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Climate Change Adaptation and Mitigation in the Face of Local Uncertainty: A Phenomenological Study

Climate Change Adaptation and Mitigation in the Face of Local Uncertainty: A Phenomenological Study

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Abstract - Nature-based tourism is an important economic industry for Maine, with winter tourism especially vulnerable to climate change. Perceptions of risk due to climate change can influence stakeholder decisions to respond (adapt or mitigate) to climate change. We used phenomenology to study how nature-based tourism stakeholders perceive their risk to climate change and how they are responding. We conducted 20 semi-structured stakeholder interviews in Western Maine. We analyzed interviews using interpretive phenomenological analysis. A key theme was that of uncertainty of the causes of climate change, impacts to the region, and whether or not experienced environmental changes were related to climate change. Participants showed a need for information about climate change specific to the study region to facilitate the adoption of more strategies to bolster the adaptive capacity of the destination.

Introduction

Globally, climate change increasingly impacts natural environments and socio-economic activities, including tourism (Matasci et al. 2014). Without adaptation, communities relying on tourism will be at risk to climate change and less able to cope with these impacts, jeopardizing the long-term sustainability of tourism destinations. The ways in which stakeholders perceive climate change risks might impact whether or not mitigation and/or adaptation strategies are employed. This study was designed to elucidate stakeholders' perceptions of the risk posed by climate change to help identify barriers and facilitators for adaptation and mitigation actions they might take in order to cope with negative impacts of climate change, take advantage of potential opportunities, and reduce their individual carbon footprints.

Climate change and nature-based tourism in Maine

Tourism is one of Maine's largest industries, supporting 17% of state employment with 116,000 jobs (Maine Office of Tourism 2019). In total, 21.8 million tourists stayed 1 or more nights in Maine in 2019, spending $5.2 billion USD (Maine Office of Tourism 2019). Many visitors come to Maine during the summer months; however, we focus herein on Maine's winter tourism industry in Western Maine due to the higher risk from climate change impacts to winter tourism (Bicknell and McManus 2006, UNWTO 2016). The economic contribution

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of winter recreation in the Northeast is $4.6 billion USD annually (Scott et al. 2007). In a study examining the economic impact of skiing between 2001 and 2016, snow played a vital role in attracting visitors to Maine. For example, the top 5 snow years increased visitation by an average of 6%, created an average of 234 additional jobs than the typical snow year, and contributed an additional $8.4 million USD (average) in labor income each year (Hagenstad et al. 2018). In contrast, the 5 years with the lowest amounts of snowfall decreased ski visitation to Maine by an average of 9%, reduced the number of jobs in the ski industry on average by 372 each year, and resulted in an average loss of $13.3 million USD each year in labor income (Hagenstad et al. 2018). Wilkins et al. (2018) found that tourists to winter destinations in Maine will spend less money as temperatures warm due to climate change. Maine can expect significant economic impacts to winter tourism as a result of climate change.

It is likely that Maine's economic reliance on natural assets to attract tourists is and will continue to be affected by climate change. Since 1895, the average annual temperature in Maine has increased by 1.67 °C and is expected to increase another 1.67–2.78 °C by 2050 (Fernandez et al. 2020). Maine's summer season has increased by 2 weeks since the early 1900s, a trend that is likely to continue, while the winter snow season has decreased by 2 weeks. Maine is expected to receive more precipitation in the form of rain as a result of climate change (Fernandez et al. 2020). In contrast, the winter tourism industry faces challenges due to decreased precipitation. Since 1895, snowfall has declined by 2.54 cm (Fernandez et al. 2020). Changes in winter snowfall and season length are jeopardizing winter recreation, especially in mountain regions of Western Maine that rely on ski tourism, although larger ski resorts often have the capacity for snow making to extend their season. We also expect to experience more frequent "weather whiplash" events whereby unexpected conditions produce back-and-forth changes in winter weather that tourism stakeholders will increasingly have to cope with (Casson et al. 2019).

