THESIS

A MOSAIC OF UNDERSTANDING: FUSING PERSPECTIVES TO LEGITIMIZE

NON-TECHNICAL WAYS OF KNOWING CLIMATE CHANGE

Submitted by

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ABSTRACT

A MOSAIC OF UNDERSTANDING: FUSING PERSPECTIVES TO LEGITIMIZE

NON-TECHNICAL WAYS OF KNOWING CLIMATE CHANGE

The impacts and implications of climate change are as diverse as the global community faced with addressing this social-ecological issue. Expert-driven communication strategies that emphasize an abundance of scientific information laden with technical language and positivist values have insufficiently appealed to non-technical audiences. This shortcoming has widened the gap between technical and non-technical publics and fails to acknowledge the legitimacy of different forms of expertise that include social dimensions of climate change. Different ways of knowing have also been ignored, largely reducing climate change communication to static, one-way presentations of climate science information. Iterative, interactive, and tangible learning processes are underrepresented in climate change communication efforts but can better resonate and engage many non-technical audiences.

The power of place-based connections and communication allows for non-technical publics to relate to global climate change through the familiarity and appreciation of local landscapes. National parks and wildlife refuges, places of public value and trust, can seed connections between non-technical visiting publics and climate change. Non-technical audiences can better relate to and understand climate change through the renegotiation of language, relevance, and resonant messages framed in a valued landscape - essentially through the lens of place. These connections, in tandem with hands-on engagement practices, can foster a network of engaged climate change citizens with the capacity to inspire others outside of parks and refuges.

ACKNOWLEDGMENTS

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INTRODUCTION

From more frequent heat waves to water availability concerns, the implications of climate change are not isolated to particular regions or locales but rather have a diverse range of impacts that will be experienced throughout the United States and world (IPCC, 2007). According to the 2007 Intergovernmental Panel on Climate Change Report (IPCC), there is high confidence that by 2050 semi-arid areas of the world will suffer from a decline in water resources due to climate change. Warming in mountains will reduce snowpack, cause more winter flooding and reduce summer in-stream flow, thereby exacerbating water scarcity issues. North American cities currently experiencing extreme heat events are "are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts" (IPCC, 2007, ¶ 6). Coastal communities and habitats will experience growing stress by development and pollution concerns that interact with climate change impacts (IPCC, 2007).

Given the all-encompassing nature of climate change impacts, it is important that countries and their citizens take proactive measures to mitigate these impacts. Despite having the capacity to significantly contribute to the success of global climate change adaptation and mitigation solutions, American citizens fail to comprehend the seriousness of this issue (Leiserowitz, Smith, & Marlon, 2010). It is my hope that this thesis, composed of two independent, but complementary manuscripts will help to address non-technical climate change communication issues and suggest solutions that are supported by empirical evidence.

A comprehensive literature review precedes the two manuscripts (Chapters 2 and 3), referencing studies and resources that lay the foundation for both manuscripts. Work related to existing non-technical understandings about climate change, theoretical groundings, challenges,

and opportunities for climate change communication draw from a rich and diverse pool of peer-reviewed work. The national and international context of these works allow the literature review to provide a holistic sense of where non-technical climate change communication stands today, and its potential future direction(s). These same sources are cited throughout Chapters 2 and 3; thus, redundancies do occur and are intentional.

Chapter 2 is my first manuscript, entitled, *Place as Post-Normal Space: Room to Renegotiate Technical and Non-Technical Understandings of Climate Change*. This chapter explores the difference in understanding and sense of connection to climate change between technical and non-technical publics. Existing communication efforts to convey climate science and its impacts on society are largely influenced by positivist principles that exclude other ways of knowing. While positivism is the cornerstone of the scientific process, other epistemological perspectives better resonate with non-technical audiences, like those of social constructivism. Post-normal science calls for the consideration of *subjective* science elements, including values, uncertainty, and a plurality of legitimate perspectives. A plurality of perspectives creates a broader, deeper pool from which expertise is derived and co-produced knowledge invites technical and non-technical expertise to combine and inform a holistic approach to climate change communication, creating amenable space for dialogue across perspectives. To demonstrate the diversity of legitimate, non-technical perspectives available for use, visitor interviews at national parks and wildlife refuges were conducted. After coding interview responses for categorical themes, I identified three key findings.

First, I identified "obvious examples" of climate change that multiple visitors referenced in emphatic, non-negotiable terms. These impacts, like melting glaciers and natural disasters/extreme weather (that have increased in frequency and intensity) are often visually-

striking and can pose immediate threats to people's livelihoods, thereby forcing a reaction from observers. Featuring obvious impacts in climate change communications helps to develop a sound foundation from which the more complex, context-specific aspects of climate change can be discussed and prevents non-technical audiences from immediately dismissing the discussion altogether.

My second finding identifies non-technical mechanisms for rationalizing climate change. Rationalizing was largely rooted in narrative, where visitors described personal observations of landscape changes. The narratives shared suggested that while non-technical audiences value science, science is not a resource used to explain their concern or connection to climate change. Communication efforts that invite visitors to make their own observations and tie in social dimensions climate change will better speak to the concerns and interests of non-technical audiences.

Finally, I identified key language used by non-technical audiences to describe climate change. An emphasis on impacts and descriptors meant that few visitors readily provided a succinct process-oriented description of climate change. Instead, less technical terms that describe the uncommon nature of climate change like *unusual* and *weird* may be used strategically to relate common non-technical feelings with the complex aura of climate change. Suggestions for the National Park Service and Fish and Wildlife are provided at the end of each finding, and these suggestions can be applied beyond park and refuges.

My second manuscript, *Propagating a Parallel Paradigm: Utilizing Action to Engage Non-Technical Audiences in Climate Change Dialogue,* revisits traditional pathways through which understanding is gained and provides a case study to reconsider the relationship between knowledge acquisition and behavior change. The Information Deficit Model suggests that issues

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related to topic literacy, like climate change, can be resolved through access to more robust, plentiful climate science information. Under this model, exposure to more information allows audiences to develop fluency in the topic, which can then inform behavior choices that complement their enlightened sense of understanding.

Alternatively, recent research suggests pathways through experiential learning and behavioral engagement can initiate simultaneous understanding. These alternative pathways are especially useful to non-technical audiences who are best engaged through active, hands-on applications. Static presentations of scientific fact insufficiently address learning styles that thrive in more interactive, iterative environments. Visitor interviews were conducted in national parks and wildlife refuges demonstrate the viability and interest in experiential outreach and communication efforts. These interviews provide a case study in the context of protected areas to promote and offer alternative forms of communication that may be more inclusive and meaningful to non-technical audiences that currently struggle with understanding, accepting, and support proactive climate change efforts.

Interviewees were asked several questions related to preferred learning styles, current environmentally friendly behaviors, and interest in participating in citizen science programs – a possible application for experiential learning. After analyzing interviewee responses, I identified three key findings that are intended for application beyond this particular case study. First, I determined that climate change deniers engage in environmentally friendly practices. Second, I found that visitors crave direction on empowering personal actions that can contribute to climate change progress. Finally, I determined that visitors, young and old, learn through hands-on activities. The assemblage of findings in this case study suggest that non-technical audiences do not need to be fluent in climate change prior to engaging in climate friendly behaviors. Instead,

audiences can develop a more thorough understanding of climate science through hands-on activities that introduce climate change in an interactive, tangible way that also contributes to climate progress; thereby flipping the understanding → complementary behavior pathway inside-out and promoting a parallel paradigm more appropriate for many non-technical audiences.

The interviews used and analyzed as empirical evidence for both manuscripts were collected as part of the qualitative methods contribution to the Place-Based Climate Change Education Partnership (CCEP), a National Science Foundation funded research partnership led by Colorado State University. The CCEP project worked with national parks and wildlife refuges in five regions across the United States to identify opportunities to enhance climate change communication and dialogue between protected areas, visitors, and adjacent communities. Opportunities pivoted around the importance of place-based communication, emphasizing familiar and tangible landscapes as an accessible entry point for conversation. Informal qualitative visitor interviews (n = 349), in addition to visitor surveys (n = 4,181), were conducted in each of the five CCEP regions to gain a better understanding of visitor perspectives on climate change; interviews were collected between May 2011 and January 2012.

To support the findings and research of the manuscripts, I developed an extensive literature review (Chapter 2). The review cites seminal works from academics and practitioners that explore the theoretical groundings, challenges, and opportunities within climate change communication. I have compiled the existing research and literature into a mosaic of insights and findings that lay the foundation for both of my manuscripts to springboard from and develop further nuances.

LITERATURE REVIEW

Introduction to Climate Change

From more frequent heat waves to water availability concerns, the implications of climate change are not isolated to particular regions or locales but rather have a diverse range of impacts that will be experienced throughout the United State and world (IPCC, 2007). According to the 2007 Intergovernmental Panel on Climate Change Report (IPCC), there is high confidence that by 2050 semi-arid areas of the world, like the western United States, will suffer from a decline in water resources due to climate change. Warming in western mountains will reduce snowpack, cause more winter flooding and reduce summer in-stream flow, thereby exacerbating Western water scarcity issues. North American cities currently experiencing extreme heat events are "are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts" (IPCC, 2007, ¶ 6). Coastal communities and habitats will experience growing stress by development and pollution concerns that interact with climate change impacts (IPCC, 2007). Despite immediate and pressing concerns related to climate change, Americans struggle to comprehend and take seriously the issues at hand (Leiserowitz, Smith, & Marlon, 2010).

Theoretical Groundings for Climate Change Communication

Informing the foundation from which research, strategies, and applications are developed, key theoretical groundings for climate change communication include dimensions of communication, sociology, psychology and interdisciplinary studies. The Information Deficit Model is the pinnacle of traditional positivist science communication and often attempts to balance the use of fear appeal tactics with Linville and Fisher's (1991) concept of one's "finite

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pool of worry." Frame analysis and discourse theory offer strategic insight to best connect broad-based topics with personalized, small-scale communication efforts that speak to the values and perspectives of a particular audience. Collectively, these theoretical concepts aid in better understanding how we have arrived in our current state of climate change communication.

Information Deficit Model

Research by Miller and Fahy (2009) describes the commonly employed Information Deficit Model of communication, in which scientists assume the public's struggle to proactively respond to climate change challenges is largely due to a lack of publicly-available, accurate information – a *deficit* of climate change information. The traditional solution entails presenting more research, data, and evidence that climate change exists through static reports that the public is expected to seek out and digest (Miller & Fahy, 2009). This solution turns a blind eye to the positivist nature of technical scientists, the existence of alternative epistemological perspectives amongst non-technical publics, and the assumption that more information will result in greater understanding across all publics. Few attempts are made to link climate science to societal values or social concerns; instead, non-scientists are expected to speak fluent *science* in the case of climate change and many other science-based concerns that spill over into society. While we do not tolerate our medical doctors speaking in language only commonly exchanged amongst colleagues, communication about climate change still largely exists in a technical bubble impenetrable by those who lack technical climate science training, yet both instances are critical bridges to disseminating information about the health of systems, be they human or the environment.

Fear Appeals

Fear appeals and alarmism are commonly used communication tactics across scientific and media outlets. Fear-inducing representations of climate change are intended to shock audiences into engaging with climate change by emphasizing the serious and potentially harmful repercussions associated that cannot be ignored (O'Neill & Nicholson-Cole, 2009). For the scientific community, the desired outcome is a more supportive and proactive audience while media newsworthiness increases if identifiable events can be linked to a threat of human life thereby boosting their ratings (Sundblad, Biel, & Garling, 2009). Yet, fear appeals have the potential to halt or reverse forward progress by overwhelming and disempowering non-technical audiences.

Finite Pool of Worry

Linville and Fischer's (1991) "finite pool of worry" states that increased concern for one risk may decrease concern for other risks, because individuals may have limited worrying capacity. Repeated exposure to fear-inducing representations of climate change may provoke a counterintuitive reaction depending on the individual's personal pre-existing level of worry. If climate change fails to resonate as a priority for individuals, worry allocation for this issue will not register (Linville & Fischer, 1991). Cognitive dissonance, a psychological coping mechanism, leapfrogs from one's worrying capacity by fostering de-motivating emotional responses to threatening or ill-understood topics of seemingly overwhelming scale, like climate change (Moser, 2008). Effects of cognitive dissonance include denial, disempowerment, and the notion that climate change exists but does not affect *me* (Moser, 2008).

