

THESIS

AN EXPLORATION OF COMMUNICATION STRATEGIES INFLUENCING PUBLIC
RESPONSES TO CLIMATE CHANGE

Submitted by

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ABSTRACT

AN EXPLORATION OF COMMUNICATION STRATEGIES INFLUENCING PUBLIC RESPONSES TO CLIMATE CHANGE

This thesis is an exploration of communication strategies and U.S. public responses to climate change. The exploration begins with an in-depth case study based in Southern Florida and proceeds with a focused analysis of U.S. National Park and U.S. National Wildlife Refuge visitors and their concern and responsibility for climate change, as well as their engagement with energy-conserving actions.

Through the lens of place-based climate change communication, the third chapter of this thesis compares results from internal and external assessments of capacity to communicate about climate change at national parks and wildlife refuges in southern Florida. The internal survey sample included agency staff, stakeholders, community partners and concessionaires; the external survey sample included visitors to Everglades and Biscayne National Parks and Ten Thousand Islands and the National Key Deer Refuges. Results demonstrate a significant gap in visitors' versus staff and partners' awareness of climate change impacts in these areas. Communicating with the public about climate change is not currently a top priority for the region's protected areas and partners, but the opportunity to engage visitors in this issue through place-based education is supported with this study.

The second component of this exploration examines the relationships between political affiliation, ascription of responsibility (AR), beliefs about climate change causes, salience, and reported pro-environmental behaviors to test the following hypotheses: [H₁] climate change salience is higher for Democrats than Republicans; [H₂] as AR increases, climate change

becomes more salient; [H₃] for respondents who believe human actions contribute to climate change, salience is higher; [H₄] as salience increases, the number of respondents' reported energy-conserving behaviors increases; [H₅] respondents who believe humans are causing climate change report engaging in more energy-conserving behaviors; [H₆] AR increases as the number of visitors' reported pro-environmental behaviors increases. Using an on-site sampling method, we administered 4,181 surveys to national park and wildlife refuge visitors in 16 sites across the United States. Results of regression analyses confirmed H₁ through H₆, and additional significant relationships were found in the path model. These findings indicate that strategic communication could potentially enhance public engagement in climate change mitigation and energy-conserving actions.

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CHAPTER 1

INTRODUCTION

Preview

The purpose of this study is to provide insight into how climate change communication efforts have failed to catalyze public engagement in energy conservation, and to discern the potential for alternative communication approaches to be utilized as tools for increasing public concern about climate change and involvement in mitigating solutions. Previous scholars have focused on public understanding of climate change, and have identified factors that can account for the gap between scientists' and nonscientists' knowledge about climate science and humans' role in the climate system. Through quantitative analyses of survey data, this study assessed public awareness and knowledge of place-based impacts of climate change as well as factors affecting the salience of this issue and individuals' likelihood to take action to conserve energy.

The next chapter is a review of research relevant to this study from numerous academic disciplines including Sociology, Psychology, Communication Studies, and Political Science. Due to the large volume of studies regarding climate change communication, literature from distinct disciplines was synthesized through outlining the most prominent findings regarding public understanding of climate change, factors influencing public perceptions of this issue, and the extent of public engagement in mitigating solutions. Research in each of these areas was integrated into a discussion of possible public responses to communication strategies through focusing on research regarding climate change and message framing.

The third chapter is a case study of public awareness and concern about site-specific ecological effects of climate change in South Florida. This chapter contains an exploration of the role of place in climate change communication, as well as an analysis of survey data regarding peoples' perceptions of place-based climate change impacts in southern Florida. The results of a visitor survey administered to protected area visitors in four locations were contrasted with results of a different survey administered to staff members in each of these protected areas. The purpose of this comparison was to determine whether there are knowledge gaps regarding climate change, both internally among National Park Service (NPS) and U.S. Fish and Wildlife Service (USFWS) personnel, and between agency staff and visitors to parks and refuges in South Florida. The effectiveness of climate change education in these protected areas was assessed, and the chapter concludes with a discussion of the potential for place-based climate change communication programs to transform public perceptions of global warming.

Chapter 4 is an evaluation of the relationship between several factors with climate change salience and public engagement in energy-conserving behaviors. Using quantitative analyses based on visitor surveys administered in national parks and wildlife refuges across the U.S., this study assessed the extent to which different concepts (ascription of responsibility, political affiliation, and beliefs about the causes of climate change) influence climate change salience, as well as individuals' reported pro-environmental actions. This study includes an overview of Schwartz's Norm Activation Theory (1977) and a discussion of how communication may be used to activate peoples' personal norms and potentially increase climate change mitigating behaviors among the American public.

The fifth chapter summarizes the analyses in the preceding chapters. Additionally, it synthesizes the findings of the quantitative studies in Chapters 2 and 3, and confirms the need for

different climate change communication approaches for engaging a wider audience in mitigating measures. Due to the seriousness and scale of climate change as an issue, public support for and engagement in energy conservation will be needed to reduce the threats associated with globally increasing temperatures. To increase the potential for success in mobilizing collective action to address climate change, communication must be targeted on specific audiences and be empirically justifiable. Determining the effectiveness of communication strategies through the development of evaluative measures would progress climate change communication research and significantly increase its applicability.

Statement of the Problem

Despite the scientific community's consensus that climate change is occurring mostly because of human activities (IPCC, 2007), a significant minority of Americans are reluctant to accept these findings and instead believe that global warming is being caused by natural changes or that it is not occurring at all (Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011). The fact that the gap between scientists' and nonscientists' views about climate change is larger in the U.S. than in many other countries makes the state of Americans' knowledge about climate science even more concerning (Weber & Stern, 2011).

Although the U.S. public's awareness of climate change has risen over the past few decades, public knowledge about its causes and humans' role in the climate system has not improved to a large degree (Reynolds, Bostrom, Read, & Morgan, 2010). Additionally, research shows that there is a prevalent misconception among Americans that scientists are not in agreement about the causes of climate change. Furthermore, many Americans are not confident in the research methods used by climate scientists (Leiserowitz, Smith, & Marlon, 2010). Findings like this demonstrate that simple dissemination of information about climate science is

not enough to effectively educate the public about climate change or convince Americans that human actions are contributing to global warming.

Compounding this problem is the fact that some Americans seem to rely on personal observations of climate change to accept its occurrence and thus acknowledge its seriousness (Li, Johnson, & Zaval, 2011; Borick & Rabe, 2010). Because the scale of climate change makes it impossible for people to see the connection between their own actions and the process of global warming, increasing the U.S. public's understanding of humans' role in climate change is a complex and challenging task. The somewhat abstract nature of climate change makes it exceedingly difficult for people to perceive it as a threat that is worth making lifestyle changes to address.

Another problem with many Americans' lack of knowledge regarding the relationship between human activities and climate change is that it can leave people feeling unable to take a firm stance on this issue. This also makes it difficult for people to see why they should take measures to reduce their carbon footprint. According to recent studies, many people believe that there is uncertainty within the scientific community about the causes of climate change, which can account for why people are likely to perceive this issue as political and contentious (Leiserowitz et al., 2010; McCright & Dunlap, 2011). Recent research has shown clearly that peoples' political affiliation can significantly influence how they perceive climate change (McCright, 2009; McCright & Dunlap, 2011), but the extent that political identification affects peoples' personal energy-consuming behaviors and support for policies aimed at energy efficiency is not well understood.

This study is an investigation of the factors determining how Americans think about climate change and engage mitigating measures. The role of some of these factors in triggering a

sense of personal responsibility for global warming is examined because I hypothesize that engaging the U.S. public in this issue will require that people feel connected to this issue. This could ultimately necessitate a change in how individuals perceive their relationship with the natural environment. Acknowledging humans' capacity to shape the environment in a way that can be self-destructive has philosophical implications that are far-reaching, and it can challenge peoples' religious views and perceptions of the world. This is a fundamental problem with confronting climate change and generating widespread public support for and involvement in mitigation. Because it could be difficult and unproductive to attempt to change some peoples' views about how they relate to nature, direct communication about the causes of climate change will not necessarily be best for reaching all Americans with information about the climate system. This study explores place-based education as a means of demonstrating the relevance of climate change and addressing some of the abovementioned problems in a potentially transformative and depoliticized way.

Research Questions

In 2010, the National Science Foundation funded the Climate Change Education Partnership (CCEP), which was a two-year research project involving Colorado State University, NPS, USFWS, and the National Parks Conservation Association. The purpose of this project was to develop a strategic plan for collaborative climate change education in national parks and wildlife refuges across America. Before this strategic plan could be developed, it was necessary to conduct an assessment of climate change communication capacity in national parks and wildlife refuges to determine the barriers to and opportunities for expanding climate change education opportunities in each of the 16 partnering sites for this study. Part of this assessment included gathering information about national park and wildlife refuge visitors in each site

through visitor surveys and interviews. Additionally, park and refuge staff members in each of the five partnering regions of the U.S. were given a separate survey regarding climate change communication in their respective site and region. The CCEP visitor survey was administered to 4,181 park and refuge visitors and assessed their awareness and knowledge of climate change and its associated site-specific effects, and the extent that visitors have taken action to reduce their energy consumption based on self-reported behaviors.

What distinguishes this research project from other ongoing climate change communication research efforts is that it was focused on exploring transformative approaches to public communication about this issue. While national parks and wildlife refuges have offered informal, place-based education for decades, little research has been done examining the effectiveness of this educational method for increasing the public's climate change literacy. The CCEP has provided a good starting point for this type of investigation through assessing park and refuge visitors' interest in place-based education as well as their knowledge about landscape-specific impacts of climate change. Through analyzing CCEP visitor survey data, this thesis explores all of the following research questions and hypotheses:

- RQ₁: Are visitors to South Florida's national parks and wildlife refuges aware that these areas are already being impacted by climate change?
- RQ₂: Is there a significant gap in the understanding of place-based climate change impacts among South Florida's park and refuge staff members versus the visitors to these areas?
- RQ₃: Do national park and refuge visitors want to learn about climate change in protected areas?
- H₁: Climate change salience will be higher for Democrats than Republicans.

- H₂: As AR increases, climate change salience will increase.
- H₃: As salience increases, respondents will be more likely to believe that human activities are contributing to climate change.
- H₄: The number of respondents' reported pro-environmental behaviors will increase as salience increases.
- H₅: Respondents who believe that climate change can be attributed to human activities will report a larger number of pro-environmental behaviors than those who attribute it to natural changes in the environment.
- H₆: As the number of visitors' reported pro-environmental behaviors increases, AR will increase.

Rationale for the Study

The changes occurring within the earth's climate system, while significant, are not always observable to the public. Americans' land-use practices and fossil fuel usage are exacerbating these changes, yet numerous recent studies have shown that many Americans either do not fully understand or fail to acknowledge this relationship (Leiserowitz et al., 2011; Reynolds et al., 2011). Over the past 100 years, the global average surface temperature has increased by 1.04 degrees Fahrenheit, with warming over the last 50 years occurring at twice the rate of the prior 50 years. Climate scientists expect that the global average temperature will increase even more rapidly over the 21st century (IPCC, 2007). In its Fourth Assessment in 2007, the Intergovernmental Panel on Climate Change stated that "most of the observed increase in global average temperatures since the mid-twentieth century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC, 2007). There is a need to

improve communication and education about climate change now because mitigating global warming will require widespread individual and government-led action.

While a huge volume of research has been conducted in recent years on the public's understanding of climate change, many studies have produced descriptive results that have revealed problems in Americans' perception of this issue but have not provided insight for addressing this problem through strategic communication (i.e., Leiserowitz et al., 2010). A trend in climate change communication research has been investigating factors that influence public knowledge about climate change. The findings of this kind of research would be more useful for communicators if future research is focused on the extent that knowledge about climate change influences the public's energy-consuming behaviors and voting decisions.

Research has shown repeatedly that political affiliation plays a role in the extent of the public's knowledge and concern about climate change, with Republicans being less likely than Democrats to be well-informed on this issue or to perceive it as important (McCright, 2009; McCright & Dunlap, 2011). While these findings do contribute to a better understanding of the American audience, researchers must now begin to examine what shapes public *engagement* in climate change mitigation, and this type of research should be used to consider and develop more effective approaches to public communication about this issue.

Understanding how different audiences within the U.S. think about and engage with climate change is important for developing communication strategies that will help connect people to this issue and effectively catalyze public action and support for mitigation. This approach to addressing this issue is similar to strategies used in public health research. To prevent and treat diseases and other health conditions, public health researchers collect information about targeted audiences in order to design educational materials specifically for

them, and they disseminate this information in a way that is culturally appropriate. Climate change communication research has made it clear that past climate change communication strategies are not equally effective for all social groups (i.e., Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011), and employing research efforts like those used in public health research could help reach less engaged audiences. Slowing the rise of global temperatures and preserving human and ecological well-being will require striving to better understand how different audiences engage with climate change, and this knowledge should be used to identify more effective, focused, and strategic communication.

In this study, I attempt to shed light on the interplay between social and psychological factors and their relationships with reported pro-environmental behaviors to provide a more complete picture of what influences public thinking about climate change and peoples' likelihood to take measures to reduce fossil fuel consumption. This study uses a theoretical analysis of public perceptions of and engagement in climate change as a basis to consider place-based communication as a tool for depoliticizing climate change and increasing public involvement in mitigating solutions.

Theoretical Framework

The theoretical framework for this thesis is primarily based on Schwartz's (1977) norm-activation theory, which outlines a model of humans' moral decision making. According to this theory, there are two distinguishing characteristics of moral decisions. One important aspect of moral decisions is that they lead to actions that could affect the welfare of other people. Additionally, when people are responsible for their decisions and intentionally choose an action among possible alternatives, the decision can be classified as moral. Decisions are judged as

good or bad based on how the actions they result in affect the welfare of other people (Schwartz, 1970; Heberlein, 1972).

In his NAT, Schwartz asserts that peoples' feelings of moral obligation to act a certain way stem from their expectations of themselves, and he uses the term 'personal norm' to refer to this psychological process (Schwartz & Howard, 1981). Because individuals' valuation of certain behaviors influence personal norms (Schwartz & Howard, 1981), decisions about a given action may enhance self-esteem or cause feelings of guilt and self-deprecation depending on their compatibility with peoples' personal moral codes (Schwartz, 1977). Schwartz asserts that there are several factors that activate personal norms, and they are categorized as either situational or personality norm activators. The four situational activators that indirectly influence behavior are not examined in this study. Because they are directly related to behavior and can be effectively assessed through survey research, the personality activators awareness of consequences (AC) and ascription of responsibility (AR) have been the focus of researchers studying environmental behaviors in the context of Schwartz's NAT (i.e., Harland, Staats, & Wilke, 2007; Milfont, Sibley, & Duckitt, 2010; Wall, Devine-Wright, & Mill, 2007). The personality activator AC refers to the awareness of how the consequences of one's actions will affect other people, and AR reflects the extent that people accept responsibility for an action and its consequences on the well-being of others (Schwartz, 1977).

Considering that climate science clearly demonstrates that rising global temperatures could negatively affect human welfare through abrupt ecological changes, and that humans' fossil fuel usage is the main reason for globally increasing temperatures, peoples' decisions about energy consumption are moral decisions based on Schwartz's NAT. As public awareness of the consequences of climate change and their own role in contributing to it increases, so too

does the extent that peoples' decisions about energy consumption could be influenced by the activation of personal norms. In this study, the relationship between ascription of responsibility for climate change with the concept of climate change salience as well as reported energy-conserving behaviors was evaluated. Additionally, the relationship between individuals' beliefs about the causes of climate change and their feelings of responsibility for this issue was examined, in large part because past researchers have not specifically explored this relationship.

While the mediating effect of personal norms on pro-environmental behavior was not analyzed in this study, the extent that climate change salience affected individuals' energy-conserving actions was evaluated. Salient beliefs influence the capacity for attitudes to predict behavior because they "will more accurately reflect or contribute to a person's attitude toward an attitude object" (Manfredo, 2008, p. 94). When climate change is more salient, people will express a higher degree of concern about it and consider it more important, which will increase the likelihood of it affecting how people make decisions about energy use. If, on the other hand, climate change is a less salient issue, it will have a more moderate effect on personal norm activation and will therefore be less likely to cause feelings of moral obligation and influence behavior (Schwartz, 1977).

Climate change communication literature has demonstrated the importance of additional concepts and theories in considering how communication can be used as tool to incite greater public interest and involvement in this issue. Because relevant studies have shown that political affiliation is a significant predictor of Americans' beliefs and concern about climate change, political identification was included in the analysis of factors that shape public perceptions of climate change and energy-conserving actions. The purpose of this study is to provide a richer understanding of how Americans are thinking about the issue of climate change and to

investigate the variables that may dictate peoples' decisions about energy usage. To increase the utility of this research, the potential for focused communication strategies to reach specific audiences and change the way they engage with this issue is also considered and discussed.