Risk perceptions, adaptation, and mitigation in the tourism industry

The tourism industry must adapt to climate change and adopt mitigation strategies that reduce greenhouse gas emissions while also supporting economic development (UNWTO 2016). Despite tourism's high risk from negative impacts due to climate change, stakeholders often perceive their risks from climate change to be minimal. Climate change risk perceptions are views derived from information-processing and sense-making practices related to climate change as an external threat, phenomenon, and situation (Shakeela and Becken 2015). We study risk perceptions because these will likely influence stakeholder views on adaptation and mitigation (Saarinen et al. 2012). Adaptation involves adjustments to actual or perceived impacts from climate change, while mitigation actions are human interventions to reduce greenhouse gas emissions or increase their carbon sinks (Oppenheimer et al. 2014).

A range of factors influence stakeholder decisions to adapt and/or mitigate. Barriers to local-level adaptation include uncertainty in the rate, magnitude, and extent of climate change impacts (Kettle and Dow 2016), lack of resources (Hardoy et

al. 2014), lack of stakeholder commitment (Wong et al. 2014), and the absence of existing government-level or industry-level adaptation policy (Picketts et al. 2014). Facilitators to adaptation include local awareness and prioritization of climate, participatory and flexible processes to incorporate adaptation into planning (Picketts et al. 2014), and processes that include cross-sectoral cooperation (Rauken et al. 2015). Understanding local perceptions of climate change risk and willingness to engage with adaptation and mitigation is an important first step to incorporating climate change into regional- and state-level climate policies and planning.

Understanding stakeholder risk perceptions of climate will help identify barriers and facilitators to adaptation initiatives undertaken to cope with negative impacts and take advantage of potential opportunities. Adaptation can enhance a community's ability to "thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis 2010:402). More research on risk-related judgements and decision-making in the face of climate change uncertainty is needed to understand willingness to engage with climate change through mitigation and adaptation (van der Linden 2015) while also preventing maladaptation in the face of uncertainty (Adger et al. 2011, Eakin and Luers 2006). We address this gap in the literature by examining what factors shape perceived risk from climate change and how these risk perceptions influence behavioral responses (if at all).

Research purpose

Our research seeks to understand how nature-based tourism stakeholders in Western Maine perceive their risk from climate change and how those perceptions influence their decisions to adapt to or mitigate climate change. Few studies have examined how the detection and attribution of observed climate-change impacts influence tourism stakeholder decisions to implement adaptation or mitigation strategies (Oppenheimer et al. 2014). To date, no studies have examined how climate change risk perceptions might be affecting adoption of adaptation and mitigation measures of Maine's nature-based tourism industry. Our study addresses the following questions: (1) How do nature-based tourism stakeholders perceive Western Maine's tourism industry's risk from climate change? (2) What factors shape perceived risk from climate change? and (3) How, if at all, do climate change risk perceptions influence stakeholder mitigation and adaptation behaviors to enhance tourism activity in the face of climactic variability? Maine's economic dependence on nature-based tourism makes it vulnerable to adverse climate change impacts. Studying stakeholder risk perceptions can help us understand the industry's preparedness to cope with climate change and suggest areas for improvement to better absorb impacts.

Field Site Description

The Maine Office of Tourism (MOT) divides Maine into 8 tourism regions, including the Lakes and Mountains Region in Western Maine (Fig. 1). This region is a four-season destination with over half of tourists visiting the area to engage primarily in outdoor recreation activities, such as hiking, biking, camping, fishing,

hunting, wildlife viewing, canoeing and kayaking, boating, alpine and Nordic skiing, snowshoeing, and snowmobiling. The region is home to Maine's largest ski resorts and includes part of the White Mountain National Forest and the Appalachian Trail. Though the region is a four-season destination, visitation is slightly higher during winter (Maine Office of Tourism 2016).

