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PREDICTING ECOLOGICAL BEHAVIOR IN THE ERA OF CLIMATE CHANGE

by

JALIKA C. STREET

Under the Direction of Marci R. Culley, Ph.D.

ABSTRACT

The most devastating effects of climate change may be avoided if humans reduce activities that produce greenhouse gases and engage instead in more sustainable ecological behaviors. The current mixed methods study of 279 undergraduate students explored whether environmental worldview, belief in climate change, knowledge of climate change, personal efficacy, and intention to address climate change influenced participants' engagement in ecological behavior. Results indicated that those with a stronger intention to address climate change and a more ecocentric worldview reported significantly more ecological behavior. Next, the study examined whether participants' intentions to address climate change mediated the relationship between their belief in climate change and engagement in ecological behavior and whether intentions mediated the relationship between efficacy and ecological behavior. Intentions to address climate change did not mediate the relationship between belief and ecological behavior but fully mediated the relationship between efficacy to address climate change and ecological behavior.

INDEX WORDS: Global warming, Climate change, Ecological behavior, Pro-environmental behavior, Behavioral intentions, Environmental attitudes, Personal efficacy

PREDICTING ECOLOGICAL BEHAVIOR IN THE ERA OF CLIMATE CHANGE

by

JALIKA C. STREET

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

In the College of Arts and Sciences

Georgia State University

2011

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2011

PREDICTING ECOLOGICAL BEHAVIOR IN THE ERA OF CLIMATE CHANGE

by

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INTRODUCTION

Climate change is arguably one of the biggest challenges of the 21st century. If no action is taken to mitigate its effects, climate change is predicted to have far-reaching negative consequences for life on earth (Intergovernmental Panel on Climate Change - IPCC, 2007). Engagement in ecological behavior, in addition to other strategies, will be essential to prevent the most devastating effects of climate change. A premier obstacle in addressing climate change, and an important step to solving any problem, lies in how the problem is defined.

Therefore, this paper first attempted to define climate change as a problem that psychologists should be concerned about and next provided an overview of the research that has been conducted on ecological behavior and related variables. Based on the theoretical models of ecological behavior, this study explored whether demographic factors, environmental worldview, belief in climate change, knowledge of climate change, personal efficacy, and intention to address climate change influenced engagement in ecological behavior. Next, this study examined whether participants' intentions to address climate change mediated the relationship between their belief in climate change and engagement in ecological behavior and whether intentions mediated the relationship between efficacy and ecological behavior. Finally, this study explored perceived barriers to ecological behavior.

Defining the Problem

Scientific evidence indicates that global temperatures are increasing due to the heat-trapping effect of greenhouse gases which have built up in the earth's atmosphere. Greenhouse gases, primarily carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), have been produced from the burning of fossil fuels and other carbon emitting processes over the last 200 years (IPCC, 2007). An increase in the global temperature, by only a couple of degrees, is predicted to have catastrophic effects on humans and other natural systems (IPCC, 2007). Although the terms "climate change" and "global warming" are often used interchangeably, there is a shift toward the term climate change as it better captures the range of potential outcomes (Environmental Protection Agency, 2009).

Climate change poses an alarming number of threats to public health and the stability of the ecosystems that sustain life. It increases the likelihood of severe storms, flooding, droughts, coastal erosion, outbreaks of infectious disease, and higher summer temperatures (IPCC, 2007). Climate change also poses a number of environmental justice concerns. The United Nations Institute for Environment and Human Security (2005) estimated that by 2010, environmental destruction, largely associated with human-influenced climate change, will have produced 50 million "environmental refugees." The fairly new term "environmental refugees" is used to refer to people displaced by environmental disasters, and recent estimates show that more people may be displaced by environmental disasters than by war (United Nations Institute for Environment and Human Security, 2005). Although globally, people of color and those who are poor are less responsible for causing climate change, research indicates that these populations will

be more adversely affected by it (St. Louis & Hess, 2008). Bevan (1991), as cited in Winter (2000), highlighted the importance of addressing climate change and stated that, "myopically investigating small questions while the big problem of human survival goes unattended is professionally irresponsible" (Winter, 2000, p.516).

Although climate change is a human-created problem, human behavior is one of the least understood components (IPCC, 2007). Psychology as a field has contributed little to the discussion on climate change until recently. However, there is growing awareness and research on the topic. For example, in 2008 the American Psychological Association (APA), the premier organization dealing with the discipline of psychology in North America, recognized global climate change as one of "society's grand challenges" and developed a report that outlined the importance of insights from the psychological sciences in creating solutions to climate change (Benson, 2008, p.1). The report identified ways that psychologists can help to develop solutions to climate change, especially in the areas of: assessing risk, promoting effective communication, policy making, exploring humans' beliefs about self in relation to nature, and managing stress caused by environmental factors (Benson, 2008). An APA taskforce was also formed to promote further attention to the issue (Swim, Clayton, Doherty, Gifford, & Howard, et al., 2009).

Furthermore, community psychologists have much to contribute to addressing the climate crisis. Research within community psychology on issues of climate change—although nascent—is beginning to take shape. For example, a special issue dedicated to climate change as it relates to community psychology will soon be published in the *American Journal of Community Psychology*, representing the work of a handful of community psychologists conducting research in this area (e.g. Culley & Angelique, in

press). Additionally, at the 2009 biennial meeting of the Society for Community Research and Action (APA Division 27), an *Environment and Justice Interest Group* was founded to facilitate research and action related to such issues.

Mitigating climate change has been difficult, in part given the nature of the political debate that has encompassed the issue. Perhaps more importantly, unlike some social problems such as war or poverty that are more visible and evoke a strong emotional response, climate change is nefariously imperceptible. The "time-delayed, abstract, and often statistical nature of the risks of global warming does not evoke strong visceral reactions" (Weber, 2006, p. 103), which makes it difficult to mobilize around the issue. However, because there is overwhelming evidence that human activity has caused climate change, solutions to climate change are rooted in human behavior change (Oreskes, 2004; IPCC, 2007).

While most scientists agree that climate change is real and created largely by humans, some argue that we must go further to examine climate change within a larger global context (Oreskes, 2004; Etkin & Ho, 2007). The actual problem, according to these scientists, is in our narrow definition of climate change. Instead, we must examine the capacity of the earth to sustain life, the limits of growth, and our use of the world's resources as infinite and expendable (Etkin & Ho, 2007). As Etkin and Ho (2007) pointed out, the discourse on climate change "normally views human induced global warming as a problem that is in need of a solution – mainly reduction of greenhouse gas emissions – that itself creates perceived risks to the wellbeing or wealth of dominant sectors in society" (p. 634). However, Etkin and Ho (2007) argue that the true problem is the

"fundamentally dysfunctional relationship between humankind and the natural world" (p. 634). Consequently,

> instead of asking the question 'How can we mitigate the emission of greenhouse gases in a way that does not incur costs that exceed the potential damage climate change will create?' it makes more sense to ask 'How can we relate to nature in a more sustainable and functional way, so that we live in harmony and equilibrium with the ecosystems that sustain us?. In other words, the issue of climate change needs to be addressed as one part of a wider question of how to live sustainably within a world that demonstrably and inevitably is finite in terms of the resources it offers. (Etkin & Ho, 2007, p. 634)

As some have pointed out, the causes of these problems are rooted in two key aspects of human behavior: overpopulation and overconsumption (Oskamp, 2000). Ultimately, solutions to climate change must be addressed within the larger framework of making human behavior more "sustainable" or better able to support life on earth for future generations. Solutions to climate change will work best if they are more comprehensive and focused on making human behavior more sustainable, rather than focused solely on reducing carbon emissions.

Given the lack of research in this area, despite the importance and urgency of this problem, this study explored variables which influenced peoples' engagement in ecological behavior. These include: demographic factors, environmental worldview, belief in climate change, knowledge of climate change, and personal efficacy to address climate change. Next, this study examined whether participants' intentions to address

climate change mediated the relationship between their belief in climate change and engagement in ecological behavior. A second mediation model was run to examine whether intentions to address climate change mediated the relationship between participants' climate change efficacy and ecological behavior. Finally, the study explored perceived barriers to ecological behavior. To place the current proposal in context, this study first provided an overview of research and theories within psychology that have examined variables thought to influence peoples' engagement in ecological behavior and attitudes towards climate change, including demographic factors, environmental worldview, belief in climate change, knowledge of climate change, personal efficacy to address climate change and intentions to address climate change. Although numerous disciplines have contributed to the discourse on climate change, a review of these literatures is beyond the scope of this research. The present literature review focused primarily on research within the field of psychology.