Preview of Literature Review

Chapter 2 is a review of climate change communication literature related to public understanding of climate change, factors influencing public perceptions of this issue, and the extent of public engagement in mitigating solutions. Through identifying gaps in the American public's knowledge about climate change and factors that influence how people perceive this issue, this review shows that past communication efforts have been too focused on climate science and have not enhanced how many Americans see climate change as a relevant issue. An overview of research to the public's engagement in energy conservation is included in this review, and shows that despite increasing awareness of climate change (Reynolds et al., 2010), peoples' behaviors have not changed significantly (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). A synthesis of research on message framing, place-based education, and the role of trust in public perceptions of climate change indicates the strong potential for focused communication efforts employing trusted messengers to help engage a wider and more diverse audience in the issue of climate change.

CHAPTER 2

LITERATURE REVIEW

The recognition that climate change is occurring as a result of human activities is widespread within the global scientific community, but research demonstrates that Americans are reluctant to accept the position of most scientists on this issue for a number of reasons (Gifford, 2011; Borick & Rabe, 2010; Weber, 2010). While most of the American public acknowledges that climate change is happening (Leiserowitz, Smith, & Marlon, 2010), the extent that people understand the consequences of global warming and are engaging in individual mitigating actions is highly variable. Because gases such as carbon dioxide and methane remain in the atmosphere for numerous years after being emitted, there is a serious need for Americans to become more personally engaged in energy conservation and to be more supportive of local, state, and federal policy initiatives to reduce greenhouse gas emissions and to invest in alternative energy projects.

A significant amount of research has been conducted over the past several years to address this need, and a multitude of studies indicate that there is not a simple solution to changing peoples' thoughts and beliefs about climate change, largely because it has become extremely politicized and contentious in the U.S. (Weber & Stern, 2011; McCright & Dunlap, 2011). Countering the impact of mixed messages in the media and the current framing of this issue based on political agendas will require a focused effort among climate change communicators to depoliticize climate change discourse and increase the relevance of this issue to social groups that are typically less engaged in its mitigation. Through synthesizing research

on the public's understanding of climate change, factors influencing peoples' views about this issue, and the extent of the public's efforts to conserve energy, this review elucidates important divides in perceptions of and engagement in climate change among different social groups as well as the similarities in values between these seemingly disparate groups. This review explores literature that provides useful insight for the development of communication strategies to address the gap between nonscientists' and scientists' views of climate change, and to make climate change mitigation more relevant and meaningful to the American public.

Relevant research suggests that in order to be more effectively engaged in climate change communication and mitigation, Americans must be aware of the consequences of this very large-scale problem, perceive it as an important issue, feel a sense of personal responsibility to take action, perceive that others are committed to this cause, and understand how addressing climate change relates to their deeply held political, cultural, and religious values. Fully committing to mitigation measures can fundamentally challenge peoples' ideological and political views, as well as their beliefs about humans' relationship with the natural world. While the concept of stewardship certainly overlaps with religious and patriotic virtues, demonstrating this to a rather skeptical audience in a contentious political climate will require employing the social influence of trusted political and religious leaders who may serve as spokespersons for a cause that is in many ways rooted in morality. Place-based climate change communication in natural areas valued by many Americans such as national parks is another promising means of increasing peoples' feelings of connectedness to this issue.

Public Understanding of Climate Change

While information alone is likely not sufficient for increasing the American public's concern about climate change, it is important for people to have enough knowledge of the

climate system to understand how different areas of the U.S. will be affected by increasing global temperatures, and also to understand how humans' actions are connected to the climate. The fact that only 49% of the American public believes that human actions are causing climate change while 84% of scientists hold this view (Pew Research Poll, 2009) demonstrates the overall inadequacy of prior communication efforts as well as the need to bridge the knowledge gap between scientists and the public.

Weber and Stern (2011) define the understanding of climate change as "...a set of cognitions about what 'climate' and 'climate change' mean, what the essential attributes of climate are, how these attributes are connected to each other, what causes climate change, what the consequences of climate change will be, and the degree of confidence that should be placed in various knowledge claims about climate change" (Weber & Stern, 2011, p.315). Numerous recent studies (Leiserowitz et al., 2010; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011) show that while awareness of climate change is increasing, Americans' understanding of this issue has been slow to improve over the past several years (Reynolds, Bostrom, Read, & Morgan, 2010). Reynolds et al. (2010) found that from 1992 to 2009, the American public became less likely to conflate stratospheric ozone depletion with global warming, and more people are aware that energy use is a major cause of climate change. Additionally, compared to 1992, in 2009 the public was better able to distinguish between actions specific to global warming and other more generally beneficial environmental practices. Over the this time period, however, the extent that people realize that atmospheric carbon dioxide concentrations are the main cause of climate change did not improve as much. In 2009, many Americans were also still unaware that atmospheric carbon dioxide concentrations have increased as a result of fossil fuel usage (Reynolds et al., 2010). For people to be informed decision makers and fully grasp their

connection to the climate system, the public's understanding of climate change must be improved, and at much more rapidly than it has to date.

Americans' Understanding of the Climate System

Because climate change is very complex and involves the interaction of human activities with physical phenomena, it is not surprising that it is difficult for the public to understand (Weber & Stern, 2011). As of 2010, 63% of Americans believe that climate change is occurring and only half of this percentage thinks that human activities are the primary cause (Leiserowitz et al., 2010). Additionally, 19% of the public say that they think climate change is not happening, and another 19% say they do not know if it is happening. Americans' confusion regarding climate change can be largely attributed to prevalent misconceptions regarding how the climate system works.

Of significance is the widespread incorrect belief among the public that the climate often changes from year to year, and that weather means the average climatic conditions of a region. Furthermore, the fact that less than half of the public (45%) understands that carbon dioxide traps heat in the atmosphere significantly limits peoples' ability to see how their actions contribute to increasing global temperatures (Leiserowitz et al., 2010). For the public to comprehend the capacity for fossil fuel usage to affect the stability of the climate system, people must understand that weather is different from climate and that carbon dioxide has been scientifically proven to possess heat-trapping properties. Having this knowledge is important because it could affect the extent that some Americans attribute global warming to human activities, and it could also improve their ability to make informed judgments as voting citizens.

Seeing how human actions affect the climate system also requires that the public recognize that the earth's climate system is best represented by a threshold model. This model

reflects the belief among climate scientists that small changes in the global climate could trigger abrupt and potentially irreversible ecosystem responses (United States Geological Survey, 2009). Just over one third of Americans (34%) are currently aware that the threshold model best represents the earth's climate, and only 57% of the public has both heard of the greenhouse effect and has an accurate of understanding of what it is. Also of importance is the fact that the majority of Americans are either unsure or incorrectly believe that if the use of fossil fuels were discontinued, atmospheric carbon dioxide levels would decrease almost immediately (Leiserowitz et al., 2010). Only 19% of the public is aware that once emitted, carbon dioxide remains in the atmosphere for one hundred years or more. Increasing public awareness of the capacity of greenhouse gas emissions to impact the climate system many years into the future after being emitted could allow Americans to better comprehend the urgency of the need to engage in individual and collective climate change mitigation.

Americans' Understanding of the Causes and Consequences of Climate Change

Despite gaps in Americans' knowledge of the climate system, the majority of the public can correctly identify some of the primary causes and potential impacts of climate change such as trucks, burning fossil fuels, and cows (Leiserowitz et al., 2010). A recent study done by Reynolds, Bostrom, Read, and Morgan (2010), however, showed that while over one third of Americans attribute climate change to automobiles and industry, this percentage does not show any improvement over the percentage of Americans holding this view in 1992. The extent of the public's awareness that other factors such as deforestation contribute to climate change has been variable in recent research. While Leiserowitz, Maibach, Roser-Renouf, and Morgan (2010) found that most Americans understand that deforestation contributes to climate change, Reynolds et al. (2010) found that the extent that Americans attribute climate change to loss of biomass has

decreased from over 50% in 1992 to less than 20% in 2009. Additionally, a significant amount of people incorrectly believe that toxic waste, acid rain, and aerosol spray cans are intensifying global climate change (Leiserowitz et al., 2010). One possible explanation for this is that the public often confuses other environmental issues such as stratospheric ozone depletion and air pollution for climate change (Dunlap, 1998; Ungar, 2000; Bord, O'Connor, & Fisher 2000, Leiserowitz et al., 2010). All of these findings show that there are many holes in the public's knowledge of the causes of climate change, which indicates that many people have an insufficient understanding of how humans can mitigate global climate change. Incomplete knowledge in these areas, however, could be remedied by more clear and consistent climate change communication efforts.

Similar to the extent of Americans knowledge of causes of climate change, the public has an adequate understanding of some, but certainly not all, important consequences of globally increasing temperatures. Many people (68%) understand that climate change will result in changing precipitation patterns, making some places more prone to either droughts or excessive precipitation and flooding. However, the majority of Americans incorrectly believe that temperature increases from global warming will be equal in all areas of the world. The extent of awareness of melting glaciers among the U.S. population is substantial, but only 21% know that not just some, but most, glaciers are currently melting. The public does possess a basic understanding of the fact that melting glaciers, in addition to melting land ice in Antarctica, are causing the global sea level to increase. They furthermore understand that warmer ocean temperatures are feeding this process of melting ice and subsequently raising the earth's sea level.

Even though most of the public seems to be generally aware of these impacts, very few are familiar with two significant consequences of global warming – coral bleaching and ocean acidification (Leiserowitz et al., 2010). Recognizing the occurrence of oceanic changes due to climate change is important because the cost to coastal economies is projected to be substantial, even based on modest carbon emissions scenarios (The Royal Society, 2005). The effects that ocean acidification could have on coral reefs would significantly affect tourism and other human livelihoods, and could result in billions of dollars in economic losses per year (The Royal Society, 2005).

The American Public's versus Scientists' Understanding of Climate Change

While 39% of Americans realize that scientists are in agreement that the occurrence of global warming is not due to natural variation, a nearly equal number of Americans (38%) think that there is a great deal of disagreement among scientists as to whether or not climate change is happening (Leiserowitz et al., 2010). As mentioned above, there is a significant difference in the extent that scientists attribute climate change to human actions compared to the American public (Pew Research Poll, 2009). As stated by Weber and Stern (2011), “It is important to emphasize that this U.S. story has not been the global one. In many other countries, public understanding appears to be much closer to scientific understanding than is the case in the United States” (Weber & Stern, 2011, p.322). This is likely because public judgment is typically influenced less by evidence and more by affect, worldviews, and values (Slovic, 1987). The influence of these factors as well as others will be discussed in the subsequent section, but an overview of the primary distinctions between scientific and nonscientific understanding of climate change is provided below.

Over the course of several generations, climate scientists have gained a better understanding of climate change through the utilization of several methods that are typically used by scientists to avoid error (Weber & Stern, p. 318, 2010). As was the case with the International Panel of Climate Scientists, when there is a dispute regarding how to interpret scientific data, consensus processes are sometimes held within a scientific community. These types of processes are fundamental to the scientific method, and while they do not prevent error entirely, they are useful for identifying areas of uncertainty and issues needing to be resolved (Weber & Stern, 2010). Nonscientists differ from scientists in that their reactions to uncertainty are more emotional than analytical (Loewenstein, Weber, Hsee, & Welch, 2001). Additionally, the nature of nonscientists' emotional reactions to uncertainty tend to be different based on whether the uncertain events in question are seen as adverse or favorable (Smithson, 2008).

A significant percentage of Americans do not have confidence in the methods used by climate scientists, which is consistent with the fact that the public's beliefs about climate change are often determined by their personal observations (Borick & Rabe, 2010; Li, Johnson, & Zaval, 2011). Roughly one in three Americans believe that computer models cannot reliably make predictions of the climate in the future, and the same number of people also believe that climate change is not being caused by humans because the climate has gone through natural variation in the past. Furthermore, 42% of the public believes it is impossible for scientists to predict the climate since scientists are very limited in their ability to predict weather several days in advance (Leiserowitz et al., 2010).

The reliance of many Americans on personal observations of climate change over scientific evidence is problematic because these observations can be easily misunderstood (Weber, 1997). A study done by Li, Johnson, and Zaval (2011) demonstrates that local daily

weather conditions can influence Americans' beliefs about climate change. In this study, survey respondents were asked if they thought the day's temperature was colder or warmer than normal, and they were then asked to answer questions about climate change. Respondents who thought the day was warmer than usual tended to believe in climate change more and have higher levels of concern about it than those who thought the day was abnormally cold (Li, Johnson, & Zaval, 2011). Relying on personal experiences as evidence to support or deny climate change can also result in the public overreacting to weather events such as heat waves and hurricanes (Hertwig, Barron, Weber, & Erev, 2004). While events such as these may temporarily increase awareness of the issue of climate change among the public, it is nevertheless the case that people generally will continue to underestimate potential future consequences of global warming (Weber & Stern, 2011). The fact that weather conditions have been shown to influence the public's beliefs about climate change could be in part attributable to the fact that people do not have firm opinions about this issue. According to the findings of Leiserowitz et al. (2010), the majority of people (76%) say they need a lot more, some more, or a little more information about global warming before they can make up their mind about this issue.

Factors Influencing Americans' Beliefs about Climate Change

While uncertainty and lack of knowledge do generally affect peoples' beliefs about the existence and causes of climate change, many other factors have been shown to influence how people process information about climate change and the extent that they perform mitigating behaviors. In order to better understand why the American public is relatively reluctant to accept the scientific consensus that human actions are increasing global temperatures, numerous studies have been done over the past few decades in the fields of Psychology, Sociology, Political Science, and Communication Studies, among others. In addition to demographic factors such as

political affiliation (McCright, 2009), what appear to be most substantial in shaping peoples' views about climate change as well as their pro-environmental behaviors are trust of experts (Gifford, 2011), ideology (Dietz, Dan, & Shwom, 2007), religious beliefs (Wardekker, Petersen, & van der Sluijs, 2009), denial of responsibility (Weber & Stern, 2011), self-efficacy (Meinhold & Malkus, 2005), and perceived risk (Leiserowitz, 2005). Structural barriers such as lack of public transportation options are certainly important to consider in exploring the public's engagement in climate change mitigation; however, the focus here is on what shapes the way Americans think about climate change and how people perceive their role in addressing it.

Political Affiliation and Ideology

While research has shown that demographic factors such as age, gender, and ethnicity do have a moderate impact on peoples' knowledge and concern about climate change and their willingness to take mitigating action (McCright, 2010; Wolf & Moser, 2011), numerous studies demonstrate that political affiliation is the strongest demographic predictor of how people engage with this issue (McCright, 2009; Borick & Rabe, 2010). Furthermore, many recent studies demonstrate that individuals' partisan leaning and ideology moderates their level of knowledge and concern about global warming (McCright & Dunlap, 2011; Malka, Krosnick, & Langer, 2009; Hamilton, 2011). In their recent and rather extensive study on the politicization of climate change, McCright and Dunlap (2011) found that for Democrats, high levels of education and self-reported knowledge of climate change were positively related to belief in and concern about this issue, whereas high levels of education and self-reported knowledge of climate change were more negatively related to belief in and concern about this problem among Republicans. Of significance as well is that the divide between Republicans and Democrats on beliefs and concern about climate change has become more substantial over the past decade (McCright &

Dunlap, 2011). This is a significant finding because it suggests that more information or knowledge about climate change may not be sufficient for influencing Republicans' and conservatives' perceptions of this problem.

The relationship between political identification, ideology and information-processing has been the focus of many recent studies (i.e., Wood & Vedlitz, 2007), and research suggests that this relationship could help explain why education does not seem to influence Republicans' beliefs and concern about climate change to the extent that it does for Democrats. In order to account for reporter bias, media coverage of climate change over the past several years has been characterized by mixed messages and an overemphasis on the presence of scientific uncertainty regarding human contributions to global warming (Boykoff & Boykoff, 2004). The information-processing perspective suggests that the portrayal of climate change as a controversial issue involving a high degree of uncertainty has led people to process information about it in a way that is largely dictated by their predispositions, political affiliation being the predominant one (Wood & Vedlitz, 2007; Krosnick et al., 2000). Similarly, the elite cues perspective suggests that people often rely on the opinions of trusted political leaders when they perceive that there is a great deal of conflicting information about a given social issue (Krosnick et al., 2000).

The way that Americans think about our society's capitalist system can also affect how they perceive the issue of climate change and the need for the implementation of mitigation measures. Feygina, Jost, and Goldsmith (2010) describe the idea of system justification in their research and explain that this occurs when people defend and tend to justify their society's status quo. Because addressing climate change at a large scale would require reducing greenhouse gas emissions and thus necessitate a change in the current system, system justifiers will be less apt to support mitigating efforts (Gifford, 2011). According to Feygina et al. (2010), it is more likely

for conservatives and Republicans to be system justifiers while liberals tend to be more willing to critique the established system. Conservatives' and Republicans' views of climate change are generally not consistent with the scientific consensus and they tend to defend the free market system of the U.S. (McCright & Dunlap, 2011). This is an important finding because it suggests that Republicans and conservatives will be less likely than liberals and Democrats to base their policy preferences on available scientific information.