Frame Analysis and Discourse Theory

Frame analysis focuses on "how social actors use language [like metaphors, rhetoric, narrative, etc.] to mobilize key stakeholders, attempt to build a broad consensus around a course of action, and focus sustained media attention on a specific issue" (Fletcher, 2009, p. 801). After all, more research cannot resolve conflicts in the perception of issues, like the validity of climate change. Furthermore, the presentation of facts as an assumed pathway to proactive behavior ignores the potential for factual results to be ambiguous and contested by intended audiences, particularly those less fluent in the context and technicalities of the research (i.e. non-technical audiences) (Fletcher, 2009).

Discourse theory examines how language is used within a particular cultural setting to advance particular interests. Frame analysis is attentive to the interplay among actors, language, and policy, using this triangulation to shape communication methods (Fletcher, 2009). Climate change "frames" are the interpretive structures through which audiences absorb and synthesize an otherwise ambiguous stream of climate-related events and issues (Fletcher, 2009).

By "reframing climate change to break perceptual gridlock" (Nisbet, 2009, ¶ 24) through an emphasis on climate change as an economic opportunity, a national security issue, and improved health and well-being campaign, communication framing reorients climate change discourse from scientific facts and dire conditions to topics of interest that resonate with a broader non-technical audience (Fletcher, 2009). By indirectly promoting climate change action through a variety of associations that do not initially appear environmental or scientific in nature, efforts to proactively engage with climate change as a global issue will likely yield a more global support base (Nisbet, 2009). These framing strategies promote a "no regrets approach" to climate change, as economic incentives, increased national security, and improved community health are

benefits to society regardless of the certainty associated with climate change (Heltberg, Siegel, & Jorgensen, 2009).

Climate Change Communication Challenges

There are several challenges to communicating climate change. In this review I focus on two key challenges that have a disproportionate impact on hindering effective non-technical climate change communication. First, the epistemological perspective of physical scientists, like climate scientists, is largely informed by positivism, but often collides with the less conventional, but still pervasive perspectives of non-technical publics. The promotion of *objectivity* and value-free science has isolated scientists from non-technical publics who cannot conceivably separate context or their values from the natural world. Second, ways of knowing and knowledge acquisition within non-technical publics greatly varies. A single, unilateral approach to learning that revolves around the static presentation of more scientific information eliminates many audiences who possess different learning styles from connecting and understanding seemingly intangible issues like climate change. Communication practitioners that are able to keep these challenges in mind will be better prepared to address and resolve these hurdles.

Colliding Epistemologies

The Yale Project on Climate Change Communication surveyed over 2000 American adults, asking 81 questions related to the respondents' overall knowledge about the processes, causes, inputs, impacts, and solutions to climate change – 52% of Americans received a failing grade on a straight grading scale (Leiserowitz et al., 2010). A critical kink in the armor of climate literacy is the communication and transfer of knowledge between scientific experts and the public. When scientists communicate with the American public, the result is often lackluster,

contributing to on-going confusion and further distancing *experts* from *non-experts*[1] in what should be an interpersonal dialogue.

Much of this communicative tension and disconnect may be attributed to distinct differences in personality, innate internal pathways for sense-making, and communication preferences between climate scientists and the general public. After conducting an assessment of personality types of both climate scientists and the general public, Weiler, Keller, and Olex (2011) assert climate scientists orient toward intuition tendencies (82%) whereas the public orients towards sensing, its binary counterpart (73%). Intuitive preferences gravitate toward future, potentially uncertain implications, focusing on the big picture whereas sensing preferences entail situating discussions in the present, where concrete facts dissolve concerns related to uncertainty by providing rigid, black and white assurances about climate change (Weiler et al., 2011).

For non-technical publics, the acceptance of scientific uncertainty is often fraught terrain. Sundblad et al. (2009) suggest that the uncertainty-friendly culture of scientific inquiry lowers confidence levels in knowledge and trust of scientific expertise by non-technical audiences. While scientific experts accept some level of uncertainty in climate science research as elemental to all scientific inquiry, non-technical publics equate uncertainty to ignorance (Somerville & Hassol, 2011). Consequently, non-technical publics perceive weaknesses in scientific consensus on the causes and severity of climate change (Doran & Zimmerman, 2009). Overwhelmingly, research indicates that while the majority of climate scientists (80-90%) agree that climate change is happening due to anthropogenic causes, the American public perceives this consensus

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[1] Empowering individuals to think critically and connect with technical issues like climate change is not aided by labeling them as 'non-experts'. This term fails to instill a sense of support and confidence in people, thereby further distancing them from developing connections with an issue often thought to only be of concern to technical scientists. This manuscript will refer to non-scientists as non-technical audiences.

to be much weaker (40-50%), fostering further debate and skepticism about climate change's legitimacy (Doran & Zimmerman, 2009); Leiserowitz et al., 2010; Oreskes, 2004).

The scientist – non-scientist culture clash is rooted in fundamental epistemological perspectives that inform different perceptions of reality. Traditional to physical sciences, like climate science, the positivist perspective intentionally strives to separate facts from values – the 'fact-value dichotomy' (Proctor, 1991). According to this dichotomy, "empirical research is to proceed independently of normative context or implications" (Fischer, 2000). Following suit, positivist climate change communications clearly delineate scientific *fact* from values, emphasizing *objective*, research-derived facts about climate change's material reality, while often intentionally avoiding reference to the social, more subjective dimensions of climate change (Weiler et al., 2011).

Because positivism promotes the conveyance of objective facts as the pathway to greater understanding and inquiry, this objective foundation is projected onto audiences. Scientists often project their own positivist epistemology on non-scientific audiences by flooding them with a surge of facts related to climate change (Miller & Fahy, 2009). Furthermore, climate scientists struggle to convey the science in language that makes sense to non-technical audiences. Terms like *thermohaline circulation* and *ocean acidification*, while appropriate in the context of trained scientific experts, make no strides in bridging the vernacular gap for non-technical audiences, lending a sense of pedantry and elitism to an already contentious topic (O'Neill & Hulme, 2009; Whitmarsh, 2009). Referring to these terms in more common language, like "changes in ocean circulation patterns and their connection to regulating air temperatures," would sufficiently address concerns related to thermohaline circulation while rooting the message in language familiar to non-technical audiences.

While positivist scientists emphasize the importance of presenting technical facts that lead to knowledge, acceptance, and possible action, positivism is just *one of many* perspectives through which people relate to and gain understanding about their world. Proponents of alternatives to positivism assert that "science and technology rule to the exclusion of other modes of thought… without major opposition" (Fischer, 2000, p. 15). The social constructivist epistemology rejects the notion of *universal truths* and is skeptical about *objectivity*, *proof,* and knowledge accumulation (Fletcher, 2009). Recognizing that to some extent, *reality*, like whether or not climate change is caused by humans, is constructed through selective exposure, "selective exposure lets you choose the information…[and] people that suit you. And it's the people who matter…It's through our connections with others, that we choose our social reality" (Manjoo, 2008, p. 49).

This is not to suggest that all social constructivists believe that everything is relative and thus available for debate. Ontological realism states that a material reality exists, independent of human perception; however the level of influence assigned to human perception and non-human material existence is likely to reflect an individual's personal perspective on a spectrum between epistemological realism and epistemological construction (Peterson, Peterson, & Peterson, 2006). The subjective role of values, experience, and context varies from person to person and is likely to be directly confronted when conducting large-scale communication campaigns about a topic as interdisciplinary as climate change. After all, climate change is not an issue restricted to the scientific or natural world – impacts to economic livelihoods, health and wellness, and quality of life concerns must be addressed.

Alternative Pathways for Understanding

For scientists, learning through the scientific method involves a process of extensive interaction with models and field data, hypothesizing how the global, regional, or local systems may respond to different inputs and dynamics associated with climate change. Numerous comparisons between anticipated and actual outcomes are revisited, chiseling down the original hypothesis into a form that most closely reflects that which is determined through research. "Paradoxically, however, scientists, having deepened their understanding through an interactive, iterative learning process, often turn around and tell the results to… the public through reports and presentations, expecting them to change their beliefs and behaviors, and then express surprise when these groups – excluded from the process, unable to assess the evidence on their own and presented with claims that conflict with deeply held beliefs – resist the message and challenge the authority of experts" (Sterman, 2011, p. 823).

Technical experts are not altogether unlike their non-technical counterparts. A search of *climate change* in Web of Science from 2009 to 2012 yielded 9,845 results. The sheer number of scientific research published in peer-reviewed journals and other research publishing outlets suggest that, in an information deficit scenario, nearly 10,000 individual information outlets about climate change should significantly strengthen the public's understanding of climate change – but 52% of Americans failed to understand the processes and implications of climate change (Leiserowitz et al., 2010). This assessment was in stark contrast to their self-reported knowledge of climate change, where 62-66% of Americans stated that they were either "fairly well-informed" or "very well-informed" (Leiserowitz et al., 2010). The vivid disconnect between the extensive database of climate science information available compared to our country's failure

to grasp climate science as an informational topic demonstrates the need to utilize alternative forms of learning.

This is not to suggest that traditional forms of learning are entirely ineffective and should be eliminated. Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) emphasizes a need to thoroughly understand the attitudes and norms of individuals, which inform behavioral intent that can lead to changes in behavior. In the TRA model, knowledge and understanding precedes behavior, as bias developed by attitudes and norms exposes individuals to particular information sources and leads to an *informed* mentality prepared to engage with complementary behaviors (Fishbein & Ajzen, 1975). While the TRA model is considered a seminal piece of attitude-behavior literature, this manuscript suggests broadening the scope of how knowledge is acquired to encompass more interactive, engaging alternatives that speak to learning through experience. Combined, a palette of understanding options for climate change may yield a more informed public prepared to support and act in favor of climate change progress.

Climate Change Communication Opportunities

Successfully addressing the challenges of climate change communication can be eased through the intentional exploration of existing opportunities. I have identified three general opportunities that can be tweaked and tailored to specific contexts, audiences, and circumstance. First, considering a Post-Normal Science approach to climate change will allow for the values and uncertainty inherent in climate change to be openly addressed and considered across technical and non-technical publics (Functowicz & Ravetz, 2003). Post-Normal Science creates space for a plurality of *legitimate* perspectives to be voiced, empowering expertise across a multitude of knowledge areas that include both the ecological and social dimensions of climate change. Second, communications that emphasize place-based examples, language, and dialogue

allow global climate change to be localized on a familiar, valued landscape. I have also included research-supported examples of place-based climate change communication informed by Post-Normal Science that demonstrate the legitimacy of this approach. Lastly, I have identified pathways for understanding that complement the hands-on, tangible learning styles of many non-technical audiences. Acknowledging different ways of knowing, learning styles, and the importance of providing non-technical audiences with visceral, interactive opportunities to connect with climate change will result in a more resonant, engaged non-technical public prepared and empowered to address issues related to climate change.

Fusing Perspectives by Legitimizing Local Voices

Addressing the tandem nature of climate change's complex social-ecological dimensions requires due diligence in challenging traditional routes of information exchange for both research and communication endeavors. Post-Normal Science is a "new conception of the management of complex science-related issues" (Functowicz & Ravetz, 2003, p. 1). This conception advocates for the inclusion of problem-solving components often neglected by traditional scientific deliberation: uncertainty, value-loading, and a "plurality of legitimate perspectives" (Functowicz & Ravetz, 2003; Nowotny, 2003). A plurality of perspectives creates a broader, deeper pool from which *expertise* is derived. Post-Normal scientists engage in the co-production of knowledge inherent within transdisciplinary research, where research is "less concerned with establishing and maintaining boundaries and more with defining procedural rules, enhancing mutual understanding, and proposing normative orientations to make the co-production a collective process of policy cultures" (Pohl, 2008, p. 50). The holistic nature of Post-Normal Science serves as a connective corridor between positivist and constructivist core values, creating amenable space for dialogue across perspectives and areas of expertise.