Literature Review

Ecological Behavior.

Because climate change is the result of human behavior, most solutions to climate change involve behavior change. Changes in consumption patterns, drastic reductions in activities that produce greenhouse gases, and large scale human engagement in ecological behavior (in addition to other strategies), will be essential to prevent the most devastating effects of climate change. It will take changes on both an individual and societal level to tackle this global issue. This study will focus on people's engagement in ecological behavior (largely an individual level phenomenon) as a means to address climate change, something that has not been explored previously by many researchers.

There remains much to be understood about peoples' ecological behavior and perceived barriers to such behavior. Both creating a definition of ecological behavior and measuring this construct is a difficult task.

The terms "environmentally conscious," "ecological," "environmentally significant," and "pro-environmental" behavior have all been used to describe behavior with a lower environmental impact. For the purposes of this study, this construct will be referred to as ecological behavior, using the definition of environmentally conscious behavior developed by Kollmuss and Agyeman (2002) which is "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world" (p. 240). Regardless of the name assigned to the construct, there is even less consistency as to what behaviors the construct includes. Researchers define which behaviors are "pro-environmental" and often focus on behaviors that have only a small effect on the environment based on energy or material use (Gatersleben, Steg, & Vlek, 2002).

Situational variables further complicate the measurement of ecological behavior as some ecological behaviors are more feasible than others, depending on the situation (Kaiser & Wilson, 2000). To address the impact of situational influences, some researchers have developed scales that weigh different behaviors based on the difficulty to perform them or the impact they have on the environment (e.g. Kaiser & Wilson, 2000; Gatersleben, et al., 2002). Another limitation of most current measures of ecological behavior is that they require participants to self-report their level of engagement in ecological behaviors. The validity of this method is questionable, and self-reported measures of ecological behavior may better reflect self-perception or behavioral

intentions to engage in ecological behavior rather than actual behavior (Gatersleben, et al., 2002). For example, Gatersleben, et al., (2002) found that typical self-reports of ecological behavior related to energy use were more strongly correlated with attitudinal variables and household income and size than with household energy usage.

For the purposes of the current study, only certain items that are commonly included in the measurement of ecological behavior were selected. Omitted items were those that would not likely to apply to the participants. For example, participants in this sample were students who were unlikely to live in, or have access to, the type of household information (e.g. type of stove or cost of electric bill) relied upon in more comprehensive behavioral measures such as the one developed by Gatersleben et al. (2004). Ecological behaviors were not weighted based on the level of difficulty to perform them or on the level of impact on the environment. Therefore, the behavioral measure used may be more strongly related to environmental attitudes or perceived ecological behavior than to actual behavior.

Demographic Factors.

Gender. Demographic factors such as a person's gender, education level, income and race have been found to relate to a person's attitudes towards climate change and engagement in ecological behavior. Women consistently perceive a greater number of environmental hazards and more risks associated with them (Bordy, Zahran, Vedlitz, & Grover 2008; Bord & O'Connor, 1997; O'Connor, Bord, & Fisher, 1999, Tribbia, 2007). For example, according to Kollumuss and Agyeman: "Women usually display less extensive environmental knowledge than men, but they are more emotionally engaged, show more concern about environmental destruction, believe less in technological

solutions, and are more willing to change" (2002, p. 248). Men's lower perception of risk in regard to environmental hazards appears to apply to climate change as well (Bord & O'Connor, 1997; Bordy et al., 2008). According to Bord and O'Connor (1997), perceptions of health risks associated with environmental hazards may be responsible for these differences. Women are also more likely to indicate that they intend to take voluntary action to address climate change (O'Connor et al., 1999). O'Connor, Bord, Yarnal, and Wiefek (2002) found that, although women were more likely than men to think that climate change will occur, they were also more likely to believe that false causes, such as pesticides, contribute to climate change. However, O'Connor, et al. (2002) also found that men were equally likely to indicate support for initiatives to address climate change. For now, it appears that findings regarding gender and climate change are mixed.

Socioeconomic Status (SES). There are also mixed findings about the relationship between SES and peoples' attitudes towards climate change and engagement in ecological behavior. For example, while some researchers cite evidence that people living in poorer nations are more concerned about the environment and are more likely to perceive risk associated with climate change than those of wealthier nations, others have proposed that there is no relationship between income and environmental attitudes (Bordy, Zahran, & Vedlitz, 2008; O'Connor, et al., 2002). Inconsistency exists not only in the relationship between income and peoples' attitudes towards the environment, but also in the relationship between income and engagement in environmental behavior. Whereas people with larger incomes may have the resources to afford cars, heat and cool large homes, and consume more products that depend on fossil fuels, they may also be able to

buy energy-efficient appliances and be educated about the causes of climate change (Tribbia, 2007).

While the relationship between income and attitudes towards climate change is unclear, people living in poverty and other disenfranchised groups are predicted to be hardest hit by the negative effects of climate change (Agyerman, Doppelt, Lynn & Hatic, 2007). For example, climate change is predicted to increase the occurrence of natural disasters, especially hurricanes, tornados, droughts, and flooding. Poor communities are at higher risk of devastation from natural disasters and slower to receive vital aid, as demonstrated by the response to Hurricane Katrina. Climate change also poses a greater threat to the health of disenfranchised groups by increasing the likelihood of outbreaks of infectious disease, natural disasters, respiratory illness, and heat stress (Elliott, Winslow, & Hoerner, 2004). These risks are compounded by the fact that many marginalized populations are often without health insurance and already suffer from polluted environments (Agyerman, Doppelt, Lynn, & Hatic, 2007).

Race. Additionally, researchers have begun to explore differences in attitudes towards the environment in relationship to a person's race. In the United States, differences in attitudes based on race have primarily been examined between African Americans and Whites. Although there is a commonly held misconception that African Americans do not care about the environment as much as Whites, several researchers have found equal concern for the environment between racial groups (e.g. Mohai & Bryant 1998; Mohai, 2003; Parker & McDonough, 1999). However, there may be some difference in concern for the environment depending on the focus of the environmental concern. For example, African-Americans have been found to be especially concerned

about the local effects of pollution and pesticides, while Whites have expressed more concern about global issues such as climate change (Mohai & Bryant 1998; Mohai, 2003; Parker & McDonough, 1999).

Environmental Worldview.

Although psychologists are just beginning to contribute to the discussion on climate change, they have been studying attitudes and behavior related to the natural environment for some time. For example, Pirages and Ehrlich (1974) first explored the idea that each person has an environmental worldview or beliefs about nature and humans' relationship to it. Drawing upon the idea that a person's attitude toward the environment is an important and measurable concept, numerous social scientists have explored the relationship between a person's beliefs about the environment and numerous other aspects of attitudes and personality. For example, a more ecocentric worldview (the view that nature has inherent worth that humans should respect) has previously been found to relate to pro-environmental beliefs as compared to people with a more anthropocentric worldview (the belief that humans are superior to nature and have dominion over nature) (Dunlap et al., 2000). Brody et al. (2008) found that environmental worldview, as measured by the New Environmental Paradigm (NEP), first developed by Dunlap and his colleagues in 1978, was a significant predictor of people's perceptions of risk associated with climate change. This scale measures where a person falls between the ecocentric/anthropocentric dimensions.

Attitudes towards Climate Change.

Although psychologists have been studying people's attitudes towards the environment for some time, less is understood about people's attitudes towards climate

change. A few studies have examined the relationship between attitudes toward climate change and more general environmental attitudes (Etkin & Ho, 2007; Weber, 2006; Heath & Gifford, 2006, Bord & O'Connor, 1997). For example, Heath and Gifford (2006) found that approximately 56% of the variance in the intention to address climate change was explained by free-market ideology, environmental worldview, and self-efficacy. Those with higher free-market ideology, greater environmental apathy, anthropocentric values, and beliefs that climate change is not occurring and is not human caused were less likely to have the intention to mitigate its effects (Heath & Gifford, 2006).