A study done by Borick and Rabe (2010) demonstrates that Republicans and conservatives may be more swayed by evidence of global warming from personal observations than from scientific evidence or information in the media. The results of their study indicate that people living in areas of the U.S. that have already begun to experience decreased rainfall or severe storms are more likely to show concern about climate change than people living in other areas, in some cases regardless of political affiliation. According to this study, because residents of Mississippi have recently dealt with extremely powerful hurricanes, the percentage of Republicans living in this state reporting that hurricanes increased their belief in global warming is substantially higher than that of Republicans and Democrats nationally (Borick & Rabe, 2010). In interpreting their findings, Borick and Rabe (2010) claim that Republicans' reliance on personal experiences and observations as evidence is consistent with their general skepticism of the media and government as well. This could mean that trust in sources of information is an influential factor in shaping Republicans' and conservatives' views about social issues like climate change.

Trust of Experts

Individuals' trust of experts has been shown to play an influential role in shaping peoples' views about global warming. Malka et al. (2009) found that for people who trust in the

credibility of scientific information, increased knowledge about climate change was associated with increased concern about this issue. Additionally, the perception of scientific consensus regarding climate change was also found to mediate the relationship between knowledge and concern about climate change for Democrats and Independents (Malka et al., 2009). For people who are more skeptical of scientists, Malka et al. (2009) found that increased knowledge did not tend to be associated with greater concern about climate change. This is a significant finding because it reiterates that information about climate change and its consequences is not all that is required to engage the public in this issue. Instead, this demonstrates the need for people to trust the sources from which they learn about climate change and for this information to be resonant, as knowledge alone is not enough to make people feel connected to this issue.

Religion

Many studies have demonstrated that the public's concern about societal problems like climate change as well as how they understand and engage with them depends to a large extent on their faith-based beliefs, and developed countries such as the U.S. are no exception (Wardekker, Petersena, & van der Sluijs, 2009; Wilkinson, 2010; Hayhoe & Farley, 2009). As explained by Wolf and Moser (2011), peoples' religious beliefs may determine whether or not they believe that humans are even capable of altering the earth's weather or climate. The fact that weather events are often referred to or thought of as 'acts of God' in westernized societies illustrates this point (Bostrom & Lashof, 2007). Adhering to beliefs of this nature can profoundly impact peoples' efforts to conserve energy to reduce climate change because it implies that "...beliefs in a higher power being responsible for weather extremes (and any possible changes therein)...[means] that people or governments are not perceived as having any control, influence or responsibility for that which is in God's hands" (Wolf & Moser, p. 560, 2011).

Denial of Responsibility

Because climate change is a global issue with far-reaching consequences, there is a tendency for people to feel that they are not capable of truly impacting this problem through engaging with it at an individual level. Based on Schwartz's Norm Activation Theory (1977), people feel responsible to act when they become aware of negative consequences that would affect other people if they fail to act. Based on this theory, personal responsibility is experienced as a moral obligation to act, and this obligation arises from the activation of an individual's personal moral norms (Weber & Stern, 2011). It can be difficult for people to understand the connection between their own actions and the well-being of others because of the complexity and scale of climate change and its consequences. The lack of a clear understanding of the climate system and humans' role in it could be one reason that many Americans are not engaging with this issue, and are thus not being driven to act out a sense of responsibility.

Efficacy of Action

Efficacy of action can influence public engagement with climate change mitigation because many people believe that they cannot accomplish anything on their own since this issue is a global problem. This type of problem is what Olson (1965) termed the collective-action problem. The daunting nature of global climate change can lead some people to hold the rather fatalistic belief that nothing can be done either individually or collectively to prevent this problem (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; O'Connor, Bord, & Fisher, 1998). A Pew Research Center poll done in 2006 revealed that 22% of Americans believe that the effects of climate change cannot be mitigated at all. Increasing the extent that people feel a sense of community and believe that their actions are part of a collective effort to mitigate climate change

could reduce the extent that they believe their actions are for naught and thus increase their sense of self-efficacy (Lazarus & Folkman, 1984; McKenzie-Mohr & Smith, 2009).

Perceived Risk

Much like the negative ecological consequences of increasing global temperatures, the risks posed to humans' well-being are difficult for the public to conceptualize. Gifford (2011) refers to the tendency for the public to discount or undervalue distant or future risks of climate change as judgmental discounting, and he claims that it can account for the lack of concern among many Americans about the risks associated with climate change (Gifford, 2011). The significance of judgmental discounting as it relates to global warming was revealed by a study done in 2005, which illustrates that 68% of Americans were most concerned about the impacts of climate change on people around the world and nonhuman animals, but only 12% were most concerned about themselves and their family (Leiserowitz, 2005). The belief that the impacts of serious environmental problems such as climate change are distant and relatively unthreatening is very problematic because this perception likely reduces the public's sense of urgency to deal with climate change and decreases peoples' motivation to engage in individual mitigating actions (Gifford, 2011).

The American Public's Engagement with Climate Change Mitigation

The public's engagement with climate change goes far beyond supporting policy initiatives, though this is an important means of Americans connecting with this issue. Other levels of public engagement with climate change include individual behavior change and simply talking or thinking about this issue. Recent studies show that most Americans believe that the government should be doing something about climate change (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011b), but citizens have yet to consider it more important than other policy

issues (Wolf & Moser, 2011). Also, the majority of Americans are minimally engaging in energy-conserving behaviors to mitigate climate change, and research suggests that most people are not willing to change their behaviors purely on their own accord (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011).

Political Prioritization of Climate Change

According to Wolf and Moser (2011), “Often, climate change falls short, sometimes by a considerable margin, when compared to other, more directly experienced environmental problems (such as water or air pollution) or when listed against broader concerns such as the economy, health care, national security, and other pertinent issues of public policy” (p. 549). This statement is supported by the fact that Leiserowitz et al. (2011b) found that only 39% of the public believes global warming should be a high or very high priority for Congress. Despite this concerning finding, it appears that Americans do see the importance of transitioning to more environmentally friendly energy sources, as 66% of the public believes that developing clean energy should be a high or very high political priority (Leiserowitz et al., 2011b). Further, 61% of Americans believe the U.S. should begin reducing domestic emissions of greenhouse gases no matter what other countries do (Leiserowitz et al., 2011b).

Climate Change Mitigating Actions Americans are Currently Doing

While Americans generally lack sufficient knowledge of the climate system and physical impacts of global warming, there is a great deal of awareness among the public regarding some possible solutions to this problem. Most Americans are already aware of many of the energy-conserving behaviors they can take to mitigate climate change, such as using public transportation, driving less, insulating buildings, and switching from gasoline-powered cars to electric or hybrid vehicles (Leiserowitz et al., 2010). The extent that the public is engaging in

these actions, however, is not particularly significant and has in many cases decreased since 2008 (Leiserowitz et al., 2011). Leiserowitz et al. (2011) found that less than 50% of the public always or often sets their thermostat at 68 degrees or cooler in the winter, which reflects a decline since 2008, at which time 62% of Americans always or often did this action. Additionally, they found that in 2008, 18% of the public stated that they always or often use public transportation or carpool, while in 2011, this percentage dropped to 13%. Importantly, Leiserowitz et al. (2011) found that 68% of the public believes that the energy-conserving actions they are taking now or plan to take in the next year will have little or no impact on their personal contribution to climate change. However, 60% of Americans believe that if all Americans did these same actions, global warming would be reduced some, or by a lot (Leiserowitz et al., 2011).

Climate Change Communication and Message Framing

While research demonstrates that many Americans are skeptical of humans' role in global warming, studies suggest that most members of the public do want more information before taking a firm stance on this issue (Leiserowitz, Smith, & Marlon, 2010). In light of this consideration, message framing could be a powerful tool for increasing the public's understanding of climate change and sense of responsibility to take individual and collective mitigating action. Effectively addressing the divergence between scientists' and nonscientists' beliefs about climate change will require creating and employing frames that apply particularly to conservatives and Republicans, as political identification has repeatedly been shown to affect the public's concern and beliefs about climate change. As stated by O'Neill and Nicholson-Cole, "...communication approaches that take account of individuals' personal points of reference (e.g., based on an understanding and appreciation of their values attitudes, beliefs, local

environment, and experience) are more likely to meaningfully engage individuals with climate change” (O’Neill & Nicholson-Cole, 2009, p.375).

Security Threat Frame

Among the ways that climate change can affect national security is by causing changes in national sovereignty over established territory through processes such as sea level rise (Barnett, 2003). It can also affect the stability of nations’ economies, and thus negatively affect state legitimacy (Barnett, 2003). According to Zia and Todd (2010), framing climate change as a security threat has become a trend in public discourse, as this is typically an area of significant concern among conservatives and Republicans (p. 757-758). Enhancing public support for reducing domestic fossil fuel usage could be accomplished through communication efforts that emphasize the connectedness of national security threats and America’s reliance on foreign energy supplies (Ungar, 2007).

Climate change could indirectly threaten national security and state legitimacy in many ways, such as through adversely affecting human health. Reducing food and water availability and spreading diseases are examples of public health threats that could potentially result from global warming (Barnett, 2003). A study conducted by Nisbet, Maibach, and Leiserowitz (2011) demonstrates the potential for the utilization of the security frame to have a transformational impact on the way Republicans and conservatives tend to think about climate change. Based on their nationally representative study, respondents who identified themselves as very conservative (53%) and who were dismissive of climate change (52%) were the most likely to believe that the health consequences of reaching peak oil production would be very harmful (Nisbet, Maibach, & Leiserowitz, 2011). In addition to addressing security and safety issues surrounding energy supplies, it is important for the public to understand how specific effects associated with climate

change such as increased frequency of floods and sea level rise could be potentially hazardous for public health and safety.

Economic Frame

Because key goals of conservatives and Republicans include economic growth, limited governmental regulations, and maintaining national sovereignty, mitigating climate change through federal greenhouse gas emissions regulations is not generally well received among this political group (Oreskes & Conway, 2010). Because maintaining a flourishing economy is a high priority for Republicans, climate change communicators should stress the economic benefits of energy conservation measures in order to increase the relevance of climate change mitigation across political divides. Some studies have shown strong support among Americans for implementing economically beneficial energy-related policies such as increasing fuel efficiency standards (Leiserowitz, 2006; Nisbet & Myers, 2007). Additionally, a study done by Gallagher & Muehlegger (2011) showed that most people in the U.S. who have purchased hybrid vehicles cited as their main reason for doing so a positive incentive such as saving money on gas or receiving a waiver on sales tax. These findings indicate that Republicans' and conservatives' support for energy conservation, on both a collective and individual basis, may be improved through emphasizing the economic incentives associated with certain climate change mitigation measures such as reducing energy use at home or purchasing produce that is in season and locally grown.

Religious Frame

According to Zia and Todd (2010), because religion is usually more prominent in shaping the beliefs of conservatives and Republicans, communicating across ideological divides could be accomplished if climate change is framed as an issue of pain and suffering for human and non-

human life. Increasing the extent that conservatives and Republicans are invested in mitigating climate change will require fostering a sense of stewardship, or the belief in the importance of protecting the well-being of the natural world. The notion of stewardship can be related to a number of religious virtues, and several studies in the U.S. illustrate that "... climate change...[can be] framed as a direct and severe threat to God's creation and to notions of social justice, that is, a violation of the dictum to 'love they neighbor', and, in turn, acting on these threats is promoted as God's work" (Wilkinson, 2010). Related to this appeal to religious virtues is the idea of stressing that the moral obligation to protect future generations of people from the threats imposed by climate change would entail actively engaging in its mitigation, individually and as a society (Zia & Todd, 2010).

The Role of Trusted Messengers

Several studies described in this review demonstrate that reaching conservatives and Republicans with information and messages affirming the role of humans in exacerbating climate change will require that messengers be highly trusted sources of information. The information-processing (Wood & Vedlitz, 2007) and elite cues (Krosnick et al., 2000) perspectives offer possible explanations for why scientific information does not seem to influence Republicans' beliefs about climate change. While the reasons that Republicans and conservatives tend to base their beliefs about climate change on their political views has not been shown clearly through empirical research, some researchers have suggested that involving trusted conservative political leaders in the effort to bridge the divide among Americans about this issue is a strategy worth exploring (Wolf & Moser, 2011). Specifically, conservative political leaders could serve to increase peoples' perception of the pertinence of this issue through publicly emphasizing the

importance of diligent investment in alternative energy production and improving economic efficiency through energy conservation.

As Malka et al. (2009) demonstrate, trust in the scientific community significantly influences peoples' beliefs about climate change as well. For people who have less faith in climate science, receiving information from trusted religious leaders about the relevance and significance of climate change from a moral standpoint could be a means of reducing skepticism and uncertainty among the public regarding the extent that addressing this issue should be a high priority.

Another means of demonstrating the relevance of climate change and reducing public skepticism that humans' activities are altering the earth's climate is through communicating with the public about global warming in a place-based context. This educational approach would allow people to both witness ecological changes associated with climate change and gain knowledge of humans' role in the climate system. Although little research has been conducted on the degree to which observing place-specific impacts of climate change firsthand influences the perceptions of Republicans and conservatives, there is some evidence suggesting that this could influence peoples' belief in and concern about climate change. Borick and Rabe's (2010) finding that Republicans are likely more swayed by personal observations of climate change than scientific information supports this notion. Additionally, research has shown that the public trusts the National Park Service as a source of information about climate change (Leiserowitz et al., 2011). In fact, 75% of the public trusts the National Park Service for information about climate change, which indicates that the effort to improve communication about this issue could be substantially improved and strengthened through place-based education in national parks (Leiserowitz et al., 2011).

Conclusion

Through exploring Americans' understanding of climate change and factors affecting individuals' perception of this issue, this review demonstrates the public's overall lack of knowledge regarding humans' role in the climate system, and shows that there are a variety of factors besides scientific information influencing how people engage with this issue. A synthesis of research on public involvement in energy conservation shows that most people are reluctant to take action to reduce climate change on their own. However, many Americans support government-led mitigation measures and believe that if everyone made an effort to conserve energy, it could have a significant impact on global warming.

The research discussed in this review indicates that trust in experts could be an important underlying factor affecting how people think about global warming and their role in it. As explained in the above sections, some Americans are convinced that climate change is a serious issue based on the position of the scientific community, but a large percentage of the public is still skeptical of climate science and needs to be engaged in this issue differently. Many Americans believe that the role of humans in climate change is uncertain, and there is evidence showing that because of this, people may be more inclined to rely on trusted public leaders in forming their opinions about global warming. For the public to be better engaged in climate change communication and mitigation, it is important for trusted political and religious leaders to develop a prominent presence in climate change discourse. Consistent messaging about climate change from diverse, non-expert spokespersons could help reduce the extent of mistrust among the American public and increase peoples' receptiveness to engaging in climate change and its mitigation.

Framing climate change in the context of economic, national security, and religious concerns could be an effective means of reducing its contentiousness because these frames

appeal to values shared by many social groups in the U.S. In addition to strategic media communication efforts such as these, framing climate change communication through a place-based lens could help bridge the divide between scientists' and non-scientists' views about this issue. While further research is needed, there is evidence showing that personal observations of place-specific climate change impacts could have a transformative effect on peoples' perception of this large-scale problem.

As national parks and wildlife refuges attract millions of American tourists each year, place-based education programs in these areas could profoundly improve the extent that the public is at least communicating about climate change. Research shows that park rangers are trusted sources of information, and because of this, they could be effective public communicators and aid in the effort to depoliticize climate change communication. Additionally, park and wildlife refuge staff members could potentially reduce public skepticism of climate science and help build support for collective and individual mitigating measures.

CHAPTER 3

ENGAGING VISITORS IN CLIMATE CHANGE COMMUNICATION: A CASE STUDY OF SOUTHERN FLORIDA'S NATIONAL PARKS AND WILDLIFE REFUGES

Introduction

Recent studies concerning the extent of Americans' knowledge of climate change (e.g. Leiserowitz, Smith, & Marlon, 2010) and factors influencing beliefs about this issue (e.g., Borick & Rabe, 2010) demonstrate the need for a more contextualized and place-based approach to communicating with the public about changes in the climate system. Research suggests that direct observation of climate change impacts is closely linked to peoples' concern about global warming and the perception of its relevance to their lives (Borick & Rabe, 2010). National parks and wildlife refuges in South Florida are especially vulnerable to sea level rise, coral bleaching, and other climate change impacts. This area is also a very popular tourist destination, with 8 million visitors to Miami-Dade County annually (Visit Florida Research Department, 2011). It is for this reason that South Florida was selected as a pilot site for the Climate Change Education Partnership (CCEP), a National Science Foundation-funded research project led by Colorado State University, the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), and the National Parks Conservation Association.

In order to develop a strategic plan for climate change education and engagement in national parks and wildlife refuges, the CCEP implemented an assessment of park and refuge visitors' awareness and knowledge of climate change and its landscape-scale impacts as well as their level of interest in learning about climate change in national parks and wildlife refuges

through an on-site visitor survey. Additionally, an online survey was administered to NPS and USFWS personnel and local partners (including concessionaires, local government and community organizations) regarding their perceptions of climate change and its impacts in the region, as well as their beliefs about their visiting audience's awareness and concern about climate change. The purpose of examining the perceptions of park/refuge visitors' and agency staff and partners' perceptions of climate change is to reveal gaps in knowledge and awareness, which provides a starting point for developing an effective place-based climate change education and engagement program for the region.