This bilateral dialogue challenges the hegemonic dynamics of expertise by enlarging the porosity between the formally recognized mastery of knowledge – the "professional expert" – and experiential knowledge gained by repeat-exposure in an informal, localized setting (Fischer, 2000). This challenge is central to citizen participation critiques of modern democracies. Decision-making power granted exclusively to experts defies the fundamental components of public inclusivity and voice in participatory democracies (Hicks, 2002). Democratic societies assign a sense of legitimacy to all citizens and the various forms of expertise that emerge, valuing the unique experiences of the individual that inform public perspectives (Fraser, 1990). These perspectives may differ or express dissent but are given voice nonetheless. After all, a society in which a select few elites decide for the collective whole is not a democracy but rather an extrapolation on the Habermasian bourgeois public sphere. "Experts… possess no analytical wizardry capable of resolving our pressing societal problems. Expert judgment provides few uncontested solutions or answers… while we still need experts, expertise cannot stand alone" (Fischer, 2000, p. 41).

To be clear, a multiplicity of expertise does not discount the importance of scientific expertise, founded in empirical evidence of material realities, but rather suggests that to fully comprehend the holistic weavings of social-ecological systems, we must also be inclusive of more subjective perspectives that speak to human nature. Empirical science plays a particularly significant role in the understanding of ecological processes, and is most productive when paired with other forms of expertise to inform policy and implementation practices. Because this manuscript focuses on the communication of climate change, it is of particular importance that non-technical, social expertise not be overshadowed or discredited. Successful climate change

communication for non-technical audiences should balance the language and values of non-technical audiences with technically-accurate climate science.

"The issues expertise confronts, the practices that are to be analyzed and assessed as to their consequences, are characterized by overlaps and linkages that *bind scientific knowledge* to its *local and societal context*" (Nowotny, 2003, p. 152). Because global climate change can be a vague and ambiguous topic, climate change communication that is situated in smaller-scale, place-based contexts can more strongly resonate with non-technical publics and help to relate the global implications of climate change to the tangible, visceral presence of its impacts on familiar, visited landscapes (Hess, Malilay, & Parkinson, 2008; Raymond, Brown, & Weber, 2010). After all, images of stranded polar bears may initially capture the attention of audiences throughout the country, but because few people actually engage with the Arctic landscape, these icons of climate change are easily ignored and fail to compel audiences to take progressive action or even simply expand their sense of understanding (O'Neill and Hulme, 2009).

For contentious global environmental issues like climate change, the importance of locally *rooting* communications in *place* is critical. National parks and wildlife refuges can serve as accessible, tangible landscapes for non-technical audiences to make observations about climate change in a trusted environment. In a recent study conducted by the Yale Project on Climate Change Communication and the George Mason University Center for Climate Change Communication, the National Park Service was considered relatively trust-worthy as a source of information about global warming with 73% of participants assigning 'somewhat' or 'strong' trust to the agency (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). The public's sense of trust with these protected areas helps to eliminate political contention that may otherwise cloud dialogue potential. Pairing a trusted, visible landscape with the linkage between these landscapes

and the people visiting them is crucial (Fischer, 2000). Utilizing visitor knowledge, visitor language, and the incorporation of visitor values in national park and wildlife refuge communication efforts helps to humanize an issue that is often dismissed as *not affecting me* or too big for personal concern.

Research asserts that an individual's value orientation influences their beliefs about specific environmental behaviors and intentions (De Groot & Steg, 2008). Value orientations include egoistic (How does this impact *me*?), altruistic (How does this impact *others*?), and biospheric (How does this impact the *environment?*). Related to value orientations is the ideology held by an individual or on behalf of a particular group; ideology is defined "as a system of values, norms, and political preferences, linked to a program of action vis-à-vis a given social and political order" (Zia & Todd, 2010, p. 3). People relate to each other and the world through shared ideologies, which are funneled through a particular value orientation. Accurately identifying the value orientation-ideology matrices of visiting publics is critical in successfully framing climate change message (Moser, 2008). Empowering visitors as non-technical experts initiates the transformation of climate change communication from an unapproachable science to a social priority that needs addressing.

Place-Based Communication Examples

I have selected two exemplary cases of place-based climate change communication. These examples address both international and national place-based contexts and yield effective results. The first example is from O'Neill and Hulme (2009) who explored sense of place theory in the context of climate change communication through climate icon-generating focus groups for southern England residents. Rather than generating a list of expert-identified icons associated with climate change and then asking participants to rank their relevance, O'Neill and Hulme

(2009) simply asked the focus groups to describe the term *climate change* as it related to them. The collection of 27 non-technical people (in two focus groups) most commonly identified the *Norfolk Broads* as the top climate icon.

The Norfolk Broads are an extensive wetland complex to the southwest of London, whose habitat provides critical breeding areas for migratory birds, water filtration, and recreational opportunities for England residents. The Norfolk Broads are threatened by rising sea levels, as the wetlands are just above sea level and protected by a shallow sand dune barrier. Interestingly, when an expert panel was asked to generate it's top climate icons, the *West Antarctic Ice Sheet, ocean acidification*, and *thermohaline circulation* ranked highest (O'Neill & Hulme, 2009). This study clearly illustrates the drastic dissonance between climate icons that make intuitive sense for non-technical audiences and those that best capture the climate concerns of scientists.

The second example of place-based climate change communication is from the National Park Service (NPS). The NPS "manag[es] with the best available science… [to] help staff and the public appreciate the implications of a changing climate" (National Park Service, 2012a). NPS interpreters, the staff that serve as liaisons between park resources (including climate change science) and the public, strive to promote public appreciation of climate change implications by illustrating the impacts of climate change on the local landscape while encouraging public involvement.

Interpreters at Sequoia Kings Canyon National Park in California developed a campfire program entitled "Global weirding: Climate change and the future of our national parks" (Anthony Bevilacqua, personal communication, February 24, 2011). The program focused on climate change impacts to the Sierra Nevada including retreating glaciers and the potential loss

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of Giant Sequoias as they are forced to migrate up in elevation to escape warmer temperatures in their current habitat (Anthony Bevilacqua, personal communication, February 24, 2011). Rather than displaying graphs to indicate climate change impacts on park resources, the Global Weirding program focuses on images that illustrate impacts – a communication medium that promotes individual interpretation for a broader, less-technical audience (Anthony Bevilacqua, personal communication, February 24, 2011). Park interpreters conclude the program with empowering actions for individuals interested in contributing toward climate change progress; audience feedback noted the accessibility and solution-oriented nature of the program helped dissuade feelings of "doom and gloom" and provided people with tangible ways to be proactively involved (Anthony Bevilacqua, personal communication, February 24, 2011).

Interpreters at Florissant Fossil Beds National Monument in Colorado share stories about climate change in the context of "one of the world's richest fossil deposits" (Jeff Wolin, personal communication, February 20, 2011). "[Interpreters] tell the story of an ancient community that lived on a warmer Earth. There was a warm temperate forest here complete with Redwoods and even Tse Tse flies!!!" (Jeff Wolin, personal communication, February 20, 2011). The Monument engages in extensive informal interpretation, sharing the climate change story with visitors on hiking trails or at exhibit displays throughout the Monument – 'People… say, "wow Redwoods in Colorado" then we discuss what scientists think the climate was like… people react to that and mention something about the current issues of climate change. Then we can discuss/interpret what is happening in the NPS today' (Jeff Wolin, personal communication, February 20, 2011). By utilizing informal opportunities for learning and discussion, interpreters build from the momentum already of visitors making their own observations about the connection between the Monument's landscape and climate change impacts.

Simple, Adaptable Climate Change Messages

Once non-technical audiences have been reintroduced to a tangible, familiar landscape under the frame of "this place you know is impacted by climate change", particular communication transactions can be exchanged. Schweizer, Thompson, Teel, & Bruyere (2009) developed nine key messages about climate change that provide room for localized adaptation. The messages were informed by feedback from communication and land management practitioners who regularly serve as liaisons between climate change impacted landscapes and non-technical audiences. Key messages included: Human choices have an impact on climate change; The future will look different and we must adapt to it; Climate change affects you and the places important to you; You can help make a difference in addressing climate change (Schweizer et al., 2009).

Public Engagement and Experiential Learning

Sterman (2011) asserts that due to the Information Deficit Model's failure in increasing climate literacy, non-technical publics "require different kinds of communication, including the use of experiential learning environments… that allow people to discover, for themselves, the dynamics of complex systems like the climate" (p. 812). Experiential learning invites audiences to tangibly interact with concepts and processes that are otherwise presented in unilateral, static forms, like scientific publications and traditional media coverage. This hands-on approach to learning creates support environment to not only increase climate change literacy, but also allows for the confrontation and reconsideration of existing attitudes that may inhibit progressive behavior change from occurring (Verplanken, 2011; Vining & Saunders, 2004). Visceral engagement helps address barriers to behavior change, including a "lack of knowledge,"

"perceived scientific uncertainty," "remoteness of the threat," and "individual helplessness" – attitudinal factors that otherwise provide justification for climate change denial or unwillingness to act (Wolf, 2011, p. 122). Research in social psychology suggests that actions can "serve to commit individuals psychologically to an attitude position" and, further, that "individuals might sometimes treat their behavior as a piece of information that is relevant to judgments about their own attitudes" (Olson & Stone, 2005, p. 223).

It should be noted that while traditional models suggest that behavior change follows fluency in the behavior-influencing topic (i.e. climate change), paths that introduce action and behavioral mechanisms first do not require extensive knowledge about the topic (Verplanken, 2011). Instead, knowledge gain and behavior change coexist, developing simultaneously in the context of interactive, hands-on actions and activities that expose participants to a holistic perspective on climate change. Delgado, Kjølberg, and Wickson (2010) conducted a meta-analysis of public expertise requirements to participate in science and technology activities, determining technical levels of "relevant and related" expertise were considered most necessary, and thus most contentious, in decision-making situations (i.e. decisions internal to science like the determination of study length, measurement and model type to implement, etc.). Large-scale decision-making scenarios are not likely to occur in public engagement activities with the exception of individual decisions to adapt behavior and attitudes based on experiences during the engagement process.

Action-forward public engagement strategies. Extensive research has been conducted to determine constitutes public engagement and the varietals of nuance within this approach to increasing knowledge and encouraging complementary behavior change (i.e. Bäckstrand & Lövbrand, 2007; Evely, Pinard, Reed, & Fazey, 2011; Lassen, Horbsøl, Bonnen, & Pedersen,

2011; Pretty, 1995; Schultz, 2011). Lassen et al. (2011) describe three fundamental discourses for participation: ecological modernization, green governmentality, and civic environmentalism. While ecological modernization and green governmentality are largely top-down participatory forms exclusive to experts and technically-fluent publics, civic environmentalism recognizes the necessary inclusion of *ordinary* citizens in increasing over all awareness and changing social practices that influence our social-ecological systems (Bäckstrand & Lövbrand, 2007; Lassen et al., 2011). The bottom-up role of engagement within civic environmentalism pivots on citizens developing "a personal state of connection" with the issue, like climate change (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007, p. 446). "This definition contrasts with engagement as a process of participation and implies that knowing about climate change is insufficient in order to be engaged," and rather cognitive, affective, and behavioral dimensions of connection must also be considered (Wolf, 2011, p. 122).

Evely et al. (2011) describe the consideration of these engagement dimensions in the context of three engagement typologies along a continuum from more participation-oriented to a deeper engagement-orientation: functional, interactive, and self-mobilization. Functional projects, and to a lesser extent interactive projects, are those that serve a purpose for the host entity and often provide limited opportunity for self-directed outcomes and reflection (Evely et al., 2011; Pretty, 1995). Conversely, self-mobilization projects balance organizational needs and outcomes with rich, tangible experiences for the participant that extend beyond basic interaction with a functional project – "While some learning outcomes in projects with lower qualities of engagement may increase over time, higher levels of learning outcomes are achieved in the early stages of projects with high levels of engagement [i.e. self-mobilization projects]" (Evely et al., 2011, p. 124). High levels of engagement include those that institutionalize opportunities for

ownership and responsibility, thereby contributing to a sustained sense of involvement that extends well beyond a single participatory experience (Evely et al., 2011; Pretty, 1995).

Climate change engagement strategies will allow for the expansion of understanding and potential behavior change in non-technical publics that are inadequately addressed in traditional communication deficit endeavors. For those who learn and inform their lifestyle through tangible, hands-on experience, climate change engagement strategies can appeal to and invite these marginalized but not insignificant populations into the conversation about a topic that will inevitably affect us all. After all, "awareness, information, and understanding is not enough to change people's habits of mind and practice; rather dialogic, two-way forms of (positive) communication and collaboration seem to stimulate change" (Lassen et al., 2011, p. 413).