Similarly, O'Connor et al. (1999) found a positive relationship between environmental worldview and willingness to act to address climate change in a national sample. Those who believed climate change is occurring and that the balance of nature is fragile (part of an ecocentric worldview) were more willing to address climate change through voluntary actions such as not buying a gas-guzzling car, installing more home insulation, and replacing older appliances (O'Connor, et al., 1999). However, fewer respondents indicated intentions to drive less, carpool, or use public transportation to address climate change. When asked to indicate what legislation they would support to address climate change, participants showed little support for large gasoline taxes, energy use taxes for businesses, and international treaties aimed to reduce carbon emissions. Conversely, respondents showed more favor for programs that involved preservation of rain forests, increased automobile fuel efficiency standards and, by narrower margins, a gas guzzler tax and heat/air conditioning controls for public buildings. This led O'Connor et al. to conclude that, "People are neither 'nonbelievers' who will take no

initiatives themselves and oppose all government efforts to reduce greenhouse gas emissions, nor 'believers' who promise both to make personal efforts and to vote for every government proposal. Instead, most people are in the middle, favoring some actions and opposing others." (p. 469)

Knowledge of Climate Change.

Several psychologists have explored the relationship between knowledge about climate change and behavioral outcomes (O'Connor et al., 1999, Grotzer & Lincoln, 2007). Knowledge of the causes of climate change appears to be a powerful predictor of a person's intention to address climate change, independent from believing that it is a real phenomenon that will have negative consequences (O'Connor et al., 1999). Research on people's knowledge of climate change, even among those deemed well educated, often reveals that most people have, at best, a minimal understanding of the causes of climate change (Grotzer & Lincoln, 2007). "Research continues to find that people tend to confuse global warming with ozone depletion, do not understand the causes of global warming – rarely mentioning energy use and automobile emissions as causes and naming pollution in general as the most commonly cited cause..." (Grotzer & Lincoln, 2007, p. 267). As Grotzer and Lincoln (2007) pointed out, this lack of knowledge about climate change may not be surprising given the complexity of the issue and lack of opportunity to learn about it for, "the current adult population grew up at a time when the curriculum did not offer the understandings necessary to enable people to understand the language or pattern of nature in general or climate change in particular" (p. 267).

Even when people have an awareness of the impact of their actions on the environment, there is often a gap between their awareness and taking action to reduce this

impact via ecological behavior (Kollmuss & Agyeman, 2002). This suggests that other factors, such as the ones discussed previously (e.g. demographic factors, institutional, social, and individual beliefs), may play a key role in the relationship between a person's knowledge and environmental behavior.

Personal Efficacy to Address Climate Change.

Personal efficacy related to climate change, or the belief that one can change the environment and make a difference, has been found to significantly explain differences in attitudes towards climate change (Kellstedt, Zahran, & Vedlitz, 2008; Brody et al., 2008). Kellstedt, et al., (2008) found that people who believed that they were able to address climate change were considerably more likely to be concerned about the issue. This has also been found to be true with similar concepts such as perceived behavioral control which "refers to people's perception of the ease or difficulty of performing the behavior of interest" (Ajzen, 1991, p. 183). Ajzen (1991) identified perceived behavioral control as an important and previously neglected factor which influences whether people act in ways that are consistent with their intentions.

Perceived Barriers to Ecological Behavior.

As a result of a disconnect between knowledge, attitudes, and behavior, researchers have examined other variables to try to parse out the reasons why some individuals behave in more ecological ways than others. There are often significant barriers that prevent behavior change from occurring. Most current theoretical models that map the relationship between attitudes and environmental behavior also include barriers to engaging in the environmental behaviors as an important component.

The development of effective strategies to promote ecological behavior depends on addressing the perceived and structural barriers that prevent the behavior from occurring (McKenzie-Mohr, 2000). Identifying and addressing perceived and structural barriers are steps that are often neglected but can make the difference between effective programs and ineffective ones (McKenzie-Mohr, 2000). For example, if a psychologist wanted to change the behavior of a community's use of incandescent light bulbs over the more expensive but more energy efficient compact fluorescent light bulbs, it would be important first to understand the barriers that prohibit the adoption of the new behavior. Although identified barriers such as time pressures and cost are generally recognized, a more in-depth analysis is needed to truly understand the forces that influence behavior change in a given community (McKenzie-Mohr, 2000). For example, researchers may detect concerns in the community about the safety of compact fluorescent light bulbs due to their mercury content or that there is a belief that the compact light bulbs do not provide favorable light. Tactics to change the light bulb usage behavior should therefore be tailored to these concerns in order to be most effective. Little has been done to explore exactly what perceived barriers exist to engaging in ecological behavior. Notably, the present study will help to fill this gap.

Theoretical Framework

Theoretical models have been used to help distinguish the complex factors that predict and explain human action and facilitate behavior change. These models have been applied to ecological behavior. The oldest and simplest models proposed a linear progression of environmental knowledge leading to environmental awareness and concern, which in turn was thought to lead to ecological behavior (Kollmuss &

Agyeman, 2002). However, there has continuously been a lack of support for these models, as the relationship between attitudes and behavior seems to be far more complex (Kollmuss & Agyeman, 2002).

The Theory of Planned Behavior takes into account the multiple factors that must be considered to predict behavior (Ajzen, 1985, 1991). According to this theory, attitudes do not determine behavior directly. Rather, they influence behavioral intentions which in turn shape our actions (Kollmuss & Agyeman, 2002). Building off of this concept, Kollmuss and Agyeman (2002) developed models to better understand the multiple factors that lead to ecological behavior. Their model includes demographics, external factors (economic, social, cultural) and internal factors (motivation, environmental knowledge, values, locus of control). The Theory of Planned Behavior highlights the importance of intentions mediating the relationship between beliefs and behavior. The current study attempted to apply this theory and test whether the intention to address climate change is critical as a mediating variable.

Summary

Variables that have been found to be most influential in relation to beliefs and behaviors regarding climate change include: beliefs about whether climate change is real, environmental worldview, gender, knowledge of climate change, and efficacy to address climate change. Very few studies have examined the likely complicated relationships (such as mediation or moderation) between variables that impact climate change beliefs and behavior. To the author's knowledge, no studies have examined these variables in regard to ecological behavior which, in addition to other strategies, will be essential to prevent the most devastating effects of climate change. The current study helped to

clarify which variables are most important in predicting reported ecological behavior and help determine whether people are making the connection between climate change and their daily consumption of natural resources.

Current Study

A mixed methods approach was used to explore this emerging area of research and to provide some insight into measurement issues related to climate change and barriers to engaging in ecological behavior. Because much is unknown about the factors that influence people's attitudes and behavior as they relate to climate change and ecological behavior, the current study was exploratory in nature. The following research questions were explored:

1) Which variables (demographic factors, environmental worldview, belief in climate change, knowledge, personal efficacy, and intention to address climate change) are related to participants' self-reported ecological behavior? (see Figure 1);

2) Do participants' intentions to address climate change mediate the relationship between their belief in climate change and engagement in ecological behavior? (see Figure 2);

3) Do participants' intentions to address climate change mediate the relationship between climate change efficacy and ecological behavior (see Figure 3); and

4) What do participants perceive as barriers to engagement in ecological behavior?

METHOD

Participants

Two hundred seventy-nine college students enrolled in entry level psychology courses at a large, Southeastern university agreed to participate in this study. Of these 279 participants, 9 did not complete the survey and were omitted from further analysis. Participants ranged in age from 18 to 48 years old (*M* = 20.69, *SD* = 4.38) and were racially diverse (39% White, 30% Black, 10% Asian, 7% Latino, 7% Multiracial, and 5% other). The majority of the sample, 45%, identified as politically *middle of the road*, 31% identified as *somewhat or very liberal*, 20% as *somewhat or very conservative*, and 4% as *other*. Most participants (76%) reported making less than $10,000 annually, whereas 13% reported earning $10,001-20,000, 5% $20,001-30,000, 2% $30,001-40,000, and 4% over $40,000. About half (55%) of the sample identified as *Christian*, 15% as *spiritual but not religious*, 13% as *Atheists* or *Agnostic*, 13% *other*, and 5% *Muslim.* The sample was predominantly female (74%) which represents a higher percentage of women as compared to the overall female population at the university— 60% (Georgia State University, 2009). However, this gender distribution was expected given the higher percentage of women enrolled in introductory level psychology courses at the university. Overall, participants tended to be female young adults who were ethnically, politically, and religiously diverse.

