for a time, and whatever phenomena will inevitably cause its undoing.

Heritage epitomizes and embodies *pratityasamutpada*. This can be illustrated by an example from Bhutan's Tibetan Buddhist folklore—the widely known, taught, and revered folktale *Four Harmonious Friends*. Artwork (e.g., Figure 4) depicting this story can be found on stupas (sacred monuments), thangkas (sacred paintings), trucks, T-shirts, and the exterior and interior walls of buildings. The story more or less goes like this:

> There was once a tree in a forest, laden with juicy and nutritious fruit. One day an elephant wandered past and, seeing the tree, announced that it belonged to him because he was the first to discover it. Upon hearing this, a monkey called down to the elephant from among the tree's branches, saying that, on the contrary, the tree belonged to him because he, the monkey, had been eating the tree's fruit well before the elephant came along. Then a rabbit hopped into the clearing and disagreed with them both, declaring that it was his tree because he had nibbled its leaves when it was but a sapling. Finally, a partridge appeared and informed the other animals that, in fact, the tree belonged to none of them because it was he who had dropped the very seed from which the tree had originally sprouted …

Cultural researcher Steve Evans (2009, p. 8) offers the following epilogue for *Four Harmonious Friends*:

> The four animals worked together and with their combined strength, each one benefited and no one went hungry. Other animals in the forest often saw them together, with the partridge on top of the rabbit, who was held up by the monkey, who rode on top of the elephant … The four animals are looked upon as an example of peace, harmony, cooperation, interdependence and friendship.

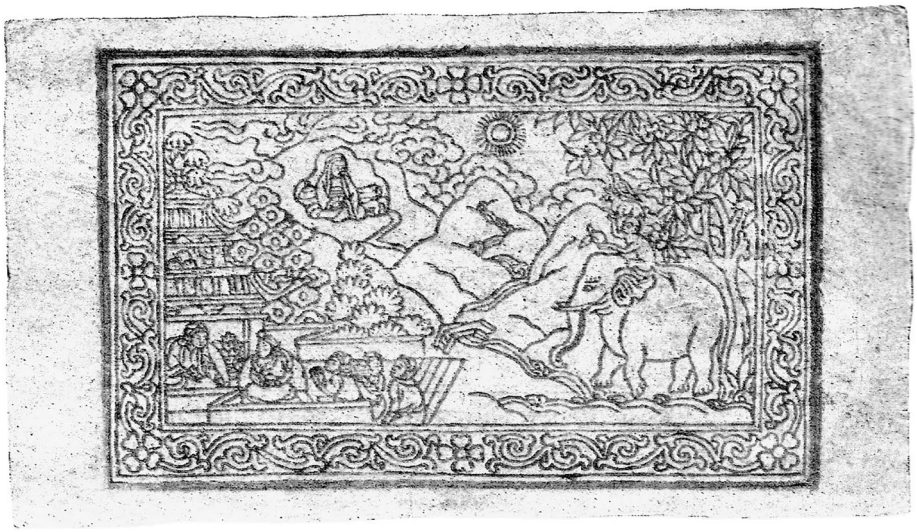

Figure 4. 25 Tam Tibetan bank note, circa 1913. Depiction of the "Four Harmonious Friends" (partridge on top of rabbit on top of monkey riding elephant) can be found on the right side of the image.

Source: Wikimedia Commons, commons.wikimedia.org/wiki/File:25_tam_back.jpg. This image is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license.

This folktale arises from a large body of ancient Buddhist allegories known as *Jataka Tales* (see Francis and Thomas, 1916), many of which are believed to reference the Buddha's previous non-human animal incarnations. However, it is not the only form in which this story appears. For example, while in Bhutan, Michael Noonan (n.d.), the founder of the Canisius Ambassadors for Conservation program, discussed *Four Harmonious Friends* with Tibetan Buddhist Lama Gembo Dorji and got an entirely different picture:

> Noonan: When we see pictures of the four friends they are standing on each other.
>
> Lama Dorji: So, that is the artistic version—also, to emphasize that the bird is the wisest, the eldest, sitting on the highest place over the other friends.
>
> Noonan: It looks like they are using each other to reach the fruit. Is that not in the Sutra?
>
> Lama Dorji: No. Nothing to do with that.
>
> Noonan: So, it is not like they are cooperating to get this fruit. That's not the story that is in the Sutra?
>
> Lama Dorji: *No. That is not the story. In the Sutra, it is not mentioned. In the Sutra, only their life—how the Buddha has acquired all these merits, even when he was born as an animal* … [emphasis added]

> Noonan: Do some people tell the story of the four friends cooperating to get the fruit? Do some people change the story?
>
> Lama Dorji: People can. They see the art in the painting and then they tell it that way. In other words, maybe to explain something differently. It is not that they are lying. It is just that we are using this as a kind of example, a kind of metaphor, to explain something …

Thus, Lama Dorji's interpretation of *Four Harmonious Friends* seems to contradict Bhutan's ubiquitous lay interpretation. Both stories probably arise from what appears in the *Vinaya-Pitaka*, Buddhism's book of monastic rules and regulations, drawn from an oral tradition compiled, winnowed, and transcribed onto palm leaves arguably around 2,000 years ago. The *Vinaya-Pitaka* story, entitled "Allowance for the First Seat, etc.,"[11] translated by I. B. Horner (2014, pp. 2210–2211) and originally published by the Pali Text Society in 1942, relates the following tale purportedly told by the Buddha himself to his monks:

> Formerly, monks, there used to be a large banyan on a slope of the Himalayas. Three friends lived near it: a partridge, a monkey and a bull-elephant … it occurred to these friends: "Now let us find out which of us is the eldest by birth. We should respect, revere, reverence, honour him, and we should abide by his advice." Then, monks, the partridge and the monkey asked the bull-elephant: "You, friend, what long-ago thing do you remember?" "When I, friends, was young I used to pass over this banyan keeping it between my thighs, and the topmost shoots brushed against my belly. This, friends, is a long-ago thing that I remember." [And so on until …] Then, monks, the monkey and the bull-elephant asked the partridge: "You, friend, what long-ago thing do you remember?" "I, having eaten one of its fruits, relieved myself in that open space, and this banyan has grown from that. So I, friends, am the eldest by birth." Then, monks, the monkey and the bull-elephant spoke thus to the partridge: "You, friend, are the eldest of us by birth. We will respect, revere, reverence, honour you and we will abide by your advice."

Unlike the *Four Harmonious Friends* folktale and, apparently, Lama Dorji's version, this story is absent one rabbit and is, as one might expect from a book of monastic rules and regulations, principally concerned with promoting respect for one's elders. But the roots of this story don't end in the Buddha's telling of it. Although he is said to have used it to teach his monks deference, there is evidence to suggest, as the Indo-European philologist A. V. Williams Jackson (1918, p. 279) put it, the "Jataka stories, though Buddhistic in form, are really adaptations of still more ancient tales in the land between the Indus and Ganges long before the rise of Buddhism."

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11 The section title, "Allowance for the First Seat, etc.," refers to an incident in which younger monks beat their elders to sleeping places inside a house, which elicited a teaching from the Buddha on respect for one's elders.

Thus, the tale *Four Harmonious Friends* originally arose from the fecund primordial soup of Indus/Gangetic cultural history. The Buddha then allegedly appropriated and repurposed it to persuade his monks to lead a disciplined life. It was later enshrined in a monastic canon. Later still, Tibetan monks like Lama Dorji promulgated the story as testament to the Buddha's many lifetimes of accumulated merit. Sometime during which all of this was happening, the tale invited a rabbit and artful shoulder stands as laypeople enlivened it in their folklore, where it now models and encourages prosocial behavior in Bhutan.

Where does the "authentic" story begin and where does it end? To paraphrase the *Vinaya-Pataka's* three friends, what long-ago thing do we remember? Indeed, one might say that this is a tale built of planks from the ship of Theseus. This example of continuity and dependent arising is not exceptional; it epitomizes the nature and culture of heritage. It embodies Liebmann's (2008) complex histories of dynamic adaptation.

Contingent merit versus transformative merit

In my critique of postcard heritage, I propose that the conventional Western view on heritage focuses on contingent merit, that is, valuations assessed by a market, if you will, of conceptions and perceptions traded by authorities, stakeholder groups, and imagined beneficiaries. The persuasiveness of this construct depends on how tightly we cling to our essentialist notions of heritage and definitions of its meaning and value.

However, from an empty heritage point of view, this approach to merit entirely misses the mark. Alexander Berzin (1999), a noted scholar of Tibetan language and Buddhism, translates the word for merit:

> from Sanskrit or Tibetan as "positive potentials" or "positive force," because this is something that arises as a result of acting constructively and which then ripens into happiness … "Constructive" here means acting in a way that, from the point of view of motivation, is free of attachment … The fundamental motivation is that it is free of acting out of desire or anger or naivety.

By "free of attachment," Berzin is speaking to the second of the Buddha's "Four Noble Truths,"[12] that is, that suffering (one translation of the Pali word, *dukkha*, which has been alternatively translated as unsatisfactoriness, stress, and, like a wheel, out of true) is caused by clinging to fundamentally impermanent phenomena—material forms, feelings, states of mind, ideas—and resisting their evolution and disintegration. According to this view, transformative potential is latent in all experience and it is possible to access this potential

12 The "Four Noble Truths" refer to the truth of suffering, the truth of the cause of suffering, the truth of the end of suffering, and the truth of the path leading to the end of suffering.

by relinquishing our grip on these phenomena. This is achieved by *cultivating an equanimous and compassionate regard for them and for our attachments to them*. Indeed, without equanimity and compassion, it is difficult to be free of acting out of desire (clinging) or anger (from loss) or naivety (about the inexorability of change). In Tibetan Tantric Buddhism, for example, transformative potential is seen in all phenomena, good or bad, profane or sacred. As Powers (1995, p. 226) writes, "in the tantra system, any action—even walking, eating, defecating, or sleeping—can be incorporated into the spiritual path."

This view is embedded in traditional Buddhist custodial practices, which reflect a fundamentally different relationship to heritage than those inspired by the moods and motivations of postcard heritage. For example, Chapagain (2013b, p. 53) writes of Tibetan Buddhists in Nepal:

> When the structure is damaged or has deteriorated for any reason, people would rather opt for an entire reconstruction, aiming to give it a better shape, stability, and appearance … In an archaeologically based conservation ideology, such practices may seem disruptive of the historic patina accumulated on the fabric of the monuments; but these traditions contribute towards the regular upkeep of monuments.[13]

Byrne (2011, p. 5) corroborates this observation from a Southeast Asian vantage point:

> In Theravada Buddhism, one of the most meritorious acts involves the restoration of old *stupas* which have fallen into disrepair or ruin. Rather than following the principles laid down in the 1964 Venice Charter, however, these restorations frequently involve encasing the remains of the original fabric inside a new shell of stucco or brick and stucco … *Stupas* which are particularly old have often undergone numerous restorations of this kind and carry inside them the history of what has been done to them in stratified form … These local practices of restoration can obviously create tension between local pious Buddhists on the one hand and archaeologists, art historians and heritage practitioners on the other … local people tend to see the sacredness of such structures not as something historical but as a *dynamic, living force that is situated solidly in the present* [emphasis added].

Thus, with respect to heritage, a concentration on transformative merit includes three key attributes: (1) it inspires an *equanimous* and *compassionate* regard for heritage in the context of its impermanence rather than imagined fixity, which (2) fosters *regenerative* approaches to heritage conservation that (3) appreciate heritage as an interdependent and, therefore, *reciprocally evolving* process.

13 In the original document, the last sentence in this quotation directly precedes those above it. I invert the order here to improve the flow; the author's intended meaning remains intact.

Natural heritage: The postcard versus empty red wolf

My decision to create a new section for this essay with the heading "Natural heritage" reinforces a false dichotomy between culture and nature. In the words of environmental historian William Cronon (1996, pp. 69–70), "As we gaze into the mirror [wilderness] holds up for us, we too easily imagine that what we behold is Nature when in fact we see the reflection of our own unexamined longings and desires."[14] To be sure, unexamined longings and desires are the colored sands with which we build a heritage paradigm founded on nostalgia—nostalgia for an imagined time and place where life was simpler, more authentic, and the natural world was uncontaminated by modernity and its commensals.

One such commensal, *Canis latrans*, the coyote, traverses the arbitrary and shifting boundaries between wilderness and civilization, nature and culture (Bright, 1987; Sandlos, 1998). Like the wolf (see Zackary 2013), whose role in Euro-American affairs has inspired fear and awe, the coyote has also conjured disgust, frustration, and prejudice. As Sandlos (p. 47) writes, "predatory animals like the coyote have been vilified as bloodthirsty beggars and thieves in the human imagination, *a form of conceptual pollution* [emphasis added] that must be removed at all cost from the productive landscape."

And yet *Canis latrans* thrives. Moreover, coyotes continue to threaten to contaminate some of our most pristine constructs of natural heritage. A case in point is the red wolf, *Canis rufus* (Figure 5). The story more or less goes like this:

> The red wolf "once roamed an extensive range including the southeastern United States, and possibly the entire woodlands of eastern North America" (Stoskopf et al., 2005, p. 1146). Due to anthropogenic factors (hunting, habitat destruction, economic development, etc.) and consequent red wolf population decline, the species was listed as endangered in 1967 and extinct in the wild in 1980. Because of fears that pure red wolves would become genetically swamped by a growing hybrid swarm of coyote/red wolves, a small group was discovered and live-trapped in Texas in the mid-1970s and moved to a facility at Point Defiance Zoo in Tacoma, Washington, where their genome was further purified through a captive breeding program. As a result of this effort, wild populations of pure red wolves have been restored in the United States using Point Defiance wolves relocated to eastern North Carolina.

14 I was reminded of Cronon's provocative work while reading an insightful consideration of it in Manganiello's (2009) analysis of the history of red wolf conservation biology.

Figure 5. Comparison of red wolf (*Canis rufus*) and coyote (*Canis latrans*)
Source: Wikimedia Commons, commons.wikimedia.org/wiki/File:Canis_rufus_%26_Canis_latrans.jpg. This image is licensed under the Creative Commons Attribution 2.0 Generic license.

This version of the red wolf story is based on others told elsewhere (e.g., Adams et al., 2003; Bohling & Waits, 2011; Manganiello, 2009; Roth et al., 2008; Stoskopf et al., 2005) and I intentionally include specific terms repeatedly occurring in those accounts, such as *threaten*, *fear*, *genetically swamped*, *hybrid swarm*, *pure*. Let us focus on the words "pure" and "threat" as an example. Using NVivo software, I conducted a textual analysis of 29 peer-reviewed scientific journal articles published between 1992 and 2015 that I collected using the search terms "hybridization" and "*Canis rufus*" in *Web of Science Biological Abstracts* and *JSTOR Life Sciences Archive Collection* online literature databases. Across this sample, the word "pure" occurred 37 times and "threat" occurred 31 times in association with discussion of the red wolf genome, hybridization, and conservation.

But is there really such a thing as a genetically pure red wolf? And is hybridization a mortal threat to this species? One recent study (vonHoldt et al., 2011) assayed over 48,000 single nucleotide polymorphisms (SNPs) from 208 gray wolves (*C. lupus*), 12 red wolves (*C. rufus*) and 57 coyotes (*C. latrans*) to explore their evolutionary heritage. According to the authors' knowledge, this represented at that time "the most extensive SNP survey of any wild vertebrate group" (ibid., p. 1). Results of the study, which reveal the red wolf to be an evolutionary admixture of coyote and gray wolf (e.g., one individual's ancestry was 75% *C. latrans* and 25% *C. lupus*),[15] led the authors to seriously question the rationale of a recovery program focused on protecting the introduced wolves from hybridization.

15 The average for the whole sample ($n = 12$) was 76.1% coyote (*C. latrans*) and 23.9% gray wolf (*C. lupus*), with ranges of 74.3–78.1% and 21.9–25.7%, respectively.

Add to this a shift in perspectives within the biological sciences community itself. As evolutionary biologist James Mallet (2005, p. 229) writes:

> In the course of the development of the biological species concept, a sort of repugnance against hybridization prevailed, akin to the fear on which "Invasion of the Body Snatchers" plays. Supporters of the biological species concept viewed hybridization as a "breakdown of isolating mechanisms." … These *almost eugenic views* [emphasis added] about species were particularly prevalent among zoologists because of Ernst Mayr's influence. (By contrast, many botanists thought that introgression[16] was common and important in adaptive evolution.) The same views led directly to the notorious hybrid policy of the US Endangered Species Act of 1973, by which "hybrids" were deemed unworthy of conservation, whereas unsullied "pure species" were apportioned higher status. But today, tastes in biodiversity are changing, and the biological species concept is under attack.

Indeed, biologist Rodrigo Vargas Pêgas (2013, p. 4) seems to pick up where Mallet leaves off with respect to this argument:

> Hybridization between *Canis rufus* and *Canis latrans* is seen as negative based on the argument that it might be anthropogenically magnified or that it may threat [sic] the red wolf integrity. If a *Homo sapiens* who might be up to 4% *Homo neanderthalensis* is not considered worthy of sterilization or elimination, then why should a *Canis rufus* × *Canis latrans* hybrid … be considered so?

Thus, the concept of pure species and, in particular, the species "*C. rufus*" itself seems to dissolve under empirical scrutiny. The red wolf is empty. So, what are we trying so hard to conserve and why? The struggle and concomitant suffering—for example, the failure of a Great Smoky Mountains red wolf colonization project (in part because the wolves preferred a different habitat and voted with their feet) (Manganiello, 2009); conflicts between wildlife professionals and local landowners (Manganiello, 2009); concerted sterilization and killing of coyote and hybrid adults and pups[17] (USFWS, 2013)—is not caused by hybrid swarms, invasions, and introgression. It is caused by a fear of loss (see Holtorf, 2015). But not loss of something that actually exists. The red wolf that actually exists is a biocultural construct, arising interdependently with its causes and conditions and evolving through reciprocal relations with other organisms, including *Homo sapiens*, and their environments.

16 Mallet (2005, p. 230) defines introgression as "invasion of foreign genetic material into a genome."

17 "i. If non-wolf females or female associates of non-wolf males localize movement, efforts should be made to determine whether she has a litter, and, if so, it should be removed. ii. If red wolf females localize movements, try to locate the den beginning one week after the suspected whelping date. Blood samples should be taken from each pup for genetic analysis, and transponders inserted. Litters identified as non-wolf following genetic analysis should be removed" (USFWS, 2013, p. 9).

In sum, when we try to save the postcard red wolf because of its contingent merit for a people, for a people's "nebulous future generations" (Smith, 2006, p. 29), for science, for ourselves, we believe that we are restoring to authenticity an essential aspect of natural heritage. Yet this is like trying to hold onto flowing water. Indeed, in the effort to capture, authorize, and iconize an arbitrary snapshot of the red wolf continuum, a mission motivated by fear of losing another "magic moment" (Mehrotra, 2004, p. 26), we simply produce another postcard of a replica built of planks from the ship of Theseus—one that reflects, like the postcard Indian, our "unexamined longings and desires" (Cronon, 1996, p. 70) rather than the living and evolving beings themselves.

Our heritage is already broken

In 1981, the venerable Thai Forest Tradition monk Ajahn Chah (2007) gave a teaching during *Vassa*, or the "Rains Retreat," at Wat Tham Saeng Phet, a Buddhist temple near the town of Amnat Cheroen in eastern Thailand. A portion of this teaching reads:

> You say, "Don't break my glass!" Can you prevent something that's breakable from breaking? If it doesn't break now it will break later on. If you don't break it, someone else will. If someone else doesn't break it, one of the chickens will! The Buddha says to accept this. He penetrated the truth of these things, seeing that this glass is already broken. Whenever you use this glass you should reflect that it's already broken. Do you understand this? The Buddha's understanding was like this. He saw the broken glass within the unbroken one. Whenever its time is up it will break. Develop this kind of understanding. Use the glass, look after it, until when, one day, it slips out of your hand … "Smash!" … no problem. Why is there no problem? Because you saw its brokenness before it broke!
>
> But usually people say, "I love this glass so much, may it never break." Later on the dog breaks it … "I'll kill that damn dog!" You hate the dog for breaking your glass … Why is this? Because you've dammed yourself up, the water can't flow. You've made a dam without a spillway. The only thing the dam can do is burst, right? When you make a dam you must make a spillway also. When the water rises up too high, the water can flow off safely. When it's full to the brim you open your spillway. You have to have a safety valve like this. Impermanence is the safety valve of the Noble Ones. If you have this "safety valve" you will be at peace.

Ajahn Chah's metaphors of the water, dam, and spillway speak directly to the dilemma of heritage conservation in the face of interdependence and impermanence. Let us briefly return to the example of the red wolf.

From a postcard heritage perspective, we see a species threatened by introgression of coyote genes. We understand how this might happen—habitat degradation, for example, can put a lot of stress on pure wolf populations and, at the same time, encourage incursions by disturbance specialists like coyotes (Bozarth et al., 2011). Species in the genus *Canis* can interbreed when conditions favor their intermixing, so it should be no surprise that territorial overlap between foreign coyotes and native wolves would lead to "mongrelization"[18] (Levin, 2002, p. 255). Thus, what we have here is a flow problem. To fix this problem, we need to prevent the mixing of pure and contaminated water (genes) by building dams (barriers to gene flow). Unfortunately, whenever we install a dam, we discover that the problem is also happening further upstream, so then we need to build another dam. And so on. It also seems that our dams can only hold back the pure water for so long; they inevitably breach our constructs and get contaminated somewhere else downstream. Or it turns out what we thought was pure water has always been contaminated. These efforts and discoveries lead to a never-ending cycle of struggle. What to do?