This South Florida case study includes Everglades National Park, Biscayne National Park, Ten Thousand Islands National Wildlife Refuge, and National Key Deer Refuge. Everglades National Park is the fourth largest national park in the U. S., and it attracts approximately one million visitors a year (NPS, 2010c; NPS, 2010b). In fairly close proximity to Everglades National Park is Biscayne National Park, which consists almost entirely of marine and estuarine environments. Despite being nearly 95% water, Biscayne National Park is also a well known tourist destination and draws nearly 500,000 visitors annually (NPS, 2010a). Although established less than two decades ago, Ten Thousand Islands National Wildlife Refuge is a relatively popular tourist destination along the southwest coast of Florida, attracting approximately 180,520 visitors yearly (2008 RAPP database, U.S. Fish and Wildlife Service, 2011, written communication). While not as popular among vacationing tourists, National Key Deer Refuge hosts about 90,000 visitors per year (USFWS, 2011).

The results discussed in this study demonstrate the presence of a substantial divide in how visitors versus NPS and USFWS staff and partners perceive place-based climate change impacts. Of significance is the fact that park and refuge staff members are concerned about

climate change and how it is affecting South Florida, but communicating about this with visitors is not yet a high priority. According to the visitor survey results, few park and refuge visitors have observed impacts of climate change in the park or refuge they visited and many are unaware that climate change is already affecting southern Florida. Based on these findings, there is ample opportunity for the South Florida sites to increase the public's awareness about place-based climate change impacts and to allow visitors to see these impacts for themselves. As discussed in the section below, observing climate change impacts firsthand has the potential to change how people think about global climate change and their role in it.

The Role of Place in Climate Change Communication

Due to the growing politicization of climate change and the overall lack of knowledge regarding its causes, consequences, and solutions among the American public, the question of how to best communicate climate science has become a prevalent concern for scientists and educators worldwide. For issues as complex as climate change, effective communication needs to transcend traditional science communication by "...raising awareness and promoting active engagement, providing more or better information is not enough" (Nerlich et al., 2010, p. 100). A growing body of research demonstrates that while there are many factors that affect the public's beliefs about climate change, observing the impacts of global warming firsthand is highly influential in shaping peoples' views about this issue (Borick & Rabe, 2010).

When people begin to understand the ways that global warming will impact where they live or other important places to them such as national parks, the likelihood of them feeling more invested in taking action to mitigate climate change, to the extent that they are able, could increase. The fact that 71% of Alaska residents see global warming as a serious threat (Leiserowitz & Craciun, 2006) and only 41% of the U.S. population believe this to be true (Pew

Research Center, 2006) suggests that exposure to observable impacts of climate change is a significant factor in peoples' perception of this issue. This idea is further demonstrated by Borick and Rabe's (2010) findings that residents of areas that have in recent years experienced severe storms or decreases in precipitation are much more likely than residents of other areas of the U.S. to attribute their belief in global warming to the changes they have observed. Additionally, the vast majority of people who deny that climate change is happening say that the primary reason is having observed stable temperatures in their place of residence (Borick & Rabe, 2010).

While there are a multitude of factors such as political affiliation contributing to the reluctance of many Americans to accept the findings of climate scientists (McCright, 2009), recent studies suggest that emphasizing the relevance of this issue to all peoples' lives on a smaller scale would likely be a very effective communication strategy (Borick & Rabe, 2010; O'Neill & Nicholson-Cole, 2009; Frantz & Mayer, 2009). O'Neill and Nicholson-Cole address this point directly: "communication approaches that take account of individuals' personal points of reference (e.g., based on an understanding and appreciation of their values, attitudes, beliefs, local environment, and experience) are more likely to meaningfully engage individuals with climate change" (O'Neill & Nicholson-Cole, 2009, p. 375). Even though it is not always possible to attribute ecological events like drought, wildfire, erosion, and coral bleaching solely to increasing global temperatures, it is important for national park and wildlife refuge visitors to understand that these impacts will be intensified without sufficient climate change mitigation. Protected areas in southern Florida draw millions of visitors each year and are thus highly valued among the American public. The visibility of climate change impacts in this part of the country will allow local communicators and educators to clearly demonstrate to the public some of the

site-specific impacts related to global climate change and the importance of climate change mitigation for preserving these unique ecosystems and their rich biodiversity.

Along with helping visitors recognize climate change impacts directly, place-based education programs in South Florida's national parks and wildlife refuges provide an opportunity to foster a stronger sense of connectedness between people and the environment. Based on their research regarding the relationship between connectedness to nature and pro-environmental behaviors, Frantz and Mayer state that "...climate scientists, environmental activists, parents, and educators who wish to promote change need to do more than simply create an informed public. To be effective, programs must also instill a sense of connection between people and the natural world" (Frantz & Mayer, 2009, p. 215). America's most beloved natural areas will be an excellent setting to communicate with the public about global warming because it will be possible to appeal more directly to peoples' values through describing current and potential climate change impacts in these places, while simultaneously fostering a stronger relationship between people and nature.

Methods

Sampling Approach

NPS and USFWS staff and partner survey. The authors administered an online survey to NPS and USFWS staff and partners using the internet survey tool SurveyMonkey. Using a purposive sampling approach, a total of 92 NPS and USFWS staff members responded to the survey, which was attached to an email invitation and registration link for a regional climate change education workshop (hosted as part of the CCEP partnership and research in South Florida). The workshop invitation and survey link was sent to 150 staff and partners in the region, for a response rate of 61%. The purpose of this survey was (a) to determine the extent

that agency personnel and partners are concerned about climate change and perceive its impacts in their parks, refuges and surrounding communities; (b) to investigate what respondents see as barriers and opportunities to communicating about climate change and; (c) to identify current climate change communication activities in each park/refuge. Respondents to the staff and partner survey were selected based on their involvement in ecological research, interpretation and/or programming, resource management, protected area law enforcement, or volunteer programs in national parks and wildlife refuges in the region. NPS and USFWS staff and partners completed the survey before participating in the regional climate change education workshop.

Visitor survey. On-site surveys were administered to a non-random sample of 956 respondents in four protected areas in South Florida, including Everglades National Park, Biscayne National Park, Ten Thousand Islands National Wildlife Refuge, and National Key Deer Refuge. The majority of respondents (412) completed the survey in Everglades National Park, and 257 surveys were administered in Biscayne National Park. Most of the survey data came from these national parks, however we collected 111 visitor surveys at Ten Thousand Islands National Wildlife Refuge and 176 at National Key Deer Refuge. The average response rate across the South Florida sites was 71%. For all of these sites together, the margin of error at a 95% confidence level is $\pm 3\%$.

The visitor survey was administered on Apple iPads using an application called iSURVEY. This survey method was chosen over other on-site alternatives because data entered onto iPads by respondents can be loaded directly onto computers in an SPSS file, thus eliminating the need to manually enter survey data. Additionally, because iPads are a relatively

new and popular technology, having the opportunity to use one potentially offered a small incentive to participant to complete the survey.

Many of the items included in the visitor survey were based on other national survey protocols regarding American's knowledge and beliefs about climate change, particularly studies conducted as part of the Yale Project on Climate Change Communication (Leiserowitz et al., 2010; Leiserowitz, Maibach, & Roser-Renouf, 2009). The survey was designed to assess visitors' awareness and knowledge of landscape-specific impacts of climate change and their level of concern and willingness to act in response to these impacts. Additionally, respondents were asked to report behaviors they have taken to conserve energy. Items concerning visitor interest in climate change education in parks and refuges and general demographic information were also included.

Variables Measured

NPS and USFWS staff and partner survey. Four variables from the agency staff and partner survey are assessed in this study in order to illustrate NPS and USFWS staff members' perceptions of climate change compared to their visiting audience and to determine the extent that communicating about climate change is a priority in South Florida parks and refuges. Respondents were asked, "On average, how concerned are you about climate change?", and were instructed to make a selection on a 5-point scale ranging from 1=not concerned to 5=extremely concerned. To evaluate how concerned staff and partners believe their audience is, respondents were asked, "How concerned do you think your stakeholders are?" and were given response options on an identical 5-point scale.

With regard to their perceptions of place-based climate change impacts, respondents were asked, "Do you believe the effects of climate change can already be seen in South Florida?"

Response options included: “no”, “unlikely”, “perhaps”, “probably”, and “definitely.”

Respondents who believed that effects of climate change are already observable in South Florida were asked to provide examples of these impacts in an open textbox below the response options for this question.

The extent that communicating about climate change is a priority for staff and partners was assessed with the question: “Within your agency, organization, or community, to what extent do you think addressing climate change is a priority with visitors and the surrounding community?” Respondents were asked to make a selection based on the following response options: “not a priority”, “somewhat of a priority”, and “a top priority.” Additionally, participants were asked if they were already communicating about climate change with the public in this region, and 79% said “yes.” Fifty respondents shared examples of specific activities in an open textbox following the yes/no question.

Visitor survey. The survey variables assessed in this study include a set of items concerning park/refuge visitor demographics as well as variables regarding visitors’ beliefs about the occurrence of climate change, awareness of or exposure to climate change impacts in South Florida, and interest in learning more about climate change in national parks and refuges. The demographic variables included are age, gender, level of education, nationality, ethnicity, and political affiliation. See Table 3.1 for information regarding variable type and response options for each demographic item.

Table 3.1. Demographic Characteristics of Survey Respondents (N = 956)

Characteristic	<i>n</i>	%
Age at time of survey (years) ^a		
10 - 17	57	6
18 - 25	115	13
26 – 35	162	18
36 – 45	151	16
46 – 55	165	18
56 – 65	160	17
66 – 75	94	10
76 – 85	13	1
86-95	2	0
Gender ^b		
Male	483	52
Female	446	48
Highest education level completed ^c		
Less than high school	29	3
Some high school	37	4
High school graduate	58	6
Some college	108	12
Two-year college degree	61	7
Four-year college degree	244	26
Graduate or professional degree	388	42
Nationality ^d		
United States citizen	796	86

Non-United States citizen	129	14
Ethnicity ^e		
American Indian or Alaska Native	9	1
Asian	53	6
Black or African American	11	1
Hawaiian or Pacific Islander	1	0
Hispanic or Latino/Latina	73	8
White or Caucasian	729	79
Other	21	2
Do not wish to answer	28	3
Political Affiliation ^f		
Republican	158	17
Democrat	310	34
Independent	139	15
No affiliation	184	20
Do not wish to answer	101	11
Other	21	2

^aThere are 37 missing values for the age variable; sample percentages do not include these missing values.

^bThere are 27 missing values for the gender variable; sample percentages do not include these missing values.

^cThere are 31 missing values for the level of education variable; sample percentages do not include these missing values.

^dThere are 31 missing values for the nationality variable; sample percentages do not include these missing values.

^eThere are 31 missing values for the ethnicity variable; sample percentages do not include these missing values.

^fThere are 43 missing values for the political affiliation variable; sample percentages do not include these missing values.

In order to assess visitor beliefs about the occurrence of climate change, visitors were asked “Do you think climate change is happening?” Response options included: “extremely sure it is happening”, “very sure climate change is happening”, “somewhat sure climate change is happening”, “not sure”, “somewhat sure climate change is not happening”, “very sure climate change is not happening”, and “extremely sure it is not happening.”

A set of survey questions evaluating visitors’ awareness of climate change impacts in South Florida and across the national park and the national wildlife refuge systems was also included in this study. Respondents were asked to state how much they agree or disagree on a 5-point scale (-2=strongly disagree, 2=strongly agree) with the following statements: “I believe that some of the effects of climate change can already be seen at our national parks/refuges” and “I believe that some of the effects of climate change can already be seen at this Park/Refuge.” Additionally, an item was included in the survey regarding specific effects of climate change visitors have seen at the park or refuge they visited. Respondents were instructed to select all of the effects of climate change they have observed from a list of global impacts including: “increasing ocean temperature”, “increased areas affected by drought”, “increasing air temperature”, “thawing of permanently frozen soil”, “loss of snow and/or ice”, “increasing number of flooding events”, “rising sea level”, “coral bleaching on reefs”, “change in plant and animal populations”, “more intense storms”, and “none of the above.”

In addition to whether or not respondents had received any information about climate change in the park or refuge they visited, the degree of visitor interest in learning about climate change in national parks and wildlife refuges was evaluated. The extent that parks and refuges have reached their visitors with information about climate change was assessed with a survey question asking respondents how they have received information on climate change from the

park/refuge they visited. The response option “I have not received information on climate change from this Park/Refuge” was included on a list of 12 types of common park and refuge interpretive materials and programs such as “trailside exhibits”, “park website”, and “Ranger guided walks/talks.” Visitor interest in learning more about climate change was measured by asking respondents to state how much they agree on a 5-point scale (-2=strongly disagree, 2=strongly agree) with the statement “I would like to learn more about climate change impacts in this Park/Refuge.”

Results

NPS and USFWS Staff and Partner Survey

In conducting frequency test analyses of the four survey items included in this analysis, results indicate that agency staff and partners are concerned about climate change, with 88% stating that they are either very or extremely concerned about climate change. For all response percentages and counts, see Table 3.2.

Table 3.2. Agency Staff and Partner Concern about Climate Change (N = 83)

Variable	<i>n</i>	%
Not concerned	0	0
Slightly concerned	0	0
Moderately concerned	10	12
Very concerned	37	45
Extremely concerned	36	43

When asked how concerned agency staff think their stakeholders are, the highest number of respondents (45%) stated that they think their stakeholders are only somewhat concerned, with the second highest number (27%) stating they think their stakeholders are slightly concerned. Among agency staff respondents, the most often cited reasons for the belief that the public is not very concerned about climate change are that the downturn of the economy has reduced peoples' level of interest in this issue and that climate change has become a contentious and political topic. Response percentages and counts are illustrated in Table 3.3.

Table 3.3. Agency Staff and Partner Perception of Stakeholder Concern about Climate Change (N = 82)

Variable	<i>n</i>	%
Not concerned	1	1
Slightly concerned	22	27
Somewhat concerned	37	45
Very concerned	16	20
Extremely concerned	6	7

With regard to impacts of climate change already being observable in South Florida, the vast majority (68%) stated that the impacts of climate change are definitely already visible in South Florida, and 23% said that at least one or two effects are visible. Seven percent of respondents said “perhaps” and only one respondent said “no.” Respondents referenced a number of ways that climate change is already affecting South Florida ecosystems such as

through the process of coral bleaching, sea level rise, abnormal weather patterns, and higher temperatures in the ocean as well as on land.

Table 3.4. Agency Staff and Partner Beliefs about Presence of Observable Effects of Climate Change in South Florida (N = 82)

Variable	<i>n</i>	%
No	1	1
Unlikely	0	0
Perhaps	6	7
Probably	19	23
Definitely	56	68

The results of the variable assessing the extent that communicating about climate change is a priority within the South Florida CCEP sites indicate that a majority (57%) of respondents see it is only somewhat of a priority at this time. The next highest number of respondents (25%) stated that communicating about climate change is not a priority within their agency. Open-ended responses to this survey question overwhelmingly reference the state of the economy as the reason that climate change communication is not a top priority. Additionally, respondents suggested that the extent that communicating about this issue is a priority is dependent on the perspective of individual organizations. Response percentages and counts for this variable are listed in Table 3.5.

Table 3.5. Agency Staff and Partner Beliefs about Extent that Communicating about Climate Change with Stakeholders Is a Priority (N = 78)

Variable	<i>n</i>	%
Not a priority	20	25
Somewhat a priority	46	57
Top priority	12	19

Visitor Survey

Based on the results of the survey items assessing demographic variables, which are depicted in Table 1, it is evident that the vast majority of South Florida’s park/refuge visitors are white U. S. citizens with either a college or advanced degree. A slightly larger number of visitors (52%) are male, and most visitors fall into the 46-55 years old age bracket.

The survey results demonstrate that a large majority of visitors (78%) think that climate change is happening. Of visitors who think that climate change is happening, 39% stated that they are extremely sure it is happening, 24% responded that they are very sure it is happening, and 15% stated that they are somewhat sure climate change is happening.

With respect to visitors’ awareness of large-scale impacts of climate change compared to place-specific impacts, the survey results suggest that there is an imbalance in the public’s knowledge. When asked if they believe that the impacts of climate change are already observable in South Florida, 56% of visitors either agreed or strongly agreed and over one-third (36%) stated that they are neutral. Significantly more visitors, however, were aware that climate change is already affecting parks and refuges nationally, with 71% of respondents either agreeing or

strongly agreeing that impacts of climate change are observable in parks and refuges, and only 22% indicating that they are neutral.

Survey respondents were asked to select all of the effects of climate change they have observed in the park or refuge they visited from a list of global impacts, and 26% of visitors asserted that they have seen “none of the above” (Table 3.6). The highest number of visitors (39%) stated that they have seen changes in animal and plant populations, and many visitors (30%) also reported observing increased areas affected by drought in the park or refuge they visited. Slightly more than one-fourth (26%) of the visitors surveyed have seen coral bleaching, and a similarly small number of visitors have observed increasing ocean (24%) and air (23%) temperatures, more intense storms (22%), and signs of sea level rise (19%).