Summary of Insights

The importance of non-technical audience involvement in climate change efforts continues to grow. Climate change is now a highly politicized global issue in which certain, very powerful people and industries have much to lose (i.e. oil and gas) and therefore leverage their power to slow or deny the issue's seriousness (Wilson & Anderson, 1997). This only further illuminates the importance of bottom-up support that unites communities rather than distancing them from the discussion that will have unprecedented impacts on all communities across the globe. Overcoming the issues posed by climate change will require the collaboration of technical and non-technical communities alike, utilizing the creativity and ingenuity potential of all involved.

With the toolbox now assembled to actively engage non-technical communities in climate change discussion, research now needs to address how to translate engagement and climate literacy into action. A climate empathetic ear has limited utility if this empathy is only applied in

recognizing climate change as a real and immediate cause for action. Recognition must be translated into empowerment and action for substantial progress to be made. This action includes lifestyle behavior changes, building networks of community supporters to spread and disseminate information and action items to others, a conveyance of expectations for government action, and demands that industry also adapt to our changing climate rather than halting progress that is critical to the success of our species and globe.

Society's ability to proactively engage with climate change begins with relevant, resonant, and empowering climate change messages shared among technical and non-technical communities, which encourages connectivity and collaboration. The use of appropriate framing and attachment to place aid in the successful resonance of these climate change messages by minimizing ineffective technical jargon while still maintaining the scientific integrity needed to uphold climate change as a global issue deserving of everyone's attention. By including more people, and excluding fewer, the efforts of communication practitioners to educate, engage, and act toward progressive climate change measures will yield more inclusive benefits for both the environment and people while building a more resilient, proactive society.

PLACE AS POST-NORMAL SCIENCE SPACE: ROOM TO RENEGOTIATE TECHNICAL

AND NON-TECHNICAL UNDERSTANDINGS OF CLIMATE CHANGE

> How can so many people living in the same world see things so
>
> differently? No longer are people holding different opinions… but
>
> different facts. (Manjoo, 2008, p. 2)

From more frequent heat waves to water availability concerns, the implications of climate change are not isolated to particular regions or locales but rather have a diverse range of impacts that will be experienced throughout the United States and world (IPCC, 2007). According to the 2007 Intergovernmental Panel on Climate Change Report (IPCC), there is high confidence that by 2050 semi-arid areas of the world will suffer from a decline in water resources due to climate change. Warming in mountains will reduce snowpack, cause more winter flooding and reduce summer in-stream flow, thereby exacerbating water scarcity issues. North American cities currently experiencing extreme heat events are "are expected to be further challenged by an increased number, intensity and duration of heat waves during the course of the century, with potential for adverse health impacts" (IPCC, 2007, ¶ 6). Coastal communities and habitats will experience growing stress by development and pollution concerns that interact with climate change impacts (IPCC, 2007).

Given the all-inclusive nature of climate change, it is important that countries and their citizens take proactive measures to mitigate these impacts. Despite having the capacity to significantly contribute to the success of global climate change adaptation and mitigation

solutions, American citizens fail to comprehend the seriousness of this issue (Leiserowitz, Smith, & Marlon, 2010)[2].

The Yale Project on Climate Change Communication surveyed over 2000 American adults, asking 81 questions related to the respondents' overall knowledge about the processes, causes, inputs, impacts, and solutions to climate change – 52% of Americans received a failing grade (Leiserowitz et al., 2010). Much of this climate literacy failure may be attributed to ineffective communication strategies that fail to connect the technical dimensions of climate change to non-technical audiences. In this manuscript, I argue that non-technical audiences can better connect and understand climate science through the renegotiation of language, relevance, and resonant messages framed in a familiar, valued landscape - essentially through the lens of place.

America's national parks and wildlife refuge systems serve as apolitical places for non-technical dialogue exchanges about climate change to occur. These protected landscapes provide a tangible foundation for visitors to make personal, *localized* connections to the implications of *global* climate change. Fostering these connections means that national parks and wildlife refuges can better communicate with non-technical audiences about the complexities of climate change. Empowering individuals to make connections between themselves and this global issue can result in a plethora of language, content, and narrative linkages derived by non-technical audiences, which can then be used by each agency for future public communication endeavors.

This manuscript will demonstrate the power non-technical ways of knowing *global* climate change through the use of place-based climate change outreach situated in *local* landscapes (like national parks and national wildlife refuges). Different forms of expertise

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[2] While the author recognizes the importance of public inclusion in policy considerations and development, this manuscript will focus on the communication of climate change to non-technical publics as a necessary first step in expanding the inclusivity of the global climate change conversation.

emerge through the deconstruction of traditional and non-traditional epistemological perspectives. It is at national parks and national wildlife refuges that the variety of *expertises* can coexist. This web of knowledge provides opportunities for audiences to build local connections and foster greater understanding about climate change and mitigation behaviors.

Colliding Epistemologies

In an interview with the Public Broadcasting Station about climate change impacts in polar areas, Eric Chivian (2007), founder and director of the Center for Health and the Global Environment at Harvard Medical School said: "Scientists, I must say, are not terribly good at communicating with the general public. I mean, we're taught to speak in technical language" (¶ 14).

A critical kink in the armor of climate literacy is the communication and transfer of knowledge between scientific experts and the public. When scientists communicate with the American public, the result is often lackluster, contributing to on-going confusion and further distancing experts from *non-experts*[3] in what should be an interpersonal dialogue. Much of this communicative tension and disconnect may be attributed to distinct differences in personality, innate internal pathways for sense making, and communication preferences between climate scientists and the general public. After conducting an assessment of personality types of both climate scientists and the general public, Weiler, Keller, and Olex (2011) assert climate scientists orient toward intuition tendencies (82%) whereas the public orients towards sensing, its binary

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[3] Empowering individuals to think critically and connect with technical issues like climate change is not aided by labeling them as 'non-experts'. This term fails to instill a sense of support and confidence in people, thereby further distancing them from developing connections with an issue often thought to only be of concern to technical scientists. This manuscript will refer to non-scientists as non-technical audiences; when specifically referring to the NPS and FWS, these are non-technical visitors. Visitors do not imply a sense of temporary interest or short-term commitment to an issue like climate change, but rather identifies them as in interested, voluntary citizen *visiting* a publicly owned place – a combination of circumstances that yield limitless opportunities for broadening the scope of expertise, effective communication, and engagement.

counterpart (73%). Intuitive preferences gravitate toward future, potentially uncertain implications, focusing on the big picture whereas sensing preferences entail situating discussions in the present, where concrete facts dissolve concerns related to uncertainty by providing rigid, black and white assurances about climate change (Weiler et al., 2011).

For non-technical publics, the acceptance of scientific uncertainty is often fraught terrain. Sundblad, Biel, and Garling (2009) suggest that the uncertainty-friendly culture of scientific inquiry lowers confidence levels in knowledge and trust of scientific expertise by non-technical audiences. While scientific experts accept a certain level of uncertainty in climate science research as elemental to all scientific inquiry, non-technical publics equate uncertainty to ignorance (Somerville & Hassol, 2011). Consequently, non-technical publics perceive weaknesses in scientific consensus on the causes and severity of climate change (Doran & Zimmerman, 2009). Overwhelmingly, research indicates that while the majority of climate scientists (80-90 percent) agree that climate change is happening due to anthropogenic causes, the American public perceives this consensus to be much weaker (40-50 percent), fostering further debate and skepticism about climate change's legitimacy (Doran & Zimmerman, 2009; Leiserowitz et al., 2010; Oreskes, 2004).

The scientist – non-scientist / technical – non-technical culture clash is rooted in fundamental epistemological perspectives that inform different perceptions of reality. Traditional to physical sciences, like climate science, the positivist perspective intentionally strives to separate facts from values – the "fact-value dichotomy" (Proctor, 1991). According to this dichotomy, "empirical research is to proceed independently of normative context or implications" (Fischer, 2000). Following suit, positivist climate change communications clearly delineate scientific *fact* from values, emphasizing *objective*, research-derived facts about climate

change's material reality, while often intentionally avoiding reference to the social, more subjective dimensions of climate change (Weiler et al., 2011).

Because positivism promotes the conveyance of objective facts as the pathway to greater understanding and inquiry, this objective foundation is projected onto audiences. Research by Miller and Fahy (2009) describes the commonly employed Information Deficit Model of communication, in which scientists project their own positivist epistemology on non-scientific audiences by flooding them with a surge of facts related to climate change. The Information Deficit Model asserts that, in the case of climate change, the public's failure to grasp the seriousness of climate change is due to a deficit of publicly accessible, accurate climate science information. Thus, providing access to more scientific information will foster a better-informed public primed to respond to challenges posed by climate change (Fischer, 2000; Miller and Fahy, 2009). Not only does this model make an assumption in correlating the quantity of scientific fact with understanding, but it also focuses communication energies on elements of climate change that may fail to sustain non-technical audience engagement due to their unintended depiction of science as removed from society (Fischer, 2000).

Furthermore, climate scientists struggle to convey the science in language that makes sense to non-technical audiences. Terms like *thermohaline circulation* and *ocean acidification*, while appropriate in the context of trained scientific experts, make no strides in bridging the vernacular gap for non-technical audiences, lending a sense of pedantry and elitism to an already contentious topic (O'Neill & Hulme, 2009; Whitmarsh, 2009). Referring to these terms in more common language, like "changes in ocean circulation patterns and their connection to regulating air temperatures," would sufficiently address concerns about changes in *thermohaline circulation* while rooting the message in language familiar to non-technical audiences.

While positivist scientists emphasize the importance of presenting technical facts that lead to knowledge, acceptance, and possible action, positivism is just *one of many* perspectives through which people relate to and gain understanding about their world. Proponents of alternatives to positivism assert that "science and technology rule to the exclusion of other modes of thought… without major opposition" (Fischer, 2000, p. 15). The social constructivist epistemology rejects the notion of *universal truths* and is skeptical about *objectivity*, *proof,* and knowledge accumulation (Fletcher, 2009). For example, recognizing that to some extent, *reality*, like whether or not climate change is caused by humans, is socially constructed means that not everyone believes the same thing. Those who believe climate change is solely a natural cycle, not influenced by human activity, demonstrate a particular view of reality informed by a selective compilation of information sources, trusted 'experts', and personal values. Therefore, the causes of climate change and other realities can be said to be constructed through selective exposure: "selective exposure lets you choose the information…[and] people that suit you. And it's the people who matter…It's through our connections with others, that we choose our social reality" (Manjoo, 2008, p. 49).

This is not to suggest that all social constructivists believe that everything is relative and thus available for debate. Ontological realism states that a material reality exists, independent of human perception; however the level of influence assigned to human perception and non-human material existence is likely to reflect an individual's personal perspective on a spectrum between epistemological realism and epistemological construction (Peterson, Peterson, & Peterson, 2006). The subjective role of values, experience, and context varies from person to person and is likely to be directly confronted when conducting large-scale communication campaigns about a topic as interdisciplinary as climate change. After all, climate change is not an issue restricted to

the scientific or natural world – impacts to economic livelihoods, health and wellness, and quality of life concerns must be addressed.

Fusing Perspectives by Legitimizing Local Voices and Local Connections

Alan Leshner, Chief Executive officer for the American Association for the Advancement of Science and Chief Editor of *Science* asserted:

> Simply trying to educate the public about specific science-based issues is not working… We need to move beyond what too often has been seen as a paternalistic stance. We need to engage the public in a more open and honest bidirectional dialogue about science… We need to respect the public's perspective and concerns even when we do not fully share them, and we need to develop a partnership that can respond to them. (Leshner, 2003, p. 977)

Addressing the tandem nature of climate change's complex social-ecological dimensions requires due diligence in challenging traditional routes of information exchange for both research and communication endeavors. Post-Normal Science is a "new conception of the management of complex science-related issues" (Functowicz & Ravetz, 2003, p. 1). This conception advocates for the inclusion of problem-solving components often neglected by traditional scientific deliberation: uncertainty, value-loading, and a "plurality of legitimate perspectives" (Functowicz & Ravetz, 2003; Nowotny, 2003). A plurality of perspectives creates a broader, deeper pool from which expertise is derived. Post-Normal scientists engage in the co-production of knowledge inherent within transdisciplinary research, where research is "less concerned with establishing and maintaining boundaries and more with defining procedural rules, enhancing mutual understanding, and proposing normative orientations to make the co-production a collective

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process of policy cultures" (Pohl, 2008, p. 50). The holistic nature of Post-Normal Science serves as a connective corridor between positivist and constructivist core values, creating amenable space for dialogue across perspectives and areas of expertise.