From a postcard heritage perspective, we see two possible directions. One, of course, is *nihilistic* and asks, if, despite our best efforts, not all contaminated water can be remediated and the pure water keeps finding ways to contaminate itself, why bother? Remove all the dams and let the water become polluted and the reservoirs run dry. A second direction is *frantic* and asks, what is there left to do but keep building and reinforcing more and more dams?

These two directions arise from moods and motivations tied to despair and fear of loss and share common essentialist assumptions about the nature of water and dams. Through an empty heritage perspective, however, these assumptions dissolve. Dams cannot function without proper spillways. Water flows downhill and tends to intermix and materialize in many forms. Thus, between nihilistic and frantic directions a middle course, so to speak, emerges—one that is instead *pragmatic* and asks, where dams are needed, how can their construction be motivated by an understanding of and appreciation for the nature of water? In other words, in the spirit of Russell's (2012, p. 260) quotation at the outset of this essay, how can we learn to love water for what it is rather than what we wish it to be?

Some cultural heritage scholars have addressed this question by exploring, in their own way, the transformative potential of heritage impermanence and destruction (e.g., Fibiger, 2015; Holtorf, 2006, 2015; Karlström, 2009; Peleggi, 2012; Russell, 2012). For example, in his essay on loss aversion and cultural

18 Interestingly, the etymology of mongrel reveals its roots in the words "mong," meaning mixture or mingling and "-rel," a pejorative suffix. From the 1540s, this word was used to denote a "person not of pure race" (Harper, 2015).

heritage, Cornelius Holtorf (2015) explores the work of Chinese artist and activist, Ai Weiwei, who, in his provocative *Dropping the Urn* project (Newland, 2010, cited in Holtorf, 2015, p. 413), appears to destroy ancient ceramic vessels by, for instance, submerging them in buckets of paint, painting commercial logos on them, or grinding them into powder. Holtorf argues convincingly that, in Ai Weiwei's apparently iconoclastic act of destroying heritage, he is paradoxically rebirthing it into a new place in the interdependent continuum of Chinese cultural heritage—one that highlights "the loss of historic material culture due to China's rapid modernization and the effects of a globalized economy of mass production on traditional craft work" (2015, p. 413). In other words, to extend another of Ajahn Chah's metaphors, when the glass is broken, its shards are seeds for transformation and the creation of new heritage.

In this reading of Chah's teaching, "the glass is already broken" means that the glass (or manuscript, or red wolf, or landscape, or story), even during the time when it is apparently whole, possesses the transformative potential we later observe arising, phoenix-like, from the dissolution of its current form. To see the broken glass in the unbroken one, then, calls for an approach that includes (1) *care for the phenomenon as it is now* while (2) *recognizing its impermanence and nurturing the transformative potential that lies behind the façade of its evanescent form*. To do otherwise denies its capacity and proclivity for change and transformative potential and causes unnecessary suffering for it (if it happens to be alive) and for those who care about and for it.

Therefore, moving from a postcard heritage to an empty heritage view entails a paradigm shift, one that not only brings a different perspective on heritage and heritage conservation, but also demands fresh approaches comprising both equanimity and compassion. In this light, Poulios (2015), drawing inspiration from value innovation trends in business management (e.g., Kim & Mauborgne, 2005), cites the need for a "Blue Ocean Strategy" in cultural heritage conservation, that is, one that challenges existing mental models and redefines the scope and process of conservation itself. As a central part of this strategy, Poulios (2010, 2014, 2015; see also Kimball et al., 2013) calls for an emphasis on *living heritage*, which requires switching the focus away from conservation of tangible and intangible cultural heritage and toward the communities for which participation in that heritage—and its reciprocally evolutionary processes—traditionally sustains and enlivens.

For heritage writ large—the construct that encompasses both cultural and natural phenomena—a Blue Ocean Strategy would support an emphasis on the transformative merit of heritage through a *regenerative conservation* which fosters efforts that prioritize reciprocal evolution of living heritage over the production and preservation of static replicas. For Mustang Valley's cultural heritage, this might mean reframing conservation research, policy, and practice to include the

needs, assets, and world views of local placekeepers, rather than an imperative for heritage objects to be "rescued." For the red wolf, it might mean research, policy, and practice that focus on habitat health and wellness and nurture, monitor, and honor the evolution and survival within these habitats of (among other organisms) wild canids, regardless of their color, shape, or resemblances. Photography is welcome, but postcards are not for sale here!

I conclude this essay where I began it—with the story of Bamiyan's Buddhas. This time, however, I re-envision the story based on the work of Bedunah et al. (2010), Blänsdorf & Petzet (2009), Flood (2002), and Husseini (2012), and insights from an empty heritage perspective. Indeed, this might be a first step in the empty heritage paradigm's pragmatic direction—to revisit the stories we weave and transmit and, then, rewrite them to enable us to see opportunities for regenerative conservation. A re-envisioned Bamiyan Buddhas story might commence like this:

> In the mountains of central Afghanistan lies the Bamiyan Valley, a landscape in progress, continuously reworked by seismic activity and the forces of temperature, wind, and water. Likewise, the valley's plant and animal species and communities have morphed, ebbing and flowing over the millennia in sync with grand and local oscillations of warm and cold, wet and dry. These communities and species included various humans and other hominin species as well, whose shifting patterns of migration, subsistence, and social interaction have left their own impressions. Indeed, the roots of the Shia Muslim Hazara extend deeply into the region's aboriginal past and mingle with its complex histories of dynamic adaptation, admixture, conquest, and colonialism. They experienced the arrival of the Silk Road and Buddhism in the 3rd century BCE; the advent of Islam between the 7th and 8th centuries CE; raids, looting, conquest, and iconoclastic destruction between the 5th and 17th centuries;[19] Hazara murder and subjugation in the 1890s[20] and by the Taliban at the turn of the 21st century. Some Hazara believe their people's ancestors carved into a cliff face and decorated with precious ornaments[21] two colossal Buddha statues about 1,400 years ago.[22] Through the centuries,

19 For example, the 5th- or early 6th-century CE Hephtalite ruler, Mihirikula, and the 9th-century Saffarid ruler, Yakub ibn Layth (Flood, 2002); the 17th-century Moghul Emperor, Aurangzeb Alamgir, and the Persian Emperor Nadir Shah (Blänsdorf & Petzet, 2009).

20 "Abdur Rahman, 'the Iron Amir,' invaded and conquered the Hazarajat with Ghilzai tribal (Pashtun) support, reduced thousands of the former inhabitants to slavery, and settled the Ghilzai on much of the land" (Bedunah et al., 2010, p. 42).

21 According to an account by traveling Chinese monk, Xuanzang, who wrote about his visit to Bamiyan in approximately 630 CE (Blänsdorf & Petzet, 2009).

22 "The present generation of Hazaras believed that the statues were carved by their ancestors with Hazara facial features in antiquity. They therefore believe that these statues are the emblems of their identity" (Husseini, 2012, p. 26).

in the midst of conquest, subjugation, and outsiders' acts of desecration,[23] Hazara have done their best to care for Bamiyan's temples, sacred caves, and objects by integrating them into the DNA of their traditions. For example, they wove Bamiyan's Buddhas into a folktale of love, duty, and responsibility in which the warrior hero Salsal completes an odyssey and slays a dragon for his beloved, Princess Shahmama, but the two tragically turn to stone on the eve of their wedding.[24] Although the Taliban succeeded in destroying much of the tangible remains of the statues, they could not extinguish their transformative merit still alive within the heritage of Hazara placekeepers, some of whom continue to share their stories, others of whom incorporate them into art and poetry of memorialization and resistance …[25]

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23 The faces of the Bamiyan Buddhas likely were erased in antiquity, as even 19th-century drawings show their absence (Blänsdorf & Petzet, 2009). Art historian Finbarr Barry Flood points out that iconoclastic defacement in Islamic history is well documented and suggests that the removal of the Bamiyan Buddha's faces might have been executed under the orders of Yakub ibn Layth in the 9th century (Flood, 2002). Although Blänsdorf and Petzet (2009, p. 18) claim that "there is no evidence for the faces having been destroyed," they footnote this statement with citations to the contrary. Husseini (2012) argues that an alternative explanation—that the faces were fitted with wooden or metallic masks—has no precedent in Ghandaran art.

24 "The people screamed on seeing [that they had turned to stone] and thereafter they lighted candles in those niches and recited tragic poems in their memory. They called it the 'niches of Love' and told this story to the travelers and also named their children after the lovers" (Husseini, 2012, p. 24).

25 For example, Husseini (2012) analyzes and presents examples of contemporary paintings and also writes, "Hazara poets have composed many poems after the destruction. Mourning, and links with Hazara identity and wish for its restoration are common themes" (p. 28). Further, he quotes Hazara artist Khadim Ali: "To me Buddha is my past, my identity. When someone is standing to remove 'my identity,' I must also stand to re-create it" (p. 27).

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Anti-Reflexivity and Climate Change Skepticism in the US General Public

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Abstract

The leading theoretical explanation for the mobilization of organized climate change denial is the Anti-Reflexivity Thesis, which characterizes the climate change denial countermovement as a collective force defending the industrial capitalist system. In this study, I demonstrate that the Anti-Reflexivity Thesis also provides theoretical purchase for explaining patterns of climate change skepticism among regular citizens. Analyzing nationally representative survey data from multiple waves of the University of Texas Energy Poll, I examine key predictors of climate change skepticism within the US general public. Identification with or trust in groups representing the industrial capitalist system increases the likelihood of climate change skepticism. Also, identification with or trust in groups representing forces of reflexivity (e.g., the environmental movement and scientific community) decreases the likelihood of such skepticism. Further, this study finds that climate change skeptics report policy preferences, voting intentions, and behavioral intentions generally supportive of the existing fossil fuels–based industrial capitalist system.

Keywords: anti-reflexivity thesis, climate change skepticism, policy preferences, voting intentions, behavioral intentions

Introduction

Over the last three decades, climate change has become successfully defined as a serious global problem deserving ameliorative action, due largely to the actions of the scientific community and environmental movement. During much of this same time, a climate change denial countermovement has mobilized to deny the reality and seriousness of climate change as a social problem by opposing the claims of the scientific community and environmental movement (e.g., Dunlap & McCright, 2016). Much scholarship analyzes the strategies,

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techniques, and effectiveness of key components of this US-based climate change denial countermovement: fossil fuels (and other) industry organizations (e.g., Freudenburg, Gramling, & Davidson, 2008; Layzer, 2007), conservative think tanks (e.g., Dunlap & Jacques, 2013; McCright & Dunlap, 2000, 2003; Oreskes & Conway, 2010), contrarian scientists (e.g., Lahsen, 2008; McCright, 2007), and Republican politicians (e.g., McCright & Dunlap, 2003, 2010). Recent work confirms the results of earlier studies and documents the evolving funding and organizational structure of this countermovement (e.g., Boussalis & Coan, 2016; Brulle, 2014; Farrell, 2016a, 2016b).

The leading theoretical explanation for this mobilization of organized climate change denial is the Anti-Reflexivity Thesis (e.g., McCright & Dunlap, 2010), which characterizes the climate change denial countermovement as a collective force defending the industrial capitalist system against claims that the system causes serious problems. In this paper, I argue that the Anti-Reflexivity Thesis also may provide insights for understanding the patterns of climate change skepticism[2] within the general public. Analyzing nationally representative survey data from multiple waves of the University of Texas Energy Poll, I test hypotheses derived from the Anti-Reflexivity Thesis to explain key predictors of climate change skepticism within the US general public. Further, since few studies focus on the attitudes and behaviors of climate change skeptics, I also examine how climate change skepticism is related to energy-related policy preferences, voting intentions, and behavioral intentions.

Briefly, this paper makes the following contributions. First, this study extends an emerging theoretical framework in environmental sociology by demonstrating the efficacy of the Anti-Reflexivity Thesis for explaining the dynamics of climate change skepticism in the general public. In the process, this study integrates key theoretical insights into the evolving scholarship on climate change skepticism. Second, the analyses determine the extent to which key Anti-Reflexivity Thesis variables (i.e., trust in and/or identification with forces of reflexivity or anti-reflexivity) influence climate change skepticism independent of the effect of political orientation. This may provide theoretical guidance for understanding

2 In this paper, I use "climate change denial" when discussing the individuals and organizations in the organized countermovement to challenge the reality and seriousness of anthropogenic climate change. I use "climate change skepticism" when discussing members of the general public who do not believe the scientific claims about climate change but who otherwise are not likely involved actively in the climate change denial countermovement. In my literature review of studies reporting the results of general public surveys, I use "skepticism" for what other scholars variously term "rejecting the science," "denial," "skepticism," "contrarianism," or "naysaying." I do recognize that using "skepticism" in this way is inconsistent with how philosophers and sociologists of science historically have used the term, especially when discussing the institution of science (e.g., Merton, 1938). Yet, social scientists who study climate change lack a more accurate term between "skepticism" and "denial." It seems prudent to reserve use of the term "denial" to those individuals and organizations actively challenging the reality and seriousness of anthropogenic climate change and apply the term "skepticism" to regular members of the general public who simply report views in opposition to the scientific community.

climate change skepticism in those countries where climate change is less politicized and skepticism is less aligned with political orientation. Third, this study is one of the first to examine how climate change skepticism is related to other environmentally consequential decisions.

In the next section, I review those studies that specifically examine climate change skepticism among regular citizens. I then explain the key arguments of the Anti-Reflexivity Thesis, deriving insights for explaining citizens' climate change skepticism. After describing the dataset and the variables used in the study, I present and discuss the results of my analyses. I close with a brief discussion of potential avenues for future research.

Survey research on climate change skepticism

The last 15 years have seen the emergence of a body of studies examining the patterns of climate change skepticism via survey research. This literature is still developing and remains characterized by a range of approaches and analytical techniques and, more consequentially, diversity in the operationalization of climate change skepticism. Nevertheless, a few clear patterns can be identified. In this section, I first describe the nature of these studies before summarizing their most robust empirical results.

Most of the studies in this emerging literature examine the predictors of climate change skepticism (e.g., Evans & Feng, 2013; Leviston & Walker, 2012; Poortinga et al., 2011), though a few treat climate change skepticism as a predictor variable (e.g., Capstick & Pidgeon, 2014; Engels et al., 2013; Smith & Leiserowitz, 2012). While some studies use small, non-representative samples,[3] most utilize large, nationally representative samples from the United States (e.g., Feldman et al., 2012; Hamilton, 2012; Leiserowitz et al., 2012; McCright & Dunlap, 2011a), Australia (e.g., Leviston & Walker, 2012; Leviston et al., 2013; Lewandowsky, Gignac, & Oberauer, 2013), Britain (e.g., Clements, 2012; Poortinga et al., 2011), or Germany (e.g., Engels et al., 2013).

Earlier work identifies four key dimensions of climate change skepticism: believing that the Earth is not warming and climate change is not happening (trend skepticism); believing that human activities are not causing climate change (attribution skepticism); believing that climate change will not have significant negative impacts (impact skepticism); and believing that there

3 These studies using small, non-representative samples examine residents of a western Canadian city (Heath & Gifford, 2006), residents of a few British counties (Whitmarsh, 2011), the UK general public (Capstick & Pidgeon, 2014), residents of an Australian state (Lo, 2014), Australian adults (Hobson & Niemeyer, 2013), residents of a Swedish city (Häkkinen & Akrami, 2014), and visitors of climate blogs from multiple countries (Lewandowsky, Oberauer, & Gignac, 2013).

is no strong scientific agreement on the reality and human cause of climate change (consensus skepticism) (e.g., McCright & Dunlap, 2000; McCright, Dunlap, & Xiao, 2013; Rahmstorf, 2004). Most of the studies in this literature operationalize climate change skepticism directly via single-item or composite measures.[4] These studies can be classified according to the dimensions of skepticism they measure (even as they may also include items that do not easily fit into the following categories):

- trend skepticism only (e.g., Hmielowski et al., 2014; Leviston et al., 2013);
- trend and attribution skepticism only (e.g., Leviston & Walker, 2012);
- trend, attribution, and impact skepticism only (e.g., Capstick & Pidgeon, 2014; Clements, 2012; Heath & Gifford, 2006; Leiserowitz et al., 2012; Lewandowsky, Oberauer, & Gignac, 2013; Lewandowsky, Gignac, & Oberauer, 2013; Lo, 2014; Whitmarsh, 2011); and
- trend, attribution, impact, and consensus skepticism (Engels et al., 2013; Feldman et al., 2012; Häkkinen & Akrami, 2014; McCright & Dunlap, 2011a; Poortinga et al., 2011).

Few of the studies using nationally representative data provide descriptive statistics to allow comparison of the spread of climate change skepticism across countries and over time. Further, those studies that do report such statistics often utilize different measures of the various dimensions of climate change skepticism. Nevertheless, four studies report the results of analyses with nationally representative survey data from 2010 or 2011, allowing for at least a rough comparison: 2011 Germany (Engels et al., 2013), 2010 Australia (Leviston & Walker, 2012), 2010 United States (McCright & Dunlap, 2011a), and 2010 Britain (Poortinga et al., 2011). The sole study examining climate change skepticism over time with multiple years of data finds that all dimensions of climate change skepticism increased in the US general public between 2001 and 2010 (McCright & Dunlap, 2011a).

With the exception of Germany where all forms of skepticism are low—only about 7% of Germans are trend skeptics, 7% are attribution skeptics, 5% are impact skeptics, and 8% are consensus skeptics—(Engels et al., 2013), trend skepticism seems to be less prevalent than does attribution, impact, or consensus skepticism in Australia, Britain, and the United States. Nearly 19% of Americans believe that global warming will never happen (McCright & Dunlap, 2011a), while 15% of the British public does not think the world's climate is changing

4 Three studies operationalize climate change skepticism indirectly: giving factually incorrect answers to specific questions about climate change (Hamilton, 2012); providing "naysayer affective imagery" in responses to open-ended questions (Smith & Leiserowitz, 2012); and believing that environmental scientists don't understand the causes of global warming very well and should have little influence in deciding what to do about global warming (Evans & Feng, 2013).

(Poortinga et al., 2011), and between 6% and 17% of Australians (depending upon the measure) are trend skeptics (Leviston & Walker, 2012). Nearly 46% of Americans (McCright & Dunlap, 2011a), 18% of the British public (Poortinga et al., 2011), and about 40% of Australians (Leviston & Walker, 2012) attribute global warming solely or primarily to natural processes. About 48% of Americans (McCright & Dunlap, 2011a) and 40% of the British public (Poortinga et al., 2011) believe that the seriousness of global warming is exaggerated. Finally, about 48% of Americans (McCright & Dunlap, 2011a) but only 21% of the British public (Poortinga et al., 2011) believe there is no scientific consensus on climate change.

Several clear patterns emerge from those studies examining predictors of climate change skepticism in the general publics of advanced industrial countries. By far the most robust predictor of climate change skepticism is political orientation, whereby ideological conservatives (Clements, 2012; Evans & Feng, 2013; Häkkinen & Akrami, 2014; Leiserowitz et al., 2012; Lewandowsky, Gignac, & Oberauer, 2013; McCright & Dunlap, 2011a) and supporters/members of conservative political parties (Campbell & Kay, 2014; Evans & Feng, 2013; Feldman et al., 2012; Hamilton, 2012; Leiserowitz et al., 2012; Leviston & Walker, 2012; McCright & Dunlap, 2011a; Poortinga et al., 2011; Whitmarsh, 2011) are more likely to report climate change skepticism than are their liberal counterparts. Several studies simply do not include a measure of political orientation (Capstick & Pidgeon, 2014; Cho et al., 2011; Engels et al., 2013; Heath & Gifford, 2006; Leviston et al., 2013; Lewandowsky, Oberauer, & Gignac, 2013; Lo, 2014). Yet, all survey studies that do include either political ideology or party identification or both find political orientation to be a significant predictor—typically one of the strongest predictors. Related to political orientation, other studies find that espousing a free market ideology (Campbell & Kay, 2014; Heath & Gifford, 2006; Lewandowsky, Gignac, & Oberauer, 2013; Lewandowsky, Oberauer, & Gignac, 2013), strongly valuing private property rights (Lo, 2014), strongly supporting hierarchies (Häkkinen & Akrami, 2014), regularly viewing Fox News (Feldman et al., 2012), holding traditional values (Poortinga et al., 2011), and being a conservative Protestant (Evans & Feng, 2013) are also associated with climate change skepticism.

The performance of social, demographic, and economic variables is less consistent, though some patterns have emerged. Several studies find that weak environmental beliefs (Engels et al., 2013; Feldman et al., 2012; Whitmarsh, 2011), weak environmental movement identity (McCright & Dunlap, 2011a), or strong environmental apathy (Heath & Gifford, 2006) are associated with climate change skepticism. Men report stronger climate change skepticism than do women (Clements, 2012; Feldman et al., 2012; Leviston & Walker, 2012; McCright

& Dunlap, 2011a).[5] Further, low socioeconomic status (education and income) is associated with climate change skepticism, but only in the United Kingdom (Clements, 2012; Poortinga et al., 2011; Whitmarsh, 2011). The remaining socio-demographic variables (e.g., age, religiosity, etc.)—when included in analyses at all—typically perform poorly or inconsistently in predicting climate change skepticism.

