

Change We Can Believe In?

The Role and Implications of Culture and Environmental Values on Climate Change  
Perceptions

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Alexander Heeren

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David C. Fulton, Adviser

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## **Abstract**

Climate change poses many ecological and social challenges to natural resource agencies. One great challenge that resource managers face is how to manage, or adapt, to climate change in a socially acceptable way. To meet this challenge, it is necessary to understand how public perceptions about climate change are formed and whether the public will support climate change management strategies. This issue was examined at the regional level (northeast Minnesota) using a conceptual framework tested with the results of focus groups and a mail survey. Chapter 1 of this thesis provides an introduction to the framework. The second chapter discusses the results of the focus groups examining how individuals talk about climate change. Chapter 3 tests the conceptual framework quantitatively using the results of a region wide mail survey. Finally, Chapter 4 provides a summary of the project and discusses directions that future research can take.

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## Chapter 1: Introduction

### *Introduction*

E.O. Wilson (1975) observed that “social behavior, like all other forms of biological response, is a set of devices for tracking changes in the environment.” This statement is very pertinent to the way individuals perceive and adapt to environmental change, such as climate change. As social animals, our perceptions of the environment depend on our interactions with others and society as well as our firsthand observations. The role that society and culture have on shaping an individual’s perception of the environment is well exemplified by the case of climate change. Since climate change is a gradual and global process, people cannot easily observe evidence of climate change firsthand. For this reason, climate change is often referred to as an “impersonal risk” as it affects society at large rather than directly affecting the average individual (Kahlor, Dunwoody, Griffin, & Neuwirth 2006). Therefore, social norms, media and culture may have a tremendous influence on both how people view climate change and how they view climate change as a risk to society. The National Academy of Sciences (2009) identified a growing need to understand how perceptions of climate change are formed which has led to an increased interest and emphasis on including human dimension research into climate change research programs at the federal level.

The purpose of this thesis study was to examine how culture and society influence public perception of climate change at a regional level. Understanding the role that culture plays in climate change perception poses a particular challenge for the ecologists, conservation biologists, and natural resource managers trying to manage ecosystems and species in the context of a changing climate. As stated by Bord, Fisher, and Connor

(1998), “Scientists need to know how the public is likely to respond to climate impacts or initiatives, because those responses can attenuate or amplify the impacts. Policy makers need to know what the public wants, in order to design policies that will be supported or at least tolerated.” Without the support of the public or policy makers, it is not likely that climate change management policies will be enacted, implemented, or enforced.

Conservationists and natural resource managers also must communicate with the public and policy makers about climate change. Traditionally, natural resource and conservation professionals have approached climate change from a scientific perspective. While there is a scientific consensus that climate change is occurring and that its causes are anthropogenic, the American public is still divided in their belief of climate change and its causes. Nisbet and Myers (2007) reported that general public belief in the existence of climate change has ranged from 67% to 77% across a number of public opinion polls conducted from 1997 to 2002.

While a majority of the public does believe climate change is occurring, it is quite clear that public opinion differs from the scientific consensus. Understanding how climate change perceptions form, and how they are influenced by culture, will help scientists and professionals properly frame and communicate with the public about climate change. This study will address these issues by examining:

- 1) How individuals discuss the topic of climate change;
- 2) How opinions about climate change are correlated with environmental, wildlife, and political ideologies; and

- 3) How belief in climate change, attitudes towards state agencies and environmental value orientations influence support for specific climate change adaptation strategies.

### *Literature Review*

Understanding climate change perceptions not only has important policy implications, but important implications for communication, too. Krause (2004) identified three principles of design: components, composition, and concept. Components refer to the individual parts of the design or message. Composition examines how individual components interact, or “flow,” within a message. Finally, concept refers to the theme, or underlying meaning, of the message.

Application of these three elements proved informative in examining the existing literature on climate change perceptions and led to three broad categories of studies. The first broad category of studies was descriptive and examined individual parts or components of climate change perceptions. For example, such component studies often divided perceptions into several components, and examined individuals’ beliefs in the existence of climate change, their beliefs concerning the cause of climate change, and their opinions on what should be done about climate change. The second category of research examined the composition of climate change perceptions, or how information about climate change flows through society. This category of studies is largely media studies and that examined how climate change information is covered by the popular media and how journalists treat the topic. The final category of studies examined the concepts of climate change perceptions, or how climate change perceptions fit into a

political and cultural context. These studies examined how culture and social interactions influence an individual's thoughts on climate change and climate change policy.

Because my study was most concerned with how culture and society influence climate change perceptions, this review focuses on studies that examined the concepts of climate change. However, I provide a brief overview of studies examining the components and composition of climate change to provide the proper context for the studies that examine how culture and society influence environmental perceptions.

One broad category of past social research on climate change includes descriptive, non-theoretical survey studies. I have classified this research as relating to the components of climate change because these studies tended to describe the public's beliefs and knowledge of climate change, but did not attempt to explain why the public holds these views. In their simplest form these descriptive studies asked respondents whether they believe climate change is occurring. For example, Leiserowitz, Mairbach and Roser-Renouf (2010) asked respondents the question, "Do you think that global warming is happening?" (In response 71% of respondents answered "yes" compared to 10% who answered "no"). Bord et al. (1998) offered a more comprehensive discussion of such studies, and Nisbet and Myers (2007) summarized polling data that addressed this issue.

Another broad category of research examined how perceptions of climate change are composed by media and journalism. Climate change perception is, "strongly influenced by media constructions of scientific knowledge" (Antilla 2010). Therefore some of the most common forms of studies on social aspects of climate change are on how climate change is portrayed in the media. These studies addressed topics such as

how climate change is portrayed differently in different countries (see Antilla 2010) and how climate change coverage changes over time (see Boykoff & Boykoff 2007). Some studies have attempted to explain why the media portrays climate change in the way that it does. Boykoff and Boykoff (2007) completed a comprehensive review of how expectations of media, or “journalistic norms,” influence the way climate change has been covered by the media.

A third broad category of research, and the focus of this review, examined the concept of climate change in a political and cultural context. Such studies attempt to explain why certain groups of people believe in climate change while certain other groups are skeptical. These studies attempt to discern why people believe what they do rather than just describing the beliefs.

Several previous studies have developed approaches that examine how an individual’s cultural or political worldview correlates with their perceptions of environmental issues (see Rockeach 1969, Dunlap, Van Liere, Mertig & Jones 2000, Dietz, Fitzgerald & Shwom 2005, and Schwartz, Vaprra & Vecchione 2010).

One such set of studies illustrating this category of research focuses on the theory of “Cultural Cognition” which draws on the cultural theory of risk developed by anthropologist Mary Douglas and political scientist Aaron Wildavsky (Douglas & Wildavsky 1982, Gastil, Braman, Kahan & Slovic 2005, Kahan in press). This set of studies illustrates how cultural and environmental world views may influence perceptions about the environment. As stated by Gastil et al. (2005):

Cultural values do not so much motivate citizens as orientate them. Citizens are guided by the stances political parties take on cultural issues. ...As a result, even citizens who are relatively tolerant of-or simply indifferent to-the values of persons who harbor cultural commitments

alien to their own will find themselves consistently arrayed against those persons... (Gastil et al. 2005)

Cultural worldviews have been effective at explaining differences in perceptions about climate change. Worldviews refer to the cognitive explanation and perspective of the fundamental nature of humanity's existence (Geertz 1966). Kahan, Braman, Slovic, Gastil, and Cohen (2007) found that cultural worldviews explained belief about climate change more powerfully than any other characteristic. Political ideology explained less than one third of the variance than cultural world views did and gender explained one tenth as much variance (Kahan et al. 2007).

Cultural wordviews have been used to help understand risk perceptions across a diverse array of issues (Kahan et al. 2007), but other similar concepts and measurement scales have been developed to understand similar cognitions more specific to the environment and natural resources (Dunlap et al. 2000, Vaske & Donnelly 1999, Fulton, Manfredo & Lipscomb 1996, Steel, List & Shindler 1994). The New Ecological Paradigm (NEP) scale (Dunlap & VanLiere 2008, Dunlap et al. 2000) measures "beliefs about humanity's ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity's right to rule over the rest of nature" (Dunlap et al. 2000). The NEP is arguably a scale that measures a cognitive paradigm (i.e. an ideology or worldview) specific to the human-natural environment relationship and it has been broadly applied to study different environmental topics across the United States (Edgell & Nowell 2008, Dunlap 2008, Schultz & Zelezny 1999, Wiidegren 1998)

A similar measurement scale addressing wildlife value orientations (WVOs) was developed by Fulton et al. (1996) and refined by Teel, Dayer, Manfredo and Bright (2005) (also, see Bruskotter & Fulton 2008). Similar to the NEP scale, fish and wildlife

value orientations measure a respondent's basic beliefs about how humans should relate to wildlife. WVOs are an extension of the value-attitude-behavior framework (Teel & Manfredo 2010, Homer & Kahle 1988). This framework states that there is a "cognitive hierarchy." At the base of this hierarchy are an individual's core values. These values shape the individual's attitudes and attitudes in turn shape behavior. Value orientations, such as those relating to wildlife, describe how ideology influences the cognitive hierarchy and "consist of networks of basic beliefs that organize around values and provide contextual meaning to those values" (Teel & Manfredo 2010). As with the NEP scale, multiple studies have used the WVOs value orientations, so that comparisons can be made with other studies. Fish and wildlife value orientations have been applied to anglers in Minnesota (Bruskotter & Fulton 2008, Bruskotter 2007) and to residents of many of the western states (Teel et al. 2005, Manfredo, Teel & Bright 2003).

Examining the role that cultural and environmental views have on public perception is important from a political science standpoint as well. Such theories of cultural cognition are at odds with traditional theories of political opinion such as those expressed by the "Democratic Theory" proposed by Dahl (1956) which states that the public is constantly dividing itself into different groups based on individual issues, much like a mass of shifting interest groups. However, as these groups are not constant from one issue to the next, a majority is never formed. The result is that the public does not divide itself permanently along specific ideological lines. Examining how climate change perceptions form can help illuminate how the public develops perceptions of such issues.

## *The Northeast Climate Change Pilot Study*

Much of the previous research on climate change perceptions has been conducted at a national level. However, as natural resource professionals often manage at the regional level, information at local and state levels will be useful for climate change management at these levels. Also, many of the existing climate change studies have examined how society can mitigate the effects of climate change, not adapt to them. However, when discussing climate change management policy, there are two broad approaches that can be taken, climate change mitigation and climate change adaptation. Climate change mitigation refers to reducing the amount of climate change that will occur by reducing greenhouse gas emissions. Climate change adaptation on the other hand tries to help ecological and/or human systems adapt to changes in the climate. The Minnesota DNR defines climate change adaptation as, “activities that help human and natural systems prepare for and adjust to climate change” (MN DNR CREST Team 2011). Their definition derives from the Intergovernmental Panel on Climate Change (IPCC 2007) definition, “Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”

Because a state or regional agency will only have a limited impact in reducing global greenhouse gas emissions, the idea of climate change adaptation is an attractive alternative to many state agencies. The Minnesota DNR is interested in exploring adaptation strategies and how their constituents, the public, may view such activities. To help understand these issues, the Minnesota DNR worked cooperatively with the University of Minnesota to develop the Northeast Climate Change Pilot Study



(NECCPS), which examined how residents of northeast Minnesota perceive climate change and to explore the extent of support for climate change adaptation strategies.

Specific questions addressed by this project include:

- 1) How do residents perceive climate change in general?
- 2) What specific environmental changes are residents concerned about?
- 3) How supportive will the public be of climate change adaptation policies?
- 4) How can the DNR best communicate about climate change with the public?

The project's focus was at the northeast Minnesota regional level, specifically in Lake, St. Louis and Cook counties (Figure 1.1). The northeast region of Minnesota was chosen as a focus for this study since there are many concerns about how this region will be affected by climate change including the region's moose population, fisheries resources, timber industry and tourism.

The NECCPS was guided by a conceptual framework. Below is a summary of the framework. However, a more detailed description is presented in Chapter 3. The proposed framework (Figure 1.2) hypothesizes that individuals form perceptions about climate change based on a variety of sources. The framework draws on previous research cited in the literature review as well as the Risk Information Seeking and Processing models (RISP) developed by Griffin, Dunwoody and Neuwirth (1999) and Kahlor (2007). Individuals may learn about climate change from firsthand observations of their community's environment. They may also learn about climate change from the media. Additionally, they may get information about climate change from talking to family, friends, or peers.

While individuals may learn about climate change from a variety of sources, it is unlikely that they will devote equal amounts of attention to each source. Individuals are likely to trust some sources of information more than others. The conceptual framework suggests that individuals will filter information based on their values, world views and political ideologies (as described by Gastil et al. 2005). They will tend to accept information that corresponds to their political beliefs and values and will ignore, or attempt to refute, information that is contrary to their values or worldviews.

An individual will form an opinion about whether climate change exists based on this filtered information. Previous studies examining risk perception have shown that information, as well as agency trust, are important components of whether an individual views an issue as a risk (Griffin et al. 1999). An individual's worldviews and political ideology will also influence the extent that he or she trusts a government agency such as the DNR and whether he or she will accept policies from this agency. According to this framework, an individual's support of climate change adaptation strategy will be heavily influenced by their belief in climate change and their trust and acceptance of natural resource agencies, both of which are based on the individual's worldviews, value orientation, and political ideology.

This framework was examined using the results from focus groups and a mail survey. Focus groups were used to look at how residents in northeast Minnesota were talking about climate change and can be used to examine the types of information that people are basing their climate change beliefs on (addressing the left half of Figure 1.2). The results of the focus groups were used to form a mail survey that quantitatively

examined residents' beliefs in climate change and their support of climate change adaptation strategies.

### *Methods and Analysis*

The first phase of the project involved conducting five focus groups about climate change in northeastern Minnesota. The purpose of the focus groups was to examine how aware residents were of climate change and what type of language they were using to talk about climate change. We were particularly interested in how individuals who were skeptical or opposed to climate change perceived and talked about the issue. Information gained from the focus groups was then supplemented with information from the literature review to draft a survey questionnaire that examined climate change perceptions in northeast Minnesota quantitatively. Approval to conduct human subject research was obtained from the University of Minnesota Institutional Review Board (Project Number: 0609E92806).

#### *Focus groups*

We conducted five focus groups in June 2011 in northeast Minnesota. A single focus group was held in the cities of Virginia, Ely, and Grand Marais. Two groups were held in Duluth. Focus group recruitment and moderation followed methods set forth by Krueger and Casey (2009). A report summarizing the findings of the focus groups and the survey has been completed and submitted to the DNR (Heeren, 2011). This thesis provides a more thorough analysis of the data; specifically examining how environmental, wildlife, and cultural worldviews influence perception of climate change and climate change management. Analysis of the qualitative data followed the method

used by other focus group studies (Krueger & Casey 2009, Bengston, Schermann, Moua, & Lee 2008, and Racevskis & Lupi 2006). Participants' comments were coded based on whether or not the comment supported the idea that anthropogenic climate change was occurring and were also coded based on the reasons the participant gave supporting the comment.

### *Survey*

Data were collected from residents in the study area using a mail-back survey during October 2011 through January 2012. Survey implementation followed procedures outlined by Dillman, Smyth and Christian (2009). The survey questionnaire was informed by the qualitative information gained from the focus groups and from information gained through the literature review. Details of the questionnaire design and study results are presented subsequently, and a copy is given in Appendix B.

### *Conclusion*

Climate change is perhaps the most pressing environmental challenge of our time. In order to design effective policy to mitigate and adapt to climate change, conservationists, policy makers, and natural resource managers need a sound understanding of how the public views climate change, and how they will respond to climate change policies. There is a considerable amount of research that describes public opinion of climate change and how the media discusses climate change. However, more research is needed to understand how people form perceptions about climate change and how these psychological processes can be applied to policy. Some research examines this issue using cultural and environmental world views. Studies that utilize cultural

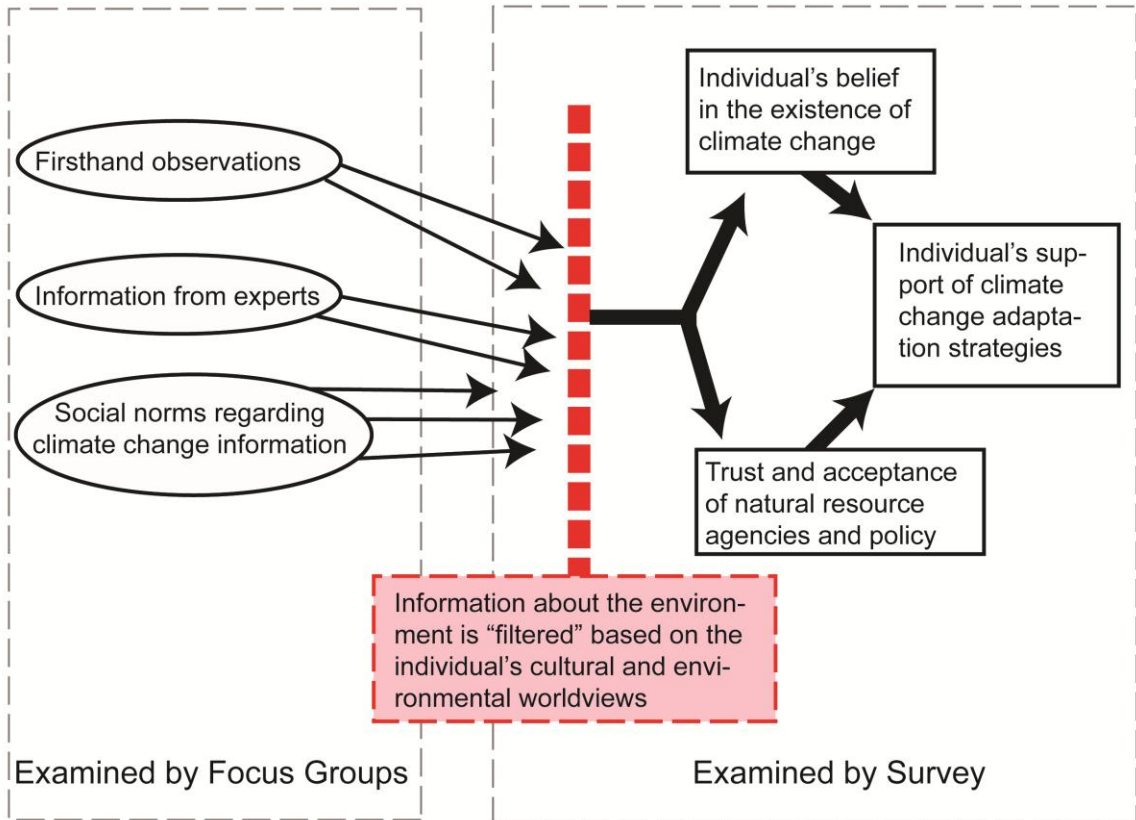
cognition (Kahan et al. 2007), wildlife value orientations (Bruskotter & Fulton 2008, Teel et al. 2005, Fulton et al. 1996) and the New Environmental Paradigm (Dunlap & LaViere 2008, Dunlap 2000) use methods to measure an individual's cultural and environmental worldviews. These methods can be applied to study how residents of northeastern Minnesota view climate change and the extent to which they will support climate change adaptation strategies.