Table 3.6. Effects of Climate Change Visitors Have Seen in the Park or Refuge They Visited (N = 777)

Specific effect of climate change	Not Selected		Selected	
	<i>n</i>	%	<i>n</i>	%
Increasing ocean temperature	591	76	186	24
Increased areas affected by drought	548	71	229	30
Increasing air temperature	601	77	176	23
Thawing of permanently frozen soil	744	96	33	4
Loss of snow and/or ice	715	92	62	8
Increasing number of flooding events	687	88	90	12
Rising sea level	628	81	149	19
Coral bleaching on reefs	578	74	199	26
Change in plant and animal populations	471	61	306	39
More intense storms	603	78	174	22
None of the above	576	74	201	26

When asked how they have received information about climate change in the park or refuge they visited, most of visitors surveyed (66%) indicated that they have not received any information on climate change. However, the survey results indicate that there is interest among park/refuge visitors in learning more about climate change, as the same number of visitors (66%) either agreed or strongly agreed that they would like to learn more about climate change impacts in the park or refuge they visited. The response counts and percentages for this variable are illustrated in Table 3.7.

Table 3.7. Extent that Visitors Would Like to Learn More about Climate Change Impacts in the Park or Refuge They Visited (N = 921)

Variable	Response Options				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
<i>n</i>	179	434	243	30	35
%	19	47	26	3	4

Discussion

These results reveal that visitors in South Florida are relatively unaware that climate change is already affecting public lands in Florida. Compared to the results of the visitor survey, the findings from the staff and partner survey demonstrate that there is a substantial gap in the extent that agency personnel and park/refuge visitors understand how climate change is affecting South Florida. A large majority (68%) of the respondents to the staff and partner survey stated that they think the impacts of climate change in South Florida can definitely already be seen, while 45% of park/refuge visitors were either neutral or disagreed that the park/refuge they visited is being impacted by climate change.

Most of the visitors surveyed believe that climate change is happening but have not seen signs that South Florida's national parks and wildlife refuges are being affected by increasing global temperatures. Fewer than 30% of the visitors surveyed have seen the ecological changes in South Florida's parks and refuges that agency staff and partners referenced as examples of observable landscape-specific impacts of global warming. Furthermore, a much larger number of visitors are aware that climate change is currently affecting national parks and refuges across the U.S. (71%) than believe that there are observable impacts of climate change in South Florida (56%).

The fact that most respondents to the agency staff survey (88%) are concerned about climate change and believe it is already impacting South Florida makes the finding that communicating about climate change within these agencies is only somewhat of a priority rather concerning. This study indicates that most park/refuge visitors have either not observed the impacts of climate change in South Florida's parks and wildlife refuges, or they were unaware that some ecological changes they have noticed are related to climate change. Contrary to agency staff's perception that visitors are likely uninterested in learning about climate change, 66% of visitor survey respondents agreed that they would like to learn more about climate change impacts in the park/refuge they visited.

The findings of this study demonstrate that place-based education and engagement programs in South Florida's national parks and wildlife refuges have the potential to help visitors' recognize climate change impacts when they see them. In learning from experts in national parks and wildlife refuges about how to see these types of changes and why they are occurring, visitors' understanding of the climate system and humans' role in it could increase. South Florida's national parks and wildlife refuges attract hundreds of thousands of visitors each

year, and because these ecologically important areas are so sensitive to climate change, they are an ideal setting to communicate with the public about this issue. As discussed above, recent studies suggest that the direct observation of climate change impacts is an important factor in determining peoples' beliefs about this issue. It is therefore possible that having the opportunity to directly perceive climate change impacts, such as coral bleaching, in places people care about and are connected to could affect the extent that people understand the consequences of climate change and begin to see it as a serious and personally relevant issue.

Interpretive programs in parks and refuges could increase the public's investment in this issue not only through providing visitors with the chance to see climate change impacts firsthand, but also through facilitating a stronger sense of connectedness between people and the natural world. Interpretation programs could incorporate information about ecological changes resulting from increasing global temperatures into existing nature tours instead of focusing solely on climate change impacts in order to attract visitors who may not be particularly interested in climate change. For example, tours could be designed to educate the public about changes occurring in Biscayne National Park's reefs. Tourists could see these changes up close, learn more about how the climate system affects ecosystems, and develop a stronger connection to the environment in a single experience. Raising awareness about place-based climate change impacts through experiential education programs could be an important step in transforming the American public's perceptions of and engagement in this globally significant issue.

Future Research

Recent studies have elucidated some of the primary factors influencing the public's knowledge and concern regarding climate change (Leiserowitz, Smith, & Marlon, 2010; Borick & Rabe, 2010), but more research is needed on the extent to which communicating the small-

scale impacts of global warming increases peoples' knowledge about this issue and their perception of its relevance for their own lives and communities. Because the effect of one's energy-conserving behaviors on mitigating climate change cannot be directly perceived, it is important for people to know or be taught how their collective behaviors impact the climate system and in turn, the places that are important to them such as national parks and wildlife refuges in South Florida. Studies that assess the influence of directly observing climate change impacts, either in one's place of residence or an outdoor setting such as a national park, on peoples' sense of responsibility to take voluntary, mitigating actions would be productive.

Further research on the extent to which participation in interpretive national park programs increases peoples' feeling of connectedness to the natural world would be useful in evaluating the mitigating effect of participation in place-based environmental education on global warming. Additionally, research examining the relationship between the perception of climate change as a relevant issue and public support for climate change policy initiatives would also be of value in assessing the outcomes of park and wildlife refuge climate change communication programs.

CHAPTER 4

A REGRESSION MODEL OF FACTORS INFLUENCING

THE SALIENCE OF CLIMATE CHANGE

AND PUBLIC ENGAGEMENT IN ENERGY-CONSERVING ACTIONS

Introduction

The recognition that climate change is occurring as a result of human activities is widespread within the global scientific community, but research demonstrates that nearly half of Americans are reluctant to accept the position of most scientists on this issue for a number of reasons including political identification and a lack of trust in experts (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011b; Gifford, 2011; Weber, 2010). While most of the American public acknowledges that climate change is happening (Leiserowitz, Smith & Marlon, 2010), the extent that people understand the consequences of global warming and are engaging in individual mitigating actions is variable. Studies indicate that there is not a simple solution to changing peoples' thoughts and beliefs about climate change, largely because it has become extremely contentious in the U.S. (Weber & Stern, 2011; McCright & Dunlap, 2011).

Ecological changes associated with climate change are already being observed in America's national parks and wildlife refuges, which has prompted the National Park Service (NPS) and the U.S. Fish & Wildlife Service (USFWS) to focus more time and resources on developing strategies to mitigate rising global temperatures to protect the valuable resources within the areas they manage. Addressing climate change impacts in parks and refuges involves

developing education programs that will both enhance peoples' understanding of the climate system and their role in it, and provoke public engagement in mitigating behaviors. Protected areas across the U.S. are ecologically sensitive and are especially vulnerable to the impacts of climate change because many are home to rare species and include coastal or high elevation environments. They are also popular tourist destinations. It is for these reasons that national parks and refuges are an ideal setting to engage the public in climate change communication and allow people to observe its associated effects firsthand. Educators in these types of protected areas can contribute to greater public understanding of how humans influence the climate system, which could increase Americans' pro-environmental behaviors and the public's ability to critically evaluate political discourse surrounding climate change.

Climate change communication research and relevant studies regarding humans' environmental decision-making suggest that the concepts of political affiliation, climate change salience, ascription of responsibility, and beliefs about the causes of climate change are influential factors affecting peoples' decisions to take energy-conserving actions. There is a growing body of research on the politicization of climate change, and studies show that political identification has a strong influence on how the public engages with this issue (McCright & Dunlap, 2011; Borick & Rabe, 2010; McCright, 2010). Recent studies of pro-environmental actions have been conducted based on behavioral theories such as Schwartz's norm activation theory (Oom Do Valle, Rebelo, Reis, & Menezes, 2005; Wall, Devine-Wright, & Mill, 2007; Cordano et al., 2010). Ascription of responsibility, which is a concept from Schwartz's norm activation model, is among the concepts examined in this article. Beyond political identification and concepts from other behavioral theories such as Ajzen's (1991) Theory of Planned Behavior and Stern's (2000) Value-Belief-Norm theory, researchers have begun to focus on factors that

affect the salience of climate change in an effort to account for the common discrepancy between peoples' stated values and their behaviors (Macnaghten, 2003; Poortinga et al., 2004; Flynn, Bellaby, & Ricci, 2009).

While there is not one model that can effectively illustrate what influences Americans' perceptions of climate change and peoples' engagement in energy conservation, it is important for researchers to strive to understand relationships between predictors of peoples' views about climate change and the extent that they are taking pro-environmental actions. Addressing climate change will require different strategies, from promoting individual action and awareness to facilitating local, state, and national changes in energy usage. Gaining a better sense of what makes different social groups care about this issue, and the extent that people are willing to change their personal behaviors are important for refining the goals of strategies that will be necessary for effective climate change mitigation.

Political Affiliation as a Predictor of the Public's Perceptions of Climate Change

While demographic factors such as age, gender, and ethnicity do have a moderate impact on peoples' knowledge and concern about climate change and their willingness to take mitigating action (McCright, 2010; Wolf & Moser, 2011), political affiliation is the strongest demographic predictor of how people think about this issue (McCright, 2009; Borick & Rabe, 2010). Research on the relationship between political identification and public perceptions about climate change has been focused on the Democratic and Republican political groups, and has not indicated that affiliation with the Independent political party is particularly influential in dictating peoples' views on climate change. Recent studies have shown that individuals' association with Democratic or Republican political ideologies moderates their level of knowledge and concern about global warming (McCright & Dunlap, 2011; Malka, Krosnick, &

Langer, 2009; Hamilton, 2011). McCright and Dunlap (2011) found that for Democrats, high levels of education and self-reported knowledge of climate change were positively related to belief in and concern about this issue, whereas high levels of education and self-reported knowledge of climate change were more negatively related to belief in and concern about global warming among Republicans. The divide between Republicans and Democrats on beliefs and concern about climate change has become more substantial over the past decade (McCright & Dunlap, 2011).

The relationship of political identification and ideology with information-processing could help explain why scientific information does not seem to influence Republicans' views about climate change to the extent that it does for Democrats (Wood & Vedlitz, 2007). To account for reporter bias, media coverage of global warming has been characterized by mixed messages and an overemphasis on scientific uncertainty regarding human contributions to changes in the climate system (Boykoff & Boykoff, 2004). The information-processing perspective suggests that the portrayal of climate change as a controversial issue involving a high degree of uncertainty has led people to process information about it in a way that is largely dictated by their predispositions, political affiliation being the predominant one (Wood & Vedlitz, 2007; Krosnick, Holbrook, & Visser, 2000). Similarly, the elite cues perspective suggests that people often rely on the opinions of trusted political leaders when there is a great deal of conflicting information about a given social issue (Krosnick et al., 2000).

Borick and Rabe (2010) demonstrate that Republicans and conservatives may be more swayed by evidence of global warming from personal observations than from scientific evidence or information in the media. People living in areas of the U.S. that have already begun to experience decreased rainfall or severe storms are more likely to show concern about climate

change than people living in other areas, in some cases regardless of political affiliation. Because residents of Mississippi have recently dealt with extremely powerful hurricanes, the percentage of Republicans living in this state reporting that hurricanes strongly affected their belief in global warming is substantially higher than for Republicans and Democrats nationally (Borick & Rabe, 2010). Borick and Rabe (2010) claim that Republicans' reliance on personal experiences and observations as evidence for global warming is consistent with their general skepticism of the media and government as well.

Schwartz's Norm Activation Theory and Pro-Environmental Behaviors

The relationship between personal responsibility, personal norms, and behavior is explored in Schwartz's (1977) norm-activation theory (NAT), (see Figure 1) illustrating humans' moral decision-making (Harland, Staats, & Wilke, 2007). According to this theory, decisions may be classified as moral based on two criteria. Schwartz argues that decisions are moral when they result in actions that may affect the well-being of others. Another important dimension of moral decisions is that they are chosen intentionally, when there are other possible alternatives. The impact of actions stemming from moral decisions on the welfare of other people determines whether the decision is considered good or bad (Schwartz, 1970; Heberlein, 1972). Because climate science demonstrates that human activities are causing climate change, which could potentially harm human well-being, decisions leading to actions requiring the use of fossil fuels may be considered moral under the NAT.

Schwartz describes how different activators and personal norms interact to affect peoples' behavior in the NAT. People have expectations of themselves that give rise to feelings of moral obligation, and it is this sort of experience that Schwartz refers to as 'personal norms' (Schwartz & Howard, 1981). One's choice about a given behavior may either incite feelings of

greater self-appreciation, or feelings of self-deprecation and guilt (Schwartz, 1977). Personal norms influence peoples' behaviors differently than social norms because as opposed to being rooted in the social environment, personal norms are based on individuals' valuation of certain actions (Schwartz & Howard, 1981, p. 199).

Four of the activators in the NAT are situational factors that affect the extent that an individual feels morally obligated to act. These activators are awareness of need, situational responsibility, efficacy, and ability. The other two activators are awareness of consequences and ascription of responsibility, which are considered personality activators. They are different from situational activators because the extent that they vary and activate personal norms depends on one's personality more than the attributes of a situation (Schwartz, 1977; Harland, et al., 2007).

Little research has been conducted on the extent that personality activators and personal norms influence peoples' energy-conserving actions. Ascription of responsibility (AR) is one of the independent variables examined in this study and refers to the extent that individuals acknowledge that the actions they take could have an impact on the welfare of others. The relationship between ascription of responsibility for climate change and peoples' reported energy-conserving behaviors is examined in this chapter.

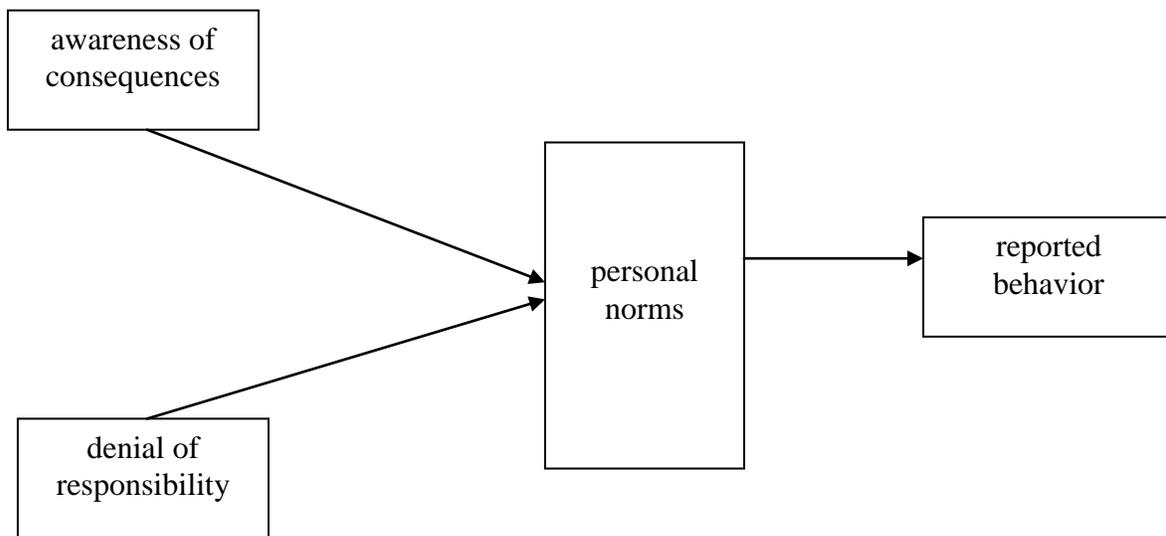


Figure 4.1. General Model of Personality Activators in Schwartz’s Norm Activation Model

The Role of Salience in Climate Change Mitigating Behaviors

“Salience...[refers to] the prominence of certain beliefs that comprise a person’s attitudes and the extent to which these beliefs routinely occur to an individual in a given situation” (Manfredo, 2008, p. 93). Despite increased awareness of climate change and its associated risks, the salience of this issue still varies across social groups. Even when people are concerned about the threats of global warming and express support for sustainable policy initiatives, they are often reluctant to significantly change their own behaviors. The inconsistency between peoples’ behaviors and their stated beliefs and values has been the focus of many researchers, and studies on this apparent ‘value-action gap’ are predominantly based on social-psychological and cognitive theories of behavior (Flynn et al., 2009). While these theories can account for some degree of variance in the salience of environmental issues and peoples’ commitment to conservation behaviors, Blake (1999) has emphasized the importance of considering structural

and institutional constraints on peoples' willingness and ability to take action in line with their values and/or beliefs.