Methods

Study design and data acquisition

    The study used a phenomenological research methodology to understand our participants' lived experiences. This methodology allowed us to research the essence of being a nature-based tourism stakeholder in the Maine Lakes and Mountains Region experiencing and adjusting to the effects of climate change. Few phenomenological studies have been conducted in tourism research. By using
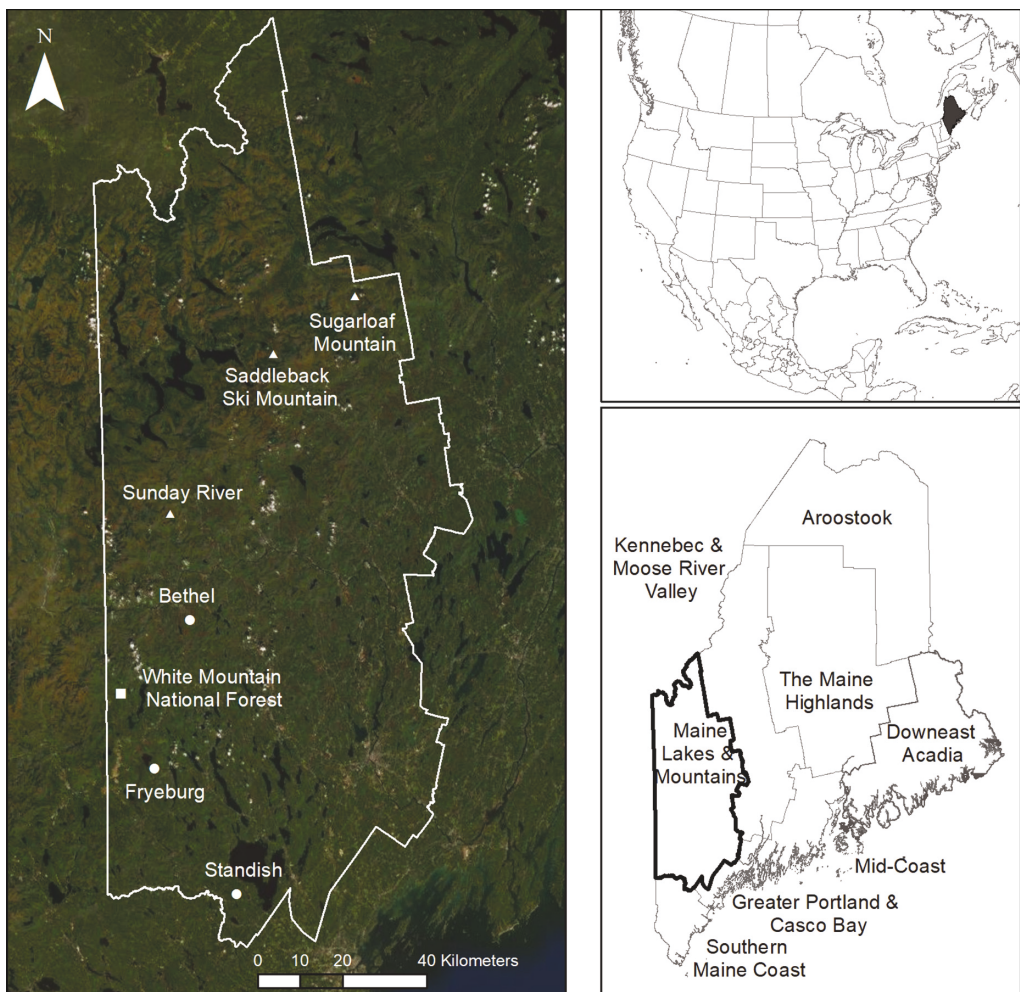

Figure 1. Maine is divided into 8 tourism regions. This study took place in the Maine Lakes and Mountains Region.