*Figures and Tables*



*Figure 1.1: Map of the study region*

The area of interest for this study was the northeast region of Minnesota. This area is formed by Lake, Cook and St. Louis counties (highlighted on the map on the left). As seen from the map on the right, this area includes several ecological subsections (map modified from MN DNR 2011).



*Figure 1.2: Conceptual Framework of the study*

An individual's perception of climate change is likely based on a set of information filtered by his or her cultural and environmental values.

## Chapter 2-Focus Group Results

### *Introduction*

The way that the public talks and thinks about climate change is quite different from the way that scientists talk about the issue. This disparity between scientific experts and the public is easily observed by polling data. While there is a near scientific consensus about climate change, one study conducted by a major television network found that among the public 56% of those polled believe there is a lot of disagreement among scientists on the issue of climate change (Nisbet & Myers 2007).

Because public opinion differs from the scientific consensus about climate change, it is important for scientists, policy makers, and natural resource managers to understand how the public perceives and talks about this issue in order to create effective management policies. An individual likely takes several factors into account when considering climate change. Some of these might be first hand observations of weather and climate. For example Leiserowitz, Maibach, Roser-Renouf, and Hmielowski (2012) examined how extreme weather events may influence an individual's perception of climate change. An individual may also base, or reinforce, their perception of climate change on information that they learn through the media (Antilla 2010, Boykoff & Boykoff 2007). Finally, information from family, friends, and the community may influence how an individual assesses the risks of climate change (Kahlor 2007, Griffin et al. 1999).

Because individuals may form opinions about climate change from a variety of different sources, it is important to understand how people talk about climate change and from what sources where they are drawing their information. This topic can be studied



by a variety of methods. One way to do this is through focus groups. Focus groups provide a qualitative way to examine how people talk about an issue, and what type of language they are using to discuss it (Krueger & Casey 2009). We conducted five focus groups in northeast Minnesota to study how residents discuss the topic of climate change, and what sort of language they are using to discuss climate change. One of the main goals of the focus groups was to study how information from peers and society shape an individual's opinion of climate change. Specific questions addressed by the focus groups included:

- 1) What do residents think about the existence of anthropogenic climate change?
- 2) What is it about the topic of climate change that residents find upsetting?
- 3) To what extent are social or cultural expectations influencing resident's perception of climate change?

### *Methods*

Focus groups are, "a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment" and were first used to study morale in the military during World War II (Krueger & Casey 2009). Krueger & Casey (2009) note that the greatest benefit of focus groups is that respondents can respond to the issue openly, and are not confined to specific response options as in a survey. For this reason, we chose focus groups to be the primary method of gaining more in depth, qualitative information about public understanding of climate change and climate change adaptation for the NECCPS study.

We conducted five focus groups in June 2011 in northeast Minnesota. A single focus group was held in the cities of Virginia, Ely, and Grand Marais. Two groups were

held in Duluth. A sample of residents living in each area was obtained from listed addresses and phone numbers. Focus group recruitment and moderation followed methods set forth by Krueger & Casey (2009). Approval to conduct human subject research was obtained from the University of Minnesota Institutional Review Board (Project Number: 0609E92806).

Letters and phone calls were used to recruit focus group participants. To make sure enough participants were recruited, we contacted potential participants through two methods. We sent recruitment letters to some 300 individuals and contacted several hundred others via phone calls. The individuals contacted came from a random selection of addresses and phone numbers purchased through the Genesys Company. The purpose of these focus groups was to generate a range of ideas and concepts about climate change, and they were not meant to be generalized back to the general population. For this reason, focus group participants did not have to be randomly selected (Krueger & Casey 2009). While we recruited participants from a random list of residents, those who volunteered to participate may not have been a representative sample. To increase participation, individuals were offered an incentive of a light supper and \$50 in compensation for their time and any costs that they might have incurred (such as travel costs or childcare).

While planning the focus groups in consultation with the DNR, there was concern that those skeptical of climate change may not participate in the focus groups if climate change was the main topic. Therefore, environmental change in general was chosen as the theme of the focus groups. For the focus groups held in Virginia, Ely and Grand Marais, recruitment letters and phone calls asked if individuals were willing to participate

in a discussion about environmental change in their area. For the Duluth focus groups, individuals received a recruitment letter with a brief survey asking the respondent to rate how important different environmental threats were to him or her. People living in the Duluth area who rated climate change as unimportant were placed in the second Duluth focus group. For this reason, this group was expected to be less concerned about climate change and also more skeptical of climate change. We used this strategy to see if a group containing more climate change skeptics would produce a different type of discussion about environmental change.

The same facilitator (Dr. David Fulton) organized and led each of the focus group discussions. An assistant and DNR observers were also present at each focus group. For the Virginia, Ely and Grand Marais focus groups one to two DNR observers were present in the room for the entire discussion. In the case of the two Duluth focus groups, two to three DNR observers watched the discussion from a closed circuit television and were not present in the room with participants.

We guided the focus group using a series of ten questions in order to generate a discussion about environmental change and natural resource issues in the northeast region (the focus group script can be found in Appendix A). Because we had concerns that participants might react negatively toward initial, direct questions about climate change and not provide an in depth discussion, general questions on natural resource issues were asked before transitioning to the topic of climate change. The first questions were designed to get the participants to introduce themselves, talk about how long they had lived in northeast Minnesota and what they valued about living in the area. The next question asked them to talk about the types of outdoor activities, both work and

recreational, that they participate in. The next two questions asked them to think about any changes to the outdoors, or natural environment, that people in their region have been talking about. This question was followed up by asking what they thought were causing these changes. If climate change had not been brought up at this time, the moderator then introduced the topic with the next question: “Some people are concerned about climate change and potential impacts from climate change. What do you think about the notion of climate change in northeast Minnesota?” Since some people find the topic of climate change upsetting, the next question asked participants to talk about how they feel about the topic of climate change and what if anything upsets them about it. After this question, the participants were asked: “What would you like the Minnesota DNR to do to prepare for and adjust to climate change?” The last question of the evening was an open ended question about changes in the region to give people the opportunity to say anything else that may have been on their minds.

### *Analysis*

The focus group discussions were recorded and transcribed. While a summary report was provided to the Minnesota DNR, this report was largely descriptive and did not examine in detail how social and cultural factors influenced participants’ perceptions of climate change (Heeren 2011). In fact, only two of the ten focus group questions produced conversations pertinent to the topic of social influences on climate change perceptions. These two questions were:

- 1) “Some people are concerned about climate change and potential impacts from climate change. What do you think about the notion of climate change in northeast Minnesota?”

2) “For some people, the topic of climate change is upsetting? Tell us how you feel about the topic and what, if anything, upsets you about the topic of climate change?”

The transcripts relating to these two questions were isolated and analyzed in detail. A coding method was developed to summarize these topics (Table 2.1).

The first set of codes was used to identify the purpose of the statement or comment. These codes broke the statements into two categories: those relating to the first question of belief in the existence of climate change (labeled as “BELIEF”) and those relating to the second question of why climate change may be upsetting (labeled as “UPSETTING”).

A second set of codes divided the statements into four categories. One group contained those comments that were promoting the idea that anthropogenic climate change exists. A second category contained those comments that were skeptical of the existence of anthropogenic climate change. The third and fourth categories implied respondent uncertainty about the existence of climate change, or those comments that did not take a stance on whether climate change exists or not.

A final category of codes was used to identify the reasons behind the statements. Based on the summary of the discussions (Heeren 2011) several categories of statements were identified (Table 2.1). While the reasons varied, they can be divided into two broad categories: those relating to society or culture (such as politics, media, etc.) and those not relating to society or culture (such as first hand observations). These codes were used to organize and describe the statements so that they could be examined and discussed more systematically.

## *Results*

Approximately 16 participants attended each of the focus groups in Virginia, Ely and Grand Marias. Eight participants attended each of the focus groups in Duluth. While about half of the people contacted to participate were female, more males volunteered to participate than females. In the case of the two Duluth groups, only male participants attended the focus groups. We did not collect background demographic information concerning age, income, education or similar characteristics, but participants, with a few exceptions were middle-aged or older.

The five focus group discussions yielded 122 score-able comments regarding the respondents' beliefs in climate change. For the purpose of this study, I defined a "comment" starting when one participant began speaking until another participant began to speak. Fifty-eight of these comments supported the perception that anthropogenic climate change does exist while 36 comments supported the perception that anthropogenic climate change does not exist (Table 2.2). Fifteen comments stated the respondent's uncertainty about climate change and thirteen comments were about the existence of climate change, but did not take a stance on whether anthropogenic climate change was occurring or not.

The reasons that respondents gave for making their statements about the existence of climate change were also coded and scored (Table 2.3). Out of the score-able reasons, 100 were non-social or non-cultural reasons and 22 comments had social or cultural reasons behind them.

Forty-eight comments addressed the topic of why climate change may be upsetting (Table 2.4). Twenty of these comments stated that climate change was

upsetting because it is occurring. Five comments discussed why the idea of climate change is upsetting because the respondent did not believe it was occurring. Six comments talked about why climate change is upsetting because the respondent was uncertain whether it was happening or not. Finally, 17 comments focused on why climate change is upsetting without taking a stance on whether climate change is occurring or not.

The respondents' reasons for why climate change is upsetting were also coded and scored (Table 2.5). Forty reasons were given (some respondents did not give any reasons for their comments while others gave multiple, therefore the totals in Table 2.5 are not equal to the totals in Table 2.4). Thirty-one out of the forty reasons were social reasons while nine were non-social or non-cultural reasons.

Participants made both social and non-social comments regarding the topic of climate change. Again, due to the qualitative nature of these focus groups it is not possible to make generalizations back to the general public. However, within these focus groups, participants tended to use non-social or non-culture based comments when discussing the existence of climate change. However, participants tended to use social and culture based comments when discussing why climate change is upsetting.

#### *Existence of climate change*

Those participating in the groups made more comments suggesting that climate change exists than comments that climate change does not exist. When looking at the reasons why respondents thought climate change did or did not exist, most of the comments were non-social.

The weather, or past weather events, was the most common cited reason. Out of the 53 identified comments regarding weather, 30 supported the existence of climate change while 20 were used as reasons why the respondent was skeptical of climate change. One common statement was that past winters were much colder than more recent winters.

Just think about our winters now. I can remember when there were days, almost weeks where the temperature didn't get above zero. I haven't seen that. I mean, it's cold, it gets below zero but it won't be sustained.

Duluth Participant

Well there is definitely a change in our climate up here in northern Minnesota, northeastern Minnesota. Like that guy was saying about our winters being warmer now and not so many frigid cold days, 40 degrees below weather. And, four seasons, well, you know that's different too, it seems like every year it seems to be a little different.

Virginia Participant

However, past weather was also a common theme among those who were skeptical of climate change. Many of these comments highlighted the cyclical nature of the area's weather patterns.

I remember years ago when the snow was all gone in February. Years ago, I remember when February was forty below. I still say it cycles.

Virginia Participant

Oh it's just a cycle, I think it's just a normal cycle. I agree with what [Participant] just said. I don't think what we are doing makes a hill of beans difference in the weather. And I, I think we just had a real winter, it was cold. My heat bill looked pretty big, I think it was cold. But in general I think it's warmed up. I think back to when I was in high school and stuff and it was routinely 30, 40, 50 below. And you didn't think much about it, that's what it was. And we don't see that anymore. So something's changed, but I don't think we're causing it. I don't believe that.

Virginia Participant

The previous comment highlighted another interesting result from the focus groups. Very few participants believed that there was no change in the climate change



occurring. Rather they disagreed whether the change in climate was anthropogenic or part of a natural cycle.

Another common reason that participants cited was ecological evidence, specifically the change in animal and wildlife habitat. This reason was mostly cited in support of climate change existing.

...in two of the different discussion, focus groups I went to on the moose, they wouldn't say specifically, there was no one smoking gun why the moose was gone. But in every case there are more parasites, more ticks, they talked about wolves too, but they couldn't nail it down to wolves. There were parasites that weren't here before. It seemed to come down to the fact that the climate is changing. It is warmer in this area.

Grand Marais Participant

Well I, we saw a raccoon family come to our birdfeeder one evening. It was a big raccoon and six or seven small ones behind her. We mentioned this to our neighbor who is a retired DNR person and who has since retired and moved away. But he said ...they would come up here but it is too cold to breed up here. The fact that we saw a mother raccoon and her litter means that they are breeding up here because it is warmer. That's due to climate change.

Ely Participant

Most of the comments regarding the existence of climate change were based on non-social and non-cultural reasons. Out of the comments that were based on social reasons, the role that the media plays was mentioned often. Throughout the focus groups, participants mentioned that opinions about climate change often depended on the news source, and that the news was quite polarized on the topic of climate change. As a participant from Duluth said, an individual's belief in climate change "depends on what news organization you are listening to". Many participants were distrustful of media in general such as a participant from Ely:

I think the world through communication has gotten so much smaller. There would be a gigantic earthquake or a fire someplace. And I remember as a kid you would read about it three weeks later in a

newspaper somewhere. And now you know instantly. There are more people in remote places where this stuff is happening where no people were before. So this stuff is going, there is going to be instant news about anything. I think we have to be careful of our news media because sometimes they like to dramatize on, they like to feed on. How can there be a constant news channel. How much news can there be?

Ely Participant

### *Why climate change is upsetting*

There were 48 comments regarding why climate change may be upsetting to some people. Twenty of these comments discussed why climate change is upsetting because it is occurring. Five comments were about why the topic of climate change is upsetting because the participant did not believe in it. Six comments discussed why climate change was upsetting because of the uncertainty of climate change. Finally, 17 comments discussed why climate change is upsetting, but were neutral on whether it existed or not.

Skeptics of anthropogenic climate change found climate change to be upsetting for economic, political and media reasons. Some individuals were upset at the amount of money being spent on climate change research. As a participant from Virginia stated, “I think there is a lot of money being wasted on research, just because I think it is a cycle and I don’t believe that it’s induced by whatever we do.” Another participant from Duluth echoed this sentiment by saying, “Maybe the bottom line is how much money is being dropped down that hole that could be spent on better things to benefit this country and mankind you know versus trying to figure out what ‘ifs’?”

A few other individuals were upset by the topic of climate change because they believed that the government was trying to push an agenda. For example, a Virginia participant stated, “I don’t believe there is a climate change. And I think there are people out there...trying to scare us into believing a big change is coming, and I don’t believe it

is going to happen”. Another participant had a similar opinion. He was concerned that the DNR and state government were pushing an agenda that did not include him and others that were skeptical of climate change:

I think the nature of the question that you asked [Moderator] is kind of like leading the witness. And to me it kind of shows the agenda of the DNR or state in general, personally... You know, I mean it was not like we all were really at a consensus that it's bad.

Duluth Participant

Those who believed climate change was occurring found climate change upsetting for a variety of reasons. Some people found climate change to be upsetting for natural and ecological reasons. One Grand Marais participant said, “When I see photographs of the ice cap at the North Pole shrinking I do feel anxious. I don't like to see that.” A Duluth participant said, “The polar bears, the polar bears are diminishing and the seals have nowhere to go and stuff like that. Some of the populations that depend on those things to survive. That can be frustrating.” Similarly, some residents were upset about how climate change may affect their families. As one Grand Marais resident said, “I am fearful of the Global Warming concept because I have this beautiful granddaughter that may never see some of the things that I've experienced here.” People also found climate change to be upsetting because it brought up so many other controversial issues as well, such as the economy and overpopulation (Grand Marais Participant).

Some found the skepticism surrounding climate change to be upsetting. As a participant from Virginia said, “I believe it is happening, and I am afraid of people that don't want to say that it is going to happen.” A Grand Marais participant expressed a similar sentiment:

I think there is one other thing that bothers me and disturbs me very much. And not only has it to do with climate change, but it has to do with the

attitude of people in this country about science. There is a kind of anti-intellectualism that goes along with: who cares about that stuff? And we've done a very poor job of science education.

Grand Marais Participant

People also found the topic of climate change to be upsetting because they did not know what to do about it. One participant commented:

As far as climate change issues I believe that it is coming. Upsetting? Yes. I don't know what there is, what we can do about it other than recycle, watch our emissions, the little things. It would be nice to be able to do more, but I don't know what.

Duluth Participant

A Grand Marais resident summed up this sentiment by saying: "I think if you believe in it, that we are causing it then you have to agree that we have to do something to fix it, and most people don't want change."

Based on the focus group discussions, there seemed to be qualitative evidence for the idea that people's opinions of climate change depends on his or her cultural or environmental worldview. A Grand Marais participant said:

I taught kids for years and the biggest weakness of the American people have is that they decide what they believe first and then with the huge amount of data that is available we pick and choose that which supports the view that we have already taken. And it's true. And I really think that is true. First we decide what side we are on. If I'm a Democrat I look at all the bad things the Republicans do, if I'm a Republican I look at and I ignore this columnist ...and I think we do the same thing with so many issues.

Grand Marais Participant

### *Discussion*

The purpose of the focus groups was to provide insights about how residents thought and talked about climate change, not to project whether or not the general population agreed with the focus group participants. The two questions regarding the

existence of climate change and why the topic is upsetting provided valuable information on how participants thought about climate change.

Overall, most of the comments made in the focus groups seemed to believe that some sort of climate change is occurring. Participants cited ecological and meteorological evidence such as warmer winters, changes in animal distributions, and changes in ice cover as reasons why they believed the climate was warming. However, participants did not necessarily agree on the reasons for these changes. A large portion of comments stated that the change in climate was due to human emissions of greenhouse gases. However, another portion was skeptical of anthropogenic climate change and believed that current changes were part of a larger natural cycle of the climate and that the change was not large enough to worry about. Quite a few comments were unsure whether climate change was anthropogenic or not.

Regardless of their belief in anthropogenic climate change, participants gave similar reasons to support their ideas about its existence or lack thereof. For example, meteorological evidence was used by participants on both sides of the issue. Some cited the recent warm winters as evidence for climate change. However, the snowfall of the 2010 and 2011 winters was also used by the skeptics of climate change as proof that temperatures are not changing dramatically.

There were a few participants who found climate change to be upsetting due to the effects it will have on wildlife (such as the polar bears), however, most reasons given for why climate change was upsetting were social in nature. Based on the discussion in these five focus groups, the comments made by participants tended to use ecological and

meteorological evidence to support their beliefs about climate change, and they tended to use social reasons to explain why the topic of climate change is upsetting.

For those who were skeptical of climate change, the topic was upsetting because participants thought too much money was being spent on climate change research. Some also found the topic to be upsetting because they viewed climate change as an example of the state government and DNR trying to force an “agenda” onto the public.

Those who believed in anthropogenic climate change thought the issue was upsetting for social reasons as well. They were concerned that the media and climate change skeptics were ignoring climate change science and that this would have a negative impact on their region’s community.