In addition to personal norms (Stern, 2000), many of the factors that have been shown to affect public engagement in pro-environmental behaviors are related to the concept of salience. For example, cultural values affect the extent that people are willing to alter their modes of transport. Stradling, et al. (2008) demonstrated that 80% of people think that using a personal vehicle for transportation has a detrimental impact on the environment, and around 66% of individuals surveyed think that people should reduce the amount that they use cars for transportation to protect the environment. However, 25% of people surveyed stated that people should be able to drive as much as they want, regardless of whether or not it is harmful to the environment (Stradling et al., 2008). Butt and Shaw (2009) found that while 70% of people think that air travel negatively affects the environment, 63% of those surveyed think that people should be able to fly as much as they like. As pointed out by Urry (2008), people in Westernized societies value having the freedom to travel as much and by whatever means they want. These values, therefore, likely reduce the potential for the salience of climate change to affect peoples' likelihood to consider climate change when making decisions related to transportation.

Salience of climate change is also influenced by socio-demographics factors and the habitual nature of energy-consuming behaviors. With regard to domestic energy use, Poortinga et al. (2004) found that more so than attitudes, socio-demographics such as household size, age, and income are strongly related to peoples' reported pro-environmental behaviors. Fossil fuel usage is tied to a variety of actions, and peoples' daily energy-consuming behaviors are often done out of habit or as part of household routines (Flynn et al., 2009).

Due to the spatial and temporal scale of global warming, people often fail to see its connection to their behaviors; this affects the extent that climate change is perceived as relevant. The Yale Project on Climate Change Communication found that people generally perceive that climate change is more of a threat to future generations than to themselves. Leiserowitz et al. (2011b) show that 29% of people think that climate change will harm them personally either a great deal or a moderate amount, but 60% of the public believes that climate change will harm future generations a great deal or moderate amount. These findings suggest that the vast scale of climate change limits the ability for people to perceive it as a direct threat, which could affect its salience as well.

Study Objectives

This chapter explores the influence of political affiliation, beliefs about the causes of climate change, and ascription of responsibility (AR) on the salience of climate change, and the relationship between salience and reported pro-environmental behaviors. The influence of AR and beliefs about climate change causes on reported pro-environmental behaviors is also examined. Based on relevant research, political affiliation and AR were expected to have significant relationships with climate change salience. Prior empirical work also suggests that salience and AR may be related to reported pro-environmental behavior. A model of factors (see Figure 4.2) influencing climate change salience and energy-conserving behaviors was developed to test the following hypotheses:

H₁: Climate change salience will be higher for Democrats than Republicans.

H₂: As AR increases, climate change salience will increase.

H₃: As salience increases, respondents will be more likely to believe that human activities are contributing to climate change.

H₄: The number of respondents' reported pro-environmental behaviors will increase as salience increases.

H₅: Respondents who believe that climate change can be attributed to human activities will report a larger number of pro-environmental behaviors than those who attribute it to natural changes in the environment.

H₆: As the number of visitors' reported pro-environmental behaviors increases, AR will increase.

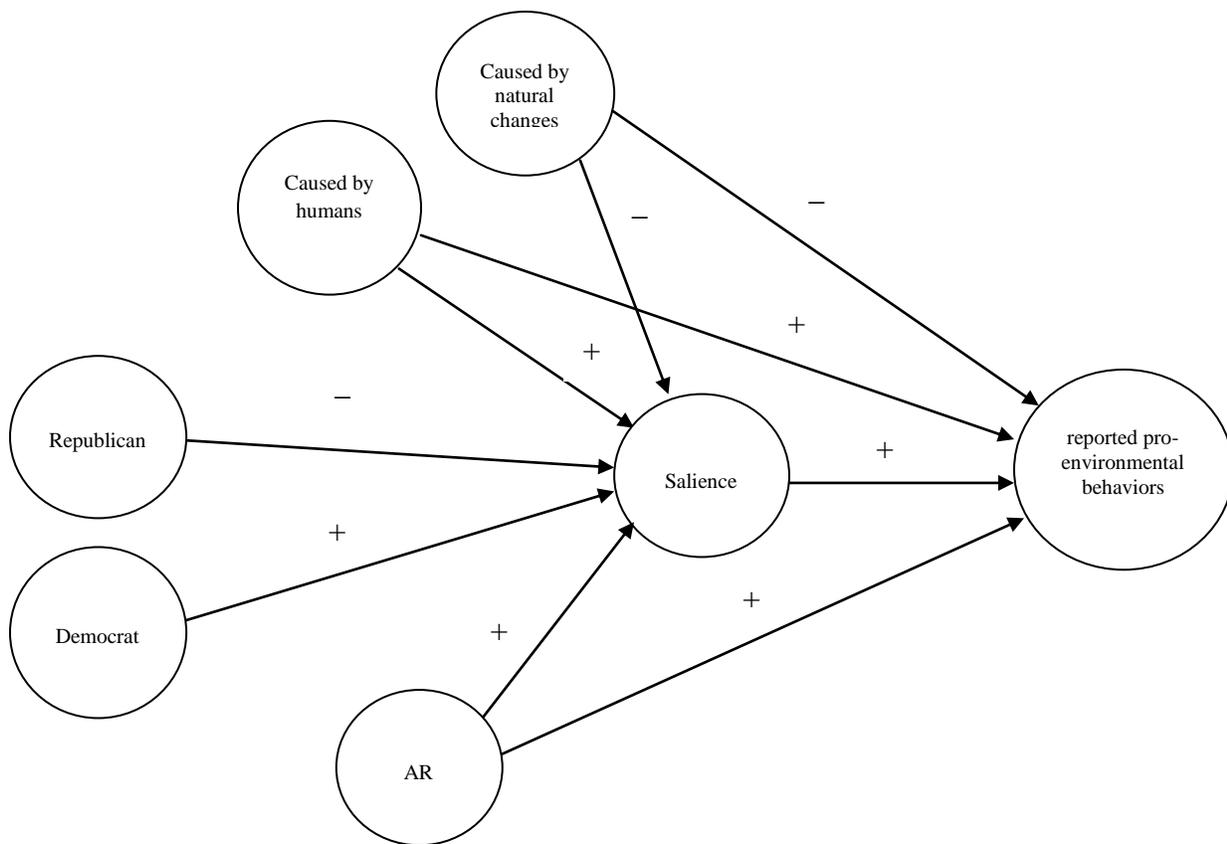


Figure 4.2. Hypothesized Relationships among Factors Influencing Salience and Reported Pro-environmental Behaviors

Methods

This study assesses data collected through the Climate Change Education Partnership (CCEP), which is a collaborative research project involving Colorado State University, the National Park Service, the U.S. Fish and Wildlife Service, and the National Parks Conservation Association. As part of an effort to assist in the development of climate change education tools for national parks and wildlife refuges, the CCEP research team developed a visitor survey assessing peoples' awareness and knowledge of site-specific impacts of climate change, their level of concern and willingness to act in response to these impacts, and the extent that they are already engaging in pro-environmental actions (based on self-reported behaviors).

Administration of the CCEP visitor survey took place over a six month period in parks and refuges within five regions of the U.S. including the Puget Sound in Washington, Kenai Fjords in Alaska, District of Columbia, northern Colorado, and South Florida. Table 4.1 shows a list of the 16 parks and refuges selected as surveying locations as well as the annual visitation of each site.

Table 4.1. Number of Surveys Administered and Response Rate by Site

Park/Refuge	Annual Visitation	<i>N</i>	% of Sample	Response Rate (%)
Olympic National Park	2,966,502 ^a	413	14	70
Dungeness NWR	80,263 ^b	155	5	58
Mt. Rainier National Park	1,038,229 ^a	409	14	63
Nisqually NWR	200,000 ^b	291	10	75
North Cascades National Park	19,208 ^a	291	10	69
Kenai NWR	1,021,525 ^b	144	5	75
Kenai Fjords National Park	346,852 ^a	493	17	68
National Capital Parks East	1,167,393 ^a	162	6	76
Prince William Forest Park	379,535 ^a	174	6	68
Harpers Ferry National Historic Park	255,348 ^a	203	7	68
Rocky Mountain National Park	3,176,941 ^a	213	7	54
Rocky Mountain Arsenal NWR	30,100 ^b	58	1	76
Everglades National Park	934,351 ^a	416	10	64
Biscayne National Park	476,077 ^a	264	6	67
Ten Thousand Islands NWR	180,520 ^b	112	3	82
National Key Deer Refuge	95,000 ^b	179	4	88
Total	12,367,844	4,181	100	--

Note. Response rate was calculated by dividing the number of visitors who agreed to take the survey by the total number of visitors who were asked to take the survey.

^a2011 national park annual visitation statistics obtained from: <http://www.nature.nps.gov/stats/>

^b2010 national wildlife refuge statistics obtained from: 2008 RAPP database, U.S. Fish & Wildlife Service, 2011, written comm.

Survey Development

The first version of the CCEP visitor survey was developed as a paper survey, and was later converted to electronic form using iSURVEY software and Apple iPads with the accompanying survey application installed. Ten iPads were used to administer visitor surveys, and using iSURVEY software allowed for an unlimited number of surveys to be gathered and electronically recorded for the duration of each one-month license period, which was updated as necessary. Through the iSURVEY website, data recorded on the iPads could be loaded directly into a data file that was automatically generated. This survey method was chosen in part because it eliminates the need to manually enter survey data and thus improves data quality and the efficiency of analysis. Additionally, because iPads are a relatively new and popular technology, having the opportunity to use one potentially offered a small, non-monetary incentive to park and refuge visitors who completed the survey.

Survey Procedure

From May 2011 to January 2012, the CCEP survey team administered a total of 4,181 surveys in 16 national parks and wildlife refuges. Due to a sizeable population of annual visitors to each site, and the inability of the research team to access a list of names of all the people visiting each park and refuge on any given day, efforts were made to randomize the sample by attempting to intercept every visitor passing by survey administration sites. To keep the sample representative, participants were uniformly recruited through utilizing a standardized script. While it was inevitable that some visitors moved past the survey administration sites without being asked to take the survey, these instances were rare and were recorded as non-responses. The survey team protocol was to administer paper surveys only by request or when all of the 10

iPads were in use. Of the total number of surveys administered, 93% were completed using the electronic version and 7% were completed using the paper version.

Survey locations were generally based on the recommendations of site contacts at each park and refuge, and typically the survey team targeted viewpoints, popular trailheads, visitor centers, and campsites. While efforts were made to have both weekends and weekdays represented at each park and refuge, most surveys were collected on weekends due to higher visitation. The response rate for the sample is 72%, but this percentage varies by site. See Table 4.1 for the response rate by site as well as the total number of surveys administered at each park and refuge.

Variables Measured

Independent Variables. The independent variables include ascription of responsibility for climate change (AR) and salience indexes as well as the visitors' political affiliation and beliefs about the causes of climate change. The AR measures included: (a) I feel somewhat responsible for the presently occurring environmental problems and (b) I feel responsible for contributing to the condition of the climate. Both were coded on a 5-point scale, with larger values indicating a greater degree of ascription of responsibility for climate change (1=strongly disagree; 5=strongly agree). The salience index included three items: (a) 'How worried are you about climate change?'; (b) 'How important is the issue of climate change to you personally?'; and (c) 'How often do you think about climate change?'. Each of these items was coded on a 5-point scale. Increasing values for this concept reflect greater climate change salience among respondents.

The causes of climate change variable was created from a survey item asking respondents to specify what they think is causing climate change from a list of the following response options: 'caused mostly by human activities'; 'caused mostly by natural changes in the

environment'; 'caused by both human activities and natural changes in the environment'; 'none of the above because climate change isn't happening'; and 'don't know'. For the regression analyses of the path model, the following four response options of the causes of climate change variable were converted to dummy variables: 'none of the above because climate change isn't happening'; 'caused mostly by natural changes in the environment'; 'caused by both human activities and natural changes in the environment'; 'caused mostly by human activities'. The 'climate change isn't happening dummy variable' was selected as the constant for the Ordinary Least Squares regression. Of the 4,181 survey respondents, 4,037 selected one of these four responses.

In the CCEP visitor survey, the political affiliation variable included the following response options: 'Democratic'; 'Republican'; 'Independent'; 'no affiliation'; 'do not wish to answer'; and 'other'. Only the responses of Democrats, Republicans, and Independents were assessed because, as mentioned above, prior research demonstrates that political identification, particularly with the Democratic and Republican parties, predicts peoples' beliefs and concerns about climate change. Of the total number of respondents, well over half ($n=2,637$) stated that they are Democratic, Republican, or Independent. Dummy variables were created for each of these political affiliations. Because the political ideology of people affiliated with the Independent party is not typically as homogenous as for Democrats and Republicans, the 'Independent dummy variable' was used as a second constant (in addition to the 'climate change isn't happening dummy variable') during all regression analyses. Thus, only the Democrat and Republican dummy variables are depicted in the path model.

Dependent Variable. The dependent variable was reported pro-environmental behaviors. Survey respondents were presented 10 energy conservation actions and asked to check all of the

behaviors they have taken (see Table 4.2). Selected behaviors were coded as 1, and unselected behaviors were coded as 0. The total number of behaviors visitors selected is represented by the reported behaviors concept.

Table 4.2. Frequency Distribution of Reported Pro-Environmental Behaviors

Behavior Variables	Yes		No	
	%	<i>n</i>	%	<i>n</i>
Switching from fossil fuels to renewable energy at home	16	601	84	3204
Planting trees	53	2026	47	1779
Switching from a gasoline to an electric or hybrid car	12	465	88	3340
Insulating your home	58	2217	42	1588
Driving less	54	2041	46	1764
Walking, riding a bike, or using public transportation instead of driving	56	2124	44	1681
Switching from regular to compact fluorescent bulbs	68	2568	33	1237
Reducing the amount of beef you eat	35	1312	66	2493
Reducing airplane travel	17	646	83	3159
Reducing energy use at home	70	2658	30	1146

Note. Respondents were asked “Which of the following actions have you taken?”.

Results

Reliability Analysis

Ascription of Responsibility Index. A reliability test conducted on the AR index yielded an overall Cronbach's alpha of .875, demonstrating its internal consistency. The 'Corrected Item Total' value for each item is above .40.

Saliency Index. The internal consistency of the 'saliency index' is verified by its overall Cronbach's alpha of .891. Removing the item "How often do you think about climate change?" would increase the overall Cronbach's alpha to a value of .913. Because this is only a slight increase in an already large Cronbach's alpha value, this item was kept in the index. If either of the other two saliency variables were removed, the overall Cronbach's alpha would fall below .891, indicating that each of these items improves the index's reliability. Additionally, the 'Corrected Item Total' values of the saliency items are all much greater than .40 and are thus acceptable.

Table 4.3. Reliability of the Ascription of Responsibility and Salience Indexes

Concept/Variable	Corrected Item- Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha
<i>Ascription of Responsibility Index</i>			.875
I feel somewhat responsible for the presently occurring environmental problems.	.779	—	
I feel responsible for contributing to the condition of the climate.	.779	—	
<i>Salience Index</i>			.891
How worried are you about climate change? ^a	.831	.806	
How important is the issue of climate change to you personally? ^b	.840	.795	
How often do you think about climate change? ^c	.706	.913	

^aResponse options for this item were coded on a 5-point scale, from 1=not worried to 5=extremely worried.

^bResponse options for this item were coded on a 5-point scale, from 1=not important to 5=extremely important.

^cResponse options for this item were coded on a 5-point scale, from 1=never to 5=all the time.

Frequency and Sums of Actions in the Pro-Environmental Behavior Index

Frequency of Pro-Environmental Behaviors. As depicted in Table 4.2, the pro-environmental action that the highest number of survey respondents reported taking is reducing energy use at home (70%). Two thirds (68%) reported that they have switched from regular to compact fluorescent bulbs, and over half of respondents (58%) reported that they have insulated their home or have walked, ridden a bike, or used public transportation instead of driving (56%). Over half reported that they have driven less (54%) and planted trees (53%).

Only 12% switched from a gasoline-powered to an electric or hybrid vehicle. Also, small percentages of people stated that they have switched from fossil fuels to renewable energy at

home (16%) and that they have reduced their air travel (17%). Just over a third of those surveyed stated that they have reduced the amount of beef they eat (35%).

Pro-Environmental Actions. The highest number of respondents (19%) reported taking 4 out of the 10 pro-environmental actions in the behavior index. The median and mode for number of reported pro-environmental behaviors is 4.0, with the mean being slightly higher at 4.4. As illustrated in Figure 4.3, 15% of respondents reported taking 3 out of 10 pro-environmental actions, and 17% reported taking 5 out of 10 pro-environmental actions. The percentage of respondents starts to decline significantly as the number of pro-environmental actions reported becomes greater than 4. Only 30% of respondents surveyed have taken 6 or more of the energy-conserving actions in the behavior index.