This bilateral dialogue challenges the hegemonic dynamics of expertise by enlarging the porosity between the formally recognized mastery of knowledge – the "professional expert" – and experiential knowledge gained by repeat-exposure in an informal, localized setting (Fischer, 2000). This challenge is central to citizen participation critiques of modern democracies. Decision-making power granted exclusively to experts defies the fundamental components of public inclusivity and voice in participatory democracies (Hicks, 2002). Democratic societies assign a sense of legitimacy to all citizens and the various forms of expertise that emerge, valuing the unique experiences of the individual that inform public perspectives (Fraser, 1990). These perspectives may differ or express dissent but are given voice nonetheless. After all, a society in which a select few elites decide for the collective whole is not a democracy but rather an extrapolation on the Habermasian bourgeois public sphere. "Experts… possess no analytical wizardry capable of resolving our pressing societal problems. Expert judgment provides few uncontested solutions or answers… while we still need experts, expertise cannot stand alone" (Fischer, 2000, p. 41).

To be clear, a multiplicity of expertise does not discount the importance of scientific expertise, founded in empirical evidence of material realities, but rather suggests that to fully comprehend the holistic interweavings of social-ecological systems, we must also be inclusive of more subjective perspectives that speak to human nature. Empirical science plays a particularly significant role in the understanding of ecological processes, and is most productive when paired with other forms of expertise to inform policy and implementation practices. Because this

manuscript focuses on the communication of climate change, it is of particular importance that non-technical, social expertise not be overshadowed or discredited, as the number of non-scientist citizens far outweighs technical climate science experts. Successful climate change communication for non-technical audiences should balance the language and values of non-technical audiences with technically accurate climate science. Creating space for dialogue between different ways of knowing rather than top-down lecturing from technical experts to non-technical audiences yields opportunities for more holistic, collaborative solutions that would be inadequately addressed if such dialogue were absent.

"The issues expertise confronts, the practices that are to be analyzed and assessed as to their consequences, are characterized by overlaps and linkages that *bind scientific knowledge* to its *local and societal context*" (Nowotny, 2003, p. 152). Because global climate change can be a vague and ambiguous topic, climate change communication that is situated in smaller-scale, place-based contexts has the potential to resonate with non-technical publics and help to relate the global implications of climate change to the tangible, visceral presence of its impacts on familiar, visited landscapes (Hess, Malilay, & Parkinson, 2008; Raymond, Brown, & Weber, 2010). Place attachment theory posits that people possess emotional ties to specific landscapes that bond people to particular places (Altman & Low, 1992). By tapping into existing place attachment and encouraging further development through place-based climate change communication, Hess et al. (2008) asserts that "emphasizing place highlights climate change's effects where they are most acutely felt, where local strengths are best understood, where place attachment can be leveraged most effectively, and where residents will reap the benefits of adaptive measures promoting sustainability and livable communities" (p. 476). After all, images of stranded polar bears may initially capture the attention of audiences throughout the country,

but because few people actually engage with the Arctic landscape, these icons of climate change are easily ignored and fail to compel audiences to take progressive action or even simply expand their sense of understanding (O'Neill and Hulme, 2009).

Sense of place

O'Neill and Hulme (2009) explored sense of place theory in the context of climate change communication through climate icon-generating focus groups for southern England non-technical residents. Rather than generating a list of technical expert-identified icons associated with climate change and then asking participants to rank their relevance, O'Neill and Hulme simply asked the focus groups to describe the term *climate change* as it related to them. The 27 non-experts (in two focus groups) most commonly identified the *Norfolk Broads* as the top climate icon. The Norfolk Broads are an extensive wetland complex to the southwest of London, whose habitat provides critical breeding areas for migratory birds, water filtration, and recreational opportunities for England residents. The Norfolk Broads are threatened by rising sea levels, as the wetlands are just above sea level and protected by a shallow sand dune barrier. Interestingly, when an technical expert panel was asked to generate it's top climate icons, the *West Antarctic Ice Sheet, ocean acidification*, and *thermohaline circulation* ranked highest (O'Neill & Hulme, 2009). This study clearly illustrates the drastic dissonance between place-based climate icons that make intuitive sense for non-technical audiences and those that best capture the climate concerns of scientists.

For contentious global environmental issues like climate change, the importance of locally *rooting* communication in *place* is critical. National parks and wildlife refuges can serve as accessible, tangible landscapes for non-technical audiences to make observations about climate change. In a recent study conducted by the Yale Project on Climate Change

Communication and the George Mason University Center for Climate Change Communication, the National Park Service was considered relatively trust-worthy as a source of information about global warming with 73% of participants assigning "somewhat" or "strong" trust to the agency (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). The public's sense of trust with these protected areas helps to eliminate political contention that may otherwise impair the potential for dialogue. Pairing a trusted, visible landscape with the linkage between these landscapes and the people visiting them is crucial in growing a reciprocal, communicative relationship - founded in trust - between people and the landscapes they visit (Fischer, 2000). Utilizing visitor knowledge, visitor language, and the incorporation of visitor values in national park and wildlife refuge communication efforts helps to humanize an issue that is often dismissed as *not affecting me* or *too big for personal concern*. Empowering visitors as non-technical experts initiates the transformation of climate change communication from an unapproachable science to a social priority that needs addressing.

Research asserts that an individual's value orientation influences their beliefs about specific environmental behaviors and intentions (De Groot & Steg, 2008). Value orientations include egoistic (How does this impact *me*?), altruistic (How does this impact *others*?), and biospheric (How does this impact the *environment?*). Related to value orientations is the ideology held by an individual or on behalf of a particular group; ideology is defined "as a system of values, norms, and political preferences, linked to a program of action vis-à-vis a given social and political order" (Zia & Todd, 2010, p. 3). People relate to each other and the world through shared ideologies, which are funneled through a particular value orientation. Accurately identifying the value orientation-ideology matrices of visiting publics is critical in successfully framing climate change message (Moser, 2008).

Local Landscapes and Voices – Utilizing National Parks and Wildlife Refuges

For American audiences, the national parks and wildlife refuge system can serve as place-based showcases of climate change effects and provide opportunities for both visitors and adjacent communities to connect this global issue to a valued, *tangible* landscape. In 2010, recognizing the influence of climate change on protected landscapes, the National Park Service (NPS) developed their Climate Change Response Strategy - "Global climate change threatens the integrity of our national parks. It challenges the NPS mission to leave park resources unimpaired for future generations unlike any threat in our history" (National Park Service, 2012a, p. 3). The U. S. Fish and Wildlife Service (FWS) developed a similar strategic plan to address climate change threats to wildlife refuges. Both plans identify core principles linking the agency's mission to its necessity to address climate change and lay out action items to best address issues related to adaptation, mitigation, and communication.

Whereas it is evident that both the NPS and FWS intend to address climate change, existing efforts to communicate with non-technical publics has been challenging for the agencies as evidenced in the recent creation of their respective communication and engagement strategies. I propose that public land management agencies, like the NPS and FWS, grounded with a sense of public trust, utilize their visitors' knowledge to shape the language, content, and participation involved in climate change dialogue. By reexamining traditional unilateral outreach pathways and giving voice to visitors and their connections to these protected places, both agencies can expand the notions of climate change expertise, empower communities adjacent to public lands, and achieve more resonant results in their attempts to increase awareness and promote action-oriented behaviors related to climate change progress (Nisbet, 2009; O'Neill & Hulme, 2009; Whitmarsh, 2009).

Methods

To assess the non-technical expertise and connection to place felt by NPS and FWS visitors, informal visitor interviews (n = 211) were conducted through convenience sampling at seven NPS units and three FWS refuges (i.e. Lindlof & Taylor, 2010; Neuman, 2006) – Harpers Ferry National Historic Park, Fort Dupont Park, Frederick Douglass National Historic Site, Kenai Fjords National Park, Kenai National Wildlife Refuge, Olympic National Park, North Cascades National Park, Mount Rainier National Park, Dungeness National Wildlife Refuge, and Nisqually National Wildlife Refuge. Visitors were approached and interviewed at trailheads, visitor centers, and in popular gathering areas like boat launches and parking lots. Interviewees were asked several questions related to climate change and the park/refuge. For the purposes of this study, analysis focused on two questions:

- How would you describe climate change to a friend?
- What does climate change mean to you?

Interviews were transcribed verbatim and responses were open-coded for content (i.e. Lindlof & Taylor, 2010; Neuman, 2006). Initial coding for six key themes helped organize the interview data into distilled categories of information for use (i.e. Lindlof & Taylor, 2010; Patterson & Williams, 2002):

1. Examples of climate change impacts
2. Figures of speech – similes, metaphors, personifications
3. Narratives (to explain personal connection to climate change)
4. Broad definitions of climate change (global scale)
5. Suggestions for changes to existing terminology
6. Key words used by multiple respondents

Because the above themes were intended for surface-level analysis, further distillation of the data within and across themes revealed deeper nuance and insight (Patterson & Williams, 2002). The second round of analysis built on the initial categories of codes by examining

examples of climate change impacts (theme one) through the lens of interviewee-supported statements of obviousness - what examples of climate change impacts given appear repeatedly across interviewees and are supported by statements of *fact*? Second, the narratives (theme three) were analyzed for mechanisms of rationalization – how do people rationalize general information about climate change through personal connections? Finally, theme six – key words used by multiple respondents – generated a short list of commonly referenced language, language that was analyzed for their implicit relationship between climate change and people.

Results

Finding 1 – 'obvious' examples.

The glaciers up here, they're receding at a horrendous rate. You see the end

moraines backed up for miles. They're backin' up something fierce.

(Kenai Fjords National Park visitor, personal communication, June 21, 2011)

While interviewees described many different examples of climate change, two references were most prominent across sites: natural disasters/extreme weather and melting glaciers. Natural disasters/extreme weather, which include impacts like "tornadoes", "flooding", "forest fires", and general "storms" were cited by 31 different respondents - a visitor to Mount Rainier National Park said, "I think what is happening is that in many places it's getting warmer and the warmth also changes the climate in general [like with] flooding [and] more storms. I realize that this has been a really weird year all over the world and a lot of people say that's not necessarily due to global warming and climate change, but I think we're… at least beginning to see some of those effects… have to do with the fact that the climate is changing. I think there's plenty of evidence [for climate change]." Temporally examining the time during which these interviews

occurred relative to large-scale, media-prominent natural disasters like the flooding and tornadoes that threatened many lives in the eastern US in 2011, shows a correlation between the prominence of these disasters in real-time and their representation as a commonly referenced example of climate change (interviews were collected between May – July of 2011).

These "extreme weather events" are tangible, immediate, visceral, and threatening to people's livelihoods, thereby forcing a reaction from observers. Unlike the slower, incremental changes often associated with climate change and couched in uncertainty in visitor responses, the immediacy of these examples garner attention and response from non-technical audiences with little hesitation or skepticism. Anticipating scientific concerns in differences between weather and climate, the NPS and FWS should more intentionally articulate differences between weather and climate in their communications by showing demonstrations of each and emphasizing the difference in temporal scale between these two factors.

It should be noted that interviewees commonly admitted confusion about what climate change means, articulating a disconnect between global warming trends and personal observations or projections of local climate impacts. The tension between warming and other indicators of climate change surfaced as many interviewees struggled to describe the process in a meaningful way – responses ranged from simply "confusing" to "it doesn't really mean anything to me because it's too broad for me to really grasp" or "I've heard that global warming is a misnomer because most people are experiencing cold rather than warming, so how can you talk about global warming?" This tension deserves recognition by the NPS and FWS to feature the impacts of climate change on a local, place-based scale that expand well beyond simplistic warming associations. More importantly, taking advantage of obvious impacts as a way of

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situating the diversity of climate change will help broaden understanding and foster personal connections to the local landscape.