The Anti-Reflexivity Thesis

Reflexive Modernization Theory (e.g., Beck, 1992; Giddens, 1990; see also Rosa, Renn, & McCright, 2014) characterizes the current era of late modernity as a distinct stage of advanced industrial society where institutions suffer from legitimacy crises brought on by their inability to effectively solve the ecological and technological problems of modernization. Reflexive modernization scholars argue that heightened reflexivity is a necessary precondition for getting past our current ecological and technological crises. They define reflexivity as a self-confrontation with the unintended and unanticipated consequences of modernity's industrial capitalist system. Two prominent forces of reflexivity, which promote such societal self-confrontation, are social movements and science (e.g., Beck, 1992; Giddens, 1990; Mol, 2000). Most notably, environmental activism and those scientific fields that examine the ecological and human health impacts of economic activities and new technologies—what Schnaiberg (1980) terms "impact science"[6]—attempt to force societal recognition of, and action on, our major ecological and technological crises.

During these times of fundamental societal change, other sectors of society—for ideological and/or material reasons—mobilize to challenge the shift toward societal self-confrontation. Gleeson (2000) refers to this as a mobilization of "anti-reflexivity," because it attempts to defend the legitimacy of the industrial capitalist system against the open-ended transformation of reflexive modernization. More specifically, it directly opposes the forces of reflexivity that identify problems caused by the industrial capitalist system and urge government action to deal with them. Within the United States, recognizing and attempting to deal with major ecological crises has provoked significant anti-reflexivity since the late 1980s (Jacques, 2006; McCright, Xiao, & Dunlap, 2014).

5 McCright & Dunlap (2011a) document what they refer to as the "conservative white male" effect, whereby conservative white males are more likely to deny the reality and seriousness of climate change than are others in the general public.

6 "Impact science" stands in conceptual distinction from what Schnaiberg (1980) terms "production science," or scientific activities in service to economic production. While this abstract, analytical typology is theoretically powerful (e.g., McCright et al., 2013), it can often be quite difficult to empirically distinguish impact science and production science (e.g., Gould, 2015).

The Anti-Reflexivity Thesis (McCright & Dunlap, 2010) initially was developed to explain why certain sectors of advanced industrial society mobilized to defend the industrial capitalist system against the claims of social movements and the scientific community used to support calls for further governmental intervention into economic markets. While such opposition to governmental regulations has been a mainstay within industry and the conservative movement for many decades, a stronger version of anti-reflexivity emerged in the early 1990s. This was due largely to the rise of international environmentalism and environmental policy-making efforts to deal with global environmental problems (signaled by the 1992 Rio Earth Summit). Such an upsurge in reflexivity—culminating in the recognition of climate change as a significant global problem deserving substantial action—posed a much more fundamental challenge to the neoliberal expansionism of the industrial capitalist system than did earlier calls for more localized regulations to deal with air and water pollution (e.g., Foster et al., 2011; Jacques, 2006; McCright, Xiao, & Dunlap, 2014).

McCright & Dunlap (2010, 2011b) argue that the most prominent manifestation of anti-reflexivity in the United States is the mobilization of the American conservative movement and fossil fuels industry to deny the reality and seriousness of climate change. The last two decades in the United States have seen an enduring conflict between those defining climate change as real and characterizing it as problematic (the scientific community, environmental organizations, and many Democratic policymakers) and those defending the industrial capitalist system by challenging climate science and denying the dangerousness of climate change (fossil fuels industry organizations, conservative think tanks, contrarian scientists, and many Republican policymakers) (Brulle, 2014; Farrell, 2016a, 2016b; McCright & Dunlap, 2000, 2003, 2010; Oreskes & Conway, 2010).

While the Anti-Reflexivity Thesis has been used primarily to explain organized climate change denial activism (McCright & Dunlap, 2010), it has been extended to explain climate change skepticism among self-identified conservatives and Republicans in the US general public (McCright et al., 2016; McCright & Dunlap, 2011b) and the ideological divide on trust in science within the US general public (McCright et al., 2013). I continue this line of scholarship by deriving key insights from the Anti-Reflexivity Thesis to explain broader patterns of climate change skepticism within the US general public. I limit this discussion to those general theoretical expectations and corresponding specific hypotheses that can be tested with the data used in this study.

Briefly, the Anti-Reflexivity Thesis expects that identification with, support for, or trust in groups representing or defending the industrial capitalist system increases the likelihood of skepticism that the system is causing significant problems necessitating governmental action. Such groups include, among others,

specific corporations (e.g., ExxonMobil), industry associations (e.g., American Petroleum Institute), conservative movement organizations (e.g., think tanks or foundations), and political parties (e.g., Republican Party) whose creeds espouse and actions embody defense of the industrial capitalist system and opposition to governmental regulations.[7] The dataset in this study allows an empirical test of the following hypotheses.

> *Trust in groups representing the industrial capitalist system increases the likelihood of skepticism of the reality and human cause of climate change.* (H1)

> *Identification with the Republican Party increases the likelihood of skepticism of the reality and human cause of climate change.* (H2)

Also, the Anti-Reflexivity Thesis expects that identification with, support for, or trust in groups representing or defending forces of reflexivity decreases the likelihood of skepticism that the system is causing significant problems necessitating governmental action. Such groups include, among others, specific environmental movement organizations (e.g., Sierra Club) or the environmental movement more generally, the scientific community in general or specific science advocacy organizations (e.g., Union of Concerned Scientists), and political parties (e.g., Democratic Party) that accept the need for—and even advocate the use of—governmental regulations to solve problems created by the industrial capitalist system.[8] The dataset in this study allows an empirical test of the following hypotheses.

> *Trust in groups representing forces of reflexivity decreases the likelihood of skepticism of the reality and human cause of climate change.* (H3)

> *Identification with the environmental movement decreases the likelihood of skepticism of the reality and human cause of climate change.* (H4)

> *Identification with the Democratic Party decreases the likelihood of skepticism of the reality and human cause of climate change.* (H5)

In addition to testing these hypotheses, this dataset also allows investigation of how climate change skepticism relates to energy-related policy preferences, voting intentions, and behavioral intentions. This is significant since, other than Engel et al.'s (2013) study of German adults, scholars have not examined how energy-related attitudes and behaviors are related to climate change

7 This provides theoretical purchase for explaining why identification with the Republican Party (or other Right-leaning parties or conservative ideology more generally) is the most consistent predictor of climate change skepticism in the literature (e.g., Evans & Feng, 2013; Feldman et al., 2012; Hamilton, 2012; McCright & Dunlap, 2011b).

8 This helps explain why several studies find that climate change skepticism is more likely among those with low or no identification with environmentalism (e.g., Heath & Gifford, 2006; McCright & Dunlap, 2011a; Whitmarsh, 2011).

skepticism. The analyses below specifically help fill this important gap and improve our understanding of the extent to which climate change skepticism in the US general public matters more generally.

The study

Data for this study come from the University of Texas at Austin Energy Poll, which is designed and managed by the Energy Management and Innovation Center of the McCombs School of Business. Since 2011, this biannual survey includes both recurring questions about energy priorities, policies, and behaviors and one-time questions about specific energy issues. Indeed, the University of Texas Energy Poll is the only ongoing nationally representative survey of Americans' energy views and behaviors. All waves, administered online in March and September, have independent samples of more than 2,000 US adults. Data weights are used to make each sample representative of the US adult population.[9]

I combined the repeated cross-sections from Wave 2 (March 2012) to Wave 7 (September 2014) into a pooled sample.[10] The social, demographic, and political characteristics of this pooled sample are presented in Table 1. I used SPSS 19.0 to perform all statistical analyses with weighted data. Not all of the selected survey items were asked in each wave or of all the subjects in a wave, so the sample sizes vary across dependent variables and models. Table 2 contains the exact wording of the survey questions used to create all composite measures and outcome variables.

Table 1: Description of the pooled sample

	Pooled sample (N = 12,958)
Gender (% female)	51.6
Age (% aged 18–39)	38.3
Race (% white)	79.0
Educational Attainment (% at least bachelor's degree)	30.1
Household Income (1–8 scale: "less than $20K" to "$200K and more")	4.11 (2.17)
Party Identification (N = 12,498)	
% Democrat	40.3
% Independent	27.7
% Republican	32.0

9 Additional details about the University of Texas Energy Poll can be found here: www.utenergypoll.com.
10 Wave 1 did not include the survey items used to create the climate change skepticism indicators.

	Pooled sample (N = 12,958)
Religious Affiliation	
% Christian	40.0
% non-Christian	6.9
% non-religious	53.1
Religiosity (1–4 scale: "not religious at all" to "very religious")	2.70 (1.01)
Parental status (% with child under 18 at home)	27.8
Employment status (% employed part- or full-time)	47.4
Place of Residence	
% Rural	24.0
% Suburban	47.9
% Urban	28.1

Note: Standard deviation is given in parentheses.

Two survey items were used to create the climate change skepticism indicators. Trend skepticism is measured by the following item: "Do you think global climate change is or is not occurring?" *Trend skepticism* is coded "1" for "is not occurring" and coded "0" for "is occurring" or "don't know." Approximately 18.2% of the pooled sample (N = 12,958) are trend skeptics who do not think that climate change is occurring.[11] While the survey does not contain a straightforward indicator of attribution skepticism as used in other studies, attribution skepticism can be reasonably approximated using the following item: "Please indicate the extent to which you think each of the following is a contributing factor in global climate change." The response categories range from "not at all a factor" = 1 to "a very significant factor" = 5. Among the options are "coal" and "oil." *Attribution skepticism* is coded "1" for those respondents who gave an answer of 0, 1, 2, or 3 for both coal and oil and is coded "0" for all other respondents. Approximately 21.1% of the pooled sample (N = 7,478) are attribution skeptics who believe that these fossil fuels are not significant contributors to climate change.[12]

11 This percentage is quite similar to that reported by McCright & Dunlap (2011a). Briefly those authors report that 18.9% of the American public in 2010 were trend skeptics.

12 This percentage is much less than the 46% of Americans in 2010 identified as attribution skeptics by McCright & Dunlap (2011a). The sizable difference between the 2010 percentage based on Gallup Poll data and the 2012–2014 percentage reported here is likely due to the different survey questions used to measure attribution skepticism. The item used here likely underestimates the actual prevalence of attribution skepticism in the US general public in 2012–2014.

Table 2: Description and coding of selected variables in the study

Variables	Survey Items	Response Coding
Trust in industrial capitalist groups (Spearman-Brown coefficient = 0.73)	Please indicate the degree to which you trust each of the following groups of organizations to provide you with information on how to [use energy more efficiently] [conserve energy]? Oil and gas companies US business community	"do not trust at all" = 1 to "trust completely" = 5
Trust in forces of reflexivity (Spearman-Brown coefficient = 0.74)	Please indicate the degree to which you trust each of the following groups of organizations to provide you with information on how to [use energy more efficiently] [conserve energy]? Environmental groups Academic/scientific community	"do not trust at all" = 1 to "trust completely" = 5
Support for new EPA rules restricting emissions at coal-fired power plants	The EPA has recently proposed new rules restricting emissions of pollutants, such as carbon dioxide, from coal-fired power plants. Do you support or oppose these kinds of rules?	"oppose" = -1 "not sure" or "neither" = 0 "support" = 1
Support for development of renewable technologies	Should the federal government focus on developing renewable technologies?	"no" = 0 "yes" = 1
Support for subsidies for renewable energy (Cronbach's alpha = 0.83)	Should the federal government subsidize: Renewable technologies Energy efficiency Electric vehicles	"no" = 0 "yes" = 1
Intention to vote for presidential candidate who supports fossil fuels development (Cronbach's alpha = 0.79)	In the next election, would you be more likely or less likely to vote for a presidential candidate who: Supports expanding offshore oil development in the Gulf Coast of Mexico Supports expanding domestic natural gas development Supports approving the construction of the XL Keystone pipeline to transport oil from Canada to the Gulf Coast	"much less likely" = 1 "somewhat less likely" = 2 "neither less likely nor more likely" or "not sure" = 3 "somewhat more likely" = 4 "much more likely" = 5

Variables	Survey Items	Response Coding
Intention to vote for presidential candidate who supports renewable energy development (Cronbach's alpha = 0.82)	In the next election, would you be more likely or less likely to vote for a presidential candidate who: Supports expanding financial incentives for companies engaged in renewable technologies Supports requiring utilities to obtain a certain percentage of their electricity from renewable sources Supports increasing funding for scientific and university research into new energy technologies	"much less likely" = 1 "somewhat less likely" = 2 "neither less likely nor more likely" or "not sure" = 3 "somewhat more likely" = 4 "much more likely" = 5
Intention to adopt energy conservation technologies (Cronbach's alpha = 0.83)	Please indicate how likely it is that you will do each of the following within the next five years: Own a hybrid vehicle Own a fully electric vehicle Own a vehicle that runs on natural gas Use "smart meter" technology that allows you to better manage your household's demand for electricity Install solar panels at your home	"not at all likely" = 1 to "very likely" = 7 "do this currently" or "have done it already" = 8
Intention to perform household energy conservation behaviors (Cronbach's alpha = 0.74)	Please indicate how likely it is that you will do each of the following within the next five years: Purchase energy efficient light bulbs Improve insulation in your home Purchase an energy efficient appliance Have a home energy audit performed	"not at all likely" = 1 to "very likely" = 7 "do this currently" or "have done it already" = 8

Notes: Reliability analysis for the last five indexes was performed with Cronbach's alpha, which is appropriate when using three or more items. Reliability analysis for the first two indexes was performed with the Spearman-Brown coefficient, which is more appropriate than is Cronbach's alpha when only two items are available (e.g., Eisinga, Grotenhuis, & Pelzer, 2013).

Two Anti-Reflexivity Thesis variables are composite measures. Briefly, respondents were asked how much they trust ("do not trust at all" = 1 to "trust completely" = 5) a few groups or organizations to provide them with information on how to use energy more efficiently or conserve energy.[13] *Trust in industrial capitalist groups* (Spearman-Brown coefficient = 0.73)[14] taps how much respondents trust in two representatives of the industrial capitalist system: "oil and gas companies" and "the US business community." *Trust in forces of reflexivity* (Spearman-Brown coefficient = 0.74) taps how much respondents trust in two forces of reflexivity: "environmental groups" and "the academic/scientific community."

Identification with the environmental movement is measured with the following item: "As the term is generally used today, do you consider yourself to be an environmentalist?" *Self-identified environmentalist* is coded "2" for "yes, active environmentalist," "1" for "yes, passive environmentalist," and "0" for "no, not an environmentalist" or "prefer not to answer." Approximately 12.4% of the pooled sample identifies as an active environmentalist, 36.4% as a passive environmentalist, and 51.2% as not an environmentalist.

Party identification is measured with a set of two dummy variables with "Independent" as the reference category.[15] *Republican* includes those respondents who identify as "lean Republican" to "strong Republican," and *Democrat* includes those respondents who identify as "lean Democrat" to "strong Democrat." The small percentages of respondents who answered "other" or "prefer not to answer" were coded as Independent. The 3.5% of the pooled sample who identified as "Libertarian" were dropped from analyses.[16] This resulted in the following percentages in the pooled sample: 32.0% Republican, 27.7% Independent, and 40.3% Democrat.

Three indicators measure energy-related policy preferences. The single-item indicator, *support for new EPA rules restricting emissions at coal-fired power plants*, measures whether respondents "oppose" (–1), "support" (1), or are "not sure" (0) about the new EPA rules. The single-item indicator, *support for development of renewable technologies*, measures whether respondents believe ("no" = 0; "yes" = 1) the federal government should focus on developing

13 The survey used "use energy more efficiently" in Wave 2, "conserve energy" in Wave 3, and both "use energy more efficiently" and "conserve energy" in a split-half design in Waves 4–7. Thus, the survey did not ask about trust in general or about trust specifically on the topic of climate change but trust on the less politicized topic of energy conservation and efficiency.

14 Reliability analysis for the first two indexes was performed with the Spearman-Brown coefficient, which is more appropriate than is Cronbach's alpha when only two items are available (e.g., Eisinga, Grotenhuis, & Pelzer, 2013).

15 Waves 2–7 did not include a survey item to measure political ideology.

16 In additional analyses, I retained those respondents identifying as Libertarian and included them in the Republican grouping. Analyses using this revised party identification indicator produced results closely similar to those presented here.

renewable technologies. A composite index, *support for subsidies for renewable energies* (Cronbach's Alpha = 0.83), measures whether respondents believe ("no" = 0; "yes" = 1) the federal government should subsidize renewable technologies, energy efficiency, and electric vehicles.

Two indicators measure energy-related voting intentions. A composite index, *intention to vote for a presidential candidate who supports fossil fuels development* (Cronbach's Alpha = 0.79), measures how more or less likely ("much less likely" = 1 to "much more likely" = 5) respondents would be to vote for a presidential candidate who supports expanding offshore oil development in the Gulf Coast of Mexico, expanding domestic natural gas development, and approving the construction of the XL Keystone pipeline to transport oil from Canada to the Gulf Coast. Another composite index, *intention to vote for a presidential candidate who supports renewable energy development* (Cronbach's Alpha = 0.82), measures how more or less likely ("much less likely" = 1 to "much more likely" = 5) respondents would be to vote for a presidential candidate who supports expanding financial incentives for companies engaged in renewable technologies, requiring utilities to get a certain percentage of electricity from renewable sources, and increasing funding for scientific and university research on new energy technologies.

Finally, two indicators measure energy conservation behavioral intentions. A composite index, *intention to adopt energy conservation technologies* (Cronbach's Alpha = 0.83), measures how likely ("not at all likely" = 1 to "very likely" = 7 and "do this currently/have done it already" = 8) that respondents would do the following within the next five years: own a hybrid vehicle, own a fully electric vehicle, own a vehicle that runs on natural gas, use "smart meter" technology allowing for better management of household electricity demand, and install solar panels at your home. Another composite index, *intention to perform household energy conservation behaviors* (Cronbach's Alpha = 0.74), measures how likely ("not at all likely" = 1 to "very likely" = 7 and "do this currently/have done it already" = 8) that respondents would do the following within the next five years: purchase energy efficient light bulbs, improve insulation in your home, purchase an energy efficient appliance, and have a home energy audit performed.

Ten demographic and social variables are employed as controls in the multivariate statistical analyses. Gender ("*female*" = 1) and race ("*white*" = 1)[17] are measured with dummy variables. *Age* varies from "18–24" = 1 to "75 or over" = 11. Socioeconomic status is measured with three variables: *education* ("less than high school diploma" = 1 to "post-graduate degree" = 5), *income* ("less than

17 For more direct comparability with prior studies of climate change skepticism, this category includes both non-Latino Whites and Latino Whites.

$20,000" = 1 to "$200,000 or more" = 8) and *employed* ("not employed" = 0, "employed part- or full-time" = 1).[18] *Religiosity* ranges between "not religious at all" = 1 to "very religious" = 4. Whether or not a respondent was the parent of a minor child ("*parent*" = 1) was measured with a dummy variable. Finally, place of residence was measured with two dummy variables ("*urban*" and "*rural*") using "suburban" as the reference category.

Results and discussion

The influence of Anti-Reflexivity Thesis variables on climate change skepticism

Since both climate change skepticism measures are dichotomous, I used logistic regression analysis to test the five hypotheses derived from the Anti-Reflexivity Thesis. Table 3 presents the estimated odds ratios of key theoretical variables from logistic regression models predicting trend and attribution skepticism in the US general public. An odds ratio greater than 1 means that a predictor increases the odds of being a climate change skeptic rather than not being one, and an odds ratio lesser than 1 means that a predictor decreases the odds of being a skeptic rather than not being one.

As expected by the Anti-Reflexivity Thesis, trust in groups representing the industrial capitalist system increases the likelihood of skepticism of the reality and human cause of climate change (supporting H1). That is, trusting oil and gas companies and the business community on the topic of energy increases the likelihood of trend and attribution skepticism. This effect endures even when accounting for the effects of other key theoretical predictors and the demographic and social controls.

Further, compared to Independents, Republicans are more likely to be trend and attribution skeptics (supporting H2). This effect (a positive relationship between conservative party identification and climate change skepticism) is consistent with most empirical work in the US (e.g., Hamilton, 2012; McCright & Dunlap, 2011a) and beyond (e.g., Leviston & Walker, 2012; Poortinga et al., 2011).

18 The "not employed" category includes full-time homemakers, students, retirees, and the temporarily unemployed.

Table 3: Estimated odds ratios from logistic regression models predicting climate change skepticism in the US general public

Predictors	Trend Skepticism Model 1	Attribution Skepticism Model 2
Anti-Reflexivity Variables		
Trust in industrial capitalist groups	1.63***	1.47***
Trust in forces of reflexivity	0.38***	0.58***
Self-identified environmentalist	0.60***	0.72***
Republican	2.29***	1.45***
Democrat	0.54***	0.87
Demographic and Social Characteristics		
Female	0.78***	0.88*
Age	1.00	1.02
White	1.62***	1.45***
Education	0.95	1.02
Income	1.02	1.01
Employed	0.96	1.04
Religiosity	1.28***	1.01
Parent	0.85*	0.94
Urban	0.99	0.76***
Rural	0.96	1.07
Survey Waves		
Wave 3	0.67***	
Wave 4	0.69***	0.96
Wave 5	0.72***	0.88
Wave 6	0.87	0.76**
Wave 7	0.76**	0.68***
Nagelkerke R^2	0.39	0.13
N	12,471	7,265

Notes: The reference category for political party identification is "Independent." The reference category for place of residence is "Suburban." The reference category for survey wave in Model 1 is Wave 2, and the reference category for survey wave in Model 2 is Wave 3.