People also found climate change to be upsetting because it brought up so many other controversial issues as well, such as the economy and overpopulation. People also found climate change (as well as these other issues) to be distressing as they would require action to prevent. However, many participants expressed that they did not know how they could change their personal lives in order prevent climate change. Therefore, it seemed like the lack of control people felt over climate change is an additional reason why the topic is upsetting.

Some people were concerned about the role that politics played in climate change perceptions. One individual mentioned that he was upset that people “pick and choose that [data] which supports the view that we have already taken.” This sentiment is strikingly similar to the ideas contained in the cultural cognition theories and Douglas and Wildavsky’s cultural theory of preference formation (Gastil et al. 2005, Kahan in press).

To examine whether there is quantitative evidence for cultural and environmental worldviews explaining an individual's climate change perception, the results of these focus groups were used to develop a survey questionnaire (results of which are the focus of Chapter 3). The discussions from the focus groups were used to identify environmental changes that participants were concerned about. These changes were used in the survey to introduce the respondent to the topic of environmental change and to ease him or her into the topic of climate change.

Based on the focus groups, it did not appear that residents were familiar with the term of climate change adaptation. They also seemed to confuse the concepts of "weather" and "climate" (Heeren 2011). For this reason, brief definitions of these terms were included on the survey to prevent respondents from becoming frustrated with a too technical survey.

While respondents did not use the term "climate change adaptation" they did talk about a number of ways that they hoped that the DNR could adapt to climate change. These suggestions were combined with strategies from Date (2010) and consultation with the DNR staff to create 19 specific climate change adaptation strategies. The discussion from the focus groups was used to keep these strategies understandable and relevant to a public audience as well as still providing useful information for the DNR.

### *Conclusion*

Overall, participants cited a variety of reasons why they either believed, or were skeptical of, climate change, and why people may find the topic upsetting. Based on the discussion, participants in the focus group generally cited first hand observations, or meteorological and ecological reasons while discussing the existence of climate change.

When discussing why the topic is upsetting, participants tended to use social and cultural reasons.

Another interesting finding from the focus groups was that most of the comments suggest that the climate was changing. However, some were skeptical that the change was caused by humans. Therefore, it seemed that participants who were skeptical of “climate change” were skeptical that it was anthropogenic climate change. They tended to believe that the climate was changing but due to natural reasons or as part of a cycle.

Again, due to the small size of the focus groups, it is not possible to generalize the above conclusions back to the general population. However, focus group participants based their perception of climate change on information from a variety of sources. The results of the focus groups were used to generate a mail survey questionnaire to provide quantitative data to study the topic of climate change perceptions in northeast Minnesota. The results of this survey provide the basis for the next chapter.



*Tables*

*Table 2.1*

*Coding system used to identify reasons behind comments about climate change and whether it exists and/or is upsetting*

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Reasons	Description
FIRSTHAND	First hand evidence or direct observation of participant
ECOLOGICAL	Natural or wildlife evidence
WEATHER	Weather or meteorological evidence (either present or historical)
MEDIA	Media evidence (information from television, radio, newspapers or magazines)
SOCIAL	Social reasons (any reason that involved the opinions or attitudes of peers, community members or friends/family)
POLITICS	Political reason (reasons that involved politics, political parties, political figures, or the government)
MONEY	Financial reasons (reasons that related to the cost of climate change or climate change science)
UNCERTAIN	Uncertainty (respondent expressed that they were uncertain about climate change or that this uncertainty was a reason why climate change is upsetting)
TECH	Technology (any reason relating to technology or technological improvements)
SCIENCE	Scientific (any reason relating to scientists or scientific information)

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*Table 2.2*  
*Comments regarding the existence of anthropogenic climate change in northeast Minnesota.*

Comments that supported the idea that...	N
... climate change <b>does</b> exist	58
...climate change <b>does not</b> exist	36
...uncertain about whether climate change exists	15
...did not take a stance on the existence of climate change	13
<b>Total</b>	<b>122</b>

*Note.* Comments were in response to the moderator's question, "What do you think of climate change in northeast Minnesota?"

Table 2.3

*Reasons given to support the idea of climate change existing or not existing*

Type of Reason	n	Comments regarding climate change...			
		...existing	...not existing	...unsure that it exists	...no stance
Non-social or non-cultural reasons	100	61	30	6	3
Firsthand observations	12	9	2	1	0
Weather or Physical observations or historical patterns	53	30	20	2	1
Ecological (changes in plant or animals species)	19	15	4	0	0
Scientific (information from scientists or scientific journals)	12	7	2	2	1
Technological reasons	1	0	0	0	1
Uncertainty (respondent was not sure about which reasons to rely on)	3	0	2	1	0
Social or Cultural Reasons	22	3	7	5	7
Social (information from, or expectation of, peers or others in the community)	7	3	2	2	0
Media (information from TV shows, news shows, magazines, talk radio)	7	0	3	1	3
Political reasons	4	0	1	0	3
Economic reasons	4	0	1	2	1
<b>Totals</b>	<b>122</b>	<b>64</b>	<b>37</b>	<b>11</b>	<b>10</b>

*Table 2.4*  
*Comments about why people may find climate change upsetting*

Comments that supported the idea that...	N
... climate change <b>does</b> exist	20
...climate change <b>does not</b> exist	5
...uncertain about whether climate change exists	6
...did not take a stance on the existence of climate change	17
<b>Total</b>	<b>48</b>

Note. Comments were in response to the moderator’s question, “For some people, the topic of climate change is upsetting? Tell us how you feel about the topic and what, if anything, upsets you about the topic of climate change?”

*Table 2.5  
Reasons given to explain why climate change may be upsetting to people.*

Type of Reason	n	Comments regarding climate change...			
		...existing	...not existing	...unsure that it exists	...no stance
Non-social or non-cultural reasons	9	6	0	1	2
Firsthand observations	1	0	0	0	1
Weather or Physical observations or historical patterns	2	2	0	0	0
Ecological (changes in plant or animals species)	2	2	0	0	0
Technological reasons	2	1	0	0	1
Uncertainty (respondent was not sure about which reasons to rely on)	2	1	0	1	0
Social or Cultural Reasons	31	13	5	4	9
Social (information from, or expectation of, peers or others in the community)	11	8	0	0	3
Media (information from TV shows, news shows, magazines, talk radio)	6	1	1	1	3
Political reasons	5	2	2	1	0
Economic reasons	9	2	2	2	3
<b>Totals</b>	<b>40</b>	<b>19</b>	<b>5</b>	<b>5</b>	<b>11</b>

## Chapter 3-Mail Survey Results

### *Introduction*

Adapting to a changing climate poses many challenges to conservationists and natural resource managers. First, there is the fundamental question of how to respond to climate change. Climate change policy can attempt to mitigate, or prevent, the effects of climate change. An alternative to climate change mitigation is adaptation or adjusting “natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC 2007). As climate change is a relatively recent threat, however, there are no clear precedents on how to design policy either to mitigate or adapt to climate change.

Not only does climate change adaptation contain numerous technical difficulties, but it contains numerous social difficulties as well. The American public is divided not only on how to respond to climate change, but whether or not climate change even exists (Nisbet & Myers 2007). Therefore, research into the human dimensions of climate change has the potential to aid natural resource managers and policy makers to craft climate change management policies.

Several frameworks have been proposed to examine how the public forms perceptions of climate change. One set of hypotheses is described by the theory of cultural cognition (Kahan et al. 2007, Gastil et al. 2005). This theory is based on previous social research on risk perception and proposes that the public is divided into different segments based on an individual’s ideology or cultural worldview (Gastil et al. 2005). Individuals will tend to adopt opinions on issues, like climate change, that correspond to the ideas of their peers holding similar cultural views. People will then

accept information that supports or aligns to their worldview and reject information that contradicts their worldview. Kahan et al. (2007) developed a psychometric scale that measured an individual's cultural worldview. They found that cultural worldviews explained an individual's belief in climate change better than other measures, such as political ideology (Kahan et al. 2007).

The theory of cultural cognition is part of a larger body of research that examines how people form ideologies and biases about current issues. Rokeach (1969) and Schwartz et al. (2010) used similar conceptual frameworks to that examine how an individual's value system (analogous to an ideology or worldview) influenced the way he or she perceived current issues. Dietz et al. (2005) examined how such value systems influenced perception of environmental issues. Dunlap et al. (2000) and Dunlap and VanLiere (1978) developed a measurement instrument known as the New Environmental Paradigm (NEP) to measure an individual's environmental worldview. Fulton et al. (1996) and Teel et al. (2005) have developed measurement scales to examine an individual's wildlife value orientations (WVOs), a similar construct that is more specifically focused on human's basic beliefs about use and protection of wildlife.

Other studies have proposed alternative frameworks to explain public perception of climate change. The Risk and Information Seeking and Processing model (RISP model; Griffin et al. 1999) was developed to examine the processes that an individual used in assessing risk. Kahlor (2007) adapted this framework to examine how individuals perceive climate change. The RISP model proposes individuals cope with risk by seeking information about the risk. According to this model, media, or social norms regarding knowledge (or how informed an individual is expected to be by his or

her peers) play a large role in how the individual perceives a risk. An individual's trust of the managing agency may also influence whether he or she perceives an issue as a risk (Griffin et al. 1999).

In practice, individuals likely draw from a variety of sources to form their perception of climate change. My study was guided by a conceptual a framework (Figure 3.1) that suggests how climate change perceptions are formed and what factors may explain an individual's support of climate change adaptation policies.

### *Conceptual framework*

The conceptual framework being assessed (Figure 3.1) is influenced by the cultural cognition model (Kahan et al. 2007) and the Risk Information Seeking and Processing models (Griffin et al. 1999, Kahlor 2007). The purpose of this framework is to help examine which variables are significant in explaining an individual's belief in the existence of climate change and his or her support of potential climate change adaptation strategies.

Previous models have shown that individuals base their perception of risk on various sources of information (Griffin et al. 1999). However, the theory of cultural cognition states that individuals will not assign the same amount of credence to all sources of information. Individuals will assign more weight to information that corresponds to their worldviews, and will tend to reject or ignore information that runs contrary to their cultural worldviews (Kahan 2007). Therefore, the conceptual framework hypothesizes that an individual will base their belief in the existence of climate change on a set of information that corresponds with (or that is "filtered" by) his or her cultural worldviews.



This framework examines three broad variables relating to climate change information. The first is information that is based off of firsthand observations or experience with environmental change. Leiserowitz et al. (2012) examined the role that extreme weather events play in individual's perception of climate change. The results from the NECCPS focus groups (Chapter 2) also indicated that participants were basing their belief in climate change largely on either first hand observations, or from observations of the weather or physical environment.

A second important variable dealing with climate change information is expert information from scientists and managers conveyed through the media. Numerous studies have examined how media influences climate change perceptions (Antilla 2010 and Boykoff & Boykoff 2007). Boykoff and Boykoff (2007) describe media as a "translator" of information. Because scientists and experts are usually quite ineffective in communicating technical information to the public, the media are often viewed as the link between the experts and the general public (Boykoff & Boykoff 2007). By conveying expert information to the public, the media acts as an important information source that may fuel climate change perceptions.

The third variable related to climate change regards the social norms, or social expectations related to climate change. Individuals may pay more attention to climate change information if they feel that their peers expect them to be knowledgeable about the topic. Conversely, individuals may ignore climate change information if they feel that their peers are not interested in the topic. Social norms are a component of RISP models (Griffin et al. 1999, Kahlor 2007). They have also been shown to be important in

other environmental issues (Goldstein, Cialdini & Griskevicius 2008, Nilsson, Borgstede & Biel 2004)

Political and cultural ideologies will also likely influence the way that an individual perceives climate change. Cultural cognition studies have demonstrated that cultural worldviews predict belief in climate change better than demographic factors (Kahan et al. 2007). Other studies have developed measurement items that attempt to measure worldviews, or “ideologies” that are specifically applied to environmental and wildlife issues (Dunlap et al. 2000; Fulton et al. 1996; Steel, List & Shindler 1994, Vaske & Donnelly 1999). The New Ecological Paradigm (NEP) scale (Dunlap et al. 2000, Dunlap & VanLiere 2008) measures “beliefs about humanity’s ability to upset the balance of nature, the existence of limits to growth for human societies, and humanity’s right to rule over the rest of nature” (Dunlap et al. 2000). As the NEP scale describes the individual’s beliefs about humanity’s role in nature, it is a logical hypothesis that this construct mediates an individual’s belief in climate change and what sort of expert information the individual accepts.

Fish and wildlife value orientations (WVO’s) measure a related concept. WVO’s measure a respondent’s basic beliefs about how humans should relate to wildlife (Fulton et al. 1996). WVOs are an extension of the value-attitude-behavior framework (Homer & Kahle 1988, Teel & Manfreda 2010). This framework states that there is a “cognitive hierarchy.” At the base of this hierarchy are an individual’s core values. These values shape the individual’s attitudes and attitudes in turn shape behavior. Value orientations, such as those relating to wildlife issues, describe how ideology influences the cognitive hierarchy and “consist of networks of basic beliefs that organize around values and

provide contextual meaning to those values” (Teel & Manfredi 2010). There are two main components of the WVO scale, domination and mutualism. Individual’s scoring high on the domination scale tend to find it is more acceptable to use and hunt or fish wildlife and fish. Individual’s scoring high on the mutualism scale feel tend to have a less utilitarian view of wildlife (Teel & Manfredi 2010). WVO’s have been used to explain hunter’s concern about bovine tuberculosis (Clark 2009), angler attitudes in Minnesota (Bruskotter 2007), participation in wildlife-related activities (Fulton et al. 1996), and shifting attitudes towards wildlife in the American West (Teel et al. 2005 and Manfredi et al. 2003). However, there has not been research relating the WVO scale with the NEP scale, or much research examining how WVO’s describe other environmental issues that are not directly focused on wildlife, but are related, such as climate change. For this reason, this framework includes both scales for comparison.

Climate change is as much a political issue as an ecological issue. Currently, the topic of climate change is quite politically polarized in America (McCright & Dunlap 2010). Therefore, political ideology may also mediate the relationship between climate change information and belief in climate change.

Belief in climate change is expected to be related to support of climate change, but not necessarily equivalent. Trust and acceptance of agency management is an important factor in support for natural resource policy (Davenport, Leahy, Anderson & Jakes 2007). An individual’s trust and acceptance of government policy, or land management decisions, will likely influence his or her support for policy in addition to whether or not he or she believes in climate change. An individual who does not trust the governing agency will likely have lower support for climate change policy regardless of

his or her belief in climate change. Trust and acceptance of government agencies will be influenced by the individual's ideologies and worldviews.

In summary, my conceptual framework hypothesizes that information related variables, such as observation of environmental change, expert information from the media, and social norms will interact with cultural and environmental ideologies to explain an individual's belief in the existence of climate change. A similar relationship is hypothesized to exist to explain an individual's trust and acceptance of climate change. Finally, the model hypothesizes that belief in climate change and trust and acceptance of natural resource policy will predict support for climate change policy.

I assessed this framework qualitatively using the results from a series of focus groups. In this chapter I use the data collected from a general public survey conducted in northeast Minnesota to examine this topic in more detail and to develop and test a series of models explaining variance in climate change belief and support for adaptation policies (Figures 3.2 and 3.3).

Specific objectives of this study are to:

- Identify what factors contribute to an individual's belief in climate change;
- Determine the extent to which cultural and environmental worldviews explain an individual's belief (or lack thereof) in climate change;
- Identify what factors are important in explaining, or predicting, an individual's support of climate change adaptation policies?

## *Methods*

### *Study Area*

Northeastern Minnesota is facing a number of environmental changes. Climate change is one of primary concern to the region as the area is on the boundary of a number of ecological sections. The study population of the survey was adult residents of Cook, Lake and St. Louis Counties. These three counties are located in northeast Minnesota and make up the region commonly referred to as the “Arrowhead”. The 2010 U.S. census data indicated a total of 173,711 adult residents within the region: Cook County (N = 4,305), Lake County (N = 8,799) and St. Louis County (N = 160,667). St. Louis County contains the city of Duluth which accounts for about 40% of the population in northeast Minnesota, and the University of Minnesota, Duluth. There are slightly more females in the three counties than males. According to information from the U.S. Census Bureau, about 50% of the residents (aged 25 years or older) have some college education and 25% have a bachelor’s degree or higher (US Census 2010).

### *Sample and Data Collection*

The potential respondent population included any adult (18 years of age or older) with a postal address in Cook, Lake, or St. Louis Counties. Respondents did not have to own the property in which they resided nor did they have to be year-round residents of the counties. A list of randomly selected addresses was obtained from the Genesys Marketing Systems Group (MSG) (<http://www.m-s-g.com/web/genesys/index.aspx>). Approval to conduct human subject research was obtained from the University of Minnesota Institutional Review Board (Project Number: 0609E92806).

The survey was implemented following a modified version of the Tailored Design Method developed by Dillman, et al. (2009). Surveys were sent to 1,500 residences in Lake, St. Louis and Cook counties. Three mailings of the survey were used to maximize the response rate. A short non-response questionnaire was sent afterwards to assess potential non-response bias. Data were collected between October 2011 and January 2012.

### *Survey Instrument*

The survey instrument was designed to capture the key concepts in the conceptual framework and was developed based on the results of a series of focus groups conducted in the region and described in Chapter 2. Items were also borrowed from studies discussed in the literature review of Chapter 1 such as Antilla (2010), Lesierowitz (2010), Nisbet & Myers (2007). (The full survey and the shorter, non-response survey can be found in the Appendix B and Appendix C). Table 3.1 describes the variables used in the analysis.

The survey asked people about their knowledge of climate change and from where they got their information about climate change and climate change adaptation. One set of questions were used to measure an individual's observation of environmental change (CHANGE). Ten environmental changes were identified from discussions in the focus groups. The survey asked respondents if they had observed the changes. "Yes" was recorded as "1" and "No" was coded as "0". Responses were averaged over the ten environmental changes.

The importance of expert media to individuals was measured by the variable EXPERT. The survey asked respondents how important information from three sources:

scientists, the DNR, and the federal government were to the individual. Possible responses ranged from “1” (not at all) to “4” (very much). Responses were averaged to give a single measurement for EXPERT.

Social expectations, or social norms, regarding climate knowledge were measured by the variable EXPECT. The survey asked respondents to indicate their agreement on a scale of “1” (strongly disagree) to “5” (strongly agree) with four statements:

- 1) “People whose opinions I value would approve of my staying on top of information about climate change”.
- 2) “It is expected of me that I seek information about climate change.”
- 3) “Seeking information about climate change is likely to give me something to talk about with others.”
- 4) “The people I spend most of my time with are likely to seek information related to climate change.”

Another section of the survey asked respondents about their environmental and cultural values. The NEP scale developed by Dunlap and Van Liere (2000) and the wildlife value orientations (WVOs) scale developed by Fulton et al. (1996) and refined by Teel et al. (2005) were used to measure environmental and wildlife associated values. The WVO’s scale is composed of two components which are described by the variables MUTUALISM and DOMINION.