Another obvious, non-negotiable impact of climate change cited by 20 interviewees was "melting glaciers". As expected, several of these references reflected direct observations in parks and refuges that have illustrative glacier recession, such as those featured at Kenai Fjords National Park's Exit Glacier, views of Mount Olympus from Olympic National Park's Hurricane Ridge, and mountaineering expeditions in North Cascades National Park. The prevalence of place-based references supports the case for utilizing place-based demonstrations of climate change on park and refuge landscapes. However, for protected areas that do not have iconic melting glaciers, hope is not lost.

In both obvious examples, people referenced impacts that are "not normal". This suggests that people are making observations about the environment, recognizing changes in intensity, frequency, and location. As scientists and communicators, it is important to recognize this practice, and empower visitors to continue making observations and connecting local *weirdness* to global patterns. While not all landscapes have glaciers to demonstrate local climate change, each park and refuge has lands impacted by climate change. *Showing* people, rather than *telling* them, how climate change is impacting *this place* will help initiate awareness and discussion about climate change on a local level.

National park and wildlife refuge visitors consistently expressed tension or anxiety related to aggressive, in-your-face climate change campaigns that cornered audiences into submission. Communication tactics that provide the space and time for visitors to develop *their own* questions through reflective inquiry allows for an interchange of dialogue between the park/refuge and its visitors, resulting in audiences receptive to information and explanations – a

visitor to Kenai Fjords National Park in Alaska simply stated, "I don't think you really need to preach at people, [instead] show them what's going on. I like subtle." Utilizing 'obvious' impacts that people already congregate toward, as the initial prompt for climate change conversation will help depoliticize the topic.

Agencies can further the discussion of obvious impacts by demonstrating how they engage with these impacts on a local scale. Both agencies have demonstrated a commitment to sustainability and energy conservation through programs like the NPS Climate Friendly Parks program. The pairing of sustainable practices with the name of this program implies that NPS (and FWS) recognize some level of human involvement in the exacerbation of climate change issues. By passively demonstrating climate sensitive practices through the use of electric fleet overhauls, energy efficient infrastructure, and increased visitor shuttle opportunities, the agencies can help further the apolitical nature of climate change while supporting the recognition of human contribution to this global issue. Bridging obvious impacts with impacts on the local landscape and proactive measures taken by the agency will require creativity and intention, but visitors' attention will be captured - rather than dismissed - creating opportunities for locally-situated climate change conversation.

Finding 2 – mechanisms for rationalization.

I was raised here. When I was a child we had a home up on the east side and
looking out our dining room window… Mt. Rainier was right there. Growing up I
never saw the slopes of Mt. Rainier get down to bare rock like they do today.
(Mount Rainier National Park visitor, personal communication, July 2011)

Narratives helped interviewees describe their personal connection to global climate change. Because much of the outreach conducted by the NPS or FWS is intended to give non-technical audiences a better understanding of the technical processes through which climate change occurs – climate science – visitors are not given explicit pathways to personalize this global issue. However, the presence of narratives in interview responses demonstrates that people often attempt to distill global projections into something personally meaningful.

Most commonly, narratives compared childhood depictions of the landscape with present observations. A sense of concern often accompanied these accounts, as interviewees reflected on past visits to parks and refuges, recollecting iconic landscapes that either no longer exist or are projected to greatly change or disappear in the near future. Additionally, these non-technical interviewees expressed concern for the wildlife that depend on these threatened landscapes, wondering where they would go if their *homes* ceased to exist. Similarly, interviewees expressed concern for their own livelihoods, in the instances of farming, ranching, and commercial fishing. When asked what climate change means to him, a rancher from Illinois replied, "For me, it's more a case of [my livelihood] because I've got a small farm and cows, [and] if we're going through a dry cycle, I gotta figure out what I'm gonna do. So I tend to think of [climate change] in those kind of terms." The rancher approaches climate change from a very localized perspective, recognizing the dependency he has on climatic factors that influence his ability to survive. Narratives such as this one demonstrate the importance of connections rooted *in place*, as it is the rancher's intimacy with the land that allows for such a personal connection to *global* climate change.

The narratives shared suggest that while non-technical audiences value science, science is not a resource used to explain their concern or connection to climate change. Visitors couched

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their connectedness and concern in how climate change will impact them and the landscapes they visit and depend on. No interviewee rationalized their understanding of climate change by outlining the process through which greenhouse gases are trapped in the atmosphere and absorbed by the surfaces of the Earth. Instead, visitors described personal observations that demonstrated localized change over time scales of various lengths.

Parks and refuges can serve as critical spaces for people to make their own comparisons over time, as protected areas strive to preserve long-term landscapes in their most whole form. Highlighting opportunities for reflection, observation, and discussion, will more strongly engage visitors in a holistic conversation that is currently limited to technical, process-oriented audiences and those interested in seemingly removed, global contexts. Learning about narratives can help parks and refuges understand the sense-making strategies of their visitors and perhaps connect these core components to their science complements, creating an interwoven web of social dimensions of climate change rooted in foundational climate science. Additionally, narratives shared that are made available to others create opportunities for audiences to identify with the experiences of others, or conversely, to think critically about how their experience significantly differs from those stated by others, thereby fostering sustained inquiry and thought related to climate change (Polletta & Lee, 2006).

Finding 3 – non-technical language for climate change outreach.

Climate change… I would say it's a complex thing, [it] has to do with the surface of the earth… getting hotter and there are some reasons. Probably one reason is the carbon dioxide from the cars that are burning fuel… pollution of the earth, and most of the influence, or some, is from humans, from us. (Dungeness National Wildlife Refuge visitor, personal communication, July 5, 2011)

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As mentioned above, rather than describing the process of climate change, interviewees most commonly described impacts of climate change and their connection to these observations. Common descriptive words attached to these statements included "extreme", "erratic", "unusual", "weird", "complex", "severe", "deteriorating", and "violent". This collection of descriptors suggests that visitors associate some level of negativity and disconcertion with climate change. While terms like "extreme", "erratic", and "severe" are common to current outreach language, less technical terms that describe the uncommon nature of climate change, like "unusual" and "weird" are absent. This may be because they lack the level of technicality and formality traditionally associated with climate science. However, if outreach efforts are targeting non-technical audiences, it makes sense to use less technical language that has a higher probability of resonating with these audiences.

The emphasis on impacts and descriptors meant that few visitors readily provided a succinct process-oriented description of climate change. Instead, visitors emphasized that climate change does not always equate to hotter and drier local climates. This notion was particularly evident in the temperate parks and refuges of southwest Alaska and western Washington where responses associated climate change with a global trend of warming but localized changes could include an increase in non-snow precipitation and more frequent flooding. In fact, some interviewees suggested "global weirding" as more resonant than *climate change* or *global warming* – "I really like the phrase *global weirding* because I think it can bring in a lot of loose ends… you know, it's not necessarily just warming." This notion suggests that blanketed warming as *the* impact of climate change is not prevalent in visitor descriptions. Instead, visitors are prepared to consider the nuances of climate change, particularly if paired with tangible evidence on a local landscape.

In addition to non-technical descriptors, another highly prevalent term across interviews was the use of "pollution" in relation to climate change – when asked what climate change means to you, responses include "a change in the temperature because of… a certain reason like pollution...," "the effect of pollution on the environment," and "I would say it means what we're doing to the earth, our carbon footprint and the effect pollution has." Because pollution is a human-created phenomenon, the overwhelming presence of this term suggests that non-technical audiences recognize the influence of human activity on climate change. While the actual term "pollution" is not generally attached to climate change in scientific circles, it should not be dismissed. Opportunities to explore and shape this term's association with climate change may serve to tangibly link visitor activity with causes of climate change. It should also be noted that spotlighted pollution campaigns are often highly successful because they can be reduced or even prevented through behavior changes. This suggests that if framed in a similar, empowering way, non-technical audiences may be receptive to changing their 'polluting' behaviors.

Discussion

Analysis indicates that there are multiple ways of knowing climate change among non-technical audiences, such as visitors at national parks and wildlife refuges. Successfully recognizing and fostering such differences will lead to the development of empowered non-technical experts who can serve to further dialogue about climate change in these places. Perspectives shared by interviewees demonstrate the need for climate change dialogue to occur on a local level that showcases the impacts of climate change on valued, familiar landscapes – like those in national parks or wildlife refuges. The relationship between describing general, large impacts of climate change and confusion expressed by interviewees about the topic suggests that current communication and outreach efforts are not appropriately featuring

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concepts and values that strike a relevant, lasting chord with visitors. Because climate change does indeed embody processes and impacts that are not obviously tied to warming (i.e., increases in precipitation), local landscapes can serve to clarify how this seemingly global issue plays out on a local scale, linking experiences, livelihoods, and interest in helping to preserve cherished public lands and the communities that surround them. For example, after hiking up to the terminus of an actively receding glacier at Kenai Fjords National Park, a visitor from Wisconsin concluded, "I guess [climate change] didn't mean a whole lot [to me] until I saw [the receding glacier]. It's happening – I guess I didn't think it was that important before. I see now that it is."

Paired with local landscapes as the centerpiece for climate change dialogue is the need to incorporate local perspectives and language. Communication strategies that utilize narratives of past and present and those connected to livelihoods impacted by a changing planet are likely to resonate with visitors regardless of their formal level of expertise in climate change science. Intentionally soliciting the perspectives of local community members and visitors also helps to empower individuals by giving them voice that is typically only granted to a limited circle of technical experts. At Kenai National Wildlife Refuge, a local outdoor guide summed up the importance of community empowerment by saying:

> I think [climate change] is hard to react to on a really personal emotional basis because it's so huge and hard to define. I think it's smart to come at it from a different angle…when you're trying to get people revved up and hit them on a level that they can feel like they can make a difference… No one wants to feel insignificant and unable to make a difference.

Conclusion

The lens of place provides an opportunity for community-based, non-technical based dialogue about climate change action. As climate change impacts and mitigation strategies are more understood by the scientific community, greater effort must be invested in creating opportunities for dialogue about climate science and actionable ideas to diverse audiences. Borrowing from technical presentations, journal articles, or technical expert-only dialogue will not suffice in engaging non-technical audiences. Our country's, and the world's, ability to proactively engage with climate change begins with relevant, resonant, and empowering climate change messages shared among technical and non-technical communities that encourages connectivity and collaboration. The use of appropriate framing and attachment to place aid in the successful resonance of these climate change messages by minimizing ineffective technical jargon while still maintaining the scientific integrity needed to uphold climate change as a global issue deserving of everyone's attention. By including more people, and excluding fewer, the efforts of communication practitioners to educate, engage, and act toward progressive climate change measures will yield more inclusive benefits for both the environment and people while building a more resilient, proactive society.

PROPAGATING A PARALLEL PARADIGM: UTILIZING ACTION-ORIENTED

OPPORTUNITIES TO ENGAGE VISITORS IN CLIMATE CHANGE DIALOGUE

Introduction

The impacts of climate change are both alarmingly subtle and profoundly palpable. Receding glaciers, salt-water intrusion, rising sea levels, desertification, and changing groundwater dynamics will affect the social-ecological systems of our planet in very different ways. Despite strong scientific consensus on the realities of climate change and its global implications, non-technical publics are still struggling to comprehend the seriousness of this issue (Doran & Zimmerman, 2009; Leiserowitz, Smith, & Marlon, 2010). Given that only five percent of the

U. S. population are scientists (including engineers and social scientists), this disconnect is critical to address (Lee & Mather, 2008).

Climate change communication, largely informed and directed by technical scientists, encompasses a variety of traditional static communication practices founded in an Information Deficit Model approach (i.e. Kellstedt, Zahran, & Vedlitz, 2008; Potter & Oster, 2008). While appropriate for some audiences, this model fails to acknowledge alternative learning styles and makes linkages between understanding and behavior change less than obvious. Behavior change is an important element of communication campaigns, as an informed but inactive audience is handicapped in their ability to influence or demand the necessary changes for climate change progress. The balance between presenting apolitical information and advocacy can be a delicate challenge, but intentional, strategic efforts applied to this balance has the potential to yield profoundly inclusive results.