Procedure

Students were recruited via Sona Systems, an online database for undergraduate research participants. Data were collected as a part of a larger, exploratory pilot study which consisted of approximately 200 questions related to participants' attitudes towards

energy sources, worldview, environmental behavior, and demographic characteristics. After consenting to participate (see Appendix I), students completed the survey via PsychData, an online survey tool. Appendix II lists the survey items used for this study. The entire survey took students approximately 45 minutes to complete. Students received class credit in exchange for their participation in the study. The university's Institutional Review Board approved the study, and all participants were treated in accordance with the guidelines set forth by the APA Ethics Code.

Outcome Variable

Ecological Behavior (DV). Responses to items on a modified version of the Ecological Behavior Measure (EBM) (Kaiser & Wilson, 2000) assessed participants' self-reported ecological behavior. This scale included 18 items measured on a 5-point Likert-type scale which ranged from *Never* to *Always*. A higher score on this scale indicated that a participant self-reported more ecological behavior (e.g. recycles, avoids using products with toxic chemicals, and travels by car less frequently).

The original measure was modified by selecting one or two questions from each of the domains of the original measure (ecological garbage removal, water and power conservation, ecologically aware consumer behavior, garbage inhibition, volunteering in nature-protection activities). One of the domains, ecological automobile use, was measured by 2 alternative items that were created to assess participant's use of transportation. Items were selected based on their relevance to the sample and in order to shorten the length of the entire survey. All responses were converted to standard scores and then averaged to compute a composite score.

As expected, the distribution of the ecological behavior DV was normal (skewness = -1.25, kurtosis = -.22). The original scale demonstrated moderately strong internal consistency (*a* = .73) and has been used with samples of college students. This internal consistency was replicated in the current study sample (*a* = .74).

Predictor Variables

Demographic Factors (Predictor 1). Participants' self-reported their gender, race, and social economic status (see Appendix II). Gender was coded 0 for male, 1 for female, and 2 for transgender. No participants identified as transgender so this category was dropped for analysis. Participants identified their race by choosing from 1 of 6 categories (*African American/Black, Asian, Caucasian/White, Latino/Hispanic, Multiracial, and other*). For analysis, participants' race was dummy coded with Caucasian/White being chosen as the comparison group because it included the most members. Participants indicted their socio-economic status choosing from 1 of 6 categories ranging from (below 5,000) to (above 40,000) dollars annually.

Environmental Worldview (Predictor 2). Responses to items on the New Environmental Paradigm (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000) assessed participants' environmental worldview. Originally published in 1978, the NEP is a widely used measure of environmental orientation or perceptions of the human-environmental relationship. The NEP is composed of 15 items measured on a 5-point Likert-type scale ranging from S*trongly Disagree* to *Strongly Agree*.

A higher score on this scale indicated an ecocentric worldview and a lower score an anthropocentric worldview. The scale has been previously used with samples of college students and ethnic minorities in the United States. The original scale

demonstrated adequate internal consistency (*a* = .83). This internal consistency was replicated in the current study sample (*a* = .77). Responses on the NEP total were mean-centered for ease of interpretation and to reduce nonessential multicollinearity.

Belief in Climate Change (Predictor 3). Participants' belief as to whether climate change is occurring was measured by one item which read: *How likely do you think it is that global warming is occurring now?* (Heath & Gifford, 2007). Response options were on a 5 point Likert-type scale that ranged from *Very Unlikely* to *Very Likely*.

Knowledge of Climate Change (Predictor 4). Responses to items on a modified version of the scale used by O'Connor, Bord, and Fisher (1999) assessed participants' knowledge of climate change. Participants were asked to rate the extent to which a list of items contributed to climate change. Participants could rate the extent to which a number of factors were perceived to contribute to climate change. A higher score on this scale indicated more knowledge of the causes of climate change. Participants received higher scores for following the responses: *Pollution/emissions from business and industry, People driving their cars, Use of coal and oil by utilities or electric companies, People heating and cooling their homes,* and *Destruction of tropical forests*. Inaccurate causes including: *Use of aerosol spray cans, Use of chemicals to destroy insect pests, Depletion of ozone in the upper atmosphere, Wind power generation*, and *Don't know,* gave participants lower scores.

Two modifications were made to the original scale. First, "wind power generation" was added in lieu of "nuclear power generation" as an inaccurate cause of climate change. In the original scale, "nuclear power generation" was included in the list of items that were considered not to be a contributor to climate change. We made this

change because the extent to which the life cycle of nuclear power generation contributes to climate change is controversial and such wording does not accurately reflect the carbon footprint of nuclear power as compared to renewable energy sources such as wind or solar power generation (Culley & Angelique, 2010, in press). Institute for Energy and Environmental Research; IEER, 2006). Also, the response choices which originally ranged from 1 *Not a cause at all* to 3 *Major or primary cause*, were changed for clarity and to discourage participants from guessing if they did not know the answer. This scale demonstrated low internal consistency in the current sample (a =.46). A Cronbach's alpha value was not provided by the developers of the measure.

Efficacy to Address Climate Change (Predictor 5). Participants' personal efficacy or their belief that they can make a difference in addressing climate change was measured by one item: *I believe that little things I can do will make a difference to ease the negative effects of global warming* (Heath & Gifford, 2007). The response options ranged from *Strongly Disagree* to *Strongly Agree* on a 5 point Likert-type scale.

Intention to Address Global Climate Change (Predictor 6, Mediator). Participants' intention to address climate change was measured by one item: *I plan to take some actions to stop global warming* (Heath & Gifford, 2007). The response options ranged from S*trongly Disagree* to *Strongly Agree* on a 5 point Likert-type scale.

Perceived Barriers to Addressing Climate Change. To better understand the extent to which participants perceived barriers to engaging in ecological behavior, participants were asked to respond to one open-ended question: *Please describe what makes it hard to perform some of these behaviors* after they completed the section on ecological behaviors.

In accordance with the systematic indexing procedures outlined by Tesch (1990), responses to the open-ended question were textually analyzed for their content. Thus, to fully capture the content of qualitative data, the researcher developed a coding scheme to capture the range of responses and to identify emerging themes. Unlimited space was provided for the responses, and all participants were required to write something before moving on to the next section of the questionnaire.

One lead coder read all responses and developed a content-related coding scheme (N= 270). Two additional coders then independently read a 10% sample (n=27) of responses, which were randomly selected via a random numbers generator. Coders met to discuss the coding scheme until 100% inter-rater agreement was reached and the lead coder reanalyzed the entire sample based on the agreed upon categories.

RESULTS

Preliminary Analyses

A mixed-methods approach was used to explore the phenomena of interest. All predictors were mean-centered to enhance interpretability of unstandardized coefficients. Before testing the model, the assumptions underlying the regression framework were tested. That is, it was determined that (a) residuals were normally distributed based on an examination of a histogram for standardized residuals against the normal curve, (b) residuals appeared to be linear based on a scatter plot of each predictor and the corresponding residuals which were equally distributed around the Loess line and Ordinary Least Square lines, (c) data were heteroscedastic based on scatter plots of the residuals and each predictor, (d) *VIF* was relatively low for all variables. Statistical outliers were left in the data set because they were determined to be valid entries.

Participants who did not complete the survey were excluded from analyses. There did not appear to be any attrition patterns among those who did not complete the survey. Because the data met all assumptions, analyses were conducted as planned.

Descriptive Statistics

Descriptive statistics for all variables are shown in Table 1. There was a wide range in response regarding participants' ecological behavior, with some participants reporting that they never engaged in ecological behavior and others reporting that they did the majority of the time. For example, most participants indicated that they engaged in behaviors such as washing only full loads of laundry (M = 4.34, SD = .80) and putting on a sweater instead of turning up the heat in the winter (M = 3.13, SD = 1.0). Illustratively, 38% of participants indicated that they *Never* or *Hardly ever* recycled empty bottles, while 28% indicated that they *Always* or *Almost always* did. Few participants described using a compost bin for leftovers (M = 2.12, SD = 1.35), donating financially (M = 1.62, SD = .83), or volunteering their time to an environmental organization (M = 1.97, SD = .82).

Participants held slightly more ecocentric beliefs than anthropocentric beliefs but generally fell in the middle range (M = 3.40, SD = .49). Participants mostly agreed that climate change is occurring. That is, 50% indicated that it is *Very Likely* and 24% reported it is *Somewhat Likely* that climate change is occurring. Only 6% indicated that it was *Very Unlikely* and 7% that it was *Somewhat Unlikely* (belief: M = 4.04, SD = 1.19).