* $p < .05$ ** $p < .01$ *** $p < .001$

Also as expected by the Anti-Reflexivity Thesis, trust in environmental groups and the scientific community on the topic of energy decreases the likelihood of trend and attribution skepticism (supporting H3). Further, identifying with the environmental movement decreases the likelihood of both dimensions of skepticism examined here (supporting H4). This effect (an inverse relationship

between environmental identity and climate change skepticism) confirms the findings of several earlier studies in the US (e.g., Feldman et al., 2012; Heath & Gifford, 2006; McCright & Dunlap, 2011a) and abroad (e.g., Engels et al., 2013; Whitmarsh, 2011). Hypothesis 5 receives partial support. Democrats are less likely than are Independents to be trend skeptics, but there is no statistically significant difference between Independents and Democrats on attribution skepticism.

Only two of the demographic and social controls have a consistent effect on both dimensions of skepticism. Briefly, males and whites are more likely than are their female and non-white counterparts to be trend and attribution skeptics, confirming an earlier finding (McCright & Dunlap, 2011a). Similar to what most prior studies find, the remaining demographic and social variables do not have consistent effects on climate change skepticism.

The influence of climate change skepticism on energy-related policy preferences, voting intentions, and behavioral intentions

Other than Engel et al.'s (2013) study of German adults, scholars have yet to examine how climate change skepticism is related to energy-related attitudes and behaviors. I investigate this here as a step to better understand the extent to which climate change skepticism in the US general public matters more broadly. The tables below present the effects of trend and attribution skepticism on citizens' energy-related policy preferences (Tables 4 and 5), voting intentions (Table 6), and behavioral intentions (Table 7) not only controlling for demographic and social characteristics and the survey wave but also the key Anti-Reflexivity Thesis variables discussed above. Except for Models 5 and 6 in Table 5 (which use logistic regression to predict a dichotomous outcome variable), the models in these tables employ ordinary least squares (OLS) regression.

Briefly, both trend and attribution skepticism lead to greater opposition to policies shifting our economy away from its fossil fuels base. Compared to their non-skeptical counterparts, trend and attribution skeptics are less supportive of policies aimed at directly reducing greenhouse gas emissions (Table 4) and at developing and subsidizing renewable energy technologies (Table 5). These results complement those of Engels et al. (2013), who find that climate change skepticism correlates with greater support for fossil fuel energy sources (e.g., coal, oil) and with lesser support for renewable energy sources (e.g., wind, solar, hydro).

Table 4: Coefficients (and standard errors) from OLS regression models predicting support for new EPA rules restricting emissions at coal-fired power plants in the US general public

	Support for New EPA Rules Restricting Emissions at Coal-Fired Power Plants	
Predictors	**Model 3**	**Model 4**
Anti-Reflexivity Indicators		
Trend skeptic	–0.38 (.05)***	
Attribution skeptic		–0.22 (0.04)***
Trust in industrial capitalist groups	–0.13 (0.02)***	–0.08 (0.02)***
Trust in forces of reflexivity	0.18 (0.02)***	0.15 (0.02)***
Self-identified environmentalist	0.14 (0.02)***	0.11 (0.03)***
Republican	–0.09 (0.04)*	–0.07 (0.05)
Democrat	0.14 (0.04)***	0.14 (0.04)**
Demographic and Social Characteristics		
Female	–0.03 (0.03)	–0.10 (0.03)**
Age	0.00 (0.01)	0.01 (0.01)
White	–0.04 (0.04)	–0.04 (0.04)
Education	0.07 (0.02)***	0.08 (0.02)***
Income	–0.01 (0.01)	–0.00 (0.01)
Employed	0.03 (0.03)	0.04 (0.04)
Religiosity	–0.03 (0.02)*	–0.03 (0.02)
Parent	0.03 (0.03)	0.04 (0.04)
Urban	0.02 (0.04)	0.02 (0.04)
Rural	–0.11 (0.04)**	–0.13 (0.04)**
Constant	–0.20 (0.10)*	–0.19 (0.11)
Adjusted R^2	0.31	0.18
N	2,029	1,468

Notes: The reference category for political party identification is “Independent.” The reference category for place of residence is “Suburban.”

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 5: Coefficients (and standard errors) from logistic regression models predicting support for renewable technology development and from OLS regression models predicting support for renewable technology subsidies in the US general public

	Support for Development of Renewable Technologies		Support for Subsidies for Renewable Energy	
Predictors	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Anti-Reflexivity Indicators				
Trend skeptic	–1.00 (0.11)***		–0.16 (0.02)***	
Attribution skeptic		–0.63 (0.16)***		–0.14 (0.02)***
Trust in industrial capitalist groups	–0.64 (0.05)***	–0.50 (0.08)***	–0.04 (0.01)***	–0.02 (0.01)**
Trust in forces of reflexivity	0.79 (0.06)***	0.75 (0.08)***	0.09 (0.01)***	0.07 (0.01)***
Self-identified environmentalist	0.47 (0.09)***	0.27 (0.11)*	0.06 (0.01)***	0.04 (0.01)***
Republican	–0.04 (0.12)	0.08 (0.19)	–0.08 (0.02)***	–0.10 (0.02)***
Democrat	0.32 (0.13)*	0.56 (0.18)**	0.02 (0.02)	0.01 (0.02)
Demographic and Social Characteristics				
Female	0.35 (0.10)***	0.05 (0.15)	–0.02 (0.01)	–0.03 (0.01)*
Age	0.03 (0.02)	0.02 (0.03)	–0.00 (0.00)**	0.00 (0.00)
White	0.51 (0.13)***	0.61 (0.17)***	–0.04 (0.02)*	–0.02 (0.02)
Education	–0.03 (0.05)	0.07 (0.08)	–0.00 (0.01)	0.01 (0.01)
Income	0.01 (0.03)	–0.01 (0.04)	–0.01 (0.00)**	–0.01 (0.00)**
Employed	0.10 (0.11)	–0.09 (0.16)	0.04 (0.01)**	0.02 (0.02)
Religiosity	–0.11 (0.05)*	–0.08 (0.08)	–0.01 (0.01)**	–0.01 (0.01)
Parent	-0.00 (0.12)	–0.27 (0.16)	0.06 (0.01)***	0.05 (0.02)**
Urban	–0.04 (0.12)	–0.24 (0.17)	–0.00 (0.01)	–0.00 (0.02)

	Support for Development of Renewable Technologies		Support for Subsidies for Renewable Energy	
Predictors	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Rural	–0.02 (0.12)	–0.17 (0.19)	–0.04 (0.02)**	–0.03 (0.02)
Constant	1.07 (0.32)**	1.26 (0.47)**	0.52 (0.04)***	0.55 (0.05)***
Survey Waves				
Wave 6	0.21 (0.12)			
Wave 7	0.09 (0.11)	0.04 (0.16)	0.05 (0.01)***	0.05 (0.01)***
Nagelkerke/Adjusted R^2	0.31	0.14	0.21	0.12
N	6,114	4,307	4,040	2,825

Notes: The reference category for political party identification is “Independent.” The reference category for place of residence is “Suburban.” The reference category for survey wave in Models 5 and 7 is Wave 5, and the reference category for survey wave in Models 6 and 8 is Wave 3.

* $p < .05$ ** $p < .01$ *** $p < .001$

Also, compared to their non-skeptical counterparts, trend and attribution skeptics are more likely to vote for a presidential candidate who supports fossil fuels development and less likely to vote for one who supports renewable energy development (Table 6). Further, compared to non-skeptics, trend and attribution skeptics are less likely to adopt energy conservation technologies and perform household energy conservation behaviors (Table 7). Briefly then, these results provide compelling evidence that climate change skepticism has an influence on environmentally consequential decisions beyond those directly related to the politicized issue of climate change. Indeed, even when controlling for the effects of other key predictors and characteristics, climate change skepticism is associated with attitudinal opposition to shifting away from fossil fuels and behavioral opposition to energy efficiency and conservation.

Several of the key Anti-Reflexivity Thesis variables also have reasonably strong effects on energy-related policy preferences, voting intentions, and behavioral intentions. For each of the seven energy-related outcome variables, trust in forces of reflexivity and identification with the environmental movement predict attitudes and behavioral intentions representing support for shifting from fossil fuels to renewable energy technologies and increasing energy conservation. Further, trust in representatives of the industrial capitalism system predicts policy preferences and voting intentions to defend the existing fossil fuel–based economic system and oppose new regulations.[19]

Compared to these variables, the party identification indicators have less consistent effects across the models. Compared to Independents, Republicans are less supportive of subsidies for renewable technologies and are more likely to vote for a Presidential candidate who supports fossil fuels development. Also compared to Independents, Democrats are more supportive of the new EPA rules restricting emissions at coal-fired power plants, more supportive of the development of renewable technologies, and more likely to vote for a Presidential candidate who supports renewable energy development. Neither party identification indicator is a consistent predictor of energy conservation behavioral intentions.

19 While trust in industrial capitalist groups has no influence on intentions to perform household energy conservation behaviors, it does have a positive effect on intentions to adopt energy conservation technologies.

Table 6: Coefficients (and standard errors) from OLS regression models predicting intentions to vote for presidential candidates in the US general public

	Intention to Vote for Presidential Candidate Who Supports Fossil Fuels Development		Intention to Vote for Presidential Candidate Who Supports Renewable Energy Development	
Predictors	**Model 9**	**Model 10**	**Model 11**	**Model 12**
Anti-Reflexivity Indicators				
Trend skeptic	0.28 (0.02)***		–0.26 (0.02)***	
Attribution skeptic		0.12 (0.03)***		–0.25 (0.02)***
Trust in industrial capitalist groups	0.31 (0.01)***	0.34 (0.01)***	–0.14 (0.01)***	–0.10 (0.01)***
Trust in forces of reflexivity	–0.14 (0.01)***	–0.11 (0.01)***	0.35 (0.01)***	0.29 (0.01)***
Self-identified environmentalist	–0.05 (0.01)***	–0.05 (0.02)**	0.25 (0.01)***	0.22 (0.01)***
Republican	0.31 (0.02)***	0.31 (0.03)***	–0.00 (0.02)	0.08 (0.02)**
Democrat	–0.02 (0.02)	0.01 (0.02)	0.13 (0.02)***	0.12 (0.02)***
Demographic and Social Characteristics				
Female	–0.15 (0.02)***	–0.14 (0.02)***	–0.05 (0.01)***	–0.09 (0.02)***
Age	0.04 (0.00)***	0.04 (0.00)***	0.01 (0.00)*	0.01 (0.00)
White	–0.00 (0.02)	–0.03 (0.02)	0.03 (0.02)*	0.06 (0.02)**
Education	–0.05 (0.01)***	–0.07 (0.01)***	–0.01 (0.01)	0.01 (0.01)
Income	0.03 (0.00)***	0.03 (0.01)***	0.00 (0.00)	0.00 (0.00)
Employed	0.01 (0.02)	0.01 (0.02)	0.05 (0.02)**	0.01 (0.02)
Religiosity	0.11 (0.01)***	0.12 (0.01)***	0.00 (0.01)	–0.01 (0.01)**
Parent	0.15 (0.02)***	0.22 (0.02)***	0.08 (0.02)***	0.09 (0.02)***
Urban	–0.02 (0.02)	–0.02 (0.02)	0.00 (0.02)	–0.00 (0.02)
Rural	–0.01 (0.02)	–0.01 (0.03)	–0.04 (0.02)**	–0.09 (0.02)***
Constant	2.66 (0.05)***	2.38 (0.07)***	2.73 (0.05)***	2.88 (0.06)***

	Intention to Vote for Presidential Candidate Who Supports Fossil Fuels Development		Intention to Vote for Presidential Candidate Who Supports Renewable Energy Development	
Predictors	**Model 9**	**Model 10**	**Model 11**	**Model 12**
Survey Waves				
Wave 3	–0.08 (0.02)**		–0.06 (0.02)**	
Wave 4	–0.10 (0.02)***	–0.01 (0.03)	–0.01 (0.02)	0.05 (0.03)
Wave 5	–0.08 (0.02)**	–0.03 (0.03)	–0.05 (0.02)*	–0.03 (0.03)
Wave 6	–0.16 (0.02)***	–0.07 (0.03)*	–0.06 (0.02)**	0.07 (0.03)**
Wave 7	–0.12 (0.02)***	–0.04 (0.03)	–0.09 (0.02)***	–0.05 (0.03)
Adjusted R^2	0.30	0.23	0.34	0.24
N	12,498	7,214	12,948	7,214

Notes: The reference category for political party identification is "Independent." The reference category for place of residence is "Suburban." The reference category for survey wave in Models 9 and 11 is Wave 2, and the reference category for survey wave in Models 10 and 12 is Wave 3.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 7: Coefficients (and standard errors) from OLS regression models predicting intentions to perform energy conservation behaviors in the US general public

	Intention to Adopt Energy Conservation Technologies		Intention to Perform Household Energy Conservation Behaviors	
Predictors	**Model 13**	**Model 14**	**Model 15**	**Model 16**
Anti-Reflexivity Indicators				
Trend skeptic	–0.22 (0.05)***		–0.19 (0.07)**	
Attribution skeptic		–0.38 (0.05)***		–0.29 (0.06)***
Trust in industrial capitalist groups	0.12 (0.02)***	0.19 (0.02)***	–0.00 (0.03)	0.03 (0.3)
Trust in forces of reflexivity	0.27 (0.02)***	0.18 (0.02)***	0.27 (0.03)***	0.23 (0.3)***
Self-identified environmentalist	0.52 (0.03)***	0.48 (0.03)***	0.35 (0.03)***	0.31 (0.04)***

	Intention to Adopt Energy Conservation Technologies		Intention to Perform Household Energy Conservation Behaviors	
Predictors	**Model 13**	**Model 14**	**Model 15**	**Model 16**
Republican	–0.14 (0.04)**	–0.09 (0.06)	–0.03 (0.06)	0.12 (0.07)
Democrat	0.03 (0.04)	0.08 (0.05)	0.02 (0.06)	0.03 (0.06)
Demographic and Social Characteristics				
Female	–0.12 (0.03)***	–0.21 (0.04)***	0.14 (0.05)**	0.14 (0.05)**
Age	–0.08 (0.01)***	–0.09 (0.01)***	0.06 (0.01)***	0.06 (0.01)***
White	–0.24 (0.04)***	–0.16 (0.05)**	–0.09 (0.06)	–0.04 (0.06)
Education	0.06 (0.02)***	0.08 (0.02)***	0.01 (0.02)	0.00 (0.03)
Income	0.07 (0.01)***	0.08 (0.01)***	0.06 (0.01)***	0.06 (0.01)***
Employed	0.15 (0.04)***	0.17 (0.04)***	–0.01 (0.05)	0.02 (0.05)
Religiosity	0.12 (0.02)***	0.13 (0.02)***	0.03 (0.03)	0.04 (0.03)
Parent	0.34 (0.04)***	0.38 (0.05)***	0.18 (0.05)**	0.17 (0.06)**
Urban	–0.01 (0.04)	–0.03 (0.05)	–0.12 (0.05)*	–0.05 (0.06)
Rural	–0.08 (0.04)	–0.09 (0.05)	–0.01 (0.06)	–0.01 (0.07)
Constant	1.74 (0.11)***	1.92 (0.14)***	3.88 (0.16)***	3.91 (0.18)***
Survey Waves				
Wave 5	0.04 (0.05)	–0.01 (0.05)		
Wave 6	–0.15 (0.05)**	–0.23 (0.05)***	–0.10 (0.05)*	–0.14 (0.05)**
Wave 7	0.06 (0.05)	0.01 (0.06)		
Adjusted R^2	0.26	0.24	0.11	0.10
N	8,164	5,710	4,083	2,888

Notes: The reference category for political party identification is “Independent.” The reference category for place of residence is “Suburban.” The reference category for survey wave in Models 13 and 14 is Wave 3, and the reference category for survey wave in Models 15 and 16 is Wave 4.

* $p < .05$ ** $p < .01$ *** $p < .001$

For the most part, respondents' demographic and social characteristics account for little of the adjusted R^2 values across the models in Tables 4 to 7. Not surprisingly, few of these control variables have consistent effects across the models. Education has a positive effect and living in a rural area (compared to living in a suburban area) has a negative effect on support for the EPA's new rules restricting emissions from coal-fired power plants (Table 4). While whites report greater support for the development of renewable technologies than do non-whites, parents and less-wealthy adults report greater support for subsidies for renewable technologies than do non-parents and wealthier adults (Table 5).

Both males and parents are more likely than are females and non-parents to vote for candidates who support the development of either fossil fuels or renewable energy sources (Table 6). While older, lesser educated, wealthier, and more religious adults are more likely than are their respective counterparts to vote for a presidential candidate who supports fossil fuels development, non-Whites and rural residents are less likely than are their respective counterparts to vote for a presidential candidate who supports renewable energy development. While males and older adults are more likely than are females and younger adults to purchase or adopt energy conservation technologies, the reverse is true for performing household energy conservation behaviors (Table 7). Also, parents and wealthier adults are more likely than are non-parents and less-wealthy adults to adopt energy conservation technologies and perform household energy conservation behaviors. Finally, non-Whites, the highly educated, employed adults, and more religious adults are more likely than are their respective counterparts to adopt energy conservation technologies.

Conclusion

While the Anti-Reflexivity Thesis has been employed primarily to explain organized climate change denial (e.g., McCright & Dunlap, 2010), this study demonstrates that it also provides theoretical purchase for explaining patterns of climate change skepticism within the general public. Briefly, identification with or trust in groups representing or defending the industrial capitalist system increases the likelihood of skepticism of the reality and human cause of climate change. These effects suggest that anti-reflexivity more generally—beyond that which is institutionalized within and promoted by the politically conservative Republican party—likely impacts climate change skepticism in the general public. Also, identification with or trust in groups representing or defending forces of reflexivity decreases the likelihood of trend and attribution skepticism.

Further, this study finds that both trend and attribution skepticism are related to citizens' energy-related policy preferences, voting intentions, and behavioral intentions in ways consistent with the Anti-Reflexivity Thesis. That is, trend and attribution skeptics report attitudes and behavioral intentions that generally support the existing fossil fuels–based industrial capitalist system and oppose regulatory interventions to reform the system either slightly or substantially. These results demonstrate that climate change skepticism influences environmentally consequential decisions beyond those directly related to the politicized issue of climate change.

The literature on climate change skepticism is still developing, even as some robust patterns have emerged. Future survey research should continue examining predictors of climate change skepticism in the general publics of countries around the world. Such work may employ the Anti-Reflexivity Thesis, especially including measures of key components of the argument. For instance, finding that trust in and identification with forces of anti-reflexivity influence climate change skepticism independent of the effect of political orientation in the US suggests that these variables may be as or more efficacious in countries where climate change is less politicized and skepticism is less aligned with political orientation. Future work also should aim to employ more sophisticated techniques (e.g., structural equation modeling) to model both direct and indirect effects in path analyses. This research also may incorporate other theoretically relevant predictors (e.g., values orientations) that are likely to influence climate change skepticism.

Scholars also should conduct experimental work to investigate the types of messages, frames, messengers, and modes of delivery that may amplify or reduce climate change skepticism. A few such experimental studies have been conducted already. While some suggest there is cause for optimism regarding efforts at decreasing skepticism (e.g., Hornsey et al., 2015), others are less sanguine (e.g., McCright et al., 2016). Nevertheless, some recent developments—such as a growing number of prominent US Republicans and conservative leaders publicly accepting the science of climate change and advocating climate action (e.g., George Schultz, Bob Inglis, etc.) and Pope Francis's June 2015 encyclical on climate change—suggest messages and messengers worthy of experimental testing.

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A Systematic Review and "Meta-Study" of Meta-Analytical Approaches to the Human Dimensions of Environmental Change

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Abstract

The human dimensions of environmental change across various spatial and temporal scales have formed a fast-growing field of study in the past decades. Given the large accumulation of scientific studies on this topic, a logical research question is whether we can draw out common patterns of causal relationships from this diverse body of literature. Meta-analysis provides a particularly useful tool for summarizing and integrating results across studies. Although there has been a growing number of meta-studies on the interrelationships between social and environmental changes, meta-analysis as a research strategy is still relatively underused in this field. Additionally, few studies have systematically examined the set of meta-analytical methods suitable to investigate relevant research questions. We used a meta-analysis framework to review and extract data on analytical approaches from 43 meta-studies published in selected peer-reviewed environmental social science journals during 2000–2014. The analysis revealed general patterns of research topics and analysis procedures, as well as associations between study characteristics and specific meta-analytical methods. These findings contribute to a better understanding of the current use and further development of the meta-analysis strategy in interdisciplinary human dimensions research.