A well-established sense of public trust bestowed upon the communicating entity has the potential to quell *hidden agenda* or *political* concerns. It is in this spirit that national parks and wildlife refuges serve as ideal places to implement innovative public engagement strategies about climate change. Trusted by the American people, these places have the infrastructure, availability of active scientific research, and public support to invite their visitors into a climate change dialogue (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2011). Facilitated dialogue that provides opportunities for hands-on engagement with climate change can allow for the co-evolution of understanding and informed behavior choices, while involving a large visiting public who, arguably learns best from interactive, synergistic methods.

Rethinking Conventional Pathways to Understanding and Behavior Change

Research by Miller and Fahy (2009) describes the commonly employed Information Deficit Model of communication, in which scientists assume the public's struggle to proactively respond to climate change challenges is largely due to a lack of publicly-available, accurate information – a *deficit* of climate change information. The traditional solution entails presenting more research, data, and evidence that climate change exists through static reports that the public is expected to seek out and digest (Miller & Fahy, 2009). This solution turns a blind eye to the positivist nature of technical scientists, the existence of alternative epistemological perspectives amongst non-technical publics, and the assumption that more information will result in greater understanding across all publics. Few attempts are made to link climate science to societal values or social concerns; instead, non-scientists are expected to speak fluent *science* in the case of climate change and many other science-based concerns that spill over into society. While we do not tolerate our medical doctors speaking in language only commonly exchanged amongst colleagues, communication about climate change still largely exists in a technical bubble

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impenetrable by those who lack technical climate science training, yet both instances are critical bridges to disseminating information about the health of systems, be they human or the environment.

The Information Deficit Model reinforces a common trajectory of acquiring knowledge and awareness by emphasizing the importance of access to static, expert-derived information as *the* means through which people gain a more thorough understanding of complex topics. In the case of understanding climate change, the Information Deficit Model does not reflect the process through which climate scientists gain deeper understandings of their specialty (Sterman, 2011). For scientists, learning through the scientific method involves a process of extensive interaction with models and field data, hypothesizing how the global, regional, or local systems may respond to different inputs and dynamics associated with climate change. Numerous comparisons between anticipated and actual outcomes are revisited, chiseling down the original hypothesis into a form that most closely reflects that which is determined through research. "Paradoxically, however, scientists, having deepened their understanding through an interactive, iterative learning process, often turn around and tell the results to… the public through reports and presentations, expecting them to change their beliefs and behaviors, and then express surprise when these groups – excluded from the process, unable to assess the evidence on their own and presented with claims that conflict with deeply held beliefs – resist the message and challenge the authority of experts" (Sterman, 2011, p. 823).

Technical experts are not altogether unlike their non-technical counterparts. A search of *climate change* in Web of Science from 2009 to 2012 yielded 9,845 results. The sheer number of scientific research published in peer-reviewed journals and other research publishing outlets suggest that, in an information deficit scenario, nearly 10,000 individual information outlets

about climate change should significantly strengthen the public's understanding of climate change. In 2010, over 2000 American adults were asked 81 questions related to climate change, including specifics about causes, impacts, and solutions - 52% of Americans received a failing grade (Leiserowitz et al., 2010). This assessment was in stark contrast to their self-reported knowledge of climate change, where 62-66% of Americans stated that they were either "fairly well-informed" or "very well-informed" (Leiserowitz et al., 2010). The vivid disconnect between the extensive database of climate science information available compared to our country's failure to grasp climate science as an informational topic demonstrates the need to utilize alternative forms of learning.

This is not to suggest that traditional forms of learning are entirely ineffective and should be eliminated. Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA) emphasizes a need to thoroughly understand the attitudes and norms of individuals, which inform behavioral intent that can lead to changes in behavior. In the TRA model, knowledge and understanding precedes behavior, as bias developed by attitudes and norms exposes individuals to particular information sources and leads to an *informed* mentality prepared to engage with complementary behaviors (Fishbein & Ajzen, 1975). While the TRA model is considered a seminal piece of attitude-behavior literature, this manuscript suggests broadening the scope of how knowledge is acquired to encompass more interactive, engaging alternatives that speak to learning through experience. Combined, a palette of understanding options for climate change may yield a more informed public prepared to support and act in favor of climate change progress.

Action first, climate change fluency to follow

Sterman (2011) asserts that due to the Information Deficit Model's failure in increasing climate literacy, non-technical publics "require different kinds of communication, including the

use of experiential learning environments… that allow people to discover, for themselves, the dynamics of complex systems like the climate" (p. 812). Experiential learning invites audiences to tangibly interact with concepts and processes that are otherwise presented in unilateral, static forms, like scientific publications and media coverage. This hands-on approach to learning creates support environment to not only increase climate change literacy, but also allows for the confrontation and reconsideration of existing attitudes that may inhibit progressive behavior change from occurring (Verplanken, 2011; Vining & Saunders, 2004). Visceral engagement helps address barriers to behavior change, including a "lack of knowledge," "perceived scientific uncertainty," "remoteness of the threat," and "individual helplessness" – attitudinal factors that otherwise provide justification for climate change denial or unwillingness to act (Wolf, 2011, p. 122). Research in social psychology suggests that actions can "serve to commit individuals psychologically to an attitude position" and, further, that "individuals might sometimes treat their behavior as a piece of information that is relevant to judgments about their own attitudes" (Olson & Stone, 2005, p. 223).

It should be noted that while traditional models suggest that behavior change follows fluency in the behavior-influencing topic (i.e. climate change), paths that introduce action and behavioral mechanisms first do not require extensive knowledge about the topic (Verplanken, 2011). Instead, knowledge gain and behavior change coexist, developing simultaneously in the context of interactive, hands-on actions and activities that expose participants to a holistic perspective on climate change. Delgado, Kjølberg, and Wickson (2010) conducted a meta-analysis of public expertise requirements to participate in science and technology activities, determining technical levels of "relevant and related" expertise were considered most necessary, and thus most contentious, in decision-making situations (i.e. decisions internal to science like

the determination of study length, measurement and model type to implement, etc.). Large-scale decision-making scenarios are not likely to occur in public engagement activities with the exception of individual decisions to adapt behavior and attitudes based on experiences during the engagement process.

Action-forward public engagement strategies

Extensive research has been conducted to determine constitutes public engagement and the varietals of nuance within this approach to increasing knowledge and encouraging complementary behavior change (i.e. Bäckstrand & Lövbrand, 2007; Evely, Pinard, Reed, & Fazey, 2011; Lassen, Horbsøl, Bonnen, & Pedersen, 2011; Pretty, 1995; Schultz, 2011). Lassen et al. (2011) describe three fundamental discourses for participation: ecological modernization, green governmentality, and civic environmentalism. While ecological modernization and green governmentality are largely top-down participatory forms exclusive to experts and technically-fluent publics, civic environmentalism recognizes the necessary inclusion of *ordinary* citizens in increasing over all awareness and changing social practices that influence our social-ecological systems (Bäckstrand & Lövbrand, 2007; Lassen et al., 2011). The bottom-up role of engagement within civic environmentalism pivots on citizens developing "a personal state of connection" with the issue, like climate change (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007, p. 446). "This definition contrasts with engagement as a process of participation and implies that knowing about climate change is insufficient in order to be engaged," and rather cognitive, affective, and behavioral dimensions of connection must also be considered (Wolf, 2011, p. 122).

Evely et al. (2011) describe the consideration of these engagement dimensions in the context of three engagement typologies along a continuum from more participation-oriented to a deeper engagement-orientation: functional, interactive, and self-mobilization. Functional

projects, and to a lesser extent interactive projects, are those that serve a purpose for the host entity and often provide limited opportunity for self-directed outcomes and reflection (Evely et al., 2011; Pretty, 1995). Conversely, self-mobilization projects balance organizational needs and outcomes with rich, tangible experiences for the participant that extend beyond basic interaction with a functional project – "While some learning outcomes in projects with lower qualities of engagement may increase over time, higher levels of learning outcomes are achieved in the early stages of projects with high levels of engagement [i.e. self-mobilization projects]" (Evely et al., 2011, p. 124). High levels of engagement include those that institutionalize opportunities for ownership and responsibility, thereby contributing to a sustained sense of involvement that extends well beyond a single participatory experience (Evely et al., 2011; Pretty, 1995).

Climate change engagement strategies will allow for the expansion of understanding and potential behavior change in non-technical publics that are inadequately addressed in traditional communication deficit endeavors. For those who learn and inform their lifestyle through tangible, hands-on experience, climate change engagement strategies can appeal to and invite these marginalized but not insignificant populations into the conversation about a topic that will inevitably affect us all. After all, "awareness, information, and understanding is not enough to change people's habits of mind and practice; rather dialogic, two-way forms of (positive) communication and collaboration seem to stimulate change" (Lassen et al., 2011, p. 413).

Propagating a Parallel Paradigm: A Case Study in National Parks and Wildlife Refuges

National parks and wildlife refuges, when combined, create a network of over 950 protected land units (National Park Service, 2012b; U. S. Fish & Wildlife Service, 2012). These landscapes are visited by millions of people –teachers, students, business owners, consultants, electricians, waitresses, carpenters, retirees, and more – each seeking a specific park or refuge

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experience. These places also serve as learning laboratories for landscape-scale environmental issues like climate change, as their protected status allows research scientists to collect long-term data within and across parks and refuges to better understand the impacts and implications of climate change (National Park Service, 2012a). The National Park Service (NPS) and U. S. Fish and Wildlife Service (FWS) also have strong visitor education platforms, striving to provide a holistic and informative visitor experience. The pairing of active and established climate change research with foundations rooted in education does not however automatically equate to a visiting public fluent in and supportive of climate science.

To better understand the discord between the availability of park and refuge climate science research and the diversity of visitor perspectives related to climate change, confusion, denial, and acceptance, informal visitor interviews (n = 349) were conducted through convenience sampling at nine NPS units and six FWS refuges[4] (i.e. Lindlof & Taylor, 2010; Neuman, 2006). Visitors were approached and interviewed at trailheads, visitor centers, and in popular gathering areas like boat launches and parking lots. For the purpose of this study, analysis focused on five questions:

- What does climate change mean to you?
- How would you describe climate change to a friend?
- Would you like to learn about climate change at this park/refuge? If so, how?
- Would you be interested in participating in a citizen science program at this park/refuge?
- [A] Do you consider yourself green-friendly? If so, what do you do? What motivates you?
  [B] Do you personally do anything to reduce your impact on the earth? If so, what motivates you?[5]

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[4] Harpers Ferry National Historic Park, Fort Dupont Park, Frederick Douglass National Historic Site, Kenai Fjords National Park, Kenai National Wildlife Refuge, Olympic National Park, North Cascades National Park, Mount Rainier National Park, Dungeness National Wildlife Refuge, Nisqually National Wildlife Refuge, Rocky Mountain Arsenal National Wildlife Refuge, Rocky Mountain National Park, Ten Thousand Islands National Wildlife Refuge, Everglades National Park, National Key Deer Refuge, and Biscayne National Park.
[5] Questions A and B were worded differently to see if responses varied based on the phrasing of the question – no significant differences were detected.

Analysis of these five questions revealed three key findings that make the case for integrating citizen engagement opportunities for park and refuge visitors into existing outreach efforts, resulting in a more holistic, inclusive, and arguably more effective approach to education and communication strategies that strive to both inform visitors and inspire and support complementary behavior choices in the context of climate change (Patterson & Williams, 2002).

Finding 1: Climate change deniers engage in environmentally friendly practices

When visitors were asked, "What does climate change mean to you?" responses varied from generalized definitions of the climate change process to narratives about observing changes on familiar, local landscapes. These responses demonstrate the success of information-focused communication strategies, as visitors recited commonly circulated climate change facts. Yet access to information available in parks and refuges about climate change is not enough for everyone. While most visitors conveyed some level of thoughtful consideration, others described outright denial of climate change's existence, claiming it to be a natural cycle or even a false concept hyped up by scientists and the media. For example, a visitor at Harpers Ferry National Historical Park said, "I think that climate change is the biggest hoax to have ever been put upon the people of North America."

While visitors may deny the reality of climate change, these same visitors often described actions they engage with to reduce their impact on the planet. The visitor at Harpers Ferry National Historical Park who believed climate change to be a hoax, when asked about environmentally friendly behaviors, said, "Oh I certainly do [things]! I recycle my garbage everyday [and] I don't waste things." A visitor at Ten Thousand Islands National Wildlife Refuge, who expressed similar dissent for climate change but engaged in environmentally friendly practices motivated by "the fact [that] that we're supposed to be the most intelligent…

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species on the planet, and we've got to try [to] think about our impact [and] reduce our impact [for] birds, bees, plants, and flora… I don't think human impact has always been positive."