Participants demonstrated some knowledge of the causes of climate change receiving an average of 9.84 out of 16 possible points on the eight questions about climate change. For example, 70% of participants were able to correctly identify that

people driving automobiles *Contributes Substantially* to climate change while 24% indicated that it *Contributes Somewhat.* Only 6% indicated that automobile traffic does not contribute to climate change or indicated that they did not know. Most participants (97%) were also aware that depletion of the ozone in the upper atmosphere does not contribute to climate change. Only 3% reported that depletion of the ozone in the upper atmosphere does contribute to climate change and 3% reported that they did not know.

Fifty-nine percent agreed *Somewhat* or *Strongly* that they could make a difference in mitigating climate change, while 22% disagreed *Somewhat* or *Strongly* with this statement (efficacy: $M = 3.43$, $SD = 1.12$). A large percentage of respondents reported an intention to engage in ameliorative actions, with 50% who *Somewhat* or *Strongly* agreed that they planned to take some steps to stop climate change. A substantial 32% were in the *Neutral* range (intention: $M = 3.44$, $SD = 1.18$).

Correlation Analysis

Significant correlations were found among many of the variables (see Table 2). There was a significant small to moderate positive correlation between all climate change variables (knowledge, beliefs, efficacy, and intention) ranging from $r = .17$ to $r = .56$. The strongest correlation ($r = .56$) was found between beliefs and intentions to address climate change.

Regression Analysis: Predicting Ecological Behavior

A hierarchical regression was conducted with ecological behavior as the outcome variable and independent variables entered in two steps as follows: demographic factors entered first, and then environmental worldview, participants' belief in climate change,

knowledge of climate change, efficacy to address climate change, and participants' intention to stop climate change entered second.

Despite the correlations between a number of the predictors and ecological behavior, many of these relationships were not statistically significant at the .05 level when entered into a hierarchical linear regression analysis (see Table 3). Four predictors (participants' race, SES, environmental worldview, and the intention to address climate change) significantly predicted climate change. Collectively, the model explained 19% of the variance in ecological behavior $F(12, 269) = 6.14$, $p < .001$.

Of the demographic variables, race and SES significantly predicted ecological behavior $p < .01$ (see Table 3). Whites reported significantly more ecological behavior than African Americans, $p < .01$ and Latinos/as, $p < .05$. Additionally, differences in SES predicted differences in reported ecological behavior. Those of higher incomes were more likely to report ecological behavior $p < .01$. Participants' environmental worldview also significantly predicted reported ecological behavior. Those with more ecocentric values reported greater engagement in ecological behavior, $p < .01$. Participants' knowledge of the causes of climate change was unrelated to their ecological behavior. Contrary to what was expected given the high correlation between the variables, participants' beliefs that climate change is occurring (climate change belief) and the belief that they are able to make a difference to mitigate its effects (efficacy) were unrelated to their ecological behavior. Interestingly, participants' intentions to take steps to address climate change were the strongest predictor of their self-reported ecological behavior $p < .01$. Those who intended to take some action to address climate change reported higher levels of ecological behavior.

Given the strong correlation between participants' beliefs that climate change is occurring, efficacy to address climate change, and their intention to address climate change, it was surprising that these variables did not significantly predicted ecological behavior when entered into the regression model. This indicated that there may be a more complex relationship between these variables, which prompted further exploration via two mediation analyses as described below.

Mediation Analyses

To test whether the intention to address climate change functions as a mediator, two mediation analyses following the methods discussed by Baron and Kenny (1986) were designed. According to Baron and Kenny (1986), variable *M* is considered a mediator if: 1) *X* significantly predicts *Y*, 2) *X* significantly predicts *M*, and 3) *M* significantly predicts *Y* controlling for *X* (Baron and Kenny, 1986, in Preacher & Hayes 2004). To test the strength of the indirect effects and produce confidence intervals, the bootstrapping technique—with 5000 bootstraps— described by Preacher and Hayes (2004) was used. This technique requires fewer assumptions and has greater power than other common mediation methods as it randomly generating pseudo samples from the data set. The strength of each of the 5000 *X, Y* relationships unique to each sub-sample due to randomization are then ranked in order based on their value. Then—based on our 95% confidence interval—the top and bottom 2.5% of these ranked values are deleted. What is left is the confidence interval and the significance of the influence of *X, Y* is determined by whether zero falls within these intervals.

Mediation Model 1. One model tested whether intentions mediated the relationship between participants' belief in climate change and ecological behavior (see

Figure 1). Because there was no direct effect of climate change beliefs on ecological behavior (X predicting Y) the mediation model was not significant. However, there was a significant indirect effect of climate change beliefs on intentions indicating whether a person believes climate change is real or not does have some effect on whether they intend to take ameliorative action (see Table 4). Additionally, the intention to reduce climate change was significantly related to ecological behavior while controlling for beliefs in climate change. While these two indirect pathways were significant, there appeared to be no direct connection between climate change beliefs and ecological behavior. The gap between beliefs and behaviors may thus be explained by barriers that prevent the behavior from happening or other variables not included in this model that are important to this relationship.

Mediation Model 2. A second model tested whether intentions mediate the relationship between efficacy and ecological behavior (see Figure 2). Results indicated that the intention to address climate change fully mediated the relationship between participants' efficacy to address climate change and their ecological behavior. That is, the apparent relationship between *X* and *Y (*efficacy and ecological behavior) was no longer statistically significant when the intention to address climate change was added to the equation. Preacher and Hayes (2004) bootstrapping technique was used to calculate coefficients for direct and indirect effects (see Figure 5). As is the case in mediation, zero did not fall within the 95% confidence intervals (estimate = .96, $CI_{95\%}$ = .47 to 1.5, *SE* = .26). Mediation model 2 indicated that efficacy was related to ecological behavior through the mediator of intentions.

Barriers to Environmental Behavior: Emerging Themes

Participants reported a variety of barriers to environmental behavior. Given unlimited space in which to respond, participants provided responses that ranged from one word to a short paragraph describing barriers to ecological behavior. The average response was approximately two sentences long. Perceived barriers to performing ecological behaviors were fully captured by nine content-related categories. Listed in order of salience, these are *Inconvenience/Effort, Expense, Lack of the services/resources, Apathy, Lack of knowledge/information, Habit, Laziness, Lack of social norm, and Miscellaneous* (See Table 5 & Figure 3). Categories were not mutually exclusive, as responses were assigned to more than one content area when appropriate.

Inconvenience/Effort. Of the 270 participants, approximately half (*n*=136, 50%) perceived inconvenience or the amount of time or effort it took to perform an ecological behavior as a barrier. Many respondents described ecological behaviors as being inconvenient to perform because they had to go out of their way to perform them. For example, a number of participants simply stated that ecological behaviors were "*Not always convenient"* or *"Difficult."* Others elaborated and made statements like:

> "*Convenience. Americans have evolved in such a way that anything that is easier to do and takes less effort is more desirable. If there was a more convenient way to recycle, wipe your hand without paper towel, and use local famers' produce then the American population would be able to participate in these "green" activities*."

Other responses that were coded as fitting into this category described ecological behavior as undesirable to perform due to the time and energy they took. For example, one participant, referring to recycling, stated: "*Who wants to separate trash?"*

Expense. Approximately one third of participants (*n* = 93, 34 %) perceived expense or cost as a barrier to ecological behavior. Many participants simply stated that "*cost*" or "*expense*" was a barrier. Others chose specific behaviors from the given list and described how they were more expensive. For example, one participant stated, *"Most of the environmentally friendly choices are more expensive, such as organic produce and using solar energy."* Another noted that *"…natural products costs a lot more than other products..."*

Lack of services and resources. Nearly one fifth (*n* = 52, 19%) of participants perceived a lack of the services and/or the resources necessary to perform ecological behaviors as a barrier. For example, participants described a lack of recycling centers and bins, public transportation, and alternatives to environmentally unsustainable packaging (e.g., Styrofoam). For example, one participant stated, *"I do not live in an area that produces fresh produce."* Another wrote "*It is hard to find recycling centers in Atlanta, especially living in a dorm*."

Lack of knowledge or information. Thirty four participants (13%) cited a lack of knowledge as a barrier to ecological behaviors. The following quotes typify participants' views in this content area: "*It is not that obvious how to recycle in the community.*" Another stated, "*Overall some people are just ignorant of how they can help make a difference.*" One said: "*Ignorance, people don't realized global climate change is a problem*."