The NECCPS study was funded by a state agency and we did not have final decision of the survey items. Unfortunately, it was felt by the agency staff that it would be inappropriate to include the cultural cognition scale used by Kahan (in publication) and Kahan, Jenkins-Smith, and Braman (in publication) on a survey instrument funded by a state natural resource agency. However, respondents were asked their political ideology as well as a series of demographic questions. Political ideology was described by the variable IDEOLOGY and respondents had the option of selecting “1” (very liberal), “2” (liberal), “3” (middle of the road), “4” (conservative), and “5” (very

conservative). Since very few individual's selected "1" (very liberal) and "5" (very conservative), the scale was condensed to "1" (liberal), "2" (middle of the road), and "3" (conservative).

The variable BELIEF was used to measure the respondent's belief in the existence of climate change. Respondents were asked, "How sure are you that climate change is happening or is not happening?" Possible responses ranged from "1" (extremely sure climate change is NOT happening) to "7" (extremely sure climate change IS happening). Intermediate responses were "very sure," "somewhat sure" and "not sure" that climate change is, or is not, occurring.

Since the public is likely not familiar with the term "climate change adaptation," the phrase "ways the Minnesota DNR can manage to respond to the potential impacts of climate change" was used instead of climate change adaptation. Questions also asked respondents to rate how trustworthy they thought various government agencies were in regards to climate change management.

A main objective of the study was to examine whether the public would support specific climate change adaptation strategies. To gain this information, the survey presented respondents with a list of 19 potential adaptation strategies that the DNR may consider and asked whether they supported or opposed the strategy. Adaptation strategies were modified from a list of strategies used in the DNR internal report on climate change (Date, 2010) and also from consulting with DNR scientists and managers in the northeast region. Respondents were presented with a short description of each strategy written in non-technical language. They then indicated their support of that policy on a scale of "1" (strongly opposed) to "5" (strongly supported). Principal



component analysis was used to reduce the list of adaptation strategies to a single category. Responses were averaged to generate an overall measure of support for adaptation strategies. This measure was labeled ADAPT.

### *Analysis*

To test the framework described in Figure 1.2, summary statistics, reliability tests and linear regression were used to examine what variables contribute to an individual's belief in climate change and support for climate change adaptation strategies. Linear regression models were the primary method used to test the relationships. Prior to analysis, the variables were mean centered to reduce co-linearity. Factors influencing belief in the existence of climate change were tested by comparing three models. One model examines the relationship between BELIEF with the variables describing climate change information (CHANGE, EXPERT and EXPECT). The second model regresses the cultural and environmental ideologies (IDEOLOGY, WVO and NEP) onto belief in climate change (BELIEF). The third model uses the significant variables from the first two models to create a full model. Figure 3.2 describes this comparison. The statistical comparison follows the methods of Howell (2010). R squared values and AIC coefficients were used to compare these three models. The R squared value is a measure of the proportion of variance that the model explains. In essence, it is the percentage of the variance explained by the model. AIC, or Akaike's Information Criterion, is a statistic commonly used to compare hierarchical models (Howell 2010). A lower AIC value indicates a more descriptive model.

The full model was re-run using standardized variables. This was done to examine the relative importance of the variable on belief while standardizing for

differences in the scale of the variables. Once standardized, a one unit of change in the variable represents a one change of standard deviation. The standardized coefficient is the number of standard deviations the dependent variable changes for each standard deviation change in the independent variable. The “simple” correlation was calculated for each variable as well. This value is the R squared value of the model when all other variables are excluded (in other words, it is the R squared of just the variable of interest). This value measures the proportion, or percent of variance explained by the variable alone. Final, the semi-correlation of the variables was calculated. The semi-correlation of the variables is a measure of the unique variance explained by each variable.

A similar method was used to examine the relationship with the variables and adaptation. The variables BELIEF, TRUST, ACCEPT, IDEOLOGY, NEP and WVO’s were regressed onto the variable ADAPT. This was done to help determine the most significant variables. A series of competing models using the significant variables and the possible interactions were compared to find the most descriptive model with the highest R squared value and lowest AIC coefficient.

The most parsimonious and descriptive model was re-run using standardized variables. This was done to examine the relative importance of the variable on belief while standardizing for differences in the scale of the variables.

## *Results*

### *Response*

Surveys were mailed to 1,383 valid addresses in Cook, Lake and St. Louis counties. A total of 437 completed, identifiable surveys were returned for a response rate of 31.6%. Compared to the study population (Census, 2010), slightly more males than

females responded. Respondents were more highly educated than the study population, and tended to have associate, bachelor or graduate degrees. Respondents tended to describe their political ideology as “middle of the road” and slightly more identified as liberals than conservatives. A non-response check (n=89) revealed that fewer respondents reported being conservative or very conservative and more reported being liberal or very liberal compared to non-respondents (the non-response instrument can be found in Appendix C). More respondents also indicated they were extremely sure that climate change is happening than those who stated that they were skeptical of climate change.

#### *Summary of variables*

Respondents were asked how sure they were that climate change *is* or *is not* occurring. On average (mean = 5.17), respondents were somewhat sure that climate change is occurring (Table 3.2).

For the variable TRUST, the Cronbach’s reliability assessment indicated that the four items proved reliable ( $\alpha = 0.93$ ; Table 3.3) measure of respondent’s trust in the Minnesota DNR. The average (mean=3.2) indicated moderate trust towards the DNR.

The reliability test for ACCEPT indicated the three items were reliable ( $\alpha = 0.92$ , Table 3.4) The average value for ACCEPT (mean=3.30) was slightly higher than TRUST.

The variables related to information also had a high reliability (EXPECT  $\alpha = 0.82$ , Table 3.5; EXPERT  $\alpha = 0.76$ , Table 3.6; CHANGE  $\alpha = 0.84$ , Table 3.7).

The adaptations strategies that best grouped together in the principal component analysis were chosen to represent the variable ADAPT. A reliability test indicated that

these strategies were highly reliable ( $\alpha = 0.94$ , Table 3.8). On average, individuals were fairly supportive of adaptation strategies (mean=4.13).

For ideology, 128 respondents identified as liberal (liberal or very liberal), 177 described their ideology as “the middle of the road” and 89 described themselves as conservative (conservative or very conservative). The average score for IDEOLOGY was just below “middle of the road” (mean= 1.902).

For the variable NEP, the Cronbach’s reliability assessment indicated that the fifteen items provided a reliable ( $\alpha = 0.84$ ; Table 3.9) measure of respondent’s environmental view. The average NEP score was 4.84 (Table 3.2).

WVO’s are measured in two distinct scales. Both scales had a moderate to high reliability score (DOMINION  $\alpha = 0.72$ ; MUTUALISM  $\alpha = 0.86$ ). The average DOMINION score (mean = 4.70) was a bit higher than the score for MUTUALISM (mean = 4.45, Table 3.10).

#### *Relationship to BELIEF and ADAPT*

A main objective of this study is to see how the variables explain belief in the existence of climate change and support for climate change adaptation strategies. For the variable BELIEF, ADAPT had the highest correlation ( $r = 0.49$ ) (Table 3.11). The second highest correlation was a negative relationship between BELIEF and IDEOLOGY ( $r = -0.41$ ). All the variables had a positive correlation with BELIEF except for IDEOLOGY and DOMINION.

When ADAPT was used as a dependent variable (Table 3.12), ACCEPTANCE and NEP had the highest correlations (both  $r = 0.46$ ). Change had the lowest correlation

( $r = 0.20$ ). All variables had a positive correlation, except for IDEOLOGY and MUTUALISM.

*Models for BELIEF and ADAPT*

A series of linear regression models were compared to examine how cultural worldviews (measured by WVO, NEP and IDEOLOGY) explain variance in BELIEF and ADAPT. To examine how cultural worldviews explain variance in belief of climate change a full model (containing all the significant variables of interest) was compared to reduced models that only contained some of the variables of interest. In the cultural model, the variables NEP and IDEOLOGY were statistically significant. In the non-cultural model change and EXPECT were significant. These significant variables were combined in the full model (Table 3.13).

Table 3.14 compares the R squared values for the three models as well as the AIC coefficient. The full model explains 33% of the variance in BELIEF and has an AIC of 1241. The model without the cultural/environmental worldview variables explains 16% of the variance (and has an AIC of 1330) while the model with only the cultural/environmental worldview variables (IDEOLOGY, WVO, NEP) explains 29% (and has an AIC of 1271) of the variance in belief.

The full model was used to compare the variables (Table 3.15). When standardized to the same scale (centered on the mean and each unit representing a change of one standard deviation of the variable) NEP had the highest coefficient (0.47) and the highest semi-partial coefficient (0.074). IDEOLOGY had the second highest standardized coefficient (-0.32) and the second highest semi-partial coefficient (0.037).

Table 3.16 displays the result for the linear model examining support for climate change adaptation using ADAPT as a dependent variable. The coefficients for the variables BELIEF, NEP, MUTUALISM and ACCEPT are significant for predictors for ADAPT.

The significant variables from the full model describing ADAPT were used to create a “final” model. To find the most parsimonious descriptive model, the significant variables were combined in a variety of ways based on the conceptual framework resulting in a series of models. The R squared values and AIC values were used to compare the models to select the most parsimonious and descriptive one (Table 3.17).

The best model was determined to be one containing the variables BELIEF, ACCEPT, MUTUALISM, NEP and an interaction between ACCEPT and the other three variables (Table 3.18).

The full model (the most descriptive in Table 3.18) was used to compare the variables (Table 3.19). When standardized to the same scale (centered on the mean and each unit representing a change of one standard deviation of the variable) ACCEPT had the highest coefficient (0.36). NEP had the highest semi-partial coefficient (0.0297).

The variable ACCEPT was found to have the highest standardized coefficient and the highest semi-partial correlation. As ACCEPT measures general support for DNR policies, it might not be the best predictor for measuring the variable ADAPT, as ADAPT could be described as an individual’s acceptance of a specific set of policies. Therefore, a model was run without using ACCEPT as a variable. When this was done, the most parsimonious model included the variables TRUST, NEP, BELIEF, MUTUALISM and

interactions involving TRUST. TRUST had the highest standardized coefficient as well as the highest semi-partial correlation.

As the non-response survey indicated a potential bias in political ideology and belief in climate change. To attempt to compensate for any potential bias, the full data set was divided to examine support for climate change adaptation strategies among various groups independently. One model describing ADAPT was found using only data from those who responded that they were at least “somewhat sure” climate change was occurring. A second model was found using data from only respondents who identified themselves as “liberal.” Two more models were also developed using data from respondents who identified as “middle of the road” and data from respondents who identified as “conservative.” Finally, one model was found using data from respondents who identified as “middle of the road” and at least “somewhat sure” climate change is occurring. Table 3.21 displays the summary of the 5 different models. In each of the models, TRUST had the highest standardized coefficient and semi-partial correlation.

### *Discussion*

The two broad objectives of this study were: (1) to measure belief in climate change and (2) support for climate change adaptation strategies among residents of northeast Minnesota. In general, respondents to the survey tended to believe in climate change and supported climate change adaptations strategies. About 70% of the respondents were at least somewhat sure that climate change is happening. Nearly 13% were somewhat sure that climate change was not occurring and the remainder was uncertain whether it existed or not. The average score for the variable measuring an individual’s belief in climate change (BELIEF) was 5.2 which corresponds to being

“somewhat” sure climate change is occurring. Leiserowitz et al. (2010) found that 63% of the population believed that climate change is occurring while 19% believed it is not happening. Nisbet and Myers (2007) compiled several polls that examined climate change beliefs in the national population throughout the years of 1997 to 2007. In these polls, belief in climate change ranged from 56% to 85%.

Support for adaptation strategies was also quite high. The average response for the adaptation strategies was just above “somewhat support” (mean = 4.13 with a confidence interval of 4.04 and 4.22). The lowest ranking strategy was “funding research to see if climate change might be impacting natural resources.” However, even this strategy had an average response of 3.9.

In addition to descriptive information on belief of climate change and the support of climate change adaptation strategies, the linear regression models showed which variables were the most effective in predicting belief in climate change and support of adaptation policies. For belief in climate change, the “full” model, containing all the significant variables, was the best fitting model (Table 3.13). This model contained two of the “cultural” variables (NEP and IDEOLOGY) and two of the “non-cultural” variables (CHANGE and EXPECT). The full model explained 33% of the variance in BELIEF compared to the cultural model (29%) and the non-cultural model (16%) (Table 3.14). However, the cultural model explained more variance than the non-cultural one. Based on this comparison, the cultural and environmental worldview measures, described by the variables NEP and IDEOLOGY, were important predictors of an individual’s belief in climate change. When the full model is standardized to compare the effect size of the variables, NEP and IDEOLOGY the greatest effect sizes and semi-partial



correlations. By itself, NEP explains 7.4% of the variance in BELIEF and IDEOLOGY explains 3.7% (compared to 2.1% and 2.6% for CHANGE and EXPECT respectively). Based on this model, it appears that an individual's NEP score and his or her political ideology is a better predictor of his or her belief in climate change than the individual's observation of environmental change and the social norms regarding climate change information.

When examining support for climate change adaptation strategies, belief in climate change, NEP score, the mutualism score of the WVO scale and acceptance of DNR policy are the significant explanatory variables (Table 3.16). There was a significant interaction between acceptance of general DNR policy and the other explanatory variables. Acceptance of general DNR policy seems to have the largest effect on support for adaptation strategies as it has the highest standardized coefficient and semi-partial correlation.

However, the importance of the variable ACCEPT may be due to the way ACCEPT was measured. The items measuring ACCEPT (Table 3.4) were borrowed from surveys examining support for angling and hunting policies. Such items may not be very applicable to climate change adaptation strategies. Individual anglers and hunters can make choices about whether or not they will follow the rules set by the DNR (even if such behaviors are illegal). However, this is not the case for the adaptation strategies that describe the variable ADAPT (listed in Table 3.8). These policies will be implemented at a regional level, not at an individual level. Also, to measure ADAPT, we asked respondents whether they would support or oppose policies. This is very similar to the items measuring ACCEPT. It might be argued that it is not appropriate to include the

variable ACCEPT as a predictor for ADAPT. This is because ACCEPT measures support for DNR management actions in general, and ADAPT measures support for a subset of DNR management actions regarding climate change.

Due to these concerns about the variable ACCEPT, an additional model was created excluding the variable ACCEPT (3.20). When this was done, a very similar model in which the variable TRUST essentially replaced ACCEPT was found to be the most descriptive. Trust in the DNR and an individual's NEP score were found to be the most important predictors for climate change adaptation strategies.

The results of this survey are important for several reasons. First of all, it appears that many residents believe in climate change and would be supportive of climate change adaptation strategies. A total of 437 completed, identifiable surveys were returned for a response rate of 31.6%. This response rate is comparable to similar studies. A non-response survey sent to 89 households indicated that respondents to the full NECCPS survey may be over representative of liberals and those who believe climate change is occurring. As with any such survey, these biases should be kept in mind and caution should be taken when generalizing the results of the survey. A series of models were developed that attempted to examine support for climate change adaptation strategies independent of potential biases (Table 3.21). When a model was run using only data of respondents who believed in climate change (isolating the potential bias for BELIEF) the variable TRUST was still found to be the significant variable that explained the most variance in belief. The same was true for the models that isolated respondents based on political ideology. In each case TRUST had the highest semi-partial correlation indicating it explained the most amount of unique variance. Therefore, even if there are

potential biases for belief in climate change and ideology, it seems reasonable to suppose that the main conclusions from the analysis are valid. Nonetheless, the results of the survey can provide a baseline understanding of public perceptions concerning climate change and climate change adaptation in northeast Minnesota.

In terms of public perception, it seems that climate change adaptation is a viable course of management for the DNR to pursue. It is also interesting to note that political ideology was a significant factor in explaining belief in climate change, but not for support of climate change adaptation policy. Based on these results, an individual's environmental views are more important in explaining his or her belief in climate change than the individual's political ideology. Since environmental consciousness as well as trust and acceptance of DNR policy are the most important variables in explaining support for adaptation strategies, the DNR may consider focusing on these aspects when communicating to the public about climate change. For example, if the DNR is interested in building support for climate change adaptation strategies, it may be more productive to focus on increasing the public's trust in the agency than trying to convince skeptics that climate change is occurring.

### *Conclusion*

Overall, residents of northeast Minnesota seemed to believe in the existence of climate change and were generally supportive of climate change adaptation strategies. Environmental values and political ideology were important components explaining belief in climate change as well as an individual's observation of environmental change and social norms regarding climate change information. Environmental values, belief in

climate change and trust and acceptance of DNR policy were important predictors of support for climate change adaptation strategies. The results of the NECCPS project can be used to help the Minnesota DNR frame and communicate about climate change as well as help the agency pursue climate change adaptation strategies.

*Tables and Figures*

*Table 3.1  
Description of Variables used*

Variable name	Description	Scale	Measurement notes
BELIEF	Belief in climate change	1-7	extremely sure climate change is NOT happening-extremely sure climate change IS happening
ADAPT	Support for adaptation strategies	1-5	strongly opposed to strongly support; averaged over 3 different of strategies
TRUST	Trust of Minnesota DNR	1-5	1-5 Not at all-Very much; averaged over 4 items
ACCEPT	Extent that an individual will accept a policy from the Minnesota DNR	1-5	Not at all-Very much; averaged over 3 items
EXPECT	Social expectations of staying informed about climate change	1-5	Strongly disagree-Strongly agree; averaged over 4 items
EXPERT	Dependence on media sources, such as national news, scientists and the internet for climate change information	1-4	Not at all-Very much; averaged over 3 different information source items
CHANGE	Observations of environmental change in the region	0-1	Have not observed the change-have observed the change; averaged over 10 items
IDEOLOGY	Political ideology	1-3	Liberal-Middle of the Road-Conservative
WVO	Wildlife value orientation	1-7	Strongly disagree-Strongly agree on two scales; Domination and Mutualism
NEP	New Environmental Paradigm (NEP) Score	1-7	Strongly disagree-Strongly agree; averaged over 15 items

*Table 3.2*  
*Summary Statistics of Variables to be tested*

Variable name	Mean	SD	95% CI
BELIEF	5.19	1.50	[5.04, 5.34]
ADAPT	4.13	0.87	[4.04, 4.22]
TRUST	3.32	1.12	[3.21, 3.43]
ACCEPT	3.32	1.11	[3.21, 3.44]
EXPECT	3.32	0.74	[3.24, 3.39]
EXPERT	2.11	0.83	[2.03, 2.19]
CHANGE	0.55	0.26	[0.53, 0.58]
IDEOLOGY	1.90	0.74	[1.83, 1.98]
NEP	4.84	0.94	[4.75, 4.94]
WVO-DOMINION	4.70	1.04	[4.60, 4.81]
WVIO-MUTUALISM	4.45	1.26	[4.32, 4.57]

*Table 3.3*  
*Summary of Items used to calculate the variable TRUST*

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.93
To what extent do you think Minnesota DNR decision-making procedures are fair?	406	2.99	0.89	0.93	
To what extent do you think the Minnesota DNR handles decisions fairly?	408	3.05	0.87	0.92	
To what extent do you trust Minnesota DNR?	420	3.24	1.06	0.90	
To what extent do you consider Minnesota DNR to be trustworthy?	421	3.29	1.04	0.90	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked: "Please respond to the following statements concerning the Minnesota DNR and decision-making."