Keywords: human–environment interactions, meta-analysis, meta-knowledge, synthetic research, systematic review

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Introduction

Ecological transformations at various spatial and temporal scales entail a wide spectrum of physical, economic, and sociocultural origins and implications. The human dimensions of environmental change (HDEC) have recently formed a fast-growing field in interdisciplinary environmental science research (Dietz & Rosa, 2002; Moran, 2010). There has been an increasing number of studies on the social causes and consequences of biophysical changes such as global warming, loss of biodiversity, and deforestation over the past decades. Given the considerable accumulation of scientific studies and the multiplicity of disciplines represented in the HDEC community, a logical research question is whether we can draw out common patterns of causal relationships from this diverse body of literature.

Meta-analysis provides a particularly useful tool for summarizing and integrating results from previous research. This research strategy normally involves pooling together findings from a set of studies to examine whether causal relations described in individual research hold more generally across the existing literature (Rudel, 2008). Originally introduced in experimental/intervention social sciences such as education and psychology (Glass, 1976; Smith & Glass, 1977), the concept of meta-analysis reflects a trend of scaling up from disparate studies to synthetic analyses in science (Magliocca et al., 2015; Poteete & Ostrom, 2008), and has been widely used in both social and natural science disciplines. Recent literature on meta-analysis has explored its applicability in new areas such as ecology, land change, environmental conservation, environmental education, and social work (e.g., Barth & Thomas, 2012; Fazey et al., 2004; Gates, 2002; Lundahl & Yaffe, 2007; Magliocca et al., 2015; Pullin & Stewart, 2006). However, relatively few studies have systematically investigated the methodology of meta-analysis in research on the interrelationships between social and environmental changes.

The purpose of this article is to explore what types of methods would be appropriate for the meta-analysis of the HDEC literature through an overview of major synthetic approaches already adopted in this field. We used a meta-analysis framework to review and extract data on analytical methods from 43 meta-studies published in selected peer-reviewed environmental social science journals during 2000–2014. The analysis revealed general patterns of research topics and analysis procedures, as well as associations between study characteristics and specific meta-analytical techniques. These findings contribute to a better understanding of the current use and further development of the meta-analysis strategy in interdisciplinary HDEC research. In the rest of the paper, we first discuss the use of meta-analysis to analyze HDEC problems, and describe major approaches employed in this emerging literature. The Methods

section details the processes of sample study selection, data extraction, and statistical analysis. The main results of our meta-analysis are then presented and interpreted. Finally, we conclude with reflections on the limitations and implications of this study.

The use of meta-analysis in HDEC research

Social science meta-analysis, in its conventional definition, refers to a research process of integrating the findings of a collection of relevant studies through the aggregate statistical analysis of quantitative results from individual experiments (Glass, 1976; Glass et al., 1981). In most cases, meta-analysis is embedded in the systematic review of prior research on a given topic (Littell et al., 2008). Nevertheless, systematic literature reviews emphasize organized and rigorous procedures of locating and synthesizing previous research findings, and do not always involve meta-analysis (Gates, 2002). In the field of HDEC, the term ''meta-analysis'' or ''meta-study'' is often used more loosely and represents any systematic attempt to identify repeatable patterns across different studies (Rudel, 2008). Prokopy et al. (2008) argued traditional, narrative literature reviews could also be considered as a simplistic form of meta-analysis.

Meta-analysis research and methodology in applied social sciences have seen substantial progress since the 1970s. This is evidenced by the large number of recently published research articles using this tool and relevant methodological textbooks (e.g., Cooper, 2010; Lipsey & Wilson, 2001; Littell et al., 2008; Rosenthal, 1991; Rothstein et al., 2005). Moreover, systematic reviews and meta-analyses have been coordinated by particular professional associations or networks (such as the Cochrane Collaboration and the Campbell Collaboration) in health, education, social welfare, and other related disciplines. Although the body of HDEC meta-studies has developed significantly in recent years, meta-analysis as a research strategy is still relatively underused in this field. There have been only a few efforts to advance the methodology of meta-analysis for analyzing human–environment interactions. These include a proposed portfolio approach (including meta-analysis) to integrating scientific knowledge on land use and land cover change (Magliocca et al., 2015; Young et al., 2006) and the design of standard guidelines for systematic reviews and meta-analyses in the area of environmental conservation and management (Pullin & Stewart, 2006).

Much of the research on the human dimensions of regional and global environmental change is place based. Rudel (2008) developed a seminal protocol of meta-analyses of case studies for analyzing the trends and drivers of forest cover change. A case in this type of meta-analysis is usually defined as a particular situation or incident (e.g., a land tenure form or a community-

based forestry project) at a specific study site and time, which is comparable to a distinct experiment or data set in the statistical meta-analysis of psychological and medical sciences. Thus, a single study may include data of multiple cases for a given meta-analysis. This comparative approach has deep roots in the tradition of case-oriented research in social sciences (Ragin, 1987), and resembles the case survey method used to aggregate the findings of business management or public policy case studies (Larsson, 1993; Yin & Heald, 1975). Although meta-analysis provides a useful technique to explore commonalities and discrepancies across a large number of studies with small samples, its use in investigating the social and policy dimensions of environmental change encounters many obstacles such as varying data quality, inconsistent conceptual approaches, and incomparable measurement and analysis protocols (Poteete & Ostrom, 2008). Other major criticisms of existing meta-studies in this field center on the overreliance on descriptive approaches and the limited number of factors included in analyses (Young et al., 2006).

Meta-analytical approaches in HDEC research

The main procedures of meta-analysis in social, behavioral, and medical sciences include the formation of research topics and analytical protocols, selection of relevant studies, data extraction (coding of collected studies), integration of research findings, and the interpretation and dissemination of meta-analytical results (Cooper, 2010; Lipsey & Wilson, 2001; Littell et al., 2008; Rosenthal, 1991). Most of these processes are readily applicable to the synthetic research of HDEC. However, due to the diversity of research areas and the distinct nature of data related to human–environment relationships, a variety of meta-analytical approaches have been identified for this field of inquiry.

Meta-analyses in the study of HDEC, particularly those based on case studies, pool findings on the linkages among important factors rather than the data or statistical results in different studies (Rudel, 2008). For most of the research questions related to HDEC, there is potentially a large number of explanatory variables. As an important tool for communicating across disciplines in society–environment studies (Heemskerk et al. 2003), interdisciplinary conceptual frameworks can be used to guide the integration of empirical data from varied social, economic, and ecological contexts. The development of conceptual specification in meta-analysis is normally an iterative process. While analytical models provide a good starting point for data extraction, new factors identified through systematic reviews can help further improve the conceptualization of causal linkages in the original frameworks.

Recent HDEC meta-analyses have moved beyond narrative literature review to adopt more innovative analytical techniques. Results of qualitative studies can be synthesized with a ''syndrome'' approach which identifies a typical co-occurrence of symptoms describing complex anthropogenic and natural phenomena (Manuel-Navarrete et al., 2007). In contrast to causal relationships within specific contexts, syndromes are integrated and consistent patterns that can be generalized to broader settings. This approach is very similar to the ''constant comparative method'' of ''meta-ethnography,'' in which researchers create theoretical categories through comparing the similarities and differences of cases (Glaser & Strauss, 1967; Noblit & Hare, 1988). Although effective in capturing dynamic interrelations among components of coupled social–ecological systems, these qualitative comparative methods are essentially built on descriptive reviews and hence are limited in terms of the number of studies that can be included in the meta-analysis.

By contrast, qualitative comparative analysis (QCA) provides a more sophisticated approach to identifying general patterns of conjunct causation (Ragin, 1987). This method requires the construction of a raw data matrix (truth table) with a series of binary variables indicating the presence or absence of particular conditions, and is especially suitable for small- to medium-sized samples of case studies. QCA uses Boolean logic to reveal limited combinations of drivers that cause or correlate with certain outcomes. It has also been improved with the inclusion of fuzzy sets to demonstrate the classification of cases in a more probabilistic manner (Ragin, 2000), and with the alternative of setting multiple values (instead of dichotomous ones) for explanatory factors (Vink & van Vliet, 2009).

Vote counting provides another useful way to summarize results from different studies. This method normally involves tallying the frequencies with which key factors are included in selected studies and the counts of significant or insignificant relationships between these variables. Despite being criticized for its potential bias (Hedges & Olkin, 1985; Stanley, 2001), this approach has been commonly used in recent applications of meta-analysis in the HDEC literature (e.g., Hofmann et al., 2011; Misselhorn, 2005; Romero-Lankao et al., 2012). Since variables and measurement vary greatly across studies, it is unfeasible to pool actual data or statistical results together in many research areas of HDEC. Vote counting can include a large number of relevant studies in a meta-analysis and allows for high transparency in the interpretation of research findings (Prokopy et al., 2008).

Typical statistical techniques can also be employed in the meta-analysis of HDEC case studies. Researchers adopting these approaches usually first code collected studies following some standard protocols, and then carry out descriptive, bivariate, and/or more advanced multivariate analyses to assess the relationships

between constructed variables (Rudel, 2008). This group of analytical methods is useful for synthesizing both quantitative and qualitative studies. When using such approaches, analysts treat extracted cases as independent subjects in the resulting meta-analysis data sets and generate new statistical results with the factors coded for individual studies.

Finally, statistical meta-analytical tools have been increasingly used to integrate quantitative results across studies on human–environment interactions. This approach requires the estimation of an effect-size statistic which quantifies the direction and strength of the relationships between major variables (Lipsey & Wilson, 2001; Littell et al., 2008). In addition to the computation of effect sizes, statistical analyses are conducted to assess the publication bias and consistency (sensitivity analysis) in the estimated effects (Rothstein et al., 2005). A series of techniques (e.g., subgroup analysis and meta-regression) are also available to examine the potential influences of methodological factors (moderators), such as research design and sample characteristics, on the variations in effect sizes (Littell et al., 2008). Although moderator analysis uses similar statistical techniques (e.g., analysis of variance (ANOVA) and multiple regression) as those meta-studies conducting statistical analysis of coded data (see above), the logics behind these two types of analyses are fundamentally different.

In summary, while the meta-analysis strategy in HDEC research shares many similarities with established meta-analysis practices, it also shows distinct features in terms of specific analysis procedures, particularly analytical models and methods. Generally speaking, the data requirement for meta-analyses is less stringent in this field than in health and applied social sciences, and multiple techniques can be used to compare and combine qualitative and/or quantitative data extracted from individual studies. This article contributes to the further advancement of meta-analytical research on HDEC by conducting a systematic review and "meta-study" of analytical approaches adopted in this growing literature.

Methods

Selection of studies

Since the field of HDEC involves a range of research topics cutting across multiple disciplines, there were no obvious keywords to be used for the search of relevant studies for our meta-analysis. In order to broadly represent the human dimensions research community, we first selected 30 peer-reviewed journals with the highest impact factors in the "Environmental Studies" subject category of the *2012 Journal Citation Reports (JCR)—Social Sciences Edition*.

Because statistical meta-analytical techniques have been commonly used by systematic quantitative reviews in economic research to synthesize econometric estimates and evaluate specification biases (Stanley & Doucouliagos, 2012), we chose to restrict our literature search to the 23 non-economic journals within the JCR sample. Table 1 presents the list of those journals included in our preliminary screening.

Table 1. Journals included in the literature search[a]

Journals included in the initial screening	Journals added in the follow-up search
Annual Review of Environment and Resources	*BioScience* (2)
Carbon Management	*Conservation Biology* (2)
Computers, Environment and Urban Systems	*Environment and Behavior* (2)
Corporate Social Responsibility and Environmental Management	*Food Policy* (1)
Ecology and Society (4)	*Human Ecology* (1)
Energy Policy (1)	*Human Ecology Review* (1)
Environmental Impact Assessment Review	*Journal of Environmental Education* (1)
Environment and Planning A	*Journal of Environmental Management* (2)
Environment and Planning D	*Journal of Soil and Water Conservation* (1)
Global Environmental Change (10)	*PLOS ONE* (1)
Global Environmental Politics	*Proceedings of the National Academy of Sciences* (1)
Journal of Environmental Psychology (4)	*Society and Natural Resources* (1)
Journal of Regional Science	*The Geographical Journal* (2)
Land Use Policy (3)	*World Development* (2)
Landscape and Urban Planning	
Marine Policy (1)	
Nature Climate Change	
Population and Environment	
Progress in Planning	
Regional Environmental Change	
Tourism Management	
Urban Forestry and Urban Greening	
Wiley Interdisciplinary Reviews: Climate Change	

[a] Journals are arranged in alphabetical order. Numbers of articles selected from individual journals are given in parentheses.

The selection process included various types of synthetic analyses identifying common patterns across individual studies. We used a general term "meta-*" (covering "meta-analysis," "meta-analyses," "meta-study," and "meta-studies") to search the title, abstract, and keywords sections of the selected journals in the

Scopus database. This criterion might have excluded some studies that could be technically counted as meta-analyses (e.g., narrative literature reviews) but which were not self-identified as such. Because meta-analysis is a relatively new tool in HDEC research, we also limited our search to articles published in or after 2000. The initial section identified 96 articles, which were then assessed for relevance to our interest in the drivers, impacts, and management of environmental change. Studies focusing solely on the biophysical processes or economic aspects of environmental systems were removed from the selections. In total, 23 meta-analyses were chosen from six journals in this phase.

The next stage of our literature search mimicked a snowball sampling approach: We checked the reference lists of the 23 articles for additional relevant meta-studies, and then repeated this process with newly included studies. As a result, we added 15 more meta-analyses to our sample. Finally, we replicated the whole literature search procedure using the databases of the 14 journals in which these 15 articles were published (Table 1), and included five new studies based on the same criteria. Through this stepwise, iterative selection process (completed in March, 2014), 43 meta-studies of HDEC issues appearing in 20 journals were identified for our systematic review and analysis (Tables 1 and 2). Review of the titles and abstracts of these articles suggested several common themes (further discussed below). As a final check of sample quality, we created a group of keyword combinations (''meta-*'' AND ''conservation''/''resource, management''/''environmental, management''/''community, management''/''environmental, behavior''/''environmental, psychology''/''environmental, education''/''deforestation''/''land, change''/''vulnerability''/''adaptation''/''environmental, change''), and searched for articles with these terms included in titles using the ScienceDirect database. This process did not retrieve any other relevant HDEC meta-analyses.

Table 2. List of studies included in the meta-analysis

Meta-analytical methods[a]	Articles[b]
Narrative review	Abrahamse et al. (2005); *Glasmeier & Farrigan (2005); Zeppel (2008)
Comparative review	Manuel-Navarrete et al. (2007); *Oberlack & Eisenack (2014); Penker (2009)
Qualitative comparative analysis	*Robinson et al. (2014)
Vote counting	Carmenta et al. (2011); Cox et al. (2014); Evans et al. (2011); Geist & Lambin (2002); *Geist & Lambin (2004); Hirschnitz-Garbers & Stoll-Kleemann (2011); *Hofmann et al. (2011); *Keys & McConnell (2005); Knowler & Bradshaw (2007); *Misselhorn (2005); Munteanu et al. (2014); Pagdee et al. (2006); Pleasant et al. (2013); Poteete & Ostrom (2008); *Prokopy et al. (2008); *Romero-Lankao et al. (2012); Rudel et al. (2009); Schmidt-Vogt et al. (2009); van Vliet et al. (2012)

Meta-analytical methods[a]	Articles[b]
Descriptive/bivariate/ multivariate statistics	*Andrade & Rhodes (2012); Brooks et al. (2012); *Carmenta et al. (2011); Clark & Kozar (2011); *Cox et al. (2010); Cox et al. (2014); Delmas et al. (2013); Mascia et al. (2010); *Pagdee et al. (2006); Poteete & Ostrom (2008); Robinson et al. (2014); Rudel (2007); *Rudel et al. (2009); *Seto et al. (2011); *van Vliet et al. (2012)
Statistical meta-analysis	Abrahamse & Steg (2013); Bamberg & Moser (2007); *Baumgart-Getz et al. (2012); Delmas et al. (2013); Hawcroft & Milfont (2010); *Klöckner (2013); *Lokhorst et al. (2013); Maliao et al. (2009); Osbaldiston & Schott (2012); Stamps (2004)

[a] Meta-analytical methods are discussed in detail in the "Meta-analytical approaches in HDEC research" section. See Table 3 for more specific definitions.

[b] Six sample studies (Hofmann et al., 2011; Manuel-Navarrete et al., 2007; Misselhorn, 2005; Poteete & Ostrom, 2008; Prokopy et al., 2008; Romero-Lankao et al., 2012) are included in the list of references. See Appendix A for the full citations of the remaining articles.

* Articles of particular interest in terms of meta-analysis procedures. The present study also showcases the combined use of vote counting as well as descriptive and bivariate statistics in meta-analysis research.

Data extraction and coding of variables

The data extraction process built on an analytical scheme including major meta-analysis procedures in HDEC research: the development or adoption of a conceptual framework, literature search, variable coding, and data analysis and synthesis (Rudel, 2008). These categories informed the design of an article review template (or coding manual) which also incorporated the following general information of the selected meta-studies: publication year, journal title, research topic, number of reviewed studies, geographic area covered in the meta-analysis, unit of analysis, and the number of units included in the analysis. This template was then used in a systematic review of the 43 sample articles. Only the first author reviewed all these papers since the definitions of the coded variables were unambiguous and the examination of method-related information involved little subjective judgment. Nevertheless, five articles randomly chosen from the pool were inspected by the second author to ensure the accuracy of constructed data. The two researchers' coding for these five studies was identical, suggesting a very high intercoder reliability (Neuendorf, 2002). Relevant qualitative data extracted from the collected studies were coded into a series of categorical or numerical variables (Table 3). The eight meta-analytical method measures were derived based on the approaches outlined in the previous section, and each was coded as: 1 = yes (adopted) and 0 = no (not adopted). A new numerical indicator was calculated as the sum of analytical methods adopted in a selected study.

Table 3. Measurement of major variables

Variables	Measurement
Publication period	1 = 2000–2007, 2 = 2008–2014
Research topic	1 = resource conservation and management, 2 = land cover change, 3 = environmental psychology and behavior, 4 = vulnerability and adaptation, 5 = others
Analytical model	Whether or not developed or adopted a conceptual model for the analysis? 0 = no, 1 = yes
Literature search	Whether or not used scientific database(s) in literature search? 0 = no, 1 = yes
Number of reviewed studies	Number of studies included in a meta-analysis
Geographic range	The geographic area covered in a meta-analysis: 1 = nation (a single country), 2 = region (multiple countries within one continent), 3 = pan-region (multiple countries in more than one continent), and 4 = globe (multiple countries in all continents)
Unit of analysis	The basic entity being analyzed in a meta-study: 1 = independent data observation (an individual data set, treatment, etc.), 2 = case (a particular situation or incident at a specific study site and time), 3 = article (an article selected for a meta-analysis)[a]
Number of units	Number of units included in a meta-analysis
Variable construction	The degree of variable coding or computation based on relevant information from the studies selected for a meta-analysis: 0 = none, 1 = simple variable coding or computation (e.g., presence/absence of a driver, positive/negative/no relationship between some variables), 2 = more complicated variable coding or computation
Coding of methods	Whether or not coded the method-related information of selected studies? 0 = no, 1 = yes
Meta-analytical method variables	Whether or not used the corresponding analytical method? 0 = no, 1 = yes
Narrative review	Traditional, narrative literature review (qualitative)
Comparative review	Identify general patterns or types through comparing similarities and differences of individual cases (qualitative)
Qualitative comparative analysis	Qualitative comparative analysis using Boolean logic (qualitative–quantitative)
Vote counting	Tally relevant factors and their relationships (frequency distribution) based on the results of selected studies (qualitative–quantitative)
Descriptive statistics	Conduct descriptive statistical analysis (e.g., mean and range) using variables coded for selected studies (quantitative)
Bivariate statistics	Conduct bivariate statistical analysis (e.g., chi-square test and Pearson's *r* correlation) using variables coded for selected studies (quantitative)
Multivariate statistics	Conduct multivariate statistical analysis (e.g., multiple regression) using variables coded for selected studies (quantitative)
Statistical meta-analysis	Conventional, statistical meta-analysis involving the estimation of an effect-size statistic based on quantitative results from individual studies (quantitative)
Total number of analytical approaches	A composite measure calculated as the sum of the eight dichotomous method variables above

[a] In a meta-analysis, a single article may include multiple data observations or cases.

Data analysis

The analysis of the constructed data set included two major steps. First, frequency distributions and simple descriptive statistics were computed for major variables to present a general picture of current HDEC meta-studies. Bivariate statistical analyses (chi-square test, ANOVA with post hoc Tukey's test, independent *t*-test/Mann–Whitney *U* test, and Pearson's *r* correlation test) were then conducted to explore the relationships between study characteristics and key meta-analysis procedures, as well as the connections among different meta-analytical approaches.

Results

Descriptive analysis

Results of the descriptive analysis for major variables are presented in Table 4. The number of meta-analyses of human dimensions clearly increased between 2000 and 2014. The majority of the 43 selected meta-studies (72.1%) were published in the second half of the study period (2008–2014). Four major peer-reviewed journals in the field of human–environment interactions—*Global Environmental Change* (23.3%), *Ecology & Society* (9.3%), *Journal of Environmental Psychology* (9.3%), and *Land Use Policy* (7.0%)—together accounted for nearly half (48.9%) of these studies. Existing HDEC meta-analyses focused mainly on four topical areas: natural resource conservation and management (39.5%), land use and land cover change (23.3%), environmental behavior and psychology (20.9%), and vulnerability and adaptation to environmental change (11.6%). Although statistical meta-analyses have been widely conducted in educational and health sciences (including environmental health), only one article was found for each of environmental education and human health in our sample.