Apathy or personal preference. Thirty eight participants (14%) attributed their or others' lack of ecological behavior to their belief that it was unimportant or not beneficial to engage in. For example, participants made statements like "*Recycling isn't necessarily hard, I just have profound cynicism that it's worthwhile since recycling centers utilize the same or nearly the same amount energy*." Another participant stated "*It is not something that is important to me. I would rather go out of my way for people or things I am passionate about*." Others indicated that although they knew that some of their choices did not represent the most environmentally conscious of decisions, they preferred using products like chemical insecticides, plastic bags, and paper towels instead of less toxic or reusable products. For example, one participant stated, "*Stores give you bags. I shouldn't have to bring my own. I already have a purse to carry*."

Habit. Twenty six responses (n = 26, 10%) perceived habit or routine as barriers to performing ecological behaviors. For example, one participant stated, *"It is what I have been doing for over eighteen years. It is hard to sometimes make changes from bad habits."* Another participant stated "*A lot of these behaviors are hard to perform simply because they take extra time to remember, such as using cloth bags at the grocery store: you have to remember to bring the cloth bags from home*."

Laziness. Twenty participants (7%) perceived laziness as a barrier to ecological behavior. Numerous participants simply wrote "*laziness*" in the space provided. Others elaborated and wrote, "*Sometimes people are just lazy and the efficiency of technology fosters our laziness*."

Not social norm. Sixteen participants perceived prevailing social norms as barrier to ecological behavior (6%). Respondents indicated that because their peers, families, and

communities were not engaging in ecological behaviors, this was a barrier to their own engagement. For example, participants wrote that ecological behavior "*Is not community supported, "we don't recycle as a family*" or that "*economic and social conditioning*" made people less likely to participate. Two participants expressed the view that environmental organizations are seen as "extremist" and therefore on the fringe of what is considered acceptable to participate in. One of those noted: "*In terms of environmental groups, it is difficult to volunteer and contribute or I am hesitant to do so because of their relative lack of notoriety and reach or because they are perceived as being extreme and on the fringe*." Two other participants reported that because ecological behaviors such as recycling are not mandated they are less likely to perform them, thus serving as a barrier. For example, one participant reported, "*I would even go as far as to say that things such as, recycling, using non-toxic cleaners etc., should be more encouraged and, perhaps, even mandated….But it is obvious that people are more likely to do things when they know those things are required*." The other participant stated *"recycling is not enforced by the government."*

Miscellaneous. Finally, 14 responses (5%) did not seem to fit in any of the other thematic categories. Responses that were coded as "miscellaneous" often denied the existence of barriers to ecological behavior (e.g. "*I don't really think it's hard to perform these behaviors*."), failed to answer the question (e.g. "*I'm not really sure*."), or were too vague to fit into any category (e.g. "*I feel bad so I do what I can here and there*").

DISCUSSION

The current study explored ecological behavior in the context of climate change. Ecological behaviors which promote the use of resources in a sustainable manner, in addition to other strategies, will be essential to curbing the overconsumption patterns responsible for climate change. While climate change is a pressing issue with wide-ranging ecological and social implications, it has received little attention in the psychological literature. Therefore, the current exploratory study sought to 1) illuminate variables pertinent to predicting ecological behavior, 2) explore whether there is a connection between peoples' beliefs about climate change and their ecological behavior, and 3) examine barriers to ecological behavior.

The largely female, undergraduate sample reported a range of ecological behaviors. For example, more participants endorsed engaging in behaviors such as washing only full loads of laundry than using a compost bin for leftovers or donating financially to an environmental organization. The sample was also slightly more ecocentric than anthropocentric. Respondents demonstrated basic knowledge about the causes of climate change. Nearly three quarters of the sample agreed that climate change is occurring. The majority of participants also stated the intention to help stop climate change and believed that they were able to make a difference (efficacy).

Researchers have documented differences in a variety of attitudes and behaviors based on where a person falls along the ecocentric/anthropocentric continuum. Results from the current study were congruent with previous research and indicated that those with more ecocentric values are more likely to report ecological beliefs and behavior (e.g. Heath & Gifford, 2006; O'Connor et al., 1999). Further investigation should be

dedicated to whether people with ecological worldviews actually engage in this behavior or just view themselves as more environmentally conscious. The present study also gives preliminary evidence that an ecocentric worldview may be positively related to the belief that climate change is real and the intention to address it, as compared to a more anthropocentric worldview (i.e. the correlation between these variables).

The present study highlighted the need for further exploration into how race and income influence ecological behavior. While in this study, Whites reported higher levels ecological behavior than African Americans and Latinos/as this finding should be interpreted with caution as race and income may be confounded in their measurement. Tools used to measure ecological behavior in this study may be biased toward people with more economic resources. For example, while some of the behaviors associated with items on the measure of ecological behavior used in this study could result in monetary savings (e.g. *I wait until I have a full load before doing my laundry*), many of the items favored the economically advantaged (e.g. *I buy locally grown produce, I contribute financially to an environmental organization*). Since African Americans and Latinos are disproportionately likely to be members of economically disadvantaged groups, this may result in lower scores on measures of ecological behavior and misrepresent their actual usage of resources. Elliott (2004) presented data that suggests that African Americans and the people of lower SES generally contribute less to climate change, having lower overall carbon "footprints."

Current measures of ecological behavior may also be picking up on group/cultural norms rather than a group's actual impact on the environment. For example, eating vegetarian meals may not have been perceived as culturally normative for African

American or Latino/a participants. While the ecological behaviors measured in the current study may not have been viewed as normative, this does not mean that African Americans or Latinos/as care less about the environment, a myth that researchers such as Mohai and Bryant (1998), Mohai (2003), and Parker and McDonough (1999) have worked to debunk. It may be the case that Whites or people of higher SES find it more socially desirable to report ecological behavior, thus explaining this difference. Furthermore, African Americans and Latinos/as may encounter more barriers to performing ecological behaviors (e.g. buying locally grown produce in an urban environment). Given these findings, it is important that researchers develop ways to measure ecological behavior that takes into consideration possible bias toward the economical advantaged or dominant racial and cultural groups.

Results from the current exploratory study begin to make the crucial and understudied connection between peoples' beliefs about climate and their ecological behavior. The current study explored whether beliefs about climate change influenced peoples' behavior. However, a gap often lies between peoples' beliefs and their behavior. As identified in the Theory of Planned Behavior (Ajzen, 1985, 1991), behavioral intentions may be the missing link between what someone believes and how they act. In the present study, this theoretical framework was applied to climate change beliefs and behaviors using two mediation models. Mediation was used to test whether intentions mediated the relationship between climate change beliefs and ecological behavior and climate change efficacy and ecological behavior. In the current sample, a belief in climate change was not directly related to increased ecological behavior. However, the intention to address climate change is related to both increased ecological

behavior and to a belief in climate change. Therefore, there seems to be a gap between believing that climate change is real and acting in more ecological ways. A number of factors could explain why this is the case. For one, people may not understand the connection between daily consumption and climate change. People may believe climate change is occurring and intend to do something about it, but because they have not emotionally connected with fullness of the devastation that it is predicted to cause (Weber, 2006), they do not prioritize ecological behavior. Furthermore, when these connections are made, barriers may prevent them from engaging in ecological behavior as explored in this paper.

Researchers such as Brody et al. (2008) and Kellstedt et al. (2008) found that individuals who regard themselves as capable of taking action against climate change (efficacy) show increased climate change risk perception. The present study found that efficacy is not only related to risk perception, but leads to greater intention to address climate change which in turn increases ecological behavior (but does not directly affect behavior). This finding should be further replicated.

Finally, barriers to ecological behaviors were explored. Even when participants stated the intention to help mitigate climate change, this only accounted for a percentage of the variance in their behavior. Barriers, whether perceived or actual, often prevent people from acting in ways that are in accordance with their beliefs and intentions. Since little work has been done to identity or measure perceived barriers, a qualitative description of barriers to ecological behavior was collected and analyzed. The content analysis of an open-ended question found that participants most often cited inconvenience or effort as a factor that made engaging in ecological behavior difficult.