Response options ranged from "1" (Not at all) to "5" (Very much). The average of the individual's response to the 4 items was averaged to calculate a score for the variable TRUST.

*Table 3.4*  
*Summary of Items used to calculate the variable ACCEPT*

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.92
To what extent do you accept the advice of Minnesota DNR on most management issues?	417	3.26	0.94	0.93	
To what extent are you willing to accept the advice of Minnesota DNR on climate change management decisions?	420	3.12	0.96	0.84	
To what extent do you intend to respect the advice of Minnesota DNR on future climate change management decisions?	420	3.19	0.99	0.88	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked: "Please respond to the following statements concerning the Minnesota DNR and decision-making".

Response options ranged from "1" (Not at all) to "5" (Very much). The average of the individual's response to the 3 items was averaged to calculate a score for the variable ACCEPT.



*Table 3.5*  
*Summary of Items used to calculate the variable EXPECT*

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.82
People whose opinions I value would approve of my staying on top of information about climate change	437	4.11	1.63	0.79	
It is expected of me that I seek information about climate change	436	3.37	1.74	0.74	
Seeking information about climate change is likely to give me something to talk about with others	437	3.8	1.55	0.76	
The people I spend most of my time with are likely to seek information related to climate change	437	3.32	1.62	0.81	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked: "We would like to find out some of your beliefs about the availability of information focused on how management agencies like the Minnesota DNR can respond to the potential impacts of climate change. Please indicate the level to which you disagree or agree".

Response options ranged from "1" (Strongly Disagree) to "5" (Strongly Agree) The average of the individual's response to the 4 items was averaged to calculate a score for the variable EXPECT.

*Table 3.6*  
*Summary of Items used to calculate the variable EXPERT*

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.76
Reports and publications from scientists	408	2.36	1.1	0.86	
Federal management agencies	411	1.98	0.95	0.51	
Minnesota DNR	406	2.03	0.99	0.65	

Note. Cronbach's alpha ( $\alpha$ ) = 0.76.

Respondents were asked: "From what sources do you get information about climate change?"

Response options ranged from "1" (Not at all) to "4" (Very much). The average of the individual's response to the 6 items was averaged to calculate a score for the variable EXPERT

*Table 3.7*  
*Summary of items used to calculate the variable CHANGE*

Change	Mean	SD	$\alpha$ if item deleted	$\alpha$
				0.84
Changes in types of tree species in forest	0.56	0.50	0.83	
Changes in health of trees in forests	0.65	0.48	0.82	
Increases in exotic, invasive species	0.83	0.38	0.83	
Declines in native wildlife species	0.48	0.50	0.82	
Changes in fish populations	0.57	0.50	0.83	
Changes in plant species	0.37	0.48	0.82	
Losses of habitat for fish and wildlife	0.62	0.49	0.81	
Losses of large and continuous habitat areas due to land use changes that break these habitat areas into smaller pieces	0.64	0.48	0.81	
Increases in urban-type development	0.66	0.47	0.82	
Decreases in water quality	0.50	0.50	0.82	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked "To what extent do you think the following changes are occurring?"

Responses options were either "1" (yes) or "0" (no). Responses were averaged over the 10 changes to measure the variable CHANGE.

Table 3.8  
Summary of items used to calculate the variable ADAPT

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.94
Increase assistance to private landowners for conservation in order to help manage the impacts of climate change.	411	3.90	1.07	0.94	
Intensify invasive species prevention and control to help offset the impacts of climate change.	410	4.27	0.96	0.94	
Provide greater protection for cold-water lakes and streams that provide refuge from climate change to some fish populations like trout and cisco.	406	4.14	0.99	0.94	
Protect or restore areas that would help species adapt to any changes related to climate to provide potential suitable habitat.	409	4.09	0.98	0.94	
Prevent overexploitation of species so that populations are not additionally stressed by climate change impacts.	410	4.14	0.97	0.94	
Protect or restore native habitats and water ways in order to help manage the impacts of climate change.	414	4.18	0.95	0.94	
Protect or restore potential refuge areas so species can resist the impacts of climate change.	411	4.13	0.96	0.94	
Expand monitoring of natural resources to see if changes are occurring that might be related to climate change.	416	4.13	1.05	0.94	
Funding research to see if climate change might be impacting natural resources.	418	3.87	1.21	0.94	
Implementing education programs to make people aware of the potential impacts of climate change.	418	4.08	1.09	0.94	
Taking specific management actions to try to help forests, lakes and fish and wildlife species adapt to any potential changes from climate change.	412	4.11	1.03	0.94	
Increase the use of forest management approaches that favor more tree species diversity and age-classes so that forests can absorb the effects of climate change	404	4.17	0.96	0.94	
Increase the genetic diversity of the seeds we use to replant forests to help forests adapt to climate change.	402	4.03	1.07	0.94	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked: "To what extent do you support or oppose the DNR taking the following actions in response to potential impacts from climate change?"

Responses were coded: "1" (strongly oppose), "2" (slightly oppose), "3" (neither), "4" (slightly support), "5" (strongly support). Responses were averaged over the strategies to generate a value for the variable ADAPT

Table 3.9  
Summary of Items used to calculate the variable NEP

Item	N	Mean	SD	$\alpha$ if item deleted	$\alpha$
					0.84
Human have the right to modify the natural environment to suit their needs <sup>a</sup>	433	3.31	1.73	0.84	
When humans interfere with nature it often produces disastrous consequences	432	5.04	1.64	0.83	
Human ingenuity will ensure that we do not make the earth unlivable <sup>a</sup>	429	3.73	1.67	0.84	
Humans are severely abusing the environment	431	5.00	1.77	0.83	
The earth has plenty of natural resources if we just learn how to develop them <sup>a</sup>	430	4.39	1.81	0.84	
Plants and animals have as much right as humans to exist	429	5.32	1.65	0.84	
The balance of nature is strong enough to cope with the impacts of modern industrial nations <sup>a</sup>	430	2.91	1.61	0.83	
Despite our special abilities humans are still subject to the laws of nature	431	5.87	1.17	0.84	
The so-called ecological crisis facing humankind has been greatly exaggerated <sup>a</sup>	427	3.42	1.87	0.82	
The earth is like a spaceship with very limited room and resources	430	4.81	1.74	0.83	
Humans were meant to rule over the rest of nature <sup>a</sup>	430	3.16	1.91	0.83	
The balance of nature is very delicate and easily upset	430	5.17	1.57	0.83	
Humans will eventually learn enough about how nature works to be able to control it <sup>a</sup>	430	3.12	1.58	0.84	
If things continue on their present course, we will soon experience a major ecological catastrophe	430	4.70	1.66	0.82	
We are approaching the limit of the number of people the earth can support	427	4.76	1.73	0.83	

Note. Cronbach's alpha = ( $\alpha$ )

Respondents were asked "In recent years some people have expressed concern about wildlife and environmental issues, but not everyone agrees. We are interested in knowing what you believe about people, wildlife, and the environment."

Response options ranged from "1" (Strongly Disagree) to "7" (Strongly Agree)

<sup>a</sup> Item was reverse coded prior to analysis

Table 3.10  
 Summary of Items used to calculate WVOs (MUTUALISM and DOMINION Variables)

Item	N	Mean	SD	$\alpha$	$\alpha$ if item deleted
Dominion				0.72	
Humans should manage fish and wildlife populations so that humans benefit	426	3.56	1.53		0.68
The needs of humans should take priority over fish and wildlife protection	429	3.54	1.63		0.73
Fish and wildlife are on earth primarily for people to use	427	3.60	1.74		0.70
We should strive for a world where there's an abundance of wildlife for hunting and fishing	426	2.73	1.34		0.71
Hunting does not respect the lives of animals <sup>a</sup>	431	2.73	1.71		0.65
Hunting is cruel and inhumane to the animals <sup>a</sup>	429	2.49	1.72		0.64
People who want to hunt should be provided the opportunity to do so	426	5.69	1.31		0.66
Mutualism				0.86	
We should strive for a world where humans and wildlife can live side by side	426	5.27	1.34		0.85
I view all living things as part of a big family	429	5.10	1.55		0.83
Animals should have rights similar to the rights of humans	426	3.88	1.81		0.85
Wildlife are like my family and I want to protect them	425	4.20	1.63		0.82
I care about animals as much as I do other people	427	4.00	1.77		0.83
I feel a strong emotional bond with animals	431	4.58	1.70		0.83
I value the sense of companionship I receive from animals	424	5.12	1.51		0.84

Note. Respondents were asked "In recent years some people have expressed concern about wildlife and environmental issues, but not everyone agrees. We are interested in knowing what you believe about people, wildlife, and the environment."

Response options ranged from "1" (Strongly Disagree) to "7" (Strongly Agree)

<sup>a</sup> Item was reverse coded prior to analysis

*Table 3.11*  
*Correlation of variables with BELIEF*

Variable name	Correlation with BELIEF	P-value
ADAPT	0.49	<0.001*
TRUST	0.08	0.099
ACCEPTANCE	0.19	<0.001*
EXPECT	0.36	<0.001*
EXPERT	0.19	<0.001*
CHANGE	0.31	<0.001*
IDEOLOGY	-0.41	<0.001*
WVO- DOMINIAN	-0.28	<0.001*
WVO- MUTUALISM	0.29	<0.001*
NEP	0.51	<0.001*

Note. N=384

\*p value significant at  $\alpha=0.05$

*Table 3.12*  
*Correlation of variables with ADAPT*

Variable name	Correlation with ADAPT	P-value
BELIEF	0.41	<0.001*
TRUST	0.41	<0.001*
ACCEPTANCE	0.46	<0.001*
EXPECT	0.31	<0.001*
EXPERT	0.21	<0.001*
CHANGE	0.20	<0.001*
IDEOLOGY	-0.27	<0.001*
WVO-DOMINION	-0.25	<0.001*
WVO-MUTUALISM	0.38	<0.001*
NEP	0.46	<0.001*

Note. N=384

\*p value significant at  $\alpha=0.05$



*Table 3.13*  
*Linear Models examining BELIEF in climate change*

Model	Variable	Estimate	T-value	P-value
Cultural Model <sup>a</sup>				
	NEP	0.58	6.77	p<0.001*
	WVO-DOM	-0.06	-0.82	0.415
	WVO-MUT	0.07	1.19	0.236
	IDEOLOGY	-0.48	-4.96	p<0.001*
Non-cultural Model <sup>b</sup>				
	CHANGE	1.35	4.96	p<0.001*
	EXPECT	0.62	5.92	p<0.001*
	EXPERT	0.01	0.09	0.929
Full Model <sup>c</sup>				
	NEP	0.51	6.61	p<0.001*
	IDEOLOGY	-0.44	-4.68	p<0.001*
	CHANGE	0.88	3.53	p<0.001*
	EXPECT	0.35	3.92	p<0.001*

Note. All variables were mean centered to reduce co-linearity.

N=384

<sup>a</sup> BELIEF=WVO+NEP+IDEOLOGY

<sup>b</sup> BELIEF=EXPERT+CHANGE+EXPECT

<sup>c</sup> BELIEF= NEP+CHANGE+EXPECT+IDEOLOGY

\*P-value significant at  $\alpha=0.05$  level

*Table 3.14*  
*Comparison of models describing belief*

Model	R Squared	df	AIC
Cultural Model <sup>a</sup>	0.29	6	1270.53
Non-cultural Model <sup>b</sup>	0.16	5	1330.44
Full Model <sup>c</sup>	0.33	6	1240.71

Note. All variables were mean centered to reduce co-linearity.

N=384

<sup>a</sup> BELIEF=WVO+NEP+IDEOLOGY

<sup>b</sup> BELIEF=MEDIA+CHANGE+EXPECT

<sup>c</sup> BELIEF= NEP +CHANGE+EXPECT+IDEOLOGY

*Table 3.15*  
*Comparison of variables in the linear model examining*  
*BELIEF in climate change*

Variable	Standardized Coefficient <sup>a</sup>	Simple Correlation	Semi-Partial Correlation
NEP	0.47*	0.26*	0.074*
IDEOLOGY	-0.32*	0.17*	0.037*
CHANGE	0.23*	0.10*	0.021*
EXPECT	0.26*	0.13*	0.026*

Note. N=384

<sup>a</sup>variables were standardized

Model: BELIEF= NEP +CHANGE+EXPECT+IDEOLOGY

\*P-value significant at  $\alpha=0.05$  level

*Table 3.16*  
*Linear model describing support for adaptation strategies*

Variable	Estimate	t-value	p-value
BELIEF	0.11	3.85	p<0.001*
NEP	0.22	4.45	p<0.001*
DOMINION	-0.01	-0.29	0.776
MUTUALISM	0.10	3.01	0.003*
IDEOLOGY	-0.01	-0.16	0.872
TRUST	0.11	1.84	0.066
ACCEPT	0.19	3.24	p<0.001*

Note. N=384

Model:

ADAPT=BELIEF+NEP+DOMINION+MUTUAL+IDEO+TRUST+ACCEPT

Variables were mean centered first to reduce co-linearity.

\* significant at  $\alpha = 0.05$  level

*Table 3.17*  
*Comparison of models describing ADAPT*

	Model Description	R <sup>2</sup>	Df	AIC	ΔAIC*
1	ADAPT=BELIEF+ACCEPT+MUTUALISM+NEP + all interactions involving ACCEPT	0.45	10	774.07	0
2	ADAPT=BELIEF+ACCEPT+MUTUALISM+NEP + all possible interactions	0.47	17	776.48	2
3	ADAPT=BELIEF+ACCEPT+MUTUALISM+NEP+BELIEF:ACCEPT+MUTUALISM:ACCEPT+MUTUALISM:NEP+BELIEF:ACCEPT:MUTUALISM	0.45	10	777.70	4
4	ADAPT=ACCEPT+MUTUALISM+NEP + all possible interactions	0.42	9	795.26	21
5	ADAPT=ACCEPT+NEP+ACCEPT:NEP	0.37	5	814.23	40
6	ADAPT=BELIEF+ACCEPT+MUTUALISM+NEP + all possible interactions	0.37	9	823.83	50
7	ADAPT=BELIEF+ACCEPT+BELIEF:ACCEPT	0.32	5	845.39	71
8	ADAPT=ACCEPT+MUTUALISM+ACCEPT:MUTUALISM	0.30	5	856.58	83
9	ADAPT=BELIEF+MUTUALISM+NEP + all possible interactions	0.30	9	867.40	93
10	ADAPT=MUTUALISM+NEP+MUTUALISM:NEP	0.26	5	878.74	105
11	ADAPT=BELIEF+NEP+BELIEF:NEP	0.26	5	879.95	106
12	ADAPT=BELIEF+MUTUALISM+BELIEF:ACCEPT	0.24	5	887.25	113

Note. The significant variables from the model in Table 3.15 were used to find the most descriptive model

Variables were mean centered to reduce co-linearity.

\* ΔAIC refers to change in AIC as compared to Model 1, the model with the lowest AIC.

*Table 3.18*  
*Most parsimonious model explaining ADAPT*

Variable	Estimate	T value	P value
BELIEF	0.10	3.74	<0.001*
ACCEPT	0.32	9.44	<0.001*
MUTUALISM	0.10	3.17	0.001666*
NEP	0.23	4.88	<0.001*
ACCEPT:NEP	-0.10	-2.21	0.027781*
ACCEPT:MUTUALISM	0.09	3.12	0.001924*
ACCEPT:NEP:MUTUALISM	-0.08	-3.72	<0.001*
ACCEPT:BELIEF:NEP:MUTUALISM	-0.03	-3.17	0.001654*

Note. N=384

Model 1 from Table 3.16

Variables were mean centered first to reduce co-linearity.

\* significant at  $\alpha = 0.05$  level

Table 3.19

Standardized model showing the most descriptive model explaining ADAPT

Variable	Standardized Coefficient <sup>a</sup>	Simple Correlation <sup>b</sup>	Semi-Partial Correlation <sub>b</sub>
ACCEPT	0.36*	0.22*	0.12*
NEP	0.21*	0.22*	0.04*
BELIEF	0.15*	0.17*	0.02*
MUTUALISM	0.12*	0.14*	0.02*
ACCEPT:MUTUALISM	0.13*	-	-
ACCEPT:NEP	-0.10*	-	-
ACCEPT:NEP:MUTUALISM	-0.10*	-	-
ACCEPT:BELIEF:NEP:MUTUALISM	-0.05*	-	-

Note. N=384

<sup>a</sup>Variables were all standardized prior to analysis

<sup>b</sup>interactions not included in the correlation analysis

\* significant at  $\alpha = 0.05$  level

*Table 3.20*  
*Standardized model showing the most descriptive model explaining*  
*ADAPT without the variable ACCEPT*

Variable	Standardized Coefficient <sup>a</sup>	Simple Correlation <sup>b</sup>	Semi-Partial Correlation <sup>b</sup>
TRUST	0.34*	0.17*	0.15*
NEP	0.23*	0.22*	0.08*
BELIEF	0.19*	0.17*	0.08*
MUTUALSIM	0.12*	0.14*	0.06*
TRUST:MUTUALISM	0.13*	-	-
TRUST:BELIEF:NEP	-0.15*	-	-
TRUST:BELIEF:NEP:MUTUALISM	-0.11*	-	-

Note. N=384

<sup>a</sup>Variables were all standardized prior to analysis

<sup>b</sup>interactions not included in the correlation analysis

\* significant at  $\alpha = 0.05$  level



Table 3.21

Standardized models explaining ADAPT compensating for potential biases in BELIEF and IDEOLOGY.

Variable	Coefficient t	Standardized Coefficient	Semi-partial Correlation
Respondents believing in climate change (N=274)			
TRUST	0.30	0.34	0.17
NEP	0.28	0.24	0.05
MUTUALISM	0.11	0.14	0.04
MUT:TRUST:NEP	-0.08	-0.10	
Respondents identifying as "Liberal" (N=125)			
TRUST	0.33	0.36	0.22
NEP	0.22	0.19	0.06
DOMINION	-0.14	.07*	0.05
TRUST:NEP	-0.25	-0.24	
Respondents identifying as "Middle of the Road" (N=171)			
NEP	0.21	0.17	0.03
TRUST	0.17	0.19	0.04
BELIEF	0.15	0.21	0.04
MUTUALISM	0.12	0.15	0.02
BELIEF:TRUST	0.10	0.16	
Respondents identifying as "Conservative" (N=88)			
TRUST	0.46	0.49	0.27
NEP	0.31	0.33	0.10
BELIEF	0.15	0.24	0.06
Respondents identifying as "Middle of the Road" and believing in climate change (N=114)			
NEP	0.25	0.19	0.05
TRUST	0.22	0.25	0.09
MUTUALISM	0.14	0.16	0.05
MUT:TRUST	0.12	0.16	

Note: The interaction term was not included for the semi-partial correlations.