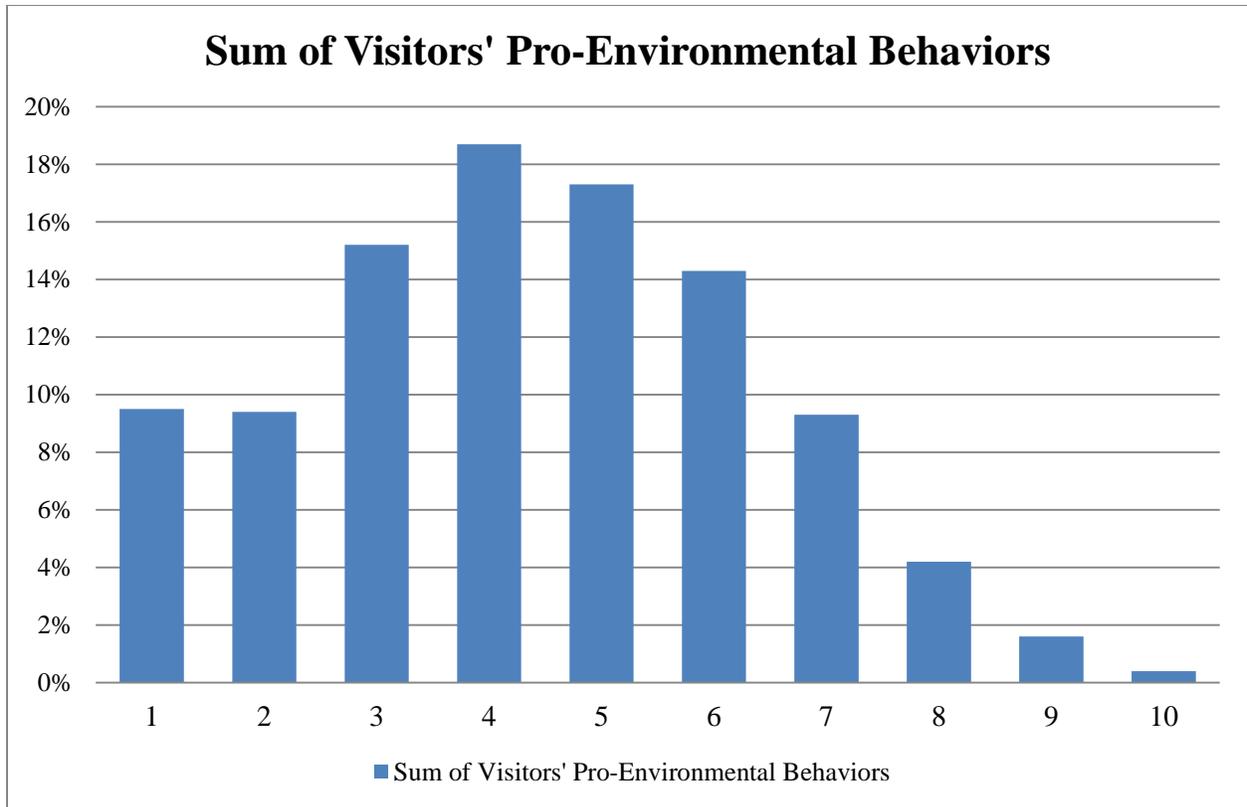


Figure 4.3. Sum of Visitors' Reported Energy-conserving Actions

Ordinary Least Squares Regression Analyses

Regression analyses were used to assess the degree to which concepts in this model influence the salience of climate change and public engagement in pro-environmental behaviors. Cohen's (1988) labels for effect size indices (e.g., .10, .30, and .50 for Pearson's r) of small, medium, and large are specific to applied psychology, but they are not particularly useful for interpreting the practical significance of relationships (Vaske, 2008). While the values represented by Cohen's effect size indices are appropriate in the context of this study, Vaske's (2008) labels of minimal, typical, and substantial were utilized because they better reflect the relative significance of relationships between the evaluated concepts.

Saliency Model. The relationships between salience and the independent variables Republican, Democrat, AR, the belief that climate change is caused by human activities, and the belief that climate change is caused by both human activities and natural changes were all significant at $p < .001$. The only independent variable in this model that did not have a significant relationship with salience was the belief that climate change is mostly caused by natural changes in the environment. Republican, Democrat, AR, the belief that climate change is caused by human activities, and the belief that it is caused by a combination of human activities and natural changes predicted an approaching substantial amount of variance in the salience of climate change ($R^2 = .481$; $p < .001$).

The belief that climate change is mostly caused by human activities had the strongest relationship with salience ($\beta = .475$). The positive β value for this relationship indicates that to a nearly substantial extent, climate change salience is higher among respondents who believe that human activities are contributing to global warming. To an approaching typical extent, salience was higher for respondents who think that climate change is caused by both human activities and natural changes ($\beta = .276$; $p < .001$). Additionally, there was an above typical relationship between greater ascription of responsibility for climate change and increased salience ($\beta = .308$; $p < .001$). This model demonstrates that for Democrats, the salience of climate change is likely to be greater ($\beta = .128$; $p < .001$), while salience is likely to be lower among Republicans ($\beta = -.139$; $p < .001$).

Reported Pro-Environmental Actions Model. A regression analysis was also used to test the relationships between the independent variables Republican, Democrat, the three beliefs about the causes of climate change, AR, and salience with the dependent variable reported behaviors. This analysis demonstrates that salience, the belief that climate change is caused by

natural changes, AR, and the belief that climate change is mostly caused by human activities all have statistically significant relationships with reported pro-environmental behaviors. These four concepts account for about 12% of the variance in reported energy-conserving actions ($R^2=.122$; $p<.001$). Republican, Democrat, and the belief the climate change is caused by both human activities and natural changes were not significantly related to reported energy-conserving actions.

To an above minimal extent, increased salience of climate change leads to an increase in the number of respondents' reported energy-conserving actions ($\beta=.224$; $p<.001$). AR was also positively related to reported pro-environmental behaviors, but the effect size for this relationship was below minimal ($\beta=.075$; $p=.001$). The belief that human actions are the primary cause of climate change had a weak, but significant relationship to higher numbers of reported pro-environmental actions ($\beta=.057$; $p=.009$). Interestingly, among respondents who believe that climate change is mostly caused by natural changes, an approaching minimal and negative relationship with pro-environmental behaviors was revealed ($\beta= -.083$; $p<.001$).

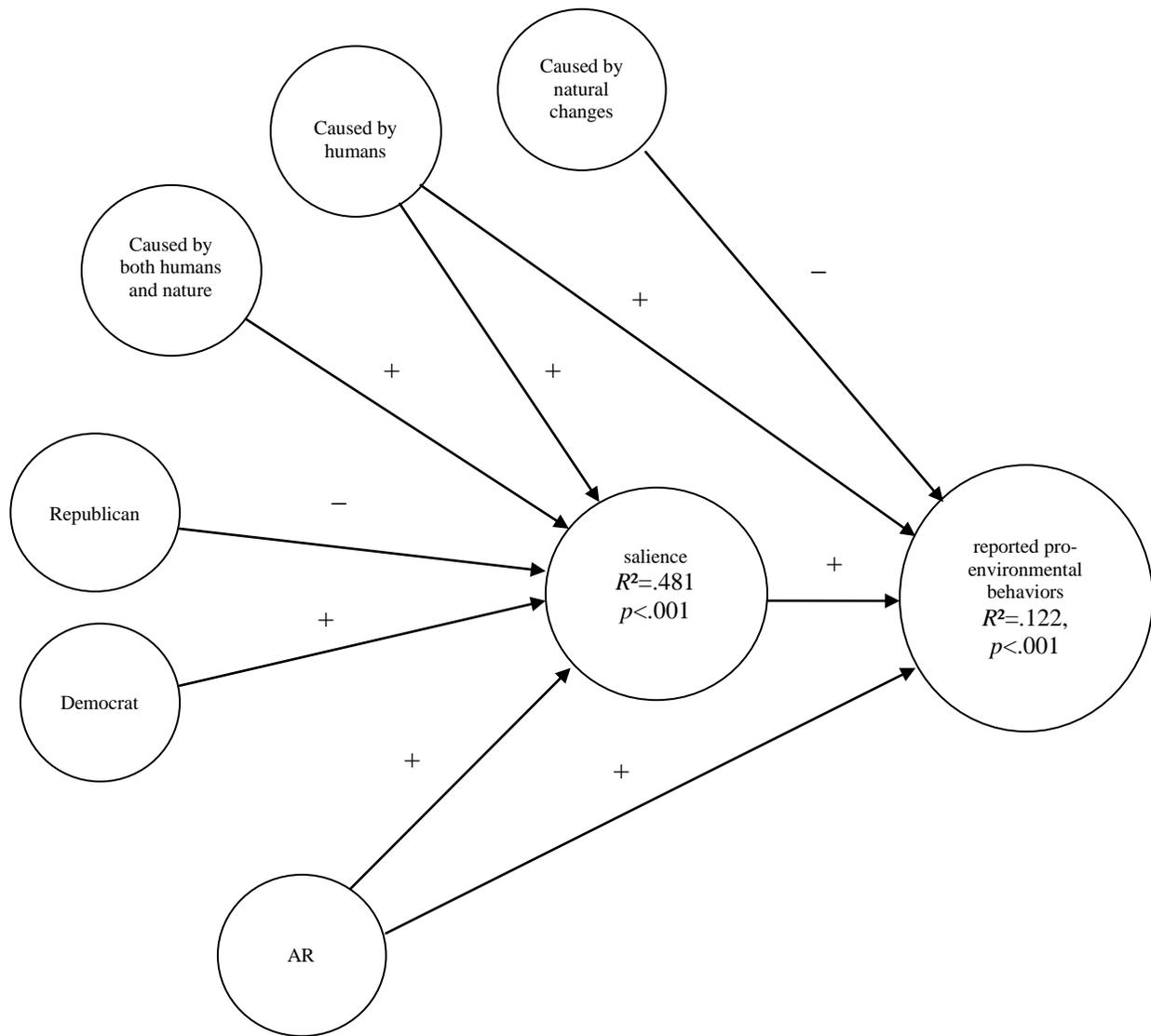


Figure 4.4. Ordinary Least Squares Regression Analysis of Factors Influencing Salience of Climate Change and Reported Pro-environmental Behaviors

Ascription of Responsibility Model. Regression analyses demonstrated the significance of relationships between Democrat, Republican, and the three beliefs about the causes with the dependent variable AR. These relationships were not hypothesized and are depicted in a separate model below (Figure 4.5). Considering that the AR concept predicts 30% of the variance in

climate change salience by itself, the finding that the other independent variables that were significantly related to salience also influence AR is theoretically logical.

The three beliefs about the causes of climate change, Democrat, and Republican together predict about 29% of the variance in AR ($R^2=.288$, $p<.001$). The belief that human activities are causing climate change had a very substantial and positive relationship with AR ($\beta=.751$, $p<.001$). The belief that climate change is being caused by both human activities and natural changes also had a substantial influence on AR, as the β value of .671 reflects ($p<.001$). While AR and the belief that natural changes are causing climate change are positively related as well, the effect size for this relationship is only slightly above minimal ($\beta=.135$, $p=.002$). The AR model demonstrates that political affiliation has a direct relationship with AR, with Republicans ($\beta= -.221$; $p<.001$) being less likely to feel responsible for climate change than Democrats ($\beta=.213$; $p<.001$). About 15% of the variance in AR can be accounted for by political affiliation alone ($R^2=.150$; $p<.001$).

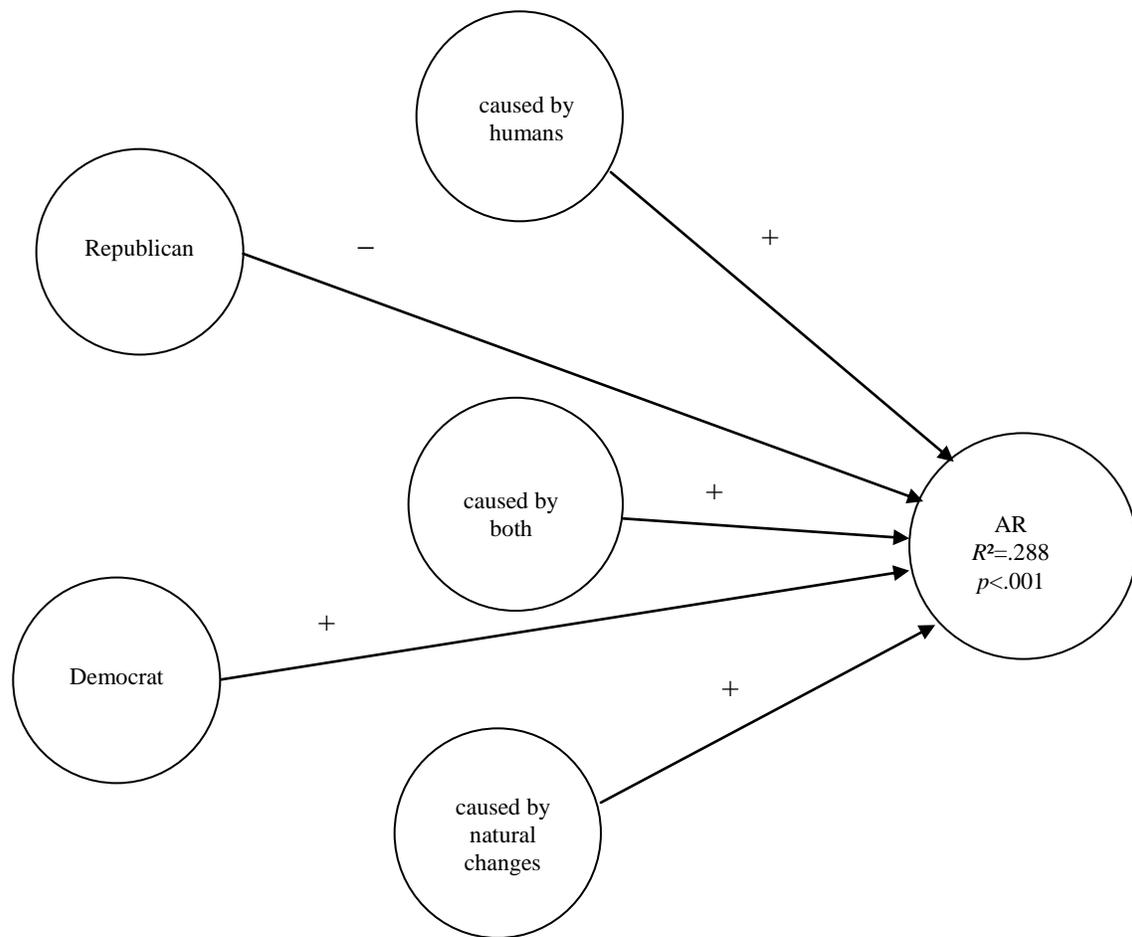


Figure 4.5. The Influence of Political Affiliation and Beliefs about Climate Change Causes on AR

Discussion

The results of the abovementioned analyses support all of the hypotheses of this study. Regression analyses revealed the additional significant relationships of Democrat, Republican, and the three beliefs about the causes of climate change with the dependent variable AR. Few studies have focused on the relationship between political affiliation and ascription of responsibility for climate change. This study demonstrates that Republicans are less likely to feel personally responsible for global warming, while Democrats tend to feel more responsible for

this issue. These are significant findings because AR is positively related to pro-environmental behaviors, indicating that energy-conserving actions do have moral dimensions.

When combined with Democrat and Republican, AR and beliefs about the causes of climate change significantly influenced salience and predicted about 48% its variance. The fact that political affiliation affects AR and salience indicates that ideology and other distinguishing factors between political groups play a substantial role in how people think about this issue. This is concerning because it suggests that increasing salience and ascription of responsibility for climate change among Republicans and conservatives could necessitate effectively depoliticizing this issue through large-scale alternative approaches to climate change communication.

There has been a great deal of descriptive research on the public's knowledge and concern about climate change, but little research has examined why some people feel more responsible for climate change and see it as a more relevant and important issue than others. The finding that the belief in anthropogenic climate change was strongly related to AR and salience suggests that more people may perceive this issue as personally relevant if the belief that climate change is caused by natural changes can be changed through education.

Salience, AR, and the belief that human activities are the primary cause of climate change were all positively related to reported pro-environmental behaviors, while the belief that climate change is caused by natural changes was negatively related to pro-environmental behaviors. Together, all of these concepts predicted about 12% of variance in peoples' energy-conserving actions, which is consistent with other studies predicting pro-environmental behaviors (i.e., Vaske & Espinosa, 2012). The positive and direct relationship between reported behaviors and the belief that human activities are causing climate change provides further evidence that to a moderate extent, public engagement in energy-conserving actions may be affected through

communication and education aimed at improving peoples' understanding of humans' role in the climate system.

While the model tested in this study does explain a significant amount of variance in reported pro-environmental behaviors, there are numerous factors that influence peoples' energy-conserving actions such as structural barriers, which cannot be captured in models of human cognition and decision-making. Many of the behaviors comprising the behavior index apply to people who own houses, thus limiting the capacity for this index to represent the full extent that people who are not property owners make efforts to conserve energy. Additionally, the response option 'switching from a gasoline to an electric or hybrid vehicle' is not applicable to people who do not own a car. This exemplifies the limits of the behavior measure to fully account for the degree to which peoples' actions and lifestyles entail less fossil fuel usage.