Expense was cited as the next most common reason. This is congruent with the fact that SES was significantly related to ecological behaviors in the regression analysis. Based on salient themes from the present study, programs targeted at increasing ecological behavior will likely be more effective if they are perceived as convenient and highlight the cost savings that can be attained through ecological behavior. Structural supports for ecological behavior should be created in these communities like urban agriculture programs for equitable access to locally grown produce.

There were a number of limitations, as in any study. For one, there is a lack of empirically validated measures to assess attitudes and behavior related to climate change. Without solid tools of measurement, there are a number of threats to validity. Ecological behavior is largely assessed through self-reported measures. While participants report engaging in ecological behavior, this may be a long way from their *actual* behavior. Participants may feel drawn to give socially desirable answers in response to questions about environmental issues. Furthermore, cognitive dissonance may make those with a disparity between their beliefs or intentions and behaviors inaccurately report their engagement in ecological behavior. Current measures do not account for these factors, and continued development of such measures is needed. Additionally, generalizability is limited, given the largely female, undergraduate sample. It is important to assess ecological behavior in a more representative sample, as related variables and perceived barriers are likely to be very different depending on the population.

Understanding what factors are related to people's environmental behavior is only a very small step towards addressing climate change. This study helped to illuminate that intentions may be one of the most important variables in predicting ecological behavior.

If behavioral intentions are critical for changing behavior, the next step is to determine the most effective way of increasing intentions and thus ecological behaviors. Making these connections is vital to preventing the most devastating effects of climate change.

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TABLES

Table 1. *Descriptive Statistics*

	M	*SD*	Observed Range
Environmental Worldview	3.40	.49	1-5
Knowledge of Climate Change	9.84	2.34	0-14
Belief in Climate Change	4.04	1.19	1-5
Efficacy to Address Climate Change	3.43	1.12	1-5
Intention to Address Climate Change	3.44	1.18	1-5
Ecological Behavior	41.73	7.58	21-67

Table 2. *Correlations Among Variables*

	1	2	3	4	5	6	7	8
1. Gender	--	.13*	-.05	-.06	.07	-.86	-.13*	-.08
2. SES		--	-.53	.05	.04	.02	.01	.08
3. Environmental Worldview			--	.31**	.24**	.17**	.33**	.29**
4. Belief				--	.30**	.26**	.32**	.12*
5. Knowledge					--	.17**	.18**	.17**
6. Efficacy						--	.56**	.23**
7. Intention							--	.34**
8. Ecological Behavior								--

*p<.05, **p<.01

Table 3. *Multiple Linear Regression*

Variable	*B*	*SE B*	β	*p*	sr^2
Step 1 Demographics					
Gender	-1.39	.97	-.08	.15	.00
SES	.86	.33	.18	.01	.02**
Race					
African American	-3.97	1.01	-.25	.00	.05**
Asian	-1.49	1.41	-.06	.29	.00
Latino/a	-3.53	1.69	-.12	.04	.01**
Multiracial	-.07	1.7	-.00	.97	.00
Other	.34	1.9	.01	.87	.00
Step 2					
Environmental Worldview	.17	.06	.17	00	.02**
Belief	-.28	.39	-.05	.46	.00
Knowledge	.25	.19	.08	.19	.00
Efficacy	.39	.41	.06	.34	.00
Intention	1.4	.44	.23	.00	.03

Note R^2=.19, Adjusted R^2=.17 for Step 2; *p<.05, **p<.01

Table 4. *Regression Coefficients for Direct and Total Effects: Beliefs as Mediator*

Variable	*B*	*SE B*	*t*	*p*
B_{YX}	.59	.37	1.59	.11
B_{MX}	.31	.05	5.50	.00
$B_{YM.X}$	1.95	.38	5.14	.00
$B_{YX.M}$	-.02	.38	-.05	.96

Table 5. *Regression Coefficients for Direct and Total Effects: Efficacy as Mediator*

Variable	*B*	*SE B*	*t*	*p*
B_{YX}	1.27	.36	3.55	.00
B_{MX}	.54	.05	11.22	.00
$B_{YM.X}$	1.76	.43	4.06	.00
$B_{YX.M}$	.31	.42	.73	.46

Table 6. *Content Analysis: Perceived Barriers to Ecological Behavior*

Perceived Barrier	*n*	Percentage
Inconvenience/Effort	136	50
Expense	93	34
Lack Resources	52	19
Apathy	38	14
Lack of Knowledge	34	13
Habit	26	10
Laziness	20	7
Social Norms	16	6
Miscellaneous	14	5