\*The standardized coefficient for the DOMINATION variable was not significant at  $\alpha = 0.05$  level.

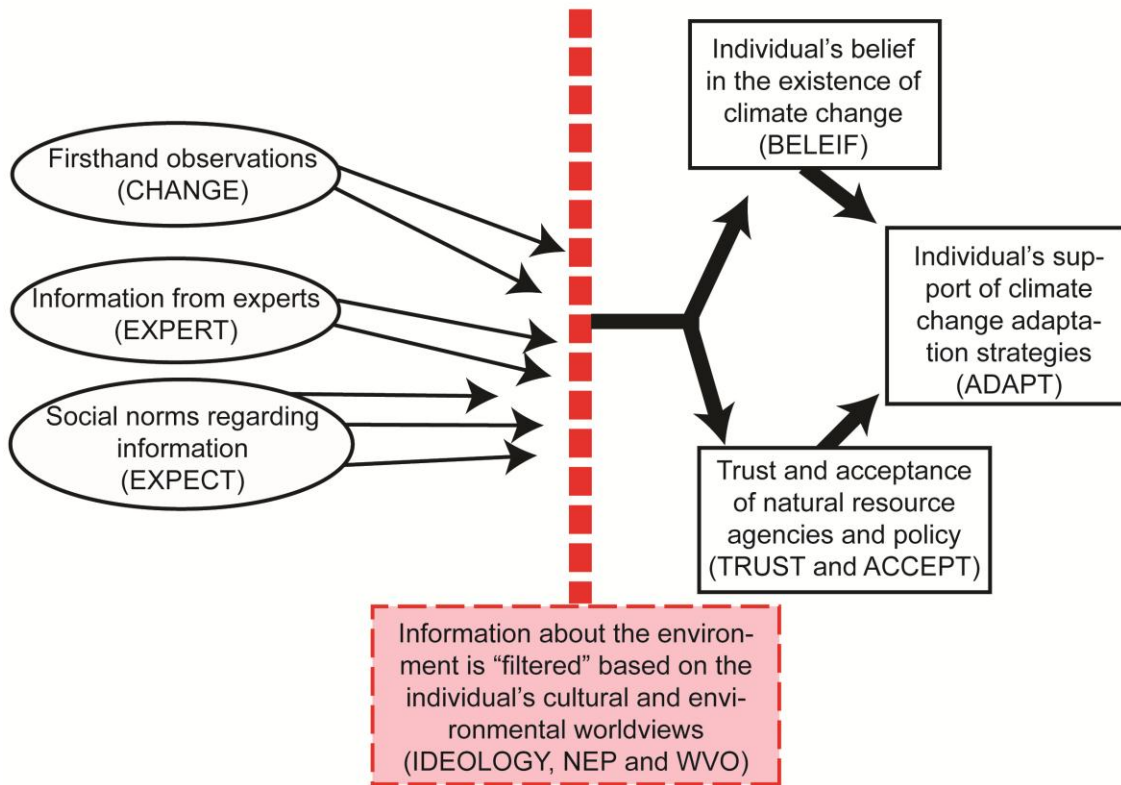
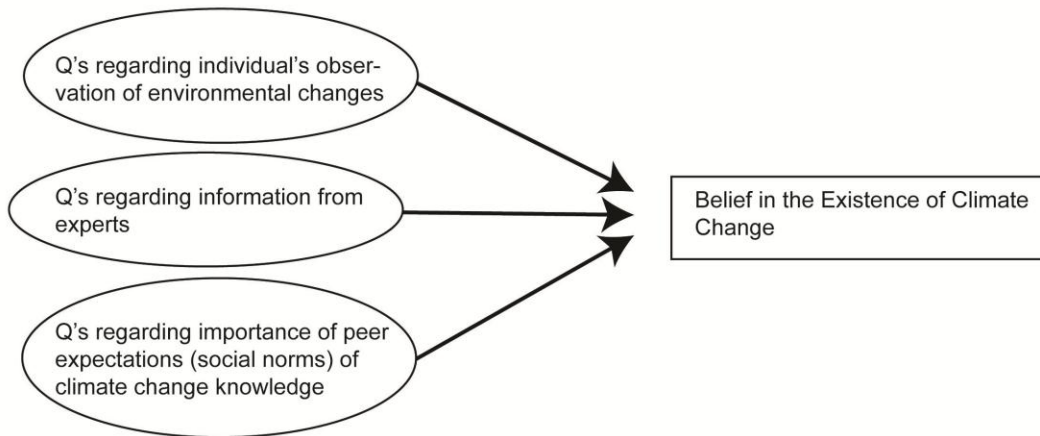
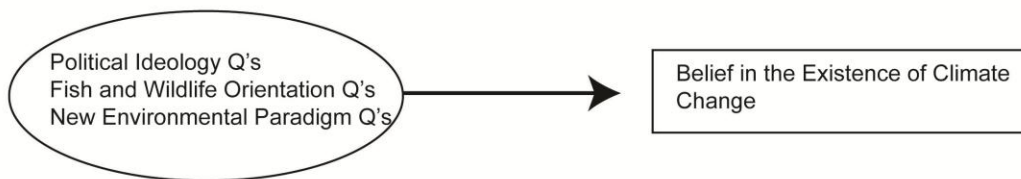


Figure 3.1: Conceptual Framework of the study

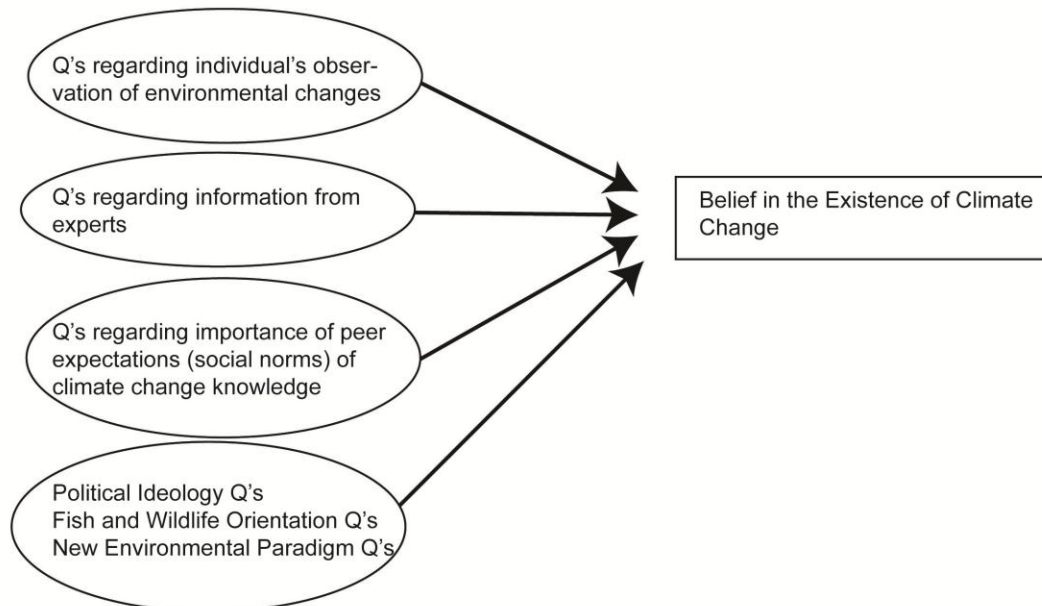
### Reduced Model 1: No Cultural Worldviews



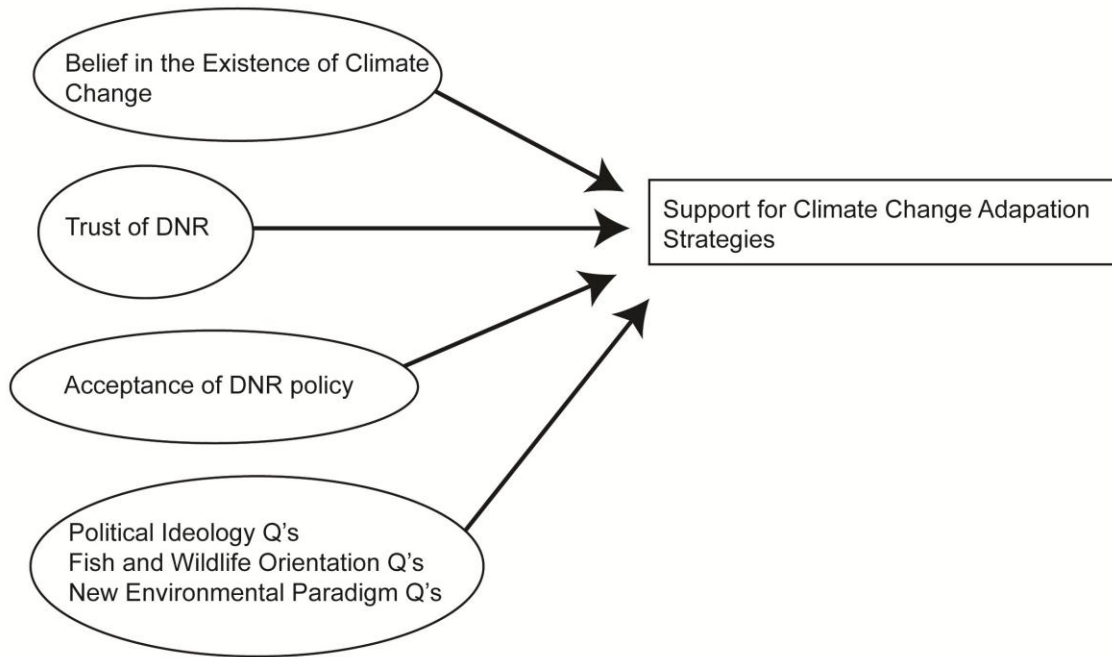
### Reduced Model 2: Only Cultural Worldviews



### Full Model: Reduced Models 1 and 2 Combined



*Figure 3.2: Models examining role of social and environmental worldviews on climate change beliefs*



*Figure 3.3: Support for climate change adaptation strategies*

## Chapter 4: Conclusion

### *Introduction*

When wildlife agencies, policy makers, or conservationists, manage for climate change they have to be aware of public perception. Survey data and focus groups can provide a good examination of public perception in regards to environmental issues. When done properly, agencies can use this data to determine which environmental issues the public is aware of and concerned about. Secondly, research on public perception and the media may help agencies to communicate better with the public about climate change. Finally, in order to gain support for environmental issues, and to present these issues in a socially acceptable method, a manager or conservationist needs to know about the processes that guide public perception. Many climate experts seem to assume that the American public's lack of concern about climate change is due to poor media coverage or miscommunication. However, if perception is actually culturally or socially determined (as described by the cultural cognition hypotheses) then the problem has to be framed and described differently. While the social and cultural aspects of climate change can be uncertain and complex, more social research studying the public's climate change perceptions will help managers and conservationists prepare for the future.

Survey studies have described the public's acceptance and awareness of climate change. Media studies have examined how climate change is covered by journalists and how information is communicated to the public. Psychological and cultural studies have attempted to explain how climate change and environmental perceptions are formed. With all of these existing studies, a legitimate question to ask is what further research, if any, is needed?

However, one limitation facing managers in incorporating public perception is that few studies exist that examine perceptions at a local or regional scale. As seen from the literature review, most studies examine public perceptions at a national level. However, the direct concern that most managers and conservationists have is how to adapt to climate change at a local level. Therefore, they are most concerned with how their local community perceives climate change. This data could be provided if there were more survey studies and that describe public perception at a finer, or local, geographic scale.

Many state agencies are re-evaluating management plans to prepare for the future ecological and social impacts of climate change. The Minnesota DNR is currently reassessing its goals and plans to incorporate climate change.

In order to conserve and manage Minnesota's wildlife populations and natural resources, the Minnesota DNR worked with the Minnesota Cooperative Fish and Wildlife Research Unit on a project that examined residents' perception of climate change and support for climate change adaptation strategies in northeast Minnesota. This project consisted of a series of focus groups and a region wide mail survey that tested a conceptual framework.

#### *Focus groups*

The aim of the focus groups was to examine how people in the region were talking about climate change. This thesis examined the discussion resulting from two of the focus group questions. The first question regarded the participants' belief in the existence of climate change. The second question asked the participants to talk about why climate change can be an upsetting topic.

Most of the comments made in the focus groups were aware of climate change, or had observed some changes in climate. There were very few participants that did not think the climate was changing. However, participants differed in whether they believed these changes were caused by humans, or if they were part of a natural cycle. Individuals who thought climate change was human caused often were more concerned by climate change than those who thought changes in climate were part of a natural cycle.

Participants found the topic of climate change to be upsetting for a number of reasons. Some were upset about the effects climate change may have on natural resources and wildlife populations. Others found the topic upsetting because climate change has become too political. In some cases, people found this upsetting because they did not believe in anthropogenic climate change and thought it was part of a government “agenda”. In other cases, people were upset because they were uncertain about climate change and did not feel like they had access to non-biased information. People also found climate change upsetting because it is associated with many other controversial or sensitive topics such as over population, “anti-intellectualism,” and the economy.

In general, it seemed that participants based their opinions regarding their belief in the existence of climate change on first hand observations or meteorological or physical evidence. Both those that believed in climate change and those that did not believe in climate change based their beliefs on evidence such as the temperature of previous winters or lake conditions. However, participants generally cited social or cultural reasons to explain why climate change is an upsetting topic. In other words, many participants made comments about climate change being upsetting due to its

impacts on society and its role in politics rather than its impacts on the environment or fish and wildlife populations.

Regardless of whether the participants accepted anthropogenic climate change or not, there was quite a bit of uncertainty of what the DNR could do to manage, or prepare for the effects of climate change. It seemed that many participants were more familiar with climate change mitigation (preventing climate change) than climate change adaptation (managing in response to changes in climate).

### *Mail survey*

The primary purpose of the mail survey was to provide quantitative data on how residents in northeast Minnesota perceive climate change and climate change adaptation as well as to examine the relationships suggested in the conceptual framework.

Almost 72% of respondents were at least somewhat sure climate change is happening. About 13% were at least somewhat sure climate change is not happening. Just over 15% were not sure whether climate change is or is not happening. Out of the list of climate change adaptation strategies respondents were most supportive of preventing the spread of invasive species to offset climate change impacts as well as protecting native habitats. Overall, respondents were supportive of most adaptation strategies. Respondents were less supportive of strategies that involved moving fish, wildlife or plant species around. Support for strategies varied by the degree to which respondents believed climate change was occurring. Those who indicated that they did not believe in climate change were generally less supportive of all management actions.

Social and cultural worldviews or ideologies were an important component of climate change belief. An individual's environmental values (as measured by the NEP



scale of Dunlap et al. 2000) and political ideology explained a significant amount of variance in belief in climate change. Belief in climate change, acceptance or trust of the DNR and environmental and wildlife values were all significant predictors of an individual's support of climate change adaptation strategies.

### *Summary*

Overall, social and cultural worldviews and ideologies were important components in how individuals perceive climate change and their support for adaptation strategies. Based on the focus groups, individuals tended to cite social and cultural reasons as reasons why climate change is upsetting. The data from the mail survey supported this conclusion by quantitatively showing that cultural and environmental ideologies were significant predictors of belief in climate change and support for climate change adaptation strategies.

Many of the hypotheses stated in the conceptual framework were supported. Observations of environmental change and social norms regarding climate change knowledge were significant variables that explained an individual's belief in climate change. An individual's political ideology and environmental views explained an additional amount of variance in climate change belief. Belief in climate change, environmental values, wildlife values and trust or acceptance of the DNR were significant predictors of an individual's support of potential climate change adaptation policies.

The results of the NECCPS project also seem to support many of the hypothesis presented in the RISP and Cultural Cognition literature. As suggested by previous RISP studies, social norms were found to be a significant predictor of whether one believed in

climate change. While it was not possible to include the same scales used by other Cultural Cognition studies in the NECCPS project, political ideology did prove to be a significant variable predicting belief in climate change. Environmental worldviews, as measured by the New Environmental Paradigm, were also significant predictors of belief in climate change and support for climate change adaptation strategy.

### *Future directions*

This project was a pilot study to provide a baseline measure of climate change perceptions in a three county region. Therefore, there is ample room for future research in this area.

First of all, this thesis only examines the data relating to climate change from the NECCPS focus groups and mail survey. The project collected quite a bit of additional data on environmental change in general that this thesis could not cover. This is especially true of the focus groups as climate change was only one topic out of a larger discussion of environmental and social change that the participants discussed. Future analysis could include a qualitative examination of how residents view environmental change and what changes in particular they are worried about. The mail survey asked some additional questions about environmental change that can examine this question quantitatively as well.

Secondly, the concept of climate change adaptation could be examined further. As this concept is relatively new, the NECCPS project just provided a preliminary, and not comprehensive, examination of support for climate change adaptation. The adaptation strategies included in the survey were the result of a “brain storming” session

with the DNR to provide a range of potential strategies to adapt to changes in the climate. However, the DNR is not necessarily interested in implementing all of the strategies. Future surveys could ask respondents about different adaptation strategies, or compare support for climate change management strategies with support for other management policies, such as invasive species control. Also, this survey did not include the concept of cost in any of its adaptation strategies. Respondents were just asked to indicate whether they would support or oppose the strategies. They were not given any information on the costs or benefits of any strategy. Including such information may provide a more realistic measure of support for climate change adaptation policies.

Finally, this pilot study only examined climate change perceptions in a three county area. Future work can help examine climate change perceptions across a broader area. Different regions of Minnesota, or of the upper Midwest, can be compared to see if residents differ in their perceptions of environmental change or support for climate change management strategies. While climate change is a global challenge, responding to climate change will occur largely at the regional level. Therefore, such studies examining the human dimensions of climate change can help natural resource agencies manage natural systems in a changing climate as well as communicate about climate change with their constituents, the public.

## References

- Antilla, L. (2010). Self-censorship and science: A geographical review of media coverage of climate tipping points. *Public Understanding of Science* 19 (2) (MAR): 240-56.
- Bengston, D.N., Schermann, M., Moua, M., & Lee, T.T. (2008). Listening to neglected voices: Hmong and public lands in Minnesota and Wisconsin. *Society & Natural Resources* 21 (10): 876-90.
- Bord, R. J., Fisher, A., & O'Connor, R.E. (1998). Public perceptions of global warming: United States and international perspectives. *Climate Research* 11 (1) (DEC 17): 75-84.
- Boykoff, M.T., & Boykoff, J.M. (2007). Climate change and journalistic norms: A case-study of US mass-media coverage. *Geoforum* 38 (6) (NOV): 1190-204.
- Bruskotter, J. (2007). Value Orientations and the Practice of Conservation: Applications in Fisheries Management and Agriculture. (Doctoral dissertation). Retrieved from the University of Minnesota.
- Bruskotter, J., & Fulton, D. (2008). Minnesota anglers' fisheries-related value orientations and their stewardship of fish resources. *Human Dimensions of Wildlife*, 13(4), 207-221.
- Clarke, C. (2009). Seeking and processing information about zoonotic disease risk: A proposed framework. *Human Dimensions of Wildlife* 14 (5): 314-25.
- Dahl, R. (1956). A preface to Democratic Theory. Chicago Illinois: University of Chicago Press.
- Date, A. (2010). Minnesota Department of Natural Resources climate change survey. (Minnesota DNR technical report) St Paul, MN.
- Davenport, M.A., Leahy, J.E., Anderson, D.H., & Jakes, P.J. (2006). Building trust in natural resource management within local communities: A case study of the Midewin National Tallgrass Prairie. *Environmental Management*. 39: 353-368.
- Dietz, T., Fitzgerald, A., & Shwom, R. (2005). Environmental values. *Annual Review of Environmental Resources* 30 : 335-72.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2009). Internet, mail, and mixed-mode surveys: The tailored design method.