Most of these meta-studies (72.1%) developed or adopted an analytical framework to guide the processes of systematic review and data extraction. A vast majority of the articles (90.7%) used academic databases in literature searches. However, the screening process was not always clearly explained in the final publication. Among the 30 meta-studies which indicated geographic coverage, a large portion (66.7%) of them integrated research findings from countries in more than one continent (''pan-region'') or all continents (''globe''). On average, the reviewed meta-analyses included about 77 studies and 104 units (i.e., article, case, or independent data observation) in the analysis, but these numbers varied greatly across the sample (with a range of 10–268 studies and 10–326 units).

Table 4. Descriptive summary of major variables

Variables	Frequencies	% total[a]
Publication period		
2000–2007	12	27.9
2008–2014	31	72.1
Research topic		
Resource conservation & management	17	39.5
Land cover change	10	23.3
Environmental psychology & behavior	9	20.9
Vulnerability & adaptation	5	11.6
Others (environmental education, human health & well-being)	2	4.7
Geographic range		
Globe	6	14.0
Pan-region	14	32.6
Region	6	14.0
Nation	4	9.3
Unspecified	13	30.2
Unit of analysis		
Article	14	32.6
Case	20	46.5
Independent data observation	9	20.9
Variable construction		
More complicated variable coding/computation	21	48.8
Simple variable coding/computation	9	20.9
None	13	30.2
Meta-analytical methods[b]		
Vote counting	19	44.2
Bivariate statistics	13	30.2
Statistical meta-analysis	10	23.3
Multivariate statistics	6	14.0
Descriptive statistics	6	14.0
Narrative review	3	7.0
Comparative review	3	7.0
Qualitative comparative analysis	1	2.3

[a] Numbers may not add up to 100% due to rounding.

[b] The sum of percentages here is more than 100% because some selected studies used multiple analytical methods.

Almost half (46.5%) of the selected 43 meta-studies had case as the basic unit of analysis. Additionally, the bulk of the studies (69.7%) involved variable coding or computation to some degree, while about one third (30.2%) coded methodological features. Vote counting, bivariate statistics, and statistical meta-analysis (effect-size estimation) were the three most common analytical approaches. In general, quantitative methods were used more often than qualitative ones in the analyses. The total number of analytical approaches employed by the selected meta-analyses ranged from 1 to 4, with a mean of nearly 1.5 per article. The results also suggest a trend of increasing adoption of statistical meta-analytical techniques in recent years. Seven out of the 10 articles using this approach were published in or after 2010.

Bivariate statistical analysis

This section summarizes important correlations between major variables included in our meta-analysis. Table 5 presents the results related to general study characteristics and several key meta-analysis procedures prior to the data analysis stage. The table shows there were some obvious differences among the study categories of publication time and research topics. Generally, meta-studies published during 2008–2014 were almost significantly more likely than those in 2000–2007 to build more complex variables and create indicators related to methods. As for the variations across different topical groups, all the 10 selected articles on land use change used case as the unit of analysis, and on average had a larger number of units in the meta-analysis than those examining resource conservation and management. Sample papers addressing environmental psychology and/or behavior issues mostly analyzed independent data sets or interventions included in reviewed studies. Both case and article were common units of analysis for meta-studies in the areas of resource conservation and of vulnerability and adaptation. Meta-studies in environmental psychology and behavior tended to involve the lowest degree of variable construction but were most likely to code methodological factors. Additionally, the numbers of studies and units included in meta-analyses were highly correlated with each other. Both of them increased with the use of scientific database searches, but were negatively associated with the use of analytical models. A broad literature search process was also logically related with a larger geographic area and more complicated variable building. Finally, meta-studies employing case as the unit of analysis generally had higher levels of variable construction but less coding of methods-related information than other selected studies, while the number of units in the analysis was nearly significantly and positively correlated with the degree of variable construction.

Table 5. Bivariate correlations among study characteristics and selected meta-analysis procedures (N = 43)

Variables	1	2	3	4	5	6	7	8	9
1. Publication period									
2. Research topic									
3. Analytical model									
4. Literature search									
5. Number of reviewed studies			2.25[c]*	–5.21[c]***					
6. Geographic range				8.19[a]*					
7. Unit of analysis		37.23[a]***							
8. Number of units		3.12[b]*	1.85[c](*)	–5.59[c]***	0.87[d]***				
9. Variable construction	5.19[a](*)	14.45[a]*		4.79[a](*)			7.64[a](*)	2.97[b](*)	
10. Coding of methods	3.79[a](*)	8.02[a](*)					12.07[a]**		

[a] Given as chi-square test statistics. Fisher's exact test was used when 25% or more of the cells had expected count less than 5.

[b] Given as ANOVA F-test statistics.

[c] Given as independent t-test statistics. A negative t value means the second group has a higher mean than the first group, while the opposite is true for a positive value. Significant results were verified with the non-parametric Mann–Whitney U test when small group samples ($N \leq 5$) were involved.

[d] Given as Pearson's r coefficients.

Marginally significant ($p < .10$) results are also included considering the exploratory nature of this study.

(*)$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

The bivariate analysis revealed several general trends of study characteristics and procedures associated with meta-studies using different analytical methods (Table 6). First, comparative review was used relatively more frequently in the area of vulnerability and adaptation than in others. In contrast, meta-analyses related to environmental psychology and behavior were less likely to use the vote-counting approach but relied significantly more on statistical meta-analytical tools than other studies. Second, adopting a comparative review approach was generally accompanied with reduced likelihood of searching relevant literature in scientific databases, and with limited numbers of studies and units that could be pooled in the analysis. While on average statistical meta-analytical studies also tended to integrate fewer articles than those using other methods, the presence of bivariate and multivariate statistics in meta-analysis was correlated with a larger amount of reviewed literature and/or more units in the analysis. Third, meta-studies adopting narrative review, vote counting, multivariate statistics, and conventional statistical meta-analysis had article, case/article, case, and independent data observation respectively as the primary unit of analysis. Fourth, narrative, comparative, and statistical meta-analytical approaches were less likely to involve variable construction than other categories, while the use of vote counting or bivariate statistics was related with an increased degree of building variables. Moreover, the coding of method-related indicators was only strongly associated with statistical meta-analysis. Overall, the total number of analytical approaches used in a meta-analysis was significantly associated with the publication period (larger in 2008–2014 than in 2000–2007), the number of units included in the analysis (positively correlated with each other), and the level of variable coding or computation (larger for studies with more complicated construction than for those with no or simple construction).

As shown in Table 7, the results also indicate some interesting relationships between specific analytical methods. Among the selected studies, vote counting was normally not used together with other meta-analytical approaches, particularly descriptive statistics of coded variables and statistical meta-analysis; while bivariate statistics were included more often than not in those meta-studies which conducted descriptive or multivariate statistical analysis. The composite meta-analytical method variable (total number of analytical approaches) showed a negative relationship with the presence of narrative and comparative review methods, but was positively related with the use of the QCA technique and with descriptive, bivariate and multivariate statistical analyses. The correlations involving the narrative, comparative, and QCA approaches should be interpreted cautiously due to the small group sample sizes. Nevertheless, the results suggest some of these analytical tools can be more readily included in a mixed meta-analysis research design than others.

Table 6. Bivariate correlations between meta-analytical methods and study characteristics as well as other meta-analysis procedures (N = 43)

Variables	Publication period	Research topic	Analytical model	Literature search	Number of reviewed studies	Geographic range	Unit of analysis	Number of units	Variable construction	Coding of methods
Narrative review							4.77[a*]		5.28[a*]	
Comparative review		6.28[a](*)		12.58[a*]	5.93[c***]			6.91[c***]	5.28[a*]	
Qualitative comparative analysis										
Vote counting		11.43[a*]	3.41[a](*)				5.13[a](*)		11.71[a**]	
Descriptive statistics										
Bivariate statistics	3.79[a](*)							–1.87[c](*)	8.97[a**]	
Multivariate statistics					–1.98[c](*)		6.61[a*]	–2.40[c*]		
Statistical meta-analysis		22.20[a***]			2.62[c*]	5.26[a](*)	16.27[a***]		4.80[a](*)	9.77[a**]
Total number of analytical approaches	–2.77[c**]			–3.82[c***]				0.32[d*]	3.81[b*]	

[a] Given as chi-square test statistics. Fisher's exact test was used when 25% or more of the cells had expected count less than 5.

[b] Given as ANOVA F-test statistics.

[c] Given as independent t-test statistics. A negative t value means the second group has a higher mean than the first group, while the opposite is true for a positive value. Significant results were verified with the non-parametric Mann–Whitney U test when small group samples ($N \leq 5$) were involved. The association between the total number of analytical approaches and the use of scientific databases for literature searches became non-significant according to the Mann–Whitney U test.

[d] Given as Pearson's r coefficients.

Marginally significant ($p < .10$) results are also included considering the exploratory nature of this study.

(*)$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Table 7. Bivariate correlations between meta-analytical method variables (N = 43)

Variables	1	2	3	4	5	6	7	8
1. Narrative review								
2. Comparative review								
3. Qualitative comparative analysis (QCA)								
4. Vote counting								
5. Descriptive statistics				5.52[a*]				
6. Bivariate statistics					9.32[a**]			
7. Multivariate statistics						9.32[a**]		
8. Statistical meta-analysis				10.32[a**]				
9. Total number of analytical approaches	3.80[b***]	3.80[b***]	42.00[c***]		–2.88[b*]	–7.68[b***]	–2.88[b*]	

[a] Given as chi-square test statistics. Fisher's exact test was used when 25% or more of the cells had expected count less than 5.

[b] Given as independent t-test statistics. A negative t value means the second group has a higher mean than the first group, while the opposite is true for a positive value. The correlations between the total number of analytical approaches and the adoption of narrative and comparative review methods became non-significant according to the Mann–Whitney U test.

[c] Given as the Mann–Whitney U test statistic. The independent t-test was not performed here since there was only one study in the QCA group. The mean numbers of analytical approaches for the QCA and non-QCA groups were 4.0 and 1.4, respectively.

*$p < .05$, **$p < .01$, ***$p < .001$

Discussion

Responding to the shift from a focus on individual local-level studies to integrative analyses in the general scientific enterprise and in the research on human–environment interactions in particular (Poteete & Ostrom, 2008), this research assesses the portfolio of analytical approaches deployed in recent meta-analyses of HDEC problems. Soundly designed and implemented systematic reviews and meta-analyses can synthesize the existing knowledge base, identify areas of strength and weakness, and pinpoint directions for future research endeavors. Our analysis revealed that the recent journal literature of HDEC meta-analyses highly concentrated on several topical areas. A variety of analytical methods were used in the 43 meta-studies selected for this review. These methods are located on a full continuum from qualitative to quantitative techniques, and are associated with specific study characteristics, data requirements, and analysis procedures.

Since research data and measurement are more diverse in HDEC research than in experimental environmental and social sciences, synthesizing the results from the large numbers of studies in this interdisciplinary field necessitates the use of a range of analytical methods in addition to the statistical estimation of cumulative effect sizes. In this sense, human dimensions research can make a special contribution to the development of a more comprehensive meta-analysis methodology. Meta-analysis has gained wide currency in recent research on society–environment relationships (Rudel, 2008; Young et al., 2006). Current studies on the meta-analysis strategy in environmental sciences focus on the adoption of statistical analytical methods from medicine and health research (e.g., Fazey et al., 2004; Gates, 2002; Magliocca et al., 2015; Pullin & Stewart 2006). Our study extends this line of research by systematically reviewing the set of meta-analytical approaches appropriate for analyzing human–environment interactions. The HDEC community has already accumulated a large number of informative small-scale studies. A more complete understanding of potentially useful meta-analytical approaches in this field can help to enable creative "data-intensive" research that may not otherwise be possible.

Findings from this study confirm some typical characteristics of particular meta-analytical methods, such as the relatively smaller numbers of included studies and cases in comparative reviews, and the correlation between the coding of method-related variables and the adoption of statistical meta-analysis (Table 6). Although well established in several relevant disciplines such as psychology and economics, statistical meta-analytical tools are not necessarily more suitable for HDEC research than those methods relying more on qualitative information. In fact, the selection of analytical approaches in meta-analysis research is largely determined by the features of the research topics and empirical scientific data in

question. The results suggest that currently available meta-analytical approaches are seldom used together, except for those common statistical techniques (descriptive, bivariate, and multivariate analyses) applied to variables coded for collected studies (Table 7). Nevertheless, some of the simple quantitative methods, like vote counting, can be improved by statistical analysis estimating common effect parameters such as the significance and direction of variable correlations (Hedges and Olkin, 1985). To understand the dynamic interrelationships within complex social–ecological systems and inform evidence-based management and decision-making, it is usually more effective to take a mixed-method approach combining multiple, complementary meta-analysis tools.

The meta-analyses reviewed in this paper can all serve as good references on how to conduct meta-studies on HDEC topics (see asterisked ones in Table 2 particularly). The results suggest statistical meta-analysis is relatively underused in analyzing the social and policy dimensions of environmental systems. This is mainly due to the obstacles resulting from the varied data forms and variable measurements across studies, but may also partly reflect the lag of meta-analysis training and practice in non-economic HDEC subfields. Although effect-size estimation was one of the major analytical methods identified in our review, relevant standard meta-analytical procedures, such as the assessment of publication bias and sensitivity analysis, were followed in less than half (40%) of the 10 selected studies taking this approach. The bivariate and multivariate statistical techniques used in HDEC meta-analyses of case studies also often encounter the problems of small sample size and low statistical power. Additionally, since reviewed articles and the observations extracted from them cannot be treated exactly as randomly selected cases, meta-analysts should be cautious in drawing any general causal conclusions based on the results of such statistical analyses.

Conceptual models play an essential role in systematic reviews and meta-analyses (Littell et al., 2008). However, this procedure was not involved in all the meta-analyses reviewed in this study. Our analysis suggested the adoption or derivation of conceptual frameworks was not restricted to any particular meta-analytical approaches to HDEC research questions. It should be noted that the negative correlation found between the use of conceptual models and the number of studies or units included in meta-analyses does not necessarily indicate any causal relationship between them. On the contrary, a well-developed model can be used to provide a common analytical scheme for synthesizing diverse research findings from studies that have already been conducted. Focusing on the linkages among conceptual constructs instead of specific variables should loosen the typically strict data requirements for meta-analysis, and increase the number of studies that can possibly be included in the analysis.

Moreover, shared conceptual frameworks can facilitate future meta-analytical work by laying solid groundwork for the development of standardized research procedures in major topical areas.

A holistic methodological strategy in the study of HDEC calls for better cooperation among researchers and replicating research designs and instruments across different socioeconomic and environmental contexts (Luloff et al., 2007). It is unsurprising that current meta-analyses in this field have been concentrated in several areas which have formed strong theoretical foundations and involved large numbers of researchers and practitioners. These lines of synthetic research can be substantially advanced if coordinated by some well-established professional networks in relevant scientific communities (e.g., the Ostrom Workshop in Political Theory and Policy Analysis organized by Indiana University and the Population and Environment Research Network hosted in Columbia University), or by a new international collaboration especially founded to promote HDEC systematic reviews and meta-analyses.

While the diversity of analytical approaches to human–environment interactions enriches the conventional, quantitative meta-analysis methodology, further meta-studies in this field can benefit greatly by linking with relevant literature of psychological, educational, and health sciences in which meta-analysis protocols are more established. Increased knowledge of general meta-analytical processes and available tools may also guide the formulation of research questions and objectives, and improve future practices of data generation and management. Standard statistical meta-analytical techniques (e.g., the estimation of effect sizes and moderator analysis) would be readily applicable to analyzing HDEC problems if research designs were more comparable across studies. Sufficient information on statistical results and sample characteristics should also be included in all publications and research reports, provided as online supplementary data, or made available by authors upon request to facilitate the use of this type of quantitative meta-analytical tool.

Concluding remarks

Although this study elaborates on the overall patterns of current meta-analytical approaches in HDEC research, there are several possible limitations that need to be considered. First, since we limited our literature search to 37 journals in environmental social science, we might have missed some relevant studies in the selection. However, the set of recent publications included in our analysis should still be representative of the literature of non-economic HDEC meta-analyses. Including environmental economic journals and articles in this study would make the distribution of analytical approaches highly skewed toward

conventional statistical meta-analysis, but the results related to other methods should remain similar. Next, as we restricted our search to research articles published in English peer-reviewed journals, there existed some potential publication bias in our analysis. Our findings and interpretations should therefore be qualified within this context. Nevertheless, given our primary objective of investigating appropriate meta-analytical approaches, selection bias is of less concern for this study than for other meta-analyses on concrete research topics. In addition, the power of our statistical analysis was restrained due to the relatively small number of existing, non-economic meta-studies on HDEC issues. The results are likely to change with the addition of new research in the analysis. Since meta-analysis has been increasingly used as an integrative approach to analyze coupled human–natural systems, follow-up methodological reviews are needed to monitor and advance the progress of systematic reviews and meta-analyses in the HDEC field.

Finally, while developing a list of detailed guidelines for the meta-analysis of human dimensions–related research questions is beyond the scope of this article, we conclude with some general comments on the direction of future work. Meta-analysis originally focused on the pooling of research data from individual studies to create larger samples, and there is a reemergence of this interest in the efforts to better conserve and reuse data among information and climate change social scientists (Qin et al., 2014). However, for a field as diverse as HDEC, it should be more feasible and productive to integrate findings rather than the actual data sets across studies at present. Furthermore, recent literature on integrative science suggests an emerging trend of moving beyond typical meta-analysis to "meta-knowledge" research investigating the effects of scientific context on knowledge generation (Evans & Foster, 2011). Meta-knowledge analysis complements meta-studies by examining the influences of disciplinary matrices and regularities on research contents. This reflexive perspective on the process of scientific inquiry reflects a long-standing tradition in the sociology of knowledge (Coser, 1977; Zhao, 1991), and echoes the wide interest in different vulnerability research lineages (natural hazards, political economy or ecology, and ecological resilience) in global environmental change science (e.g., Adger, 2006; Eakin & Luers, 2006; Romero-Lankao & Qin, 2011). A recent study by Janssen et al. (2006) also explored the role of collaboration networks in knowledge production within three major domains of HDEC research: resilience, vulnerability, and adaptation. All analytical methods reviewed in this article, particularly the statistical moderator analysis technique, can be used to examine the possible effects of research paradigms and instruments on the results of previous studies. A combination of meta-analysis and meta-knowledge strategies can provide better evidence on the multifaceted human dimensions of environmental change and management.

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Explaining Energy Conservation and Environmental Citizenship Behaviors Using the Value-Belief-Norm Framework

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Abstract

Despite decades of research, uncertainty remains about what motivates individuals to engage in pro-environmental behavior. The multifaceted and complex nature of energy conservation, like other forms of pro-environmental behavior, still poses a challenge to efforts at accurately explaining or predicting it. This paper examines the extent to which variables in the value-belief-norm framework are able to explain engagement in energy conservation and environmental citizenship behavior in an institutional setting. The results indicate that value-belief-norm constructs, which largely reflect environmental considerations, were more successful at explaining subjects' pro-environmental citizenship behavior than their energy conservation behavior. Individuals' personal norms and self-transcendence values were found to be the most influential precursors of their pro-environmental behavior. Subjects' behavior-specific beliefs also influenced their pro-environmental behavior and were mediated by their personal norms. The implications of our results for the design of pro–energy conservation intervention are discussed.

Keywords: beliefs, energy conservation, environmental citizenship, norms, self-enhancement value, self-transcendence value

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Introduction

Events such as the British Petroleum oil spill in 2010 in the Gulf of Mexico and the Fukushima Daiichi nuclear disaster in Japan in 2011 highlight some of the social, economic, and environmental challenges associated with energy production and use. At the same time, scientific studies (e.g., IPCC, 2014) increasingly show that man-made climate change is a problem that will adversely affect people and the environment. Achieving a sustainable energy future with adequate environmental protection has again become part of debates in politics, education, business, and everyday life (Herring, 2006). Increased energy efficiency and energy conservation, among other things, are perceived to have promise as parts of a strategy to help reduce energy consumption and greenhouse gas generation.

Current efforts at improved energy conservation have primarily focused on technology-based solutions. Nevertheless, inventing better technology alone is likely to prove insufficient for reducing individuals' energy consumption since efficiency gains from such technologies are often offset by consumption growth resulting from consumers' increased acquisition and use of more electric appliances (Midden et al., 2007). Also, the effectiveness of technology-based solutions has been undermined by consumers' reluctance to invest in low-emission technologies over less expensive and more established products (Brown, 2001). More efficient energy use likely will require behavioral change to adopt and maintain improved technologies and practices. Promoting such behavioral changes may benefit from a better understanding of the social systems and underlying factors of human behaviors that shape energy consumption (Steg and Vlek, 2009).