FIGURES

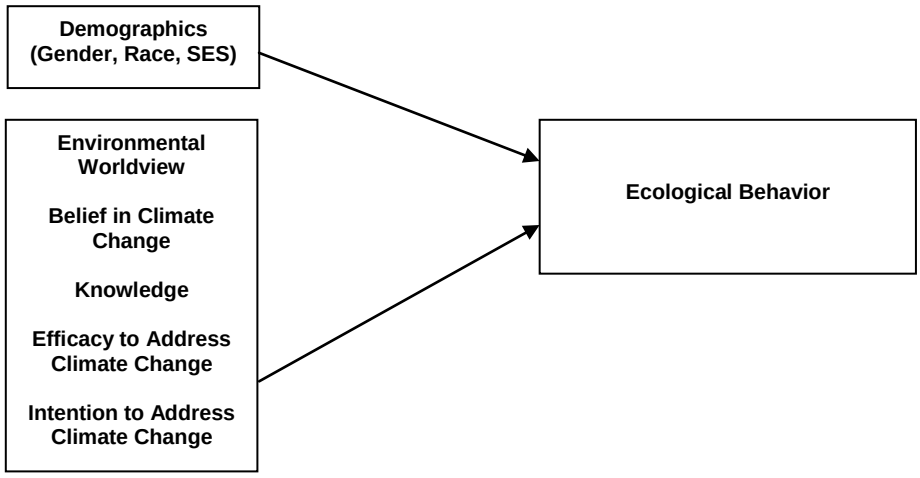

Figure 1. *Hypothesized Heirarchical Regression Model of Ecological Behavior*

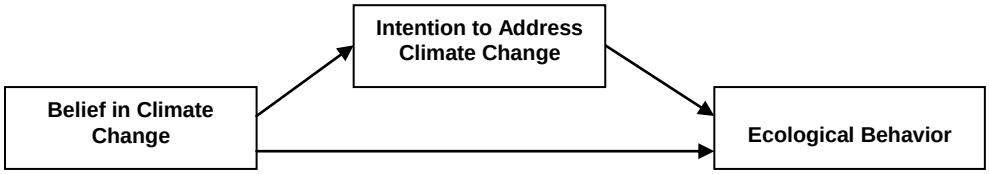

Figure 2. *Hypothesized Mediation Model of Ecological Behavior*

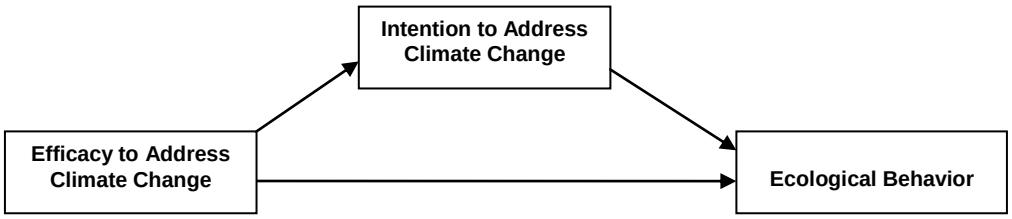

Figure 3. *Hypothesized Mediation Model of Ecological Behavior*

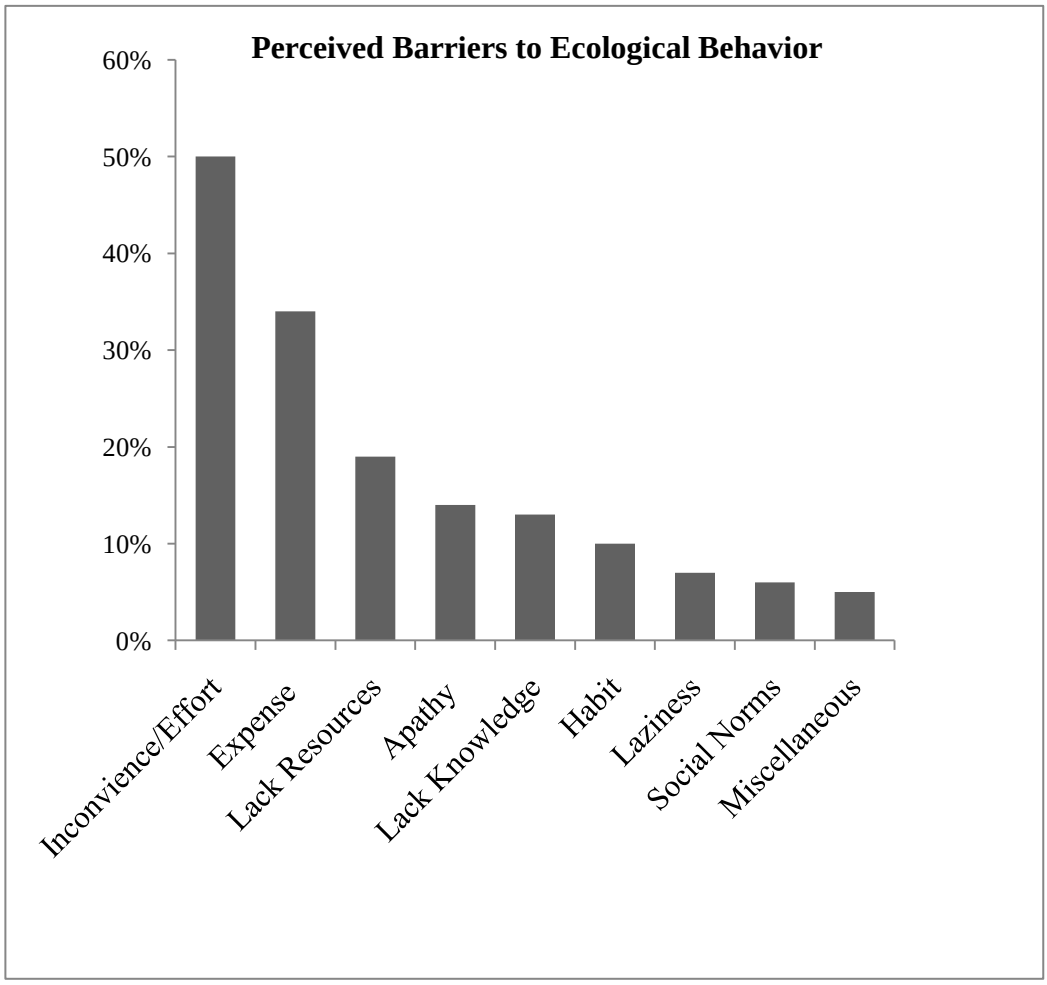

Figure 4. *Content Analysis: Perceived Barriers to Ecological Behavior*

APPENDICES

Georgia State University
Department of Psychology
Informed Consent Form

Title: "Attitudes Toward and Knowledge of U.S. Energy Sources and Global Climate Change: An Analysis of Environmental Perceptions and Behaviors."

Principal Investigator: Marci R. Culley, Ph.D.

I. Purpose:

You are invited to participate in a research study to assess your perceptions of U.S. energy sources, the environment, and the nature of our world (worldviews). We will also ask you about pro-environmental behaviors and what you perceive as barriers to these behaviors. You are being asked to join the study because you are a part of the student research participant pool at Georgia State University. A total of 200 participants will be recruited for this study.

II. Procedures:

If you agree to participate, you will complete an on-line survey about your attitudes and perceptions regarding a range of energy sources, the environment, and the nature of our world (worldviews). You will also be asked about pro-environmental behaviors and barriers to these. You will complete the on-line survey using any computer that is connected to the internet. The survey will take about 35 minutes to complete.

III. Risks:

In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:

Participation in this study may not benefit you personally, but the results may benefit society in general as decisions are made regarding our energy options.

V. Voluntary Participation and Withdrawal:

Participation in research is voluntary. You do not have to be in this study. If you decide to be in the study and change your mind, you can drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VI. Confidentiality:

We will keep your records private. All information that is collected will be stored in a secure place at Georgia State University and information including your name will be destroyed when the project has ended. Your name and other facts that might point to you will not appear when we present this study or publish its results. The findings will be summarized in group form; you will not be identified personally.

VII. Contact Persons:

APPROVED *Consent Form Approved by Georgia State University IRB February 03, 2009 - January 30, 2010*

Appendix II

Demographic Factors

With which gender do you most identify?

Male
Female
Transgender

What is your annual individual income? In other words, how much money do you--yourself--make in a single year?

Less than $5,000
$5,000-$10,000,
$10,001-20,000
$20,001-30,000
$30,001-40,000
Over $40,000

With which ethnicity do you most identify?

African American/Black, Asian
Caucasian/White
Latino/Hispanic
Multiracial (Please specify)
Other (Please specify)

Environmental Worldview (New Environmental Paradigm)

Below are some questions about your worldview. Please indicate the extent to which you agree with each statement.

Strongly Disagree
Somewhat Disagree
Neutral, Somewhat
Agree
Strongly Agree

We are approaching the limit of the number of people the earth can support.
Humans have the right to modify the natural environment to suit their needs. (Reverse Coded)
When humans interfere with nature it often produces disastrous consequences.
Human ingenuity will insure that we do NOT make the earth unlivable. (Reverse Coded)
Humans are severely abusing the environment.

The earth has plenty of natural resources if we just learn how to develop them. (Reverse Coded)
Plants and animals have as much right as humans to exist.
The balance of nature is strong enough to cope with the impacts of modern industrial nations. (Reverse Coded)
Despite our special abilities humans are still subject to the laws of nature.
The so-called "ecological crisis" facing humankind has been greatly exaggerated. (Reverse Coded)
The earth is like a spaceship with very limited room and resources.
Humans were meant to rule over the rest of nature. (Reverse Coded)
The balance of nature is very delicate and easily upset.
Humans will eventually learn enough about how nature works to be able to control it. (Reverse Coded)
If things continue on their present course, we will soon experience a major ecological catastrophe.

Knowledge of Climate Change

Please indicate the extent to which you think each of the following contributes to global warming.

Does not contribute
Contributes somewhat
Contributes substantially
Don’t Know

Use of chemicals to destroy insect pests.
Wind power generation.
Use of coal and oil by utilities or electric companies.
People heating and cooling their homes.
Destruction of tropical forests.
Pollution/emissions from business and industry.
Depletion of ozone in the upper atmosphere.
People driving their cars.

Belief in Climate Change

Please respond to the following questions about global warming (also called climate change or global climate change).

How likely do you think it is that global warming is occurring now?

Very Unlikely
Somewhat Unlikely
Neutral,
Somewhat Likely
Very Likely

Personal Efficacy to Address Climate Change

I believe that little things I can do will make a difference to ease the negative effects of global warming.

Strongly Disagree
Somewhat Disagree
Neutral, Somewhat
Agree
Strongly Agree

Intention to Address Climate Change

I plan to take some actions to stop global warming.

Strongly Disagree
Somewhat Disagree
Neutral, Somewhat
Agree
Strongly Agree

Ecological Behavior

We now would like to talk about some of your behaviors. For each item, indicate the extent to which each behavior occurs on a typical day in your life.

Never
Hardly ever
Sometimes
Almost always
Always

After meals, I dispose of leftovers in a compost bin.
I recycle used paper
I bring empty bottles to a recycling bin.
In the winter, I am more likely to turn the heat up rather than put on a sweater/wrap up in a blanket. (Reverse Coded)
I wait until I have a full load before doing my laundry.
If there are insects in my apartment, I kill them with a chemical insecticide. (Reverse Coded)
I use non-toxic natural cleaning products in my home.
For shopping, I use cloth bags rather than plastic or paper bags.
I avoid using Styrofoam or other containers that cannot be recycled.
I eat vegetarian meals.
I talk with people about problems related to the environment
I buy beverages in cans and bottles.
I buy locally grown produce.
I use paper towels more often than washable rags.
When I see an opportunity, I volunteer with an environmental organization.
I contribute financially to an environmental organization.

On average, how many miles per day do you travel by car?

0
1-10
11-20
21-30
31-40
41-50
51-60
61-70
71-80
81-90
90+

On average, how times in one year do you make a round trip flight within the U.S.?

0
1
2
3
4
5
6
7
8+

Perceived Barriers to Ecological Behavior

The following few questions have to do with things that may affect the types of behaviors that we just asked you about (i.e., environmental behavior).

Please describe what makes it hard to perform some of these behaviors.