- Dunlap, R.E. (2008). The New Environmental Paradigm Scale: From Marginality to Worldwide Use. *The Journal of Environmental Education*. 40:1, 3-18
- Dunlap, R. E., & Van Liere, K. D. (2008). The "New Environmental Paradigm". *Journal of Environmental Education* 40 (1): 10.
- Dunlap, R. E., Van Liere, K.D., Mertig, A.G., & Jones, R.E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues* 56 (3): 425-42.
- Douglas, M., & Wildavsky, A. B. (1982). Risk and Culture: An essay on the selection of technical and environmental dangers. Berkeley: University of California Press
- Edgell, M.R. & Nowell, D. E. (1989). The new environmental paradigm scale: Wildlife and environmental beliefs in British Columbia, *Society & Natural Resources: An International Journal*, 2:1, 285-296
- Fulton, D.C., Manfredi, D. E. & Lipscomb, J. (1996). Wildlife values orientations: a conceptual and measurement approach. *Human Dimensions of Wildlife*.
- Gastil, J., Braman, D., Kahan, D.M., & Slovic, P. (2005). The 'Wildavsky heuristic': The cultural orientation of mass political opinion. *Public Law & Legal Theory Research Paper Series* 107 .
- Geertz, C. (1993) Religion as a cultural system. In: The interpretation of cultures: selected essays, Geertz, Clifford, pp.87-125. Fontana Press.
- Goldstein, N.J., Cialdini, R.B., & Griskevicius, V. (2008). A Room with a Viewpoint. Using social norms to motivate environmental conservation in hotels. *Journal of Consumer Research*. Vol. 35.
- Griffin, R.J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Risk Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research*. Vol 80, S230-2345.
- Heeren, A. (2011). Northeast Climate Change Pilot Study: Focus Group Summary. Minnesota Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife, and Conservation Biology. University of Minnesota. St. Paul, MN.
- Heeren, A. (2012). Natural resource and environmental changes in northeast Minnesota: a study of local residents in Cook, Lake and St. Louis counties. Minnesota Cooperative Fish and Wildlife Research Unit, Department of Fisheries, Wildlife, and Conservation Biology. University of Minnesota. St. Paul, MN 55108

- Homer, P.M., & Kahle, L.R. 1988. A structural equation test of the value-attitude-behavior hierarchy. *Journal of Personality and Social Psychology*. Vol. 54, 5, 638-646.
- Howell, D.C. (2010). *Statistical Methods for Psychology*. Seventh Edition. Belmont CA: Wadsworth, Cengage Learning.
- IPCC. (2007). Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Kahan, D.M. (In publication). Cultural cognition as a conception of the cultural theory of risk. *Handbook of Risk Theory*.
- Kahan, D. M., Jenkins-Smith, H., & Braman, D. (In publication). Cultural cognition of scientific consensus. *Journal of Risk Research* 14 (2): 147-74.
- Kahan, D. M., Braman, D. Slovic, P., Gastil, J., & Cohen, G.L. (2007). The second national risk and culture study: Making sense of-and making progress in-the American culture war of fact. *GWU Legal Studies Research Paper No. 370, Yale Law School Public Law Working Paper No. 154, GWU Law School Public Law Research Paper No. 370, Harvard Law School Program on Risk Regulation Research Paper No. 8-26.*  
[http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1017189](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1017189)
- Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming. *Media Psychology*. 10:414-435
- Kahlor, L. A., Dunwoody, S., Griffin, R.J., & Neuwirth, K. (2006). Seeking and processing information about impersonal risk. *Science Communication* 28 (2): 163.
- Krause, J. (2004). *Designs Basic Index*. Cincinnati Ohio: HOW Design Books.
- Krueger, R. A., & Casey, M.A. (2009). *Focus groups: A practical guide for applied research* Sage.
- Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2010). Climate change in the American mind: Americans' global warming beliefs and attitudes in January 2010. *Yale University and George Mason University. New have: CT. Yale Project on Climate Change. Available at:*  
<http://environment.Yale.edu/uploads/AmericansGlobalWarmingBeliefs2010.Pdf>
- Leiserowitz, A., Maibach, E., Roser-Renouf, C., & Hmielowski, J. D. (2012) *Extreme Weather, Climate & Preparedness in the American Mind*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change

Communication. <http://environment.yale.edu/climate/files/Extreme-Weather-Climate-Preparedness.pdf>

- McCright, A. M., & Dunlap, R. E. (2010). Anti-reflexivity: The American Conservative Movement's Success in Undermining Climate Science and Policy. *Theory, Culture & Society*, 27(2-3), 100.
- Manfredo, M., Teel, T., & Bright, A. (2003). Why are public values toward wildlife changing? *Human Dimensions of Wildlife* 8 (4): 287-306.
- Minnesota DNR. (2011). Ecological Subsection Map.
- Minnesota DNR Climate and Renewable Energy Steering Team. (2011). Climate Change and Renewable Energy: Management Foundations. Minnesota DNR Staff Report.
- National Academy of Sciences. (2009). *Restructuring federal climate research to meet the challenges of climate change*.
- Nilsson, A., Borgstede, C., & Beil, A. (2004). Willingness to accept climate change strategies: The effect of values and norms. *Journal of Environmental Psychology*. Vol. 24 267-277.
- Nisbet, M. C., & Myers, T. 2007. Trends: Twenty years of public opinion about global warming. *Public Opinion Quarterly*: 444-70.
- Racevskis, Laila A., & Lupi, F. (2006). Comparing urban and rural perceptions of familiarity with the management of forest ecosystems. *Society & Natural Resources* 19 (6): 479-95.
- Rokeach, M. (1969). The role of values in public opinion research. *Public Opinion Quarterly* 32 (4): 547-59.
- Schultz, P.W., & Zelezny, L. (1999). Values as predictors of environmental attitudes: Evidence for consistency across 14 countries. *Journal of Environmental Psychology*. Vol. 19, 255-265.
- Schwartz, S., Vaprra, G., & Vecchione, M. (2010). Basic personal values, core political values, and voting: A longitudinal analysis. *Political Psychology* 31 (3).
- Steel, B.S., List, P., & Schindler, B. (1994). Conflicting values about federal forests: a comparison of national and Oregon publics. *Society and Natural Resources*. 7: 137-153.
- Teel, T.L., Manfredo, M.J. (2010). Understanding the diversity of public interests in wildlife conservation. *Conservation Biology*. Vol. 24, No. 1, 128-139.

United States Census Bureau. (2010). American Fact Finder.  
<http://factfinder2.census.gov>

Teel, T. L., Dayer, A. A., Manfredi, M. J., & Bright, A. D. (2005). Regional results from the research project entitled "Wildlife Values in the West." (Project Rep. No. 58). Project report for the Western Association of Fish and Wildlife Agencies. Fort Collins, CO: Colorado State University, Human Dimensions in Natural Resources Unit.

Vaske, J.J., & Donnelly, M.P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society & Natural Resources*. Vol. 12. Issue 6.

Wiidegren, O. (1998). The New Environmental Paradigm and personal norms. *Environment and Behavior*. Vol 30: 75

Wilson, E.O. (1975, 2000 reprint). *Sociobiology: The New Synthesis*, Twenty-fifth Anniversary Edition. Harvard University Press.



## **Appendices**

## Appendix A: Focus Group Script

### **Focus Group Script Climate Change Pilot Study**

Opening: 1. Tell us your first name, where you live and how long you have been living in northeast Minnesota.

Introduction: 2. What do you most value about living in northeast Minnesota?

Transition: 3. How much time do you spend outdoors and what kinds of things, work or play, do you do outdoors in northeast Minnesota?

Key: 4. During the past few years what kinds changes to the outdoors or natural environment have people in your area been talking about?

5. Are there any changes that you are particularly worried about? If so, what are they and what worries you about them?

6. What do you think is causing or is behind these changes?

7. Some people are concerned about climate change and potential impacts from climate change. What do you think about the notion of climate change in northeast Minnesota?

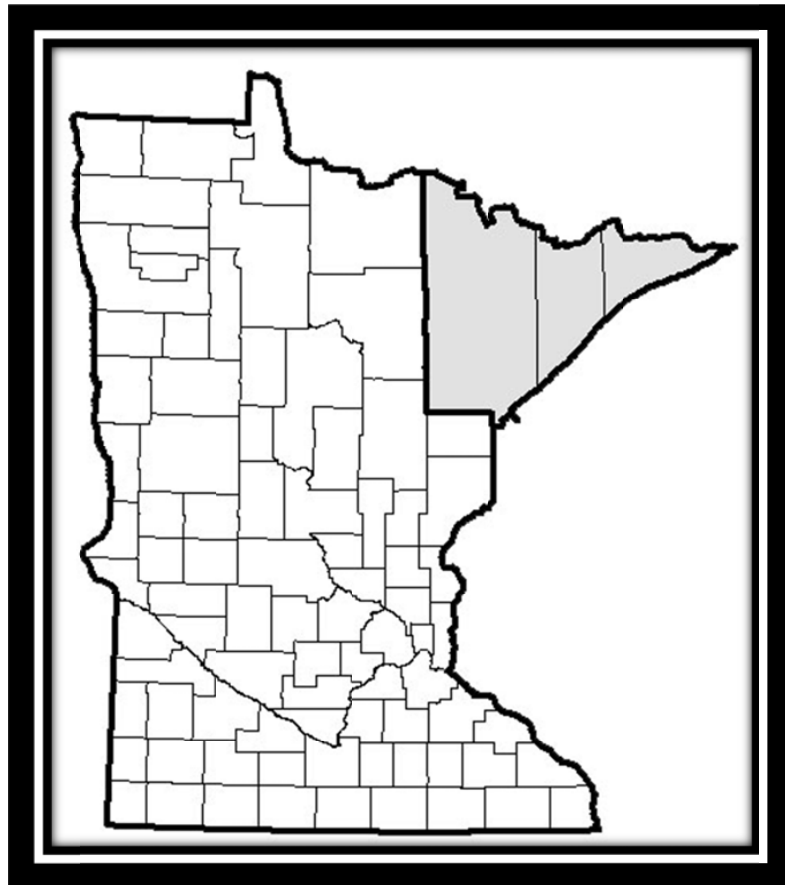
8. For some people, the topic of climate change is upsetting? Tell us how you feel about the topic and what, if anything, upsets you about the topic of climate change?

9. What would you like the Minnesota DNR to do to prepare for and adjust to climate change?

Ending: 10. We want to understand how you feel about environmental changes in northeast Minnesota and how the Minnesota DNR should manage in response to any changes. Is there anything else about this topic that you haven't had a chance to say?

# **Natural Resource and Environmental Changes in Northeast Minnesota:**

**A Study of Local Residents in Cook, Lake and St. Louis  
Counties**



**Fall 2011**

**A cooperative study conducted by the University of Minnesota for the Minnesota  
Department of Natural Resources**

**Your help on this study is greatly appreciated!**

*Please complete this survey and return it in the postage-paid return envelope.*

**A. FIRST WE WOULD LIKE TO KNOW A LITTLE ABOUT HOW YOU SPEND TIME OUTDOORS IN MINNESOTA**

Q1. To what extent does your job involve working outside? *(Please circle one).*

- |            |        |              |       |                  |
|------------|--------|--------------|-------|------------------|
| 1          | 2      | 3            | 4     | 5                |
| Not at all | Seldom | Occasionally | Often | Most of the time |

Q2. How important a part of your life is outdoor recreation? *(Please circle one).*

- |                      |                    |                      |                |
|----------------------|--------------------|----------------------|----------------|
| 1                    | 2                  | 3                    | 4              |
| Not important at all | Slightly Important | Moderately Important | Very Important |

Q3. Think back over the last 12 months. About how many days in the last 12 months did you go outside for recreation of **all** types (including walking, fishing, camping, biking, skiing, hunting, golfing, sightseeing and so on)? *(Please check one)*

- |                   |                        |
|-------------------|------------------------|
| ___ Zero days     | ___ 21 to 50 days      |
| ___ 1 to 5 days   | ___ 51 to 100 days     |
| ___ 6 to 10 days  | ___ 101 to 150 days    |
| ___ 11 to 20 days | ___ More than 150 days |

Q4. When you recreate outdoors, what are your favorite activities? *(Please check all of your favorite activities).*

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> ATV/OHV riding                  | <input type="checkbox"/> Guided nature trails  | <input type="checkbox"/> Sightseeing               |
| <input type="checkbox"/> Bicycling                       | <input type="checkbox"/> Hiking/Walking        | <input type="checkbox"/> Snowmobiling              |
| <input type="checkbox"/> Bird watching                   | <input type="checkbox"/> Horseback riding      | <input type="checkbox"/> Swimming                  |
| <input type="checkbox"/> Boating/canoeing<br>kayaking    | <input type="checkbox"/> Hunting               | <input type="checkbox"/> Taking a self-guided walk |
| <input type="checkbox"/> Camping                         | <input type="checkbox"/> Jogging/Running       | <input type="checkbox"/> Trapping                  |
| <input type="checkbox"/> Cross-country skiing            | <input type="checkbox"/> Learning about nature | <input type="checkbox"/> Wildlife-viewing          |
| <input type="checkbox"/> Downhill<br>Skiing/Snowboarding | <input type="checkbox"/> Nature observation    |  |
| <input type="checkbox"/> Fishing                         | <input type="checkbox"/> Picnicking            |  |

Other: \_\_\_\_\_

**B. NATURAL RESOURCE QUALITY AND CHANGES**

Q5. How would you rate the natural resource quality of the following in Northeast Minnesota? *(Please circle one response for each below).*

	Poor	Fair	Good	Excellent	Don't Know
Forest conditions	1	2	3	4	9
Conditions of lakes	1	2	3	4	9
Water quality conditions	1	2	3	4	9
The abundance of native plants and animals	1	2	3	4	9
Air quality conditions	1	2	3	4	9
Wetland conditions	1	2	3	4	9
Conditions of recreational trails	1	2	3	4	9
Conditions of State Wildlife Management areas	1	2	3	4	9
Conditions of State Forests	1	2	3	4	9
Quality of small game populations	1	2	3	4	9
Quality of big game populations	1	2	3	4	9
Quality of fisheries	1	2	3	4	9
Overall quality of natural resources	1	2	3	4	9

Q6. Over the years you have lived in Northeast Minnesota, would you say the natural resource quality of the following in Northeast Minnesota has worsened, remained about the same, or improved? *(Please circle one response for each below).*

	Worsened	Remained about the Same	Improved	Don't Know
Forest conditions	1	2	3	9
Conditions of lakes	1	2	3	9
Water quality conditions	1	2	3	9
The abundance of native plants and animals	1	2	3	9
Air quality conditions	1	2	3	9
Wetland conditions	1	2	3	9
Conditions of recreational trails	1	2	3	9
Conditions of State Wildlife Management areas	1	2	3	9
Conditions of State Forests	1	2	3	9
Quality of small game populations	1	2	3	9
Quality of big game populations	1	2	3	9
Quality of fisheries	1	2	3	9
Overall quality of natural resources	1	2	3	9

Q7. To what extent do you think the following changes are occurring and how worried are you about this change? (Please circle "N" for No or "Y" for Yes. If you think changes are occurring then circle one number to indicate how worried you feel about the changes).

	Are changes occurring?		If Yes→	How worried are you about this change?			
	NO	YES		Not at all	Slightly	Moderate	A great deal
Changes in types of tree species in forest	N	Y	If Yes→	1	2	3	4
Changes in health of trees in forests	N	Y	If Yes→	1	2	3	4
Increases in exotic, invasive species	N	Y	If Yes→	1	2	3	4
Declines in native wildlife species	N	Y	If Yes→	1	2	3	4
Changes in fish populations	N	Y	If Yes→	1	2	3	4
Changes in plant species	N	Y	If Yes→	1	2	3	4
Losses of habitat for fish and wildlife	N	Y	If Yes→	1	2	3	4
Losses of large and continuous habitat areas due to land use changes that break these habitat areas into smaller pieces	N	Y	If Yes→	1	2	3	4
Increases in urban-type development	N	Y	If Yes→	1	2	3	4
Climate change	N	Y	If Yes→	1	2	3	4
Decreases in water quality	N	Y	If Yes→	1	2	3	4

### C. CLIMATE CHANGE

In the next section we will ask you several questions about climate change and your opinions about managing natural resources. By climate change we mean a significant and lasting change in weather patterns over decades or longer periods of time. It may be a change in average weather conditions in an area like Northeast Minnesota or the frequency of weather events like storms and droughts (e.g., more or fewer extreme weather events).

Q8. First, how sure are you that climate change IS happening or is NOT happening?

(Please check the one statement that most closely matches your views)

- Extremely sure climate change is **NOT** happening
- Very sure climate change is **NOT** happening
- Somewhat sure climate change is **NOT** happening
- Not sure that climate change **IS** or is **NOT** happening
- Somewhat sure climate change **IS** happening
- Very sure climate change **IS** happening
- Extremely sure climate change **IS** happening

Q9. Assuming climate change is happening, do you think it is...  
 (Please check the one statement that most closely matches your views)

- Caused mostly by human activities
- Caused mostly by natural changes in the environment
- Caused by both human activities and natural changes
- None of the above because climate change isn't happening
  
- Don't know

Q10. Which of the following statements reflects your view of when the effects of climate change will begin to happen in the USA? (Please fill in the circle next to the statement that most closely matches your views)

- The effects have already begun to happen.
- The effects will start happening within a few years.
- The effects will start happening within my lifetime.
- The effects will not happen within my lifetime, but they will affect future generations.
- The effects will never happen.

Q11. Which of the following statements reflects your view of when the effects of climate change will begin to happen in Northeast Minnesota? (Please fill in the circle next to the statement that most closely matches your views)

- The effects have already begun to happen.
- The effects will start happening within a few years.
- The effects will start happening within my lifetime.
- The effects will not happen within my lifetime, but they will affect future generations.
- The effects will never happen.

Q12. On a scale of 0 to 10, how likely is it that climate change will have an impact on the natural resources that you personally use and value? (Please circle one response with 0 = very unlikely and 10 = very likely).