Climate change deniers were not alone in their practice of environmentally friendly behaviors – *96% of all visitors interviewed* described such behaviors. The overwhelming prevalence of behavior-oriented practices amongst visitors, regardless of their personal opinion about climate change, demonstrates the power of action as a way to remove the divisive, polarizing tendencies of politically charged topics like climate change. Easing into dialogue about climate change through the introduction of personal, achievable actions may recruit audiences that traditionally shy away from or dismiss other climate change communication outlets. Action-oriented outreach strategies introduce the connectivity between people and the environment in a proactive and mutually beneficial manner. After establishing and practicing environmentally friendly behaviors, audiences can reflect on the purpose of these actions and how they might be tied to issues like climate change. National parks and wildlife refuges can serve as technical expert liaisons in this dialogue, providing supplemental scientific information backed by rigorous, peer-reviewed processes that ease concerns related to bias.

Finding 2: Visitors crave direction on empowering personal actions that contribute to climate change progress

Building on the actions visitors currently practice in their personal lives, the interviews demonstrate a desire on behalf of visitors to make actions that contribute to climate change progress more readily available at national parks and wildlife refuges. Many visitors expressed feeling overwhelmed or confused by the global scale of climate change, unsure if and how they could help this seemingly dire situation; a visitor at Biscayne National Park described this sentiment, stating, "I guess the whole thing about climate change is that it feels so

overwhelming… what am I supposed to do about it? It's easier to do nothing because it feels like the momentum is already there… Tying into the literature things that [visitors' can do, that people feel are do-able [would be helpful]."

Rather than presenting information and actions as separate communication pieces, visitors at national parks and wildlife refuges desire communication efforts that lead with ways visitors can be contribute to meaningful progress. Tendencies to shy away from promoting action have created a public that is failing to relate to and take ownership in climate change. Civic engagement strategies that convey a sense of ownership sustain longer-term interest and commitment by participants; a visitor at Olympic National Park said, " It seems like [climate change] is happening and someone else will take care of it… Nobody has ownership of it." Ownership in climate change is critical; failure to establish ownership enables climate change to be disregarded as an issue undeserving of public consideration and solution ingenuity. The absence of climate change stakeholders also disempowers interested parties who simply lack the knowledge or resources to take complementary actions.

Interviewees articulated desire for actions that provide a sense of public ownership through enthusiasm conveyed in sharing the actions they are already doing in the personal lives. Excitement and interruption erupted amongst groups of interviewees, the volume of speaking increased, and stronger, more emphatic language was used to describe personal behavior choices: "definitely," "I'm a firm believer," and "it's absolutely a concern of mine." The energy embedded in these responses suggests that people are proud to share their contributions to an issue that can at times seem too large to comprehend. Further, visitor empowerment and engagement can be strengthened and supported with more explicit guidance on resources and ways to contribute that are rooted in scientific evidence developed in national parks and wildlife

refuges. By leading with climate-friendly actions that are supported by scientific research, national parks and wildlife refuges can better engage visitors who desire more tangible, interactive methods with which to connect to the theoretical concepts of climate change. Practicing actions can allow for participants to contribute while learning more about and the interlinkages between human behavior and climate change, resulting in a more informed *and* proactive visitor.

Finding 3: Visitors, young and old, learn through hands-on activities

"I have so much information at home that I'm drowning" (Everglades National Park visitor, personal communication, January 5, 2012). While visitors expressed interest in learning about climate change through traditional mediums like interpretive displays and visitor center exhibits, many also expressed sentiment of wanting something that is not commonly offered - the ability to engage with climate change through hands-on activities. A visitor at North Cascades National Park remarked that "doing [something] hands-on [is preferred] because I'm not really good with listening to people drone on and on…" Similarly, a visitor at the National Key Deer Refuge said, "I think it's much more meaningful to interact with somebody than to sit here and read it yourself."

Although interest in hands-on activities may be traditionally associated with children, adult and youth visitors alike expressed interest in dynamic, interactive ways of learning. Hands-on enthusiasts ranged from a group of North Carolina middle school students to a retired woman from Missouri who offered to sign up immediately. Hands-on activity suggestions included service learning projects, ranger-led tours of climate change impacts, and stations where people take photographs and compare their images with historic photographs. However, the most common hands-on activity people referenced were programs that allowed visitors to collect data

in the field with research scientists. The visceral experience of collecting information about climate change allows non-technical audiences who may feel removed or excluded from this topic to physically connect and relate to climate change and climate scientists.

As a follow-up to their independently identified preferred ways of learning, visitors were asked about their interest in citizen science programs specifically, a formal program implemented by organizations throughout the world that pair non-technical citizens with research experts to collect scientific data in places like national parks and wildlife refuges. Because citizen science is very similar in nature to what many visitors had previously described, there was much enthusiasm related to this opportunity. Enthusiasm was generally founded in three fundamental appeals – (1) hands-on learning helps make sense of complex topics; (2) *ordinary* people feel empowered through involvement; (3) hands-on involvement promotes a sense of ownership that is absent in static presentations of information (Appendix 1).

Interest in engagement opportunities like citizen science programs were often rooted in the visitors' self-reflection of learning styles; many people commented on the resonance that tactile interaction with topics that can be notoriously complex or large in scale provides. Few, if any, visitors claimed to have a thorough or fluent sense of climate change dynamics, yet behaviors demonstrated and encouraged during hands-on activities can be replicated elsewhere, allowing proactive behavior and intellectual capacity to grow simultaneously from a single experience like that of a citizen science day in the field. Additionally, humanizing climate science through the involvement and mentoring of scientists, *accessible* to field questions and share their own stories of relating to climate change, allows non-technical publics to strengthened and legitimate the social dimension of an often considered non-social discipline.

Conclusion

Climate change can be a polarizing, divisive topic that excludes non-technical audiences from the dialogue – particularly if these audiences have different learning and engagement styles than those of positivist climate scientists and other technical experts. Communication strategies intended to inform non-technical audiences about climate change, employed by organizations like the NPS and FWS, are often static and struggle in resonating with audiences who benefit from more interactive environments. Introducing climate change through the lens of accessible and meaningful actions can invite and sustain the involvement of non-technical audiences that may otherwise fade away from climate change communication efforts. Once recruited, these audiences can begin to simultaneously adopt climate-friendly behaviors while developing a stronger understanding about climate change as a social-ecological issue.

Strategic public engagement activities negate the need for participants to be fluent in climate change and provide varying degrees of involvement and complexity to fit the variety of perspectives and fluency present in non-technical audiences. Utilizing hands-on activities, like citizen science programs, speaks to the interest of non-technical audiences and achieves multiple outcomes that benefit both the host organization and participants - participant empowerment and sense of ownership, the collection of useful scientific data, and an assemblage of technical – non-technical relationships that can expand beyond a single activity into a network of engaged climate change citizens with the capacity to inspire others outside of parks and refuges.

CONCLUSION

Society's ability to proactively engage with climate change begins with relevant, resonant, and empowering climate change dialogue exchange between technical and non-technical communities that encourages connectivity and collaboration. Climate change can be a polarizing, divisive topic that excludes non-technical audiences from the conversation – particularly if these audiences have different learning and engagement styles than those of positivist climate scientists and other technical experts. Communication strategies intended to inform non-technical audiences about climate change, employed by organizations like the NPS and FWS, are often static and struggle in resonating with audiences who benefit from more interactive environments and tangible, localized implications rooted in place.

The lens of *place* provides an opportunity for locally based non-technical climate change dialogue to occur. Climate change is a social-ecological issue. Empowering these publics as legitimate experts of the social dimensions of climate change on a local scale ensures a sense of ownership and inclusivity absent in top-down communication efforts. Borrowing from technical presentations, journal articles, or technical expert-only dialogue will not suffice in engaging non-technical audiences. Utilizing the skills and resources derived by non-technical audiences like *obvious* impacts, commonly-held rationalizing mechanisms, and climate change language can help to establish the recognition of different forms of expertise most effective for particular audiences. When paired with climate science, these tools create a holistic, interdisciplinary and multidimensional approach to climate change engagement.

As climate change impacts and mitigation strategies are more understood by the scientific community, greater effort must be invested in creating opportunities for symbiosis between climate science and complementary behavior. Introducing climate change through the promotion

of accessible and meaningful actions can invite and sustain the involvement of non-technical audiences that may otherwise fade away from climate change communication efforts. Once recruited, these audiences can begin to simultaneously adopt climate-friendly behaviors while developing a stronger understanding about climate change as a social-ecological issue.

Strategic public engagement activities negate the need for participants to be fluent in climate change and provide varying degrees of involvement and complexity to fit the variety of perspectives and fluency present in non-technical audiences. Utilizing hands-on activities, like citizen science programs, speaks to the interest of non-technical audiences and achieves multiple outcomes that benefit both the host organization and participants - participant empowerment and sense of ownership, the collection of useful scientific data, and an assemblage of technical – non-technical relationships that can expand beyond a single activity into a network of engaged climate change citizens with the capacity to inspire others outside of parks and refuges.

Building from this foundation, future research should explore the potential to expand resource and engagement networks that exist within park and refuge boundaries. Inclusion of adjacent communities, local stakeholders, and network-scale collaboration is challenging. While place-based climate change begins on an acute, localized scale, its foundation of tangible, accessible climate change dialogue is not limited to a particular scale or locale. In fact, broadening the scope of place-based dialogue allows for ecological thought to occur, promoting a sense of fluid connectivity while reducing the false sense of social and environmental isolation.

The clear and often fraught distinction between public and private sectors, despite immense areas of content overlap, must be addressed; each sector serves a unique purpose but has the potential to collaborate in ways that yield results unattainable if divided. Non-governmental stakeholders are critical in giving voice to the public. Due to historically-rooted

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bureaucratic restrictions, opportunities to seek visitor perspectives and opinions on issues like climate change are exceptionally difficult for government agencies to acquire, yet this feedback is crucial, as demonstrated by the interviews in this thesis. Leveraging the strengths and resources available to the public and private sectors while recognizing limitations will create a more solid, coherent, and informed approach to climate change. Climate change disregards political boundaries and its impacts and implications will be widespread. Interdisciplinary research opportunities that approach climate change from an ecosystem, not political scale will empower the technical and non-technical publics referenced in this manuscript more meaningfully and sustainably.

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APPENDIX 1: Interview excerpts from national park and wildlife refuge visitors

Appeal	Interview Excerpt	Date and Location
Hands-on learning helps make sense of complex topics	"Yes, the more hands-on you are the better, the more you realize what's going on. I find that a lot of people's… opinions change once they get out onto the ice and see how much it's melting… It's easier for them to see something physically."	June 21, 2011 at Kenai Fjords National Park
	'You'd be observing it too… We're going to learn more than just walking through saying, "This is pretty…" I like that idea!'	July 6, 2011 at Olympic National Park
	"Anytime you can get people involved [it] makes a huge difference instead of just hearing it from somebody or reading it in the paper, people are really suspect of the media anymore and suspect of science – it's crazy. But, if they can do [science] and see [science], I think that would really change things – I think that's a great idea."	January 4, 2012 at Ten Thousand Islands National Wildlife Refuge
Ordinary people feel empowered through involvement	"The more opportunities given to ordinary people the better. People also feel like… they have a stake in something, [they are] helping in some way."	June 21, 2011 at Kenai Fjords National Park
	"Anything that would help our community learn more about what's going on. Plus I'm a teacher, it empowers me with more information and I can talk to my students about it so that's kind a trickle down to the community too."	June 21, 2011 at Kenai Fjords National Park
	"I think the more we can get people who are not scientists involved in the hands-on, actually collecting data, seeing how science is really done, I think it's a superb idea."	July 2011 at Mount Rainier National Park
Hands-on involvement promotes a sense of ownership that is absent in static presentations	"Nothing like getting people actively involved. They take ownership when they're actually part of the process instead of just being a bystander."	July 7, 2011 at Nisqually National Wildlife Refuge
	"Family oriented [activities] would be great. I know my 4-year old would love to feel like she was doing something to help."	July 9, 2011 at North Cascades National Park