This study therefore focuses on some underlying factors influencing energy conservation behavior (ECB) and environmental citizenship behavior (EAB) of members within a large institution. Developing a better understanding of how the values, beliefs, and norms of constituent members of institutions shape energy conservation and pro-environmental behavior may prove useful in helping to frame and craft effective long-term strategies to promote pro–energy conservation behavioral change.

Background

Despite decades of research, considerable uncertainty still remains about what motivates individuals to engage in energy conservation and other pro-environmental behavior. Researchers have investigated the role of environmental knowledge (e.g., Abrahamse et al., 2007; Bradford

& Fraser, 2008), environmental values and attitudes (e.g., Milfont et al., 2010; Stern, 2000), and demographic characteristics and contextual factors (e.g., Clark et al., 2003; Schultz & Oskamp, 1996) as determinants of pro-environmental behavior. Several theoretical frameworks have also been developed to integrate various combinations of these factors in attempts to guide the design of behavioral interventions. However, the multifaceted and complex nature of energy conservation, like other forms of pro-environmental behavior, still poses a challenge in efforts to accurately explain or predict such behavior.

Individuals' environmental/ecological insights and concerns

It is important to keep in mind how individuals' environmental and ecological insights and concerns arise in the first place. Empirical evidence suggests that individuals' ecological and environmental concerns arise and are influenced by the interplay of diverse factors. Some studies point to people's experiences as a key source of their environmental concern (Nisbet et al., 2009). For instance, affinity, interest, indignation, and positive nature experiences have been found to be predictive of nature protective behavior (Kals et al., 1999; Nisbet et al., 2009). Maiteny (2002) provides some evidence that emotional involvement and experience are central to individuals' sustained pro-environmental values and behavior. However, particular experiences may result in quite different meanings across individuals.

Kollmuss and Agyeman (2002) demonstrate how the meanings that individuals construct to make sense of significant formative and transformative experiences play a powerful part in "loosening" internal constraints to changing old habits and generating impetus for new action. While experiences are essential, it appears that the framing of such experiences or the meaning derived from them leads to the formation of individuals' environmental concern. Those experiences may induce concern about the environment per se in cases where the individual anticipates catastrophic effects from environmental degradation. Similarly, experiences may also create concerns about personal well-being as a result of situations in which an individual believes that behaving in environmentally benign ways enhances their sense of self-worth and self-esteem (Maiteny 2002).

Environmental concern may also arise and be transmitted through social modeling. People may become altruistic (toward the environment) by imitating or learning from their role models, especially from family and parents (Mattis et al., 2009; Mikulincer and Shaver, 2005). For instance, a child raised to be kind to the environment may grow up with that character trait. Similarly, individuals may develop a sense of environmental concern as a result of social compulsion or pressure arising from their association with people who are environmentally

friendly. Lee et al. (2005) also point to the role of spiritual and religious beliefs as sources of environmental concern; that spiritual and religious beliefs or ideologies that place a premium on caring for others and nature may inform a greater sense of personal responsibility toward the environment.

While a complete treatment of how ecological insights and concerns arise in the first place is beyond the scope of this paper, it is important to remember that they arise within individuals who hold them in different ways and are developed within society, families, and everyday settings.

Value-belief-norm theory

Building on previous theories of environmentalism, Stern and his colleagues (1999) developed the value-belief-norm (VBN) theory, which links value theories (Schwartz, 1992, 1994; Stern & Dietz, 1994), environmental beliefs (Dunlap & Van Liere's, 1978, new environmental paradigm), and a norm-activation model (Schwartz, 1977) into a causal chain. The VBN theory posited that individuals' values drive beliefs and, in turn, norms which impact individuals' behaviors. Distinguishing between four types of pro-environmental behavior—environmental activism (active involvement in environmental organizations or demonstrations), non-activist behavior in the public sphere (support or acceptance of public environmental policies), private-sphere environmentalism (the purchase, use, and disposal of personal and household products that have environmental impact), and organizational actions that promote environmental protection (design of environmentally benign products)—the authors argued that their model could explain behavior undertaken with pro-environmental intent. To date, the VBN theory has provided a powerful explanatory framework of a variety of ecological behavior including ecological citizenship, political support, and private sector actions. Evidence has shown that, depending on the type of behavior (i.e., private-sphere behavior, policy support action, or environmental citizenship), the VBN model can effectively explain 19% to 35% of the variance in respondents' self-reported pro-environmental behavior (Steg et al., 2005; Stern et al., 1999). Given the weight of previous VBN research, we adopt the VBN theoretical framework for our study of individual-level factors influencing two forms of non-activist, pro-environmental behavior—ECB and EAB—in a large, institutional context.

Previous research using the value-belief-norm framework

Researchers have used the VBN model in its entirety or parts thereof (i.e., subsections of it) in a range of investigations including consumer behavior (Kaiser et al., 2005), willingness to sacrifice (Stern et al., 1999), willingness to

reduce car use (Nordlund & Garvill, 2003), acceptability of energy policies (Steg et al., 2005), and consumers' adoption of high involvement eco-innovation (Jansson et al., 2011; see also Andersson et al., 2005; Ibtissem, 2010; Kaiser et al., 2005). A few reported studies have used VBN theory as part of efforts to explore and explain behaviors related to energy conservation. For instance, Steg and his colleagues (2005) applied the full VBN model in a household setting to explain acceptability of energy policies aimed at reducing carbon dioxide emissions. Their results confirmed the causal order of the variables in the VBN theory, with the full model explaining about 32% of the variance in acceptability judgments. Similarly, Ibtissem (2010) adopted subsections of the VBN model to explore the extent to which ECB is influenced by norms. His study demonstrated the efficacy of the VBN theory to explain ECB among the Tunisian public. Nevertheless, virtually all of these studies have been conducted using household surveys, in household settings. Only one known reported study has drawn on VBN theory to examine energy conservation in an institutional setting (Scherbaum et al., 2008). Scherbaum and colleagues (2008) examined individual-level factors related to employee ECB in a large midwestern university and found environmental personal norms (PN) to be a key predictor of self-reported ECB and behavioral intent as well as a mediator between environmental world views and ECB. However, these authors employed only sections of the VBN theory, excluding the values and some of the belief components of the model. Therefore, the comparability and generalizability of VBN measures as well as the role of individuals' VBN on ECB in an institutional context remains an unanswered question.

Study focus

In this study, we focus on the influence of individual-level VBN factors on two forms of non-activist, pro-environmental behavior—ECB and EAB—that were identified by an institution as central to its sustainability goals. While ECB (e.g., reducing electricity consumption) has direct environmental impacts, EAB (e.g., voting for pro-environmental candidates) positively affects the environment indirectly via public policy. Relative to ECB, EAB often accrues high collective rather than direct individual benefits. For instance, voting for pro-environmental candidates may result in increased environmental legislation, providing environmental protection for all. In contrast, individual actions to conserve energy may result in direct financial savings and increased personal comfort in addition to such collective benefits as improvements in environmental quality. This suggests that, unlike EAB, ECB may be motivated by an array of factors which may not necessarily be borne out of environmental concerns. Thus, as VBN constructs principally reflect respondents' environmental considerations, the model is likely to evidence different relative effects on ECB and EAB unless they are both principally motivated by environmental considerations. In fact,

while much research has shown that values are related to environmental citizenship (Stern et al., 1999), some studies indicate that personal values tend to have no effect or are weakly associated with intention to reduce energy use (e.g., Abrahamse, 2007; Neuman, 1986). However, to date, no empirical study has examined such potential differences in determinants on these two forms of pro-environmental behavior.

Research hypotheses

We hypothesized that respondents' VBN constructs will have different effects on their ECB and their EAB (Hypothesis 1). Furthermore, we hypothesized that respondents' environmental values would be positively related to their pro-environmental beliefs (Hypothesis 2) and, in turn, their environmental PN (Hypothesis 3). Additionally, we expected respondents' PN to be related to both their ECB and their EAB (Hypothesis 4) while mediating the relationship between environmental beliefs and their energy conservation and their environmental citizenship (Hypothesis 5). Finally, we hypothesized being able to detect direct effects (in addition to indirect effects) of respondents' environmental values and beliefs on ECB and EAB (Hypothesis 6).

Materials and methods

Survey sample and response rate

Participants in this study were part of a random sample of 15,652 students, faculty, and staff drawn from the official records of Michigan State University, a large, research-intensive university in the United States Midwest. Every member of the university population has an e-mail address, access to the Internet, and regularly uses e-mail and Web-based forms to conduct university business. Roughly 30% of the campus population was invited to participate in a Web-based campus planning survey. The study population, while not representative of the general population, is typical of other 'special populations' used for experimental inquiries. Moreover, we do know some of the sample's demographic characteristics and those of the target population. Our use of a Web-based survey with a probability-based sample avoided many pitfalls associated with online Web survey panels (Baker et al., 2010). Members of the random sample were invited to participate in the survey as many as three times, in the event that they had not responded to a previous invitation. After accounting for undeliverable and incorrect addresses, the overall survey response rate was 24.9% with 3,896 respondents completing the survey (AAPOR, 2009). This response rate is in line with response rates for other Web or Internet surveys (Cook et al., 2000; Kaplowitz et al., 2004; Sheehan, 2001).

Survey design

The survey instrument was designed, developed, and implemented following best practices, principles and guidelines of Dillman's Tailored Design Method (Dillman, 2007), Presser et al. (2004), and Couper (2008). The instrument was primarily aimed at helping to provide input concerning the institution's energy use, conservation, and generation options. Therefore, the researchers first conducted individual interviews with key informants concerning energy options and barriers with university administrators, consulting engineers, and personnel. Next, focus group discussions were held with members of the target population. The findings from these preliminary studies formed the baseline knowledge for the initial survey design. An iterative pretesting and revision process of the survey instrument that included draft value, belief, norm, and energy behavior questions followed. The final survey instrument consisted of multiple sections including an inquiry of respondents' policy preferences and questions assessing respondents' values, attitudes, and energy use behavior. Results of the energy use, conservation, and alternative questions are reported elsewhere (Komarek et al., 2011).

Measurement

Typically, the use of established compound measures of VBN components such as the new environmental paradigm scale requires researchers to include a large number of survey items in their studies' questionnaires. However, considering the time and cognitive burdens on our respondents as well as the limited questionnaire space in our large campus planning survey, we used truncated versions of the VBN constructs in our analysis. Using truncated versions of environmental attitudinal scales has proven to be effective in other studies (e.g., Bord et al., 2000; Scherbaum et al., 2008). Next, we discuss the measures used for each construct.

Values

Study participants' value systems were assessed using a shortened version of Schwartz's (1992) universal value scale. Reduced forms of the Schwartz value scale were successfully used in previous studies (Jansson et al., 2011; Nordlund & Garvill, 2002; Steg et al., 2005; Stern et al., 1998). For our study, we focused on measures of values related to respondents' dimensions of self-enhancement (SE) and self-transcendence (ST) because, among other things, they were previously reported to be related to pro-environmental behavior (Karp, 1996; Nordlund & Garvill, 2002; Stern et al., 1998) and also because they neatly embody the oft-used biospheric-altruistic-egoistic value classification (Stern et al., 1995). According to Schwartz (1992), in any culture, individual values will fall along

a dimension of SE to ST reflecting the distinction between values oriented toward the pursuit of self-interests even at the expense of others and values related to concern for the welfare of others, close and distant, and of nature.

Initial drafts of our questionnaire used items with single-word representations of Schwartz's value items as other researchers have done (e.g., Karp, 1996). However, during pretesting the feedback concerning this formulation of the value items revealed that participants had too many questions about those items and repeatedly asked for explanations of what each value term meant. As a result, the value survey items were redrafted (and pretested) until brief statements adapted from Schwartz (1992) were developed for the measures of value items.

In the end, measures of nine values were included in the survey instrument (Table 1). Participants were asked to indicate their level of agreement with value statements using a five-point Likert-type response scale ranging from 1 *strongly disagree* to 5 *strongly agree*. Based on a factor analysis, the responses to these items were grouped into two factors—six of the items loading on a single factor reflecting measures of ST values (e.g., unity with nature, helpfulness, social justice, equality) and three items reflecting measures of SE values (authority, social power, wealth). All six items in the ST scale were interrelated and showed sufficient internal consistency in the reliability analysis (Cronbach $\alpha = 0.73$). This was also true for the three items in the SE values scale, which demonstrated more modest internal consistency (Cronbach $\alpha = 0.43$). The mean score of each value scale item was used in the analysis. Table 1 presents the value items and their factor loadings. Overall, respondents expressed higher levels of ST values ($M = 4.02$, $SD = .52$) than SE values ($M = 3.10$, $SD = .58$). That is, on average, respondents were less concerned about pursuing self-interests relative to their concern about the welfare of other people and nature.

Table 1. Value orientation items

	Factor loadings	
	1	2
Self-transcendence (ST) values		
It is important to help and care for people around me	.754	
I take action to improve well-being of people I do not know	.657	
I am willing to sacrifice for good of those around me	.654	
It is important that every person care for nature	.634	
It is important that every person in the world be treated equally	.583	
My responsibility is to provide only for my family and myself	.572	
Self-enhancement (SE) values		
It is important that people recognize my achievements		.778
It is important to be respected by others		.579
It is important to have a lot of money and expensive things		.574

Beliefs

Typically, the "new environmental paradigm" scale (Dunlap & Van Liere, 1978) and its subsequent revisions such as the "new ecological paradigm" (NEP) scale (Dunlap et al., 2000) have been used as measures of respondents' ecological beliefs. Following Kotchen and Moore (2007), we measured the NEP of our respondents using a simplified measure of five items (Table 2). Each item in our study's NEP scale corresponds with one of the reported five facets of the NEP world view: (1) reality of limits to growth, (2) anti-anthropocentricism, (3) fragility of nature's balance, (4) rejection of exceptionalism, and (5) possibility of an ecological crisis (Dunlap & Van Liere, 1978; Dunlap et al., 2000). Study participants were asked to rate their level of agreement with our five NEP items using a five-point Likert-type scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. A higher average score for these five items reflected a stronger ecological view. Results of these items were correlated and the additive scale had a Cronbach alpha reliability of 0.66. Respondents' mean scores on NEP items were used in subsequent analyses ($M = 3.63$, $SD = 0.71$).

Table 2. Belief and norm items

New ecological paradigm (NEP) scale items, Cronbach α = 0.66
The so-called 'ecological crisis' facing humankind has been greatly exaggerated (R)
The balance of nature is strong enough to cope with the impacts of modern industrial nations (R)
Earth is like a spaceship with limited room and resources
Plants and animals have as much right as humans to exist
Human ingenuity will ensure that we do not make Earth unlivable (R)
Awareness of consequences (AC) belief item
Conserving energy helps to reduce the effect of climate change
Ascription of responsibility (AR) belief item
My energy use makes a noticeable contribution to climate change
Energy use personal norms (PN)
I feel guilty when I waste energy

Note: (R) survey items were reverse coded.

We used single survey items to measure respondents' beliefs regarding the consequences of their actions as well as their feelings of responsibility for causing (or averting) the consequent environmental problems related to energy conservation and pro-environmental behavior. Subjects were asked to indicate the extent to which they agreed, using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*), with statements designed to reflect their awareness of consequences (AC) and ascription of responsibility (AR) regarding energy use (Table 2). The statement used to assess AR beliefs reflected the extent to which respondents felt responsible for the problems associated with energy use,

including climate change. The statement concerning AC measured the extent to which respondents believed their energy conservation could reduce the effect of climate change. On average, respondents were generally aware of the environmental consequences of their energy use ($M = 3.45$, $SD = 1.01$) and felt somewhat responsible for the energy-related problems ($M = 3.18$, $SD = .96$).

Norms

Norms are typically measured using statements that respondents are asked to evaluate or rate. For example, Steg et al. (2005) asked respondents to rate a series of statements representing normative perceptions about energy use in efforts to understand normative factors influencing the relative acceptability of energy policies. We used an individual survey item concerning energy conservation to assess respondents' PN regarding energy conservation. The survey item presented a statement reflecting the extent to which the subject feels a moral obligation to conserve energy: I feel guilty when I waste energy (Table 2). Study participants were asked to indicate the extent to which they agreed with the statement using a scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. On average, participants reported feeling somewhat obligated to conserve energy ($M = 3.77$, $SD = .87$).[2]

Behaviors

In our study setting, two forms of behavior—energy conservation and environmental citizenship—were central to our substantive inquiry and the institution's sustainability goals. After pretesting alternative forms of survey items, the final questionnaire included seven items that asked respondents about self-reported behaviors and behavioral intentions. Responses to these items were used to gauge subjects' habitual and purchase-related ECBs and measure their EAB (Table 3). For the ECB items, respondents indicated their frequency of such behavior using a five-point Likert-type scale with 1 representing *never* and 5 representing *always*. For EAB items, respondents expressed their level of agreement with the items using a five-point scale from 1 = *strongly disagree* to 5 = *strongly agree*. Factor analysis of the behavior items revealed two main factors reflecting the two hypothesized components of behavior. The first factor consisted of three items reflecting EAB and yielded an additive scale with a Cronbach's alpha of 0.70 in the reliability analysis. The second factor, energy use behavior, comprised three items concerning participants' habitual energy use and one item concerning purchasing related to energy conservation. The energy use behavior factor items were interrelated with an additive scale having a Cronbach's alpha reliability of 0.51 (see Table 3 for factor loadings).

2 Note that measures of AC, AR, and PN were worded to capture the general environmental concerns associated with energy use, which we believe also underlie their engagement in EAB.

Table 3. Behavior items

	Factor loading	
	1	2
Environmental citizenship behavior (EAB)		
I adjust my purchases based on environmental concerns	.828	
I participate in activities that promote environmental protection	.793	
I consider an elected official's environmental record before voting	.734	
Energy conservation behavior (ECB)		
Turn off computers, printers, etc. overnight		.694
Unplug electrical appliances when not in use		.678
Turn off lights in unoccupied rooms		.582
Purchase energy-efficient appliances (e.g., EPA Energy Star)		.560

Data analysis

Survey data from the 3,896 respondents provides the basis for empirical analysis of our hypotheses. Using principal component factor analysis procedures and reliability analysis tests, scale measures for each construct were computed as the mean score of all valid responses to the items within a factor (Brown, 2012). Next, a series of regression analyses based on the VBN model were run to test the study's hypotheses.

First, the measures of ECB and EAB were regressed on the set of predictors in the basic VBN causal model (PN, AR, AC, NEP, and ST and SE values) (Table 4). Then, each variable in the posited causal chain (SE or ST values → NEP → AC → AR → PN) was regressed (stepwise) onto the preceding variables in the model. This enabled us to test whether variables directly affected variables further down the causal chain when intermediate variables are controlled for, and follows the approach used by Steg et al. (2005) and Stern et al. (1999).

To establish a causal link, intermediate variables must have some mediating effect on variables next to them in the model. We follow Baron and Kenny's (1986) approach to test for these mediation effects. As Baron and Kenny (1986) suggest, mediation occurs when four conditions are satisfied: (1) the independent variable significantly affects the mediator; (2) the independent variable significantly affects the dependent variable in the absence of the mediator; (3) the mediator has a significant unique effect on the dependent variable; and (4) the effect of the independent variable on the dependent variable shrinks

upon the addition of the mediator to the model. Therefore, we ran a series of regression analyses to test for these conditions. Then, following Dudley et al. (2004), we used a Sobel test to test the hypothesis that the mediation effect is equal to zero (see also Preacher & Leonardelli, 2010). The Sobel test enabled us to determine the presence of a mediating effect of the mediator variables in the model. When mediation was found to be significant, we computed the amount of explained variance accounted for by the mediating variable (see Jasti et al., 2008, for detailed procedure).

Results

Environmental citizenship, energy conservation, and value-belief-norm theory

Table 4 presents the unstandardized regression coefficients of models of EAB and ECB using our predictor variables based on the VBN theory. As the results illustrate, to varying degrees, the VBN framework was useful in explaining some of the variance in EAB and ECB. The results suggest that our VBN model was more successful explaining variation in participants' EAB than their ECB. Overall, the complete set of predictor variables in our VBN model accounted for 57.7% of the variance in EAB and only 7.9% of the variance of ECB (Hypothesis 1).

The model's PN variable had a large, direct effect on respondents' EAB; PN accounted for about 27.2% of EAB's explained variance (bivariate correlation between PN and EAB was 0.52) when variables further up the chain were excluded from the regression model. That is, those respondents reporting higher levels of PN were associated with higher levels of engagement in EAB. This was also found to be true for respondents' ECB; respondents' PN accounted for more than half (4.2%) of the total explained variance (7.9%) in ECB. These finding are consistent with and support the hypothesis that there are direct, positive effects of PN on subjects' EAB and ECB (Hypothesis 4).