<b>VERY UNLIKELY</b>	0	1	2	3	4	5	6	7	8	9	10	<b>VERY LIKELY</b>
--------------------------	---	---	---	---	---	---	---	---	---	---	----	------------------------

Q13. On a scale of 0 to 10, how important to you is the issue of climate change impacts on natural resources? (Please circle one response with 0 = not at all important and 10 = very important).

<b>NOT AT ALL IMPORTANT</b>	0	1	2	3	4	5	6	7	8	9	10	<b>VERY IMPORTANT</b>
---------------------------------	---	---	---	---	---	---	---	---	---	---	----	---------------------------

Q14. On a scale of 0 to 10, how much do you worry about climate change impacts on natural resources? (Please circle one response with 0 = not at all and 10 = very much).

<b>NOT AT ALL</b>	0	1	2	3	4	5	6	7	8	9	10	<b>VERY MUCH</b>
---------------------------	---	---	---	---	---	---	---	---	---	---	----	----------------------

Q15. Rate your current knowledge about climate change on a scale of 0 to 100, where zero means knowing nothing and 100 means knowing everything you could possibly know about this topic.

\_\_\_\_\_ (write in number from 0 to 100)

Q16. Think of that same scale again. This time, we would like you to estimate how much knowledge you would need in order to achieve a comfortable understanding of climate change. *(You might feel you need the same, more, or possibly even less information about this topic. Using a scale of zero to 100, how much information would be sufficient for you to understand climate change?)*

\_\_\_\_\_ (write in number from 0 to 100)

Q17. Rate your current knowledge about how agencies like the Minnesota DNR can manage to respond to the potential impacts of climate change on a scale of 0 to 100, where zero means knowing nothing and 100 means knowing everything you could possibly know about this topic.

\_\_\_\_\_ (write in number from 0 to 100)

Q18. Think of that same scale again. This time, we would like you to estimate how much knowledge you would need in order to achieve a comfortable understanding of how agencies like the Minnesota DNR can manage to respond to the potential impacts of climate change *(Using a scale of zero to 100, how much information would be sufficient for you?)*

\_\_\_\_\_ (write in number from 0 to 100)

Q19. Using a scale of 1–7, please indicate whether you feel that seeking information about how management agencies like the Minnesota DNR can respond to the potential impacts of climate change is worthless or valuable to you. *(Please circle one response below).*

**WORTHLESS** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | **VALUABLE**  
extremely    quite    slightly    neither    slightly    quite    extremely

Q20. Using a scale of 1–7, please indicate whether you feel that seeking information about how management agencies like the Minnesota DNR can respond to the potential impacts of climate change is wise or foolish for you. *(Please circle one response below).*

**FOOLISH** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | **WISE**  
extremely    quite    slightly    neither    slightly    quite    extremely

Q21. Using a scale of 1–7, please indicate whether you feel that seeking information about how management agencies like the Minnesota DNR can respond to the potential impacts of climate change is unhelpful or helpful to you. *(Please circle one response below).*

**UNHELPFUL** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | **HELPFUL**  
extremely    quite    slightly    neither    slightly    quite    extremely



**Q22.** From what sources do you get information about climate change? (Please indicate how much you depend on each as a source of information about climate change?).

	Not at all	Slightly	Moderately	Very Much	Don't Know
Radio News	1	2	3	4	9
Television news	1	2	3	4	9
Local newspapers	1	2	3	4	9
National newspapers and news magazines	1	2	3	4	9
Internet sources and websites	1	2	3	4	9
Television shows and documentaries	1	2	3	4	9
Broadcast meteorologists (weather reporters)	1	2	3	4	9
Talk radio	1	2	3	4	9
Reports and publications from scientists	1	2	3	4	9
Political leaders	1	2	3	4	9
Co-workers	1	2	3	4	9
Friends and family	1	2	3	4	9
Federal management agencies	1	2	3	4	9
Minnesota DNR	1	2	3	4	9
Other (describe): _____	1	2	3	4	9

**Q23.** We would like to find out some of your beliefs about the availability of information focused on how management agencies like the Minnesota DNR can respond to the potential impacts of climate change. Please indicate the level to which you disagree or agree. (Please circle a number for each row).

	Strongly disagree	Disagree	Feel neutral	Agree	Strongly Agree	Don't Know
People whose opinions I value would approve of my staying on top of information about climate change.	1	2	3	4	5	9
It is expected of me that I seek information about climate change.	1	2	3	4	5	9
Seeking information about climate change is likely to give me something to talk about with others.	1	2	3	4	5	9

**Q23. Continued.** Please indicate the level to which you disagree or agree. *(Please circle a number for each row).*

	Strongly disagree	Disagree	Feel neutral	Agree	Strongly Agree	Don't Know
The people I spend most of my time with are likely to seek information related to climate change.	1	2	3	4	5	9
When I want to, I am easily able to locate information about climate change.	1	2	3	4	5	9
It is mostly up to me whether I seek information about climate change.	1	2	3	4	5	9
If I wanted to seek information about climate change in the next month, I could.	1	2	3	4	5	9
I plan to seek more information about climate change in the future.	1	2	3	4	5	9
I intend to find out more about climate change.	1	2	3	4	5	9
In the future, I will try to seek as much information as I can about climate change.	1	2	3	4	5	9
When the topic of climate change comes up, I'm likely to tune it out.	1	2	3	4	5	9
Whenever the topic of climate change comes up, I go out of my way to avoid learning more about it.	1	2	3	4	5	9
Gathering a lot of information about climate change is a waste of time.	1	2	3	4	5	9
When the topic of climate change comes up, I try to learn more about it.	1	2	3	4	5	9
When it comes to climate change, I'm likely to go out of my way to get more information.	1	2	3	4	5	9
After I encounter information about climate change, I am likely to stop and think about it.	1	2	3	4	5	9
If I need to act on climate change, the more viewpoints I get the better.	1	2	3	4	5	9
When I encounter information about climate change, I read or listen to most of it, even though I may not agree with its perspective.	1	2	3	4	5	9
After thinking about climate change, I have a broader understanding.	1	2	3	4	5	9
When I see or hear information about climate change, I rarely spend much time thinking about it.	1	2	3	4	5	9
There is far more information on climate change than I personally need.	1	2	3	4	5	9
When I encounter information about climate change, I focus only on a few key points.	1	2	3	4	5	9
If I need to act on climate change, the advice of one expert is enough for me.	1	2	3	4	5	9

Q24. How much do you trust the following organizations to make sound recommendations on natural resource management actions to deal with any potential effects of climate change in Northeast Minnesota? *(Please indicate how much you trust each as a source of information of climate change? Please circle one response for each row).*

	Strongly Trust	Somewhat Trust	Somewhat Distrust	Strongly Distrust	Don't Know
US Fish and Wildlife Service	1	2	3	4	5
Sporting groups like Ducks Unlimited or Minnesota Deer Hunters Association	1	2	3	4	5
National Park Service	1	2	3	4	5
The Nature Conservancy	1	2	3	4	5
Forest Industry	1	2	3	4	5
Minnesota Pollution Control Agency	1	2	3	4	5
Soil and Watershed Conservation Districts	1	2	3	4	5
US Forest Service	1	2	3	4	5
US Congress	1	2	3	4	5
The University of Minnesota	1	2	3	4	5
Minnesota DNR	1	2	3	4	5
Mining Industry	1	2	3	4	5
Cities and Municipalities	1	2	3	4	5
Minnesota Counties	1	2	3	4	5
The Minnesota State Legislature	1	2	3	4	5
Groups like the Audubon Society or National Wildlife Federation	1	2	3	4	5

Q25. Please respond to the following statements concerning the Minnesota DNR and decision-making.  
*(Please circle one response for each row).*

	Not at all	2	Some what	4	Very Much
To what extent do you consider an opportunity to voice opinions to Minnesota DNR on climate change management to be desirable?	1	2	3	4	5
To what extent do you consider an opportunity to voice opinions to Minnesota DNR about climate change management to be important?	1	2	3	4	5
Minnesotans should have the right to voice opinions about climate change management to the Minnesota DNR.	1	2	3	4	5
To what extent do you think Minnesota DNR decision-making procedures are fair?	1	2	3	4	5
To what extent do you think the Minnesota DNR handles decisions fairly?	1	2	3	4	5
To what extent do you trust Minnesota DNR?	1	2	3	4	5
To what extent do you consider Minnesota DNR to be trustworthy?	1	2	3	4	5
To what extent do you accept the advice of Minnesota DNR on most management issues?	1	2	3	4	5
To what extent are you willing to accept the advice of Minnesota DNR on climate change management decisions?	1	2	3	4	5
To what extent do you intend to respect the advice of Minnesota DNR on future climate change management decisions?	1	2	3	4	5

Q26. To what extent do you support or oppose the DNR taking the following actions in response to potential impacts from climate change? (Please circle one response for each row).

	Strongly Oppose	Somewhat Oppose	Neither	Somewhat Support	Strongly Support	Don't Know
Expand monitoring of natural resources to see if changes are occurring that might be related to climate change.	1	2	3	4	5	9
Funding research to see if climate change might be impacting natural resources.	1	2	3	4	5	9
Implementing education programs to make people aware of the potential impacts of climate change.	1	2	3	4	5	9
Taking specific management actions to try to help forests, lakes and fish and wildlife species adapt to any potential changes from climate change.	1	2	3	4	5	9
Increase the use of forest management approaches that favor more tree species diversity and age-classes so that forests can absorb the effects of climate change	1	2	3	4	5	9
Increase the genetic diversity of the seeds we use to replant forests to help forests adapt to climate change.	1	2	3	4	5	9
Establishing captive populations of species that would otherwise go extinct due to climate change to preserve species if they cannot survive in the wild.	1	2	3	4	5	9
Use management strategies that mimic natural disturbances (such as controlled burning) to resist the impacts of climate change.	1	2	3	4	5	9
Move <u>plant</u> species into more suitable areas in anticipation of climate changes to help species adjust to changing conditions.	1	2	3	4	5	9
Move <u>animal</u> species into more suitable areas in anticipation of climate changes to help species adjust to changing conditions.	1	2	3	4	5	9

**Q26. Continued**

To what extent do you support or oppose the DNR taking the following actions in response to potential impacts from climate change? *(Please circle one response for each row).*

	Strongly Oppose	Somewhat Oppose	Neither	Somewhat Support	Strongly Support	Don't Know
Move <u>fish</u> species into more suitable areas in anticipation of climate changes to help species adjust to changing conditions.	1	2	3	4	5	9
Increase land acquisition/easements so species can resist the impacts of climate change.	1	2	3	4	5	9
Increase assistance to private landowners for conservation in order to help manage the impacts of climate change.	1	2	3	4	5	9
Intensify invasive species prevention and control to help offset the impacts of climate change.	1	2	3	4	5	9
Provide greater protection for cold-water lakes and streams that provide refuge from climate change to some fish populations like trout and cisco.	1	2	3	4	5	9
Protect or restore areas that would help species adapt to any changes related to climate to provide potential suitable habitat.	1	2	3	4	5	9
Prevent overexploitation of species so that populations are not additionally stressed by climate change impacts.	1	2	3	4	5	9
Protect or restore native habitats and water ways in order to help manage the impacts of climate change.	1	2	3	4	5	9
Protect or restore potential refuge areas so species can resist the impacts of climate change.	1	2	3	4	5	9

**D. QUESTIONS ABOUT YOU**

Q27. In recent years some people have expressed concern about wildlife and environmental issues, but not everyone agrees. We are interested in knowing what you believe about people, wildlife and the environment. (Please indicate whether you agree or disagree with the following statements. Circle one response for each statement).

	Strongly Disagree		Neither			Strongly Agree	
	1	2	3	4	5	6	7
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5	6	7
When humans interfere with nature it often produces disastrous consequences.	1	2	3	4	5	6	7
Human ingenuity will ensure that we do <u>not</u> make the earth unlivable.	1	2	3	4	5	6	7
Humans are severely abusing the environment.	1	2	3	4	5	6	7
The earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5	6	7
Plants and animals have as much right as humans to exist.	1	2	3	4	5	6	7
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5	6	7
Despite our special abilities humans are still subject to the laws of nature	1	2	3	4	5	6	7
The so-called “ecological crisis” facing humankind has been greatly exaggerated.	1	2	3	4	5	6	7
The earth is like a spaceship with very limited room and resources.	1	2	3	4	5	6	7
Humans were meant to rule over the rest of nature.	1	2	3	4	5	6	7
The balance of nature is very delicate and easily upset.	1	2	3	4	5	6	7
Humans will eventually learn enough about how nature works to be able to control it	1	2	3	4	5	6	7
If things continue on their present course, we will soon experience a major ecological catastrophe.	1	2	3	4	5	6	7
We are approaching the limit of the number of people the earth can support.	1	2	3	4	5	6	7

**Q27. continued**

In recent years some people have expressed concern about wildlife and environmental issues, but not everyone agrees. We are interested in knowing what you believe about people, wildlife and the environment. *(Please indicate whether you agree or disagree with the following statements. Circle one response for each statement).*

	Strongly Disagree		Neither			Strongly Agree	
	1	2	3	4	5	6	7
Humans should manage fish and wildlife populations so that humans benefit.	1	2	3	4	5	6	7
Animals should have rights similar to the rights of humans.	1	2	3	4	5	6	7
We should strive for a world where there's an abundance of wildlife for hunting and fishing.	1	2	3	4	5	6	7
I view all living things as part of one big family.	1	2	3	4	5	6	7
Hunting does not respect the lives of animals.	1	2	3	4	5	6	7
I feel a strong emotional bond with animals.	1	2	3	4	5	6	7
The needs of humans should take priority over fish and wildlife protection.	1	2	3	4	5	6	7
I care about animals as much as I do other people.	1	2	3	4	5	6	7
Fish and wildlife are on earth primarily for people to use.	1	2	3	4	5	6	7
Hunting is cruel and inhumane to the animals.	1	2	3	4	5	6	7
We should strive for a world where humans and wildlife can live side by side without fear.	1	2	3	4	5	6	7
I value the sense of companionship I receive from animals.	1	2	3	4	5	6	7
Wildlife are like my family and I want to protect them.	1	2	3	4	5	6	7
People who want to hunt should be provided the opportunity to do so.	1	2	3	4	5	6	7
It is acceptable for people to kill wildlife if they think it poses a threat to their property.	1	2	3	4	5	6	7



Q28. Overall would you say you are? *(Please check one).*

- VERY LIBERAL
- LIBERAL
- MIDDLE-OF-THE-ROAD
- CONSERVATIVE
- VERY CONSERVATIVE

Q29. What is your gender?

- Male
- Female

Q30. What year were you born? \_\_\_\_\_ YEAR

Q31. How many years have you resided in Northeast Minnesota? *(Northeast Minnesota may refer to Lake, St. Louis and Cook counties).*

\_\_\_\_\_ YEARS

Q32. Which best describes your property in Northeast Minnesota? *(Please check one).*

- Primary residence
- Rental property
- Business property
- Seasonal or recreational residence → ***If seasonal:***

How many months of the year? \_\_\_\_\_ MONTHS

Where is your full time residence? *(Check all that apply).*

- Elsewhere in Minnesota
- Out of state
- Metropolitan area or suburb
- Rural area

Q33. What was your total household income before taxes last year? \$ \_\_\_\_\_

Q34. What is the highest level of education you have completed? *(Please check one).*

- Grade school
- Some high school
- High school diploma or GED
- Some vocational or technical school
- Vocational or technical school (associate's)
- Some college
- Four-year college (bachelor's)
- Some graduate school
- Graduate/Professional degree

**Please write any comments you might have in the space below:**

**Thanks!**

***Please complete this survey and return it in the postage-paid return envelope.***

Appendix C: Non-response Survey

**Natural Resource and Environmental Changes in Northeast Minnesota**

Dear Northeast Minnesota Resident,

During the past few weeks we have contacted you to complete a survey on natural resource and environmental changes in Northeast Minnesota that we are conducting for the Minnesota Department of Natural Resources. So far, we have yet to hear back from you. At this time, we would like to find out some information from people who did not complete the survey. This information will allow us to know if the people who responded to the survey actually represent the larger population in Northeast Minnesota. For this reason it is very important to us that you complete the few questions on this form and send them back to us in the enclosed envelope.

**Please have the adult (age 18 or over) in your household who has had the most recent birthday complete this short questionnaire.**

We want you to know that participation in the study is voluntary. Skip any questions you do not wish to answer. We will treat all your responses with confidentiality and your responses will not be connected with any information that could be used to identify you. We would be happy to answer any questions you might have. Please call or e-mail me at (612) 625-5256 [dcfulton@umn.edu](mailto:dcfulton@umn.edu).

Thank You!

David C. Fulton, Adj. Assoc. Professor Department of Fisheries, Wildlife and Conservation Biology  
University of Minnesota

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Q1. What is your gender?

- Male
- Female

Q2. What year were you born? \_\_\_\_\_ YEAR

Q3. How many years have you resided in northeast Minnesota? (*Northeast Minnesota may refer to Lake, St. Louis and Cook counties*)

\_\_\_\_\_ YEARS

Q4. Which describes your property in northeast Minnesota?

- Primary residence
- Rental property
- Business property
- Seasonal or recreational residence

Q5. What is the highest level of education you have completed? (*Please check one.*)

- Grade school
- Some high school
- High school diploma or GED
- Some vocational or technical school
- Vocational or technical school (associate's)
- Some college
- Four-year college (bachelor's)
- Some graduate school
- Graduate/Professional degree

Q6. What was your total household income before taxes last year?  
\$ \_\_\_\_\_

Q7. Overall would you say you are? (Please check one)

- VERY LIBERAL
- LIBERAL
- MIDDLE-OF-THE-ROAD
- CONSERVATIVE
- VERY CONSERVATIVE

**In the questions below, by climate change we mean a significant and lasting change in weather patterns over decades or longer periods of time. It may be a change in average weather conditions in an area like Northeast Minnesota or the frequency of weather events like storms and droughts (e.g., more or fewer extreme weather events).**

Q8. First, how sure are you that climate change IS happening or is NOT happening?  
(Please check the one statement that most closely matches your views)

- Extremely sure climate change is **NOT** happening
- Very sure climate change is **NOT** happening
- Somewhat sure climate change is **NOT** happening
- Not sure that climate change **IS** or is **NOT** happening
- Somewhat sure climate change **IS** happening
- Very sure climate change **IS** happening
- Extremely sure climate change **IS** happening

Q9. Assuming climate change is happening, do you think it is...  
(Please check the one statement that most closely matches your views)

- Caused mostly by human activities
- Caused mostly by natural changes in the environment
- Caused by both human activities and natural changes
- None of the above because climate change isn't happening
- Don't know

Q10. Please respond to the following statements concerning the Minnesota DNR and decision-making. *(Please circle one response for each row).*

	Not at all		Some what		Very Much
To what extent do you trust Minnesota DNR?	1	2	3	4	5
To what extent do you accept the advice of Minnesota DNR on most management issues?	1	2	3	4	5
To what extent are you willing to accept the advice of Minnesota DNR on climate change management decisions?	1	2	3	4	5