The finding that Democrat and Republican were not directly related to reported behaviors is promising because it suggests that engagement in energy conservation is not as politicized as public perceptions of climate change. This is important because it provides evidence that political ideology does not have a strong effect on whether or not people are motivated to reduce their energy consumption. Additionally, the fact that the belief that human activities are causing climate change was positively and directly related to behaviors suggests that better communication regarding humans' influence on climate change could increase public engagement in energy conservation. The belief in anthropogenic climate change influences AR and salience as well, so improving the public's understanding of humans' role in the climate system could also indirectly lead people to take measures to conserve energy.

While more scientific information is certainly not all it will take to affect how people think about the causes climate change, there are some fundamental aspects of climate processes

that people must understand to be able to conceptualize how human actions influence the climate system. Although many people understand that scientists attribute climate change to burning fossil fuels, only 45% of the public is aware that carbon dioxide is a heat trapping gas. Furthermore, only 19% of the public is aware that once emitted, carbon dioxide remains in the atmosphere for 100 years or more (Leiserowitz, Smith, & Marlon, 2010). This study demonstrates that in some ways, public understanding of climate change does influence the extent that people are taking individual-level action to conserve energy. Despite the fact that political affiliation affects peoples' perceptions of climate change, it was not significantly related to reported pro-environmental behaviors. This suggests that there are other, potentially more mutable factors than political ideology that lead people to conserve energy. Connecting climate change to human actions requires a certain degree of knowledge, but for public opinion to be influenced, people must trust the sources where they receive information about this issue.

One of the aims of the CCEP is to increase the public's engagement in climate change communication and mitigation through apolitical, place-based climate change education. Because there is evidence to show that Republicans' beliefs about climate change are based more on personal observations than scientific information, being able to see the impacts of climate change in places like Kenai Fjords National Park in Alaska and Everglades National Park in South Florida while simultaneously learning about the climate system could increase the extent that people are receptive to the scientific community's consensus on climate change.

Additionally, a study conducted through the Yale Project on Climate Change Communication demonstrated that the public trusts the National Park Service as a source of information about climate change. The results of this recent study by Leiserowitz, Maibach, Roser-Renouf, Smith, and Hmielowski (2011) showed that 75% of the public either somewhat or

strongly trusts the National Park Service for information about global warming, which is only 1% less than the two most trusted sources – the National Oceanic and Atmospheric Association and scientists (76% of the public either somewhat or strongly trusts both) (Leiserowitz, Maibach, Roser-Renouf, Smith, & Hmielowski, 2011).

Exposure to apolitical information about climate change from trusted sources in a place-based setting could strengthen all peoples' connection to the issue of climate change as well as their understanding of the role of humans in exacerbating its consequences. This type of educational effort could reduce the extent that many people are relying on the opinions of political leaders to formulate their beliefs about climate change, and it could help prevent people from filtering information about this issue based on their partisan leanings.

Conclusion

In examining the factors that influence public engagement in energy conservation, this study demonstrates that ascription of responsibility for climate change increases the salience of this issue as well as the extent that people personally engage in energy-conserving actions. These findings provide support for Schwartz's NAT, and indicate that personal norms do play a role in public involvement in individual-level climate change mitigating actions. The extent, however, that personal norms are activated and have a positive influence on pro-environmental behaviors depends on peoples' understanding of humans' role in the climate system.

Political affiliation also affected ascription of responsibility for climate change, which is consistent with studies demonstrating a divide between the scientific community's versus Republicans' and conservatives' understanding of the relationship between humans activities and global warming. Climate change salience was lower among Republicans than Democrats,

providing support for past studies showing that Republicans and conservatives see climate change as a less concerning and important issue than Democrats and liberals.

Place-based education could be a means of depoliticizing climate change, and increasing the extent that people see this as an important issue and understand its connection to human activities. Research examining the extent that participation in place-based education programs on climate change influences salience and peoples' beliefs about the causes of climate change would be useful in developing communication strategies aimed at engaging a wider public in this issue. Additionally, further research is needed on the relationship between the perception of climate change as a relevant issue and salience; if observing the impacts of climate change in places people care about such as national parks and wildlife refuges can make this global issue more relevant to people and increase its salience, then these types of programs could help increase the public's commitment to energy conservation.

Gaining insight about the relationship between knowledge of localized climate change impacts and salience would be useful, as a positive relationship would also indicate that place-based education could serve as a means of increasing the public's mitigating actions. Research on the relationship between awareness of consequences of climate change and reported pro-environmental actions or willingness to conserve energy would be prolific, and it would provide additional insight into the extent that personal norms relate to energy-conserving actions. Studies examining whether awareness of possible negative economic impacts of climate change increases the salience of this issue among Republicans would also be beneficial for determining how to better engage this political group in mitigating efforts.

The Yale Project on Climate Change has conducted a series of studies on the level of public trust in different sources of information about climate change. To increase the robustness

of these types of descriptive studies, researchers should begin examining the relationship between peoples' trust of different information sources about global warming and other concepts, such as salience and ascription of responsibility for climate change. Ensuring that the public trusts the information they are exposed to regarding climate change is an important part of closing the gap between scientists' and nonscientists' understanding of this problem.

Along with enhancing climate change communication and education efforts, research focusing on public opinion regarding the removal of structural barriers to energy conservation would be fruitful. Societal inequalities and structural impediments deter the involvement of many social groups in the effort to mitigate climate change. While many studies have been done regarding public opinion of federal climate change policy alternatives, research should also assess the extent of public support for state- and local-level policy alternatives. Evaluating public support for things like improved public transportation, having the opportunity to purchase renewable energy from utility companies, and the establishment of community gardens and compost centers would be helpful as we continue to strive to identify achievable ways of further involving the public in energy conservation initiatives.

CHAPTER 5

CONCLUSION

Summaries of Studies

Case Study of Southern Florida

Based on this investigation of NPS and USFWS staff members' versus park and refuge visitors' perceptions of place-based climate change impacts in South Florida, it is clear that visitors are much less aware that climate change is affecting this region than agency personnel. A large majority of agency staff (88%) are concerned about climate change, and most (68%) think that its impacts can definitely already be seen in this area. Visitors to South Florida's parks and refuges, however, are relatively unaware that rising global temperatures are causing ecological changes on public lands in this region. While most visitors surveyed believe climate change is happening, nearly half (45%) were either neutral or disagreed that climate change is already impacting the park or refuge they visited.

Most visitors to parks and refuges in South Florida have not personally observed signs that increasing global temperatures are affecting ecosystems in this area. Respondents to the agency partner survey specified a number of impacts of climate change that are currently observable in South Florida, but less than 30% of visitors surveyed stated that they have seen any of these ecological changes. This gap in awareness of place-based impacts of climate change reflects that visitors have either not had the opportunity to observe climate change impacts in South Florida's parks and refuges, or they are unable to identify these kinds of ecological changes on their own. While visitors are relatively unaware that global warming is affecting

South Florida, the vast majority (71%) are aware that it is currently affecting national parks and refuges across the U.S.

Although agency staff are concerned about climate change and aware that it is impacting South Florida, communicating about this issue within these agencies is only somewhat of a priority at this time. Contrary to the agency staff respondents' belief that most visitors are not interested in learning about climate change, this study demonstrates that visitors do want to learn about climate change in the area they visited. The presence of observable impacts of climate change in South Florida's parks and refuges that visitors have not seen indicates that there is a substantial potential to increase public awareness of local-level impacts of global warming in this region.

Factors Influencing Public Responses to Climate Change

The regression analysis in Chapter 3 of factors influencing ascription of responsibility for climate change demonstrates that peoples' political affiliation and beliefs about the causes of climate change significantly influenced the extent that they feel personally responsible for this issue. Political affiliation had a substantial effect on AR, with Republicans being much less likely than Democrats to believe their actions are contributing to global warming. Additionally, the belief that human activities are causing climate change was substantially related to increased AR, while the belief that natural changes are driving global temperature increases was only minimally related to AR.

Political affiliation, beliefs about the causes of climate change, and AR together predicted a great deal of variance in climate change salience. Consistent with past studies, climate change salience was much lower among Republicans than Democrats. The belief that humans are mostly or at least partially contributing to climate change was also positively related to salience, while

the belief that natural changes are causing climate change did not have a statistically significant relationship with salience. The extent that individuals feel responsible for contributing to climate change was related to higher levels of climate change salience as well.

When paired with salience, AR, political affiliation, and beliefs about the causes of climate change explained 12% of the variance in pro-environmental behaviors. Climate change salience had the strongest relationship with reported energy-conserving actions, demonstrating that the perception of this issue as a serious concern does influence peoples' behaviors. AR was directly related to reported pro-environmental behaviors, which suggests that peoples' decisions about energy usage are influenced by the activation of personal norms. This finding provides evidence that moral considerations play a role in peoples' energy-conserving actions. The belief that human activities are causing climate change was directly and positively related to reported pro-environmental behaviors, while people who believe that climate change is caused by natural changes are taking fewer energy-conserving actions. These findings provide additional support that acknowledgement of anthropogenic climate change significantly affects public engagement in mitigating actions.

These regression analyses demonstrate that political affiliation affects AR and salience, but neither Republican nor Democrat was directly related to reported pro-environmental behaviors. While these results do illustrate the political polarization of ascription of responsibility for climate change and concern about this issue, peoples' partisan leaning did not directly affect the extent of public engagement in energy conservation.

Practical Application

Place-based climate change education programs in South Florida's national parks and wildlife refuges could substantially improve peoples' knowledge of the climate system and their

role in it. This public communication approach is also appropriate for other national parks and wildlife refuges across the U.S. because public lands are often located in coastal and high elevation environments, making them more sensitive to the impacts of climate change. Many visitors to South Florida's protected areas were not aware that this region is already being impacted by climate change, and visitors may be unaware of how other areas of the U.S. are being affected as well. The fact that the vast majority of visitors surveyed in this study expressed a high degree of interest in learning about climate change in national parks and wildlife refuges shows that there is great potential for education on public lands to serve as means of increasing peoples' knowledge and understanding about how global warming is changing different ecosystems and why this is important.

To engage a more diverse audience in these types of programs, information about climate change and its impacts on protected areas could be incorporated into existing nature tours in national parks and wildlife refuges. For example, guided tours in Everglades National Parks focusing on mangrove forests could include information about mangroves migrating inland due to rising sea levels resulting from climate change (NWF, 2006). Incorporating climate change education into existing interpretive programs and materials could help attract visitors who may not otherwise seek out information about this issue. If place-based education can reduce the extent that people see climate change as a distant issue affecting others more than themselves, then it could lead more people to take action to help address this problem.

The results of Chapter 3 demonstrate that affiliation with the Republican Party has a significant and negative influence on AR and climate change salience. The finding that AR and salience were related to the number of visitors' reported energy-conserving actions indicates that there is a need to develop apolitical climate change communication strategies. Because there is

evidence showing that Republicans' and conservatives' beliefs about climate change are based more on personal observations than scientific information, place-based education could be a means of increasing climate change salience for this audience. The American public in general could become more accepting of the scientific community's stance on climate change if they have opportunities to learn how it is affecting public lands, particularly in places where the effects of global warming are obvious such as Kenai Fjords National Park in Alaska. If audiences that are skeptical of the seriousness of climate change have the chance to learn and see how it is affecting specific places, then they may begin to see this problem as more than an overhyped political issue.

Another important finding discussed in the third chapter is that beliefs about the causes of climate change significantly affected peoples' perceptions of this issue, as well as their level of engagement in energy-conserving behaviors. People who believe that natural changes are driving climate change reported engaging in fewer pro-environmental actions. Because there are many factors that influence how people formulate beliefs about the causes of global warming, it is important that the public receive information about humans' role in the climate system from sources they trust. The public trusts that National Park Service as a source of information about climate change, and part of the mission of this agency is to educate visitors about the cultural and natural resources they manage. Education on federally protected lands could be an ideal way to enhance public understanding of climate change and its causes, which could lead to greater public engagement in mitigating solutions.

With more direct public communication in parks and refuges about climate change, the extent that people perceive this issue as involving significant scientific uncertainty could decrease. This could reduce the extent that people rely on political leaders to form their opinions

about the importance of climate change and the need for it to be addressed. As the public learns more about climate change from trusted sources, political ideology may have less of an influence on how people perceive this issue, making the public better equipped to critically evaluate political discourse related to climate change.

Future Studies

The extent that different communication strategies increase public understanding of climate change and humans' role it should be an area focus in future climate change communication research. Because the scale of climate change prohibits people from seeing how their actions affect the climate system and places they value such as national parks, researchers should assess the extent that awareness of place-based climate change impacts may influence how people perceive the relevance of this issue. Specifically, research on how knowledge and awareness of place-based impacts of climate change relate to salience and ascription of responsibility would be productive. Discerning a positive relationship between awareness of small-scale impacts of climate change with salience and AR would provide further support that place-based communication could increase public concern about this issue and engagement in energy conservation.

Future research should also focus on the relationship between awareness of consequences of climate change and reported pro-environmental behaviors, or willingness to engage in energy-conserving actions. Because this study demonstrates that ascription of responsibility for climate change was directly related to respondents' reported engagement in energy conservation, there is reason to believe that the activation of personal norms affects peoples' decisions about actions entailing energy consumption. As this study provides support for Schwartz's NAT (1977) in the context of public reactions to climate change, the norm activator 'awareness of consequences'

could be an influential factor in prompting people to take individual action to conserve energy. Studies investigating how awareness of consequences of climate change affects peoples' engagement in mitigating measures would be valuable for refining public communication approaches.

The findings of this study show that political affiliation greatly influenced peoples' feelings of responsibility for climate change, and that AR was significantly related to the public's reported engagement in pro-environmental behaviors. However, bridging the gap between scientists' and nonscientists' views about the causes of climate change is a complex and challenging task. While place-based communication could be an effective means of transforming more skeptical audiences' perceptions of climate change and their engagement in energy conservation, message framing could be another means of increasing public involvement in mitigating measures without necessarily affecting how people think about humans' role in the climate system.

Republicans' beliefs and concerns about climate change could be influenced through the utilization of frames that connect climate change to the interests of this political group. Relevant literature suggests that this could be accomplished through portraying climate change as a national security threat, an economic issue, and an issue of morality. For any of the frames to effectively transform peoples' perceptions of climate change, Republicans have to trust in the sources and messengers delivering these types of messages. Future studies should focus on the extent that the abovementioned frames and trust in different sources of information increase the salience of climate change across political groups. For example, determining the extent of public concern about the effects of climate change on the economy, natural security, and future

generations could allow researchers to gain a better understanding of whether these frames may increase the salience of this issue and public support for collective and individual mitigation.

An additional area of future research that would build on the past climate change communication research regards public support for policy initiatives aimed at removing structural and institutional barriers to peoples' engagement in energy conservation. While many researchers have focused on public opinion regarding federal climate change policy alternatives, studies should also assess the extent of public support for state- and local-level policy alternatives. Evaluating Americans' opinions regarding things like improved public transportation and the establishment of community gardens and compost centers would be helpful as we continue to strive to identify achievable ways of further involving the public in energy conservation initiatives.

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APPENDIX 1

Description of the Place-based Climate Change Education Partnership



Place-Based Climate Change Education Partnership
Human Dimensions of Natural Resources, Colorado State University
1480 Campus Delivery, Fort Collins, Colorado 80523
<http://warnercnr.colostate.edu/ccep/>

Place-based Climate Change Education Partnership

Building Climate Change Communication Capacity at National Parks & Wildlife Refuges

The National Science Foundation awarded nearly \$1 million to a collaborative team led by Colorado State University to develop a strategy for educating national park and wildlife refuge visitors about climate change. Project partners are the National Parks Conservation Association, the National Park Service and the U.S. Fish and Wildlife Service. The collaborative team will build a national network of partners at parks, refuges and surrounding communities to develop a suite of innovative educational programs and resources for communicating the impacts of climate change on some of America's favorite landscapes.

Each year, more than 300 million people visit America's national parks and wildlife refuges, areas that serve as natural laboratories for mitigating and adapting to climate change impacts. "Partnering with the national parks and wildlife refuges creates a unique opportunity to use place-based learning to educate a diverse audience about the impacts of climate change," said Jessica Thompson, team leader and assistant professor in the Department of Human Dimensions of Natural Resources in CSU's Warner College of Natural Resources. For example, at any one of the 391 national park sites or 552 wildlife refuges, citizens may witness the impact of disappearing glaciers, increased wildfires, drought, sea level rise and erosion, and large tracts of vegetation change, such as thousands of acres of forests killed by bark beetle infestations at Rocky Mountain National Park.

The partnership network will bring together park, refuge and community members to share resources, experiences and ideas for improving informal public education about climate change. "Currently, there is a gap between scientific research and climate change education for citizens. Hopefully, visitors will begin to understand how climate change is impacting America's greatest treasures and be motivated to make choices to live more sustainably," Thompson said. In the next six months, the team plans to work with partners in parks, refuges and communities in Colorado, Alaska, Washington, Florida, Minnesota and Washington D.C. Together, the partners will develop place-based education plans to effectively engage audiences in hands-on climate change education.

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