Table 4. Unstandardized regression coefficients of value-belief-norm model and causal chain

Independent variable	ECB	EAB	PN	AR	AC	NEP
PN	.124	.162				
	(7.63***)	(16.28***)				
AR	.114	.147	.160			
	(8.29***)	(17.41***)	(12.06***)			
AC	.064	.206	.135	.139		
	(4.66***)	(24.50***)	(10.22***)	(8.92***)		
NEP	–.058	.189	.165	.210	.372	
	(–2.90***)	(15.44***)	(8.509***)	(9.21***)	(16.72***)	
ST values	.060	.298	.395	.330	.537	.613
	(2.15**)	(17.44***)	(14.92***)	(10.59***)	(17.78***)	(32.15***)
SE values	–.148	.006	.038	.126	.005	-.073
	(–7.10***)	(.50)	(1.86)	(5.22***)	(.19)	(-4.27***)
Intercept	2.932	–0.073	.493	.214	-.074	1.40
	(25.51***)	(–1.04)	(4.42***)	(1.61)	(-.55)	(15.23***)
Adjusted R^2	0.079	0.577	0.263	0.146	0.211	0.204
N	3,949	4,009	4,010	4,022	4,031	4,054

Note: AC = awareness of the negative (environmental) consequences of energy use; AR = feelings of responsibility for (environmental) problems related to energy use; EAB = self-reported environmental citizenship behavior; ECB = self-reported energy conservation behavior; NEP = beliefs about human–environment relationships; PN = feelings of personal obligation to conserve energy; SE = self-enhancement; ST = self-transcendence.

t-values of coefficients in parentheses.

** $p < .05$, *** p 0.001.

Also, the PN variable was not the only VBN construct variable that appears to have a direct effect on subjects' EAB and ECB. As illustrated in Table 4, all of the other VBN construct variables preceding PN in the causal chain had significant direct effects on ECB and EAB. For instance, respondents' ST values, a previously reported precursor of pro-environmental behavior, had positive direct effects on both ECB and EAB, thus supporting Hypothesis 6. The results indicate that respondents' ST values were the most influential factor in activating PN, supporting Hypothesis 3. Our results show that respondents' ST values indeed had the largest direct effect on AC, AR, and NEP beliefs (Hypothesis 2). On the other hand, respondents' SE values were less consistently related to the dependent variables. For instance, SE values appear to have no effect on EAB, PN, and AC while only marginally influencing ECB, NEP, and AR (Table 4). The results also show that subjects' NEP, AC, and AR beliefs have a significant direct effect on EAB and ECB (Hypothesis 6).

Causal chain of value-belief-norm components

The results appear to confirm the causal order suggested by the VBN framework. All of the variables were significantly related to the next variable in the causal chain. The Sobel test results reveal that the effect of almost all the mediator variables was significantly different from zero at the 95% confidence interval with the exception of NEP mediating SE and AC beliefs. This implies that the mediator construct variables had at least a partial mediating effect on the variable directly following it in the model. Based on the Sobel test results, it appears that the relationships between respondents' feelings of responsibility for energy-related problems (AR) and participants' EAB and ECB were mediated by respondents' PN, $t = 18.59$, $p < .0001$ and $t = 8.766$, $p < .0001$ respectively (Hypothesis 5).

Our results met the four conditions suggested by Baron and Kenny (1986) to establish mediation for PN, AR, AC, and NEP. For example, in the test of PN as a mediator variable between EAB and AR, our analysis revealed a significant effect of AR on PN, $F(1, 4{,}027) = 510.73$, $p < .0001$. Also, EAB was significantly affected by AR [$F(1, 4{,}038) = 1{,}102.39$, $p < .0001$] and PN [$F(1, 4{,}031) = 1{,}504.43$, $p < .0001$]. Finally, significant impacts were found in the regression of EAB on AR beliefs and PN, $F(2, 4{,}023) = 1{,}159.67$, $p < .0001$. That is, although both PN and AR beliefs contributed significantly to respondents' EAB, the effect of AR beliefs on EAB was reduced when PN was controlled for, suggesting a partial mediating role of PN. These conditions also hold true for the relationship between ECB and AR with PN as a mediator. A calculation of the amount of mediation indicates that PN accounted for about 29.6% of the effect of AR on EAB and about 26.7% of the effect of AR on ECB. We conducted similar analyses for the remaining variable links in the VBN chain to test for mediation effects.

For the sake of space and brevity, we focus on reporting the Sobel test and the amount of mediation occurring for the remaining links in the causal chain for which significant mediation was established.

The results of the Sobel test suggest that the relationship between AC and PN was mediated by AR ($t = 12.98$, $p < .0001$) and that AC, in turn, mediated the relationship between NEP and AR ($t = 11.203$, $p < .0001$). We also found that AR mediated about 20.4% of the effect of AC on PN while AC accounted for about 26% of the effect of NEP on AR. Likewise, NEP was found to mediate the relationship between ST and AC ($t = 16.18$, $p < .0001$), accounting for about 29.6% of the effect of ST on AC. On the other hand, the role of NEP as a mediator between SE and AC was not established. Individuals' SE values had no significant direct effect on their AC ($t = 0.113$, $p < .910$). Even when NEP is controlled for, our SE values did not significantly affect AC ($t = 1.249$, $p < .212$), thereby violating Baron and Kenny's (1986) conditions for mediation. Hence, the mediation role of NEP between SE values and AC beliefs was not established.

Discussion and conclusion

As part of efforts to inform the design of effective strategies to promote pro-conservation behavior at a large academic institution, this study focused on developing an understanding of underlying factors driving ECB and EAB of the members of the institution. We first examined the viability of the VBN framework to illuminate these two forms of non-activist behavior, cited as central to the institution's sustainability goals, and then identified those factors that significantly influence those two forms of behavior in our population.

Regarding the viability of the VBN framework, the results suggest that VBN theory successfully helps explain ECB and EAB, to varying degrees, of university constituents. Our model explained more variance in participants' reported EAB as a function of VBN constructs than the observed variance in reported ECB. The reported disparity in explained variance supports our hypothesis that the two forms of non-activist behavior examined are motivated by a different array of factors and hence the VBN constructs will reveal different effects on them. It appears that EAB is largely dependent on respondents' environmental considerations. Hence, the relatively large explained variance reported may be a reflection of the VBN constructs used in our model, which largely tapped respondents' general environmental concerns, beliefs, and norms. Similarly, the relatively attenuated effect of VBN constructs on explaining ECB might imply that environmental considerations were not key determinants of the reported behavior. This appears to be supported by our finding of a negative relationship between respondents' NEP and respondents' self-reported energy conservation

activities. Perhaps other factors besides environmental considerations (e.g., convenience of the activity, social pressure) may be driving the reported behavior and these factors may not be directly captured in a VBN model. In such a case, the attitudinal constructs in the VBN model will be expected to have an attenuated effect on energy conservation as our results and other studies suggest (Abrahamse, 2007; Diekmann & Preisendörfer, 2003). It is important to note that other studies have also reported lower predicting power of the VBN model for energy conservation (e.g., Abrahamse, 2007; Ibtissem, 2010). Those authors attribute their findings to the inability of the VBN model to account for external factors that are not psychological in nature.

Moreover, our study results confirm the causal order of all the variables of VBN theory as they relate to pro-environmental behavior. Moving from the relatively stable personal values to general beliefs about human–environment relations to more specific beliefs and norms for actions that correspond with pro-environmental behavior, the VBN construct variables in our model were significantly related to the next variable in the causal chain. Also, in line with results from previous studies (Nordlund & Garvill, 2003; Steg et al., 2005), the hypothesized mediation effects of most of the variables were confirmed. PN mediated the relationship between AR beliefs and the two forms of non-activist behavior—energy conservation and environmental citizenship—while AR beliefs in turn mediated the relationship between AC beliefs and PN. Similarly, the results confirmed the mediating role of AC and NEP beliefs for the relations between AR and NEP beliefs and AC beliefs and ST values respectively. These findings demonstrate the applicability of the VBN framework for examining pro-environmental behavior in an institutional context.

In exploring the factors underlying these two forms of behavior, our results revealed that high levels of EAB and ECB were associated with stronger PN. Individuals' PN accounted for more than half of the variance in EAB and ECB in the model. Also, ST values were found to be most influential in activating PN while having a strong direct effect on both EAB and ECB. That is, individuals with ST-value orientation were more likely to feel guilty for wasting energy and more likely to engage in ECB and EAB. This fits with the wide array of research that has found ST values to be positively related to pro-environmental behavior, including energy conservation (Dietz et al., 2005; Karp, 1996; Poortinga et al., 2004; Schultz & Zelezny, 1999; Stern et al., 1993). It also reflects the stable nature of the relationship between environmental values and pro-environmental behavior, which cannot easily be moderated by interventions.

In addition, ST-value orientation was found to be associated with a favorable view of the human–environment relations (NEP) as well as specific AC and AR beliefs concerning energy conservation. On the other hand, the results suggest that subjects' SE values have a more complex role in influencing pro-environmental

behavior. As expected, SE was negatively related to ECB and NEP. Nevertheless, it generally proved ineffective as a predictor of EAB, AC beliefs, and PN and it unexpectedly had a positive relation with AR beliefs. Our finding of a complex role of SE values converges with the findings of Ibtissem (2010) but contrasts with the findings of Steg et al. (2005). Obviously, more work is needed in this area including better tests of alternative measures of relevant constructs.

Furthermore, the results show that respondents who feel that their energy use makes a noticeable contribution to climate change (AR beliefs) are associated with higher levels of awareness of the consequences of their energy use (AC beliefs). Such respondents are more likely to feel guilty for wasting energy (PN). That is, as respondents are increasingly aware of the negative environmental consequences of their energy use, the more they assume responsibility for the negative environmental problems related to their energy use, and the more dutiful they feel about working to reduce their energy consumption.

While we need to exercise caution in drawing conclusions about causality based on these associations, the findings provide some insights toward crafting effective strategies to promote environmental citizenship and energy conservation in institutional settings. First, they suggest that institutional education programs that strengthen individuals' ST values while highlighting the negative impacts of individuals' energy use may be able to induce a sense of responsibility and activate personal moral norms needed to initiate pro-ECB and EAB. To be effective, messages from such education programs need to be framed to reflect and appeal to the values of the recipients (Schultz & Zelezny, 2003) while providing information on specific behavioral changes they could undertake to conserve energy and protect the environment. In other words, education programs may need to equip the target group with the why, what, and how of the behavior in question to initiate the desired behavioral change (Kaplowitz et al., 2009).

Such an education program could also harness the experiences of the target groups to design messages that could facilitate their interpretation of life experiences in an environmentally benign manner. Education programs designed this way, we believe, would help strengthen pro-environmental PN, which this study shows is an important precursor of ECB and EAB among the populace. At the same time, such a program could foster development of pro-environmental social norms that may subsequently pressure others to act in environmentally benign manners because of social modeling (Mattis et al., 2009; Mikulincer and Shaver, 2005). Members of the institution join the university with a wide range of life experiences, personal characteristics, and antecedents or determinants of environmental awareness and concern. It would be informative to explore how useful specific program designs and program

elements can be at promoting institutional sustainability across individuals with different backgrounds and experiences. Doing so may provide useful insights into programmatic interventions for increased institutional sustainability.

Additionally, in corroboration with previous studies (Abrahamse, 2007; Ibtissem, 2010), our results demonstrate an attenuated effect of the VBN constructs on ECB. It is possible that, unlike other pro-environmental behavior, ECB is primarily undertaken independently of environmental considerations. This could imply that programs aimed at promoting behavioral change related to energy use in an institutional setting may need to account for factors other than environmental considerations—such as convenience and direct economic benefits—in their design to have the greatest impact. Also, it may be necessary that future research on the determinants of ECB integrate some external or contextual factors into the VBN model to improve its predictive power of energy use activities.

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Book Reviews

The Tragedy of the Commodity: Oceans, Fisheries, and Aquaculture

by Stefano B. Longo, Rebecca Clausen, and Brett Clark

New Brunswick, NJ: Rutgers University Press, 274 pp., 2015
ISBN: 978-0-8135-6577-4

Reviewed by Julius Alexander McGee[1]

In 1978, William Catton and Riley Dunlap published their groundbreaking piece, "Environmental Sociology: A New Paradigm," outlining the "new environmental paradigm," which urged sociologists to be mindful of ecological constraints when conducting analyses on issues such as stratification and social justice. In the proceeding decades, the work of Allan Schnaiberg (1980) and John Bellamy Foster (1999, 2000) would expand on this point, bringing to light how deeply ingrained the destructive relationship between human society and nature truly is. Since then, a slew of environmental sociological analyses have operated under the framework set forth by Catton, Dunlap, Schnaiberg, and Foster, demonstrating the specific fundamental features of capitalist societies that perpetuate environmental degradation. The book *The Tragedy of the Commodity: Oceans, Fisheries, and Aquaculture*, written by Stefano Longo, Rebecca Clausen, and Brett Clark, takes the next logical step in the vein of environmental sociological inquiry, bringing to light not only an underexplored area of environmental sociology (marine ecosystems), but the pitfalls of specific attempts within capitalist economies to correct the ecological contradictions they bring out. In doing so, the authors write a new but intriguingly familiar book that combines interdisciplinary research, comparative historical analysis, and critical Marxism in a unique and fascinating way.

Longo, Clausen, and Clark's book is the next logical step in environmental sociological research because it deals heavily with the issue of sustainability. While sustainability is not new to environmental sociological inquiry, critical discussions regarding capitalism and sustainability that are grounded in empiricism are few and far between, which is what makes this work so important. *The Tragedy of the Commodity: Oceans, Fisheries, and Aquaculture* does not just argue that fisheries and aquaculture are intentionally hazardous to the environment due to the choices made by individuals operating within them; on the contrary, it demonstrates that the contradictions between capitalism and nature are so perverse that attempts at sustainability are mostly futile. This is

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one of the book's strongest features, and although it isn't necessarily a focal point of the book, it lays the groundwork for future critical Marxist analyses into environmental sustainability. My personal fascination with the book is its discussion on sustainability, which highlights the range of environmental sociologists this research would appeal to, and why it should be read by more than just those of us embedded within the critical Marxist tradition.

Perhaps the most compelling feature of the book is its diverse range of contributions. On one hand, the book outlines the importance of sociological inquiry into marine environments, demonstrating the disastrous relationship between humans and water ecosystems. On the other hand, the book is a great theoretical contribution that takes Garrett Hardin's concept of the tragedy of the commons and turns it on its head by placing it within a Marxist framework. The book also puts forth concrete solutions to the ecological crises faced by marine ecosystems. In this, the authors succeed where many fail, by not simply providing an alarmists' cry against modern human–environment relations, but also outlining potential ways to move forward. It accomplishes all of these feats in a concise, coherent way that never gets too tangential, which is what makes the book such a great contribution.

The book is not without flaws though. The middle chapters, which focus on two separate case studies—the trapping of bluefin tuna and salmon fisheries—feel somewhat disconnected from each other. Although they are tied together by the theory of the tragedy of the commodity, the purpose behind focusing on these specific cases as opposed to others is not explained, and would have given the book some much-needed empirical depth. While this does not take away from the overall contributions of the book, it falls into the trap that many Marxist-driven analyses are often criticized for, which is cherry picking its empirical cases to prove its point. I am sure there are multiple reasons why these case studies were chosen over others that would easily put this argument to rest, but, without acknowledgment of this, the book runs the potential of being dismissed by some academics as polemic for the sake of being provocative. Aside from this admittedly minor gripe, *The Tragedy of the Commodity: Oceans, Fisheries, and Aquaculture* is a fantastic piece of literature that should be a staple book for graduate courses in environmental sociology.

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Sustainable Food Systems: Building a New Paradigm

Edited by Terry Marsden and Adrian Morley

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Reviewed by Federico Davila[1]

Of the 17 United Nations Sustainable Development Goals agreed in September 2015, four were concerned with the importance of dealing with global food insecurity, climate change, good health, and women's empowerment. Although these four priorities have been given their own sets of goals and targets, there are cross-cutting sustainability processes and issues that link them. One sustainability domain that encapsulated all these issues is food systems. A food system is broadly defined as the full suite of activities ranging from production, processing, and distribution to consumption of food, including the feedbacks that operate between these activities and influence their behavior (Ericksen, 2008; Ingram et al., 2010). Food-systems thinking is becoming a core way of understanding the problem of global food insecurity and environmental change (Ericksen, 2008; Ingram, 2011; Ingram et al., 2010; iPES Food, 2015).

In *Sustainable Food Systems: Building a New Paradigm*, Marsden and Morley argue that food studies need to embrace a critical approach which embeds core dimensions of sustainability. Throughout 10 chapters, multiple authors present case studies, detailed literature, and a range of arguments to demonstrate that linking economics, human well-being, environmental change, and different world views can contribute toward more sustainable outcomes in food systems. In their concluding chapter, the authors state that they have provided:

> A range of theories and concepts to explore questions of food futures, food governance, the public realm and procurement, adaptive supply chains, biosecurity risks, animal welfare and political consumption, and the current implosion of the regulatory and geo-graphical binaries between rural and urban spaces, all as new food spaces of hope and alterity. (p. 206)

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Contributions to knowledge

The book will be of great use to students and early career researchers familiarizing themselves with the current trends in food systems, as well as some prevalent theories and proposed solutions.

The introductory chapter sets the context, and argues that there is a critical need to link food security objectives within a normative sustainability world view. The chapter presents an overview of key dimensions for a sustainable food system, including environmental well-being, intergenerational equity, governance, and economic reforms. The chapter identifies high-export agriculture and industrial agribusiness as key barriers to creating a food system that integrates greater ethical concerns for people and environments. These themes are used by other authors throughout the book, and used in Chapter 10 to propose a framework that links food security with sustainability.

Chapter 2 provides an authoritative review of the state of global food systems, and mixes a range of secondary statistical information with recent public, academic, and private perspectives on the future of food. Although comprehensive in its scope, the chapter does not provide any critical analysis of the themes identified throughout the reports, especially in the context of broader literatures. For example, the authors identify "sustainable intensification" (pp. 52, 58) as one of the main solutions to food scarcity presented in the literature, and acknowledge the term ignores other alternatives. Deep explorations of what "sustainable intensification" proposes, however, are not pursued (see, for example, Loos et al., 2014). Similarly, corporations are presented in the context of market-based and technological solutions (p. 56), yet a more critical examination of the role of agribusiness might have been expected, given the food regimes theories discussed in Chapter 1 (for an overview of the role of corporations in food, see McMichael, 2009).

Chapters 3 to 9 present detailed studies and arguments on issues including food governance, supply chains, consumer power, biosecurity, animal welfare, rural–urban relationships, and urban food strategies. Chapter 10 concludes the book, and identifies the themes of climate change impacts and neoliberal world views as two overarching barriers to overcome if progress is to be made toward sustainable food systems.

Critical omissions and future works

Despite the ambitious focus of the book and well-documented construction of the core elements of a sustainable food system, some gaps are noticeable. The first is the Western-centric narrative present throughout the chapters, and echoed by the locations of the host universities of the authors. This Western-centric focus makes the arguments relevant to industrialized food systems in the United States, Europe, Canada, Australia, and some rapidly growing economies, such as Brazil and China, but less so to countries facing the basic challenge of producing food in non-industrial ways, such as the Philippines or Bolivia.

A focus on advanced industrial food systems fails to shine a light on the multiple sociopolitical, environmental, and economics issues that permeate the developing world. For example, there is little to no discussion on the role that women's empowerment and rights in food production play in creating a genuine sustainable food system. Similarly, discussions of good food and healthy eating relate to affluent consumers who can make conscious food choices and have a food system that allows food availability to exist. The extent to which freely available food choices are applicable to the approximately 2 billion people suffering from hidden hunger and marginalization from food markets is not explored.

Finally, discussions of food governance and rural–urban linkages would benefit from deeper exploration of how the world's poor and semi self-sufficient food producers, who continue to produce a vast majority of the world's food (ETC Group, 2009), are included in food decision-making processes.

There are discussions about landownership, notably Chapter 8, where the focus is on issues of community land sharing and the changing nature of rural communities to meet urban demand. However, the structural roots of land inequality, such as poor tenure status or corruption, which prevail emerging economies, are not brought to light (Borras, 2009; Scoones, 2009). The rural–urban discussions would have benefited from linking to global food system discussions, for example, using the ideas of Clapp (2015), who uses global market trends to discuss the sustainability of food. Alternative production practices, such as agroecology, could have been included to discuss how alternative production methods in non-industrialized countries present opportunities for future food systems (Altieri & Toledo, 2011). Finally, there is a crucial omission of debates around the root world views that dominate food system policies, critically the tensions between food security and food sovereignty (Jarosz, 2014).

A future publication that links their proposed normative sustainability paradigm with other critical developmental literatures will make for a more informed, globally relevant food systems paradigm debate. Furthermore, globalizing the discussion would facilitate crucially needed policy and political innovations

and experimentations with environmentally and socially equitable food system interventions. Educators using this book would benefit from coupling it with additional, critical literatures on food, for example, Wittman et al. (2010) on food sovereignty, Clapp (2014, 2015) on financialization, Borras (2007, 2009) on land reform, Berdegué et al. (2015) on territoriality, or Scoones (2009) on livelihoods. Early scholars exploring the deep trenches of interdisciplinary food literature will benefit from the insights and rigor in this book, but need to be wary of the geographical and conceptual limitations. Practitioners dipping their toes into food-systems thinking need to be wary of the limited solutions provided by "new paradigms" that focus on industrialized food systems, without highlighting the depth of challenges occurring throughout the developing world. Only when both Western and developing country discourses align in solutions will we begin to genuinely work toward sustainable food systems.

Despite some omissions, Marsden and Morley have provided a rigorous update on food-systems thinking from an industrialized economic perspective, making a valuable contribution to the growing body of food-systems publications. Educators, students, and policy makers will benefit from the up-to-date insights provided by the book—as long as they understand the contributions need to be complemented by literature that deals with non-industrialized countries.

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