phenomenology, we can understand what it means to be a tourism stakeholder facing these changes from an emic perspective (i.e., from an insider's or local perspective, as opposed to an outside perspective "looking in"). We conducted 20 semi-structured interviews with nature-based tourism stakeholders in the study region. Nature-based tourism stakeholders included business owners and employees, non-profits whose mission supported or facilitated tourism activities associated with natural assets and attractions, and those working on destination planning, development, and management. We interviewed people from different stakeholder groups to construct a more in-depth understanding of the factors that influence their perceived risk from climate change (Creswell 2013). We selected interviewees using snowball sampling whereby participants recommended other potential participants until data saturation was achieved, while also allowing for a wide variety of participants to be studied (Patton 2015). Because we were not familiar with the study region, we used snowball sampling to rapidly generate a list of potential participants across a large study area. Additionally, not all nature-based tourism businesses and organizations are members of their local Chambers of Commerce, making it difficult to find some businesses and organizations. Snowball sampling allowed us to recruit participants that we might not have discovered otherwise.

We used a semi-structured interview protocol with open-ended questions that allowed participants to shape the direction of the interview and insert their own ideas (Dearnley 2005). Participants responded to questions concerning (1) belief and knowledge of climate change, (2) experiences with climatic changes, (3) challenges and opportunities for their organization posed by these changes, (4) what participants knew about their peer's climate change perceptions and resulting behavioral changes, and (5) planned and adopted mitigation and/or adaptation strategies. We used probes where further clarification or elaboration was needed (Dearnley 2005).

We interviewed participants from June to December of 2016. All but 1 interview was conducted face-to-face. We recorded all interviews with the permission of the participant. Interviews were transcribed verbatim (Kowal and O'Connell 2014) and stored and analyzed using NVivo 11 Pro$^©$ (QSR International, Burlington, MA). When quoting participants in this document, all names have been changed to protect confidentiality.

To ensure trustworthiness, we kept reflective journals to enhance credibility, dependability, confirmability, and transferability (Patton 2015). Additional steps to ensure credibility included open-ended interview questions, acknowledging the role of researcher as instrument, and triangulation across multiple sources (Patton 2015). We used multiple readings of interview transcripts and peer debriefing to enhance credibility of conclusions (Miles et al. 2020). We used NVivo 11 Pro$^©$ to create a database to enhance dependability and confirmability. Finally, the use of in-depth interviews with participants and detailed description of the methods helped address transferability across other potential studies (Miles et al. 2020).

Data analysis

We used interpretive phenomenological analysis (IPA) to analyze interview transcripts using an iterative process of constructing subordinate themes and

sub-themes from the transcripts (Giorgi 1997, Moustakas 2014). The purpose of IPA is to analyze participants' experiences of a phenomenon rather than attempting to produce an objective interpretation of a phenomenon (Giorgi 2010). We focused our research questions on understanding participants' perceptions and experiences, and therefore chose IPA as our approach to data analysis. We coded transcripts numerous times to ensure that themes were directly related to participants' experiences and perceptions. Following IPA's guidelines, we focused on exploring the experiences of participants from their unique perspectives and constructing a shared understanding of these experiences with 2 coding cycles (Giorgi 1997, Miles et al. 2020).

We began the analysis process by bracketing past knowledge about the phenomenon to consider "what is given precisely as it is given" by participants (Giorgi 1997). Then we conducted first cycle coding to identify and highlight patterns that emerged using In Vivo analysis/coding (Miles et al. 2020) and performed preliminary grouping into descriptive nodes, a process also known as horizontalization (Moustakas 2014). An overview of the analysis process is presented in Figure 2. This process of data reduction included the breaking down of all transcripts into "meaning units" expressed in participants' words (Giorgi 1997). Meaning units, or codes (i.e., a short phrase that symbolically assigns an essence-capturing attribute to a portion of the data), are drawn from the body of the text to understand the essence of the phenomenon being experienced by participants and are later related to each other to get a sense of the whole (Giorgi 1997, Miles et al. 2020). In other words, the meaning unit is a researcher-generated code that attributes meanings to the data, enabling later analysis (Miles et al. 2020). During second cycle coding, we

First cycle In Vivo codes
- "So it's kind of, I really have no idea if it will change in the next ten years."

Second cycle categories
- High uncertainty of knowledge
- Low levels of knowledge (self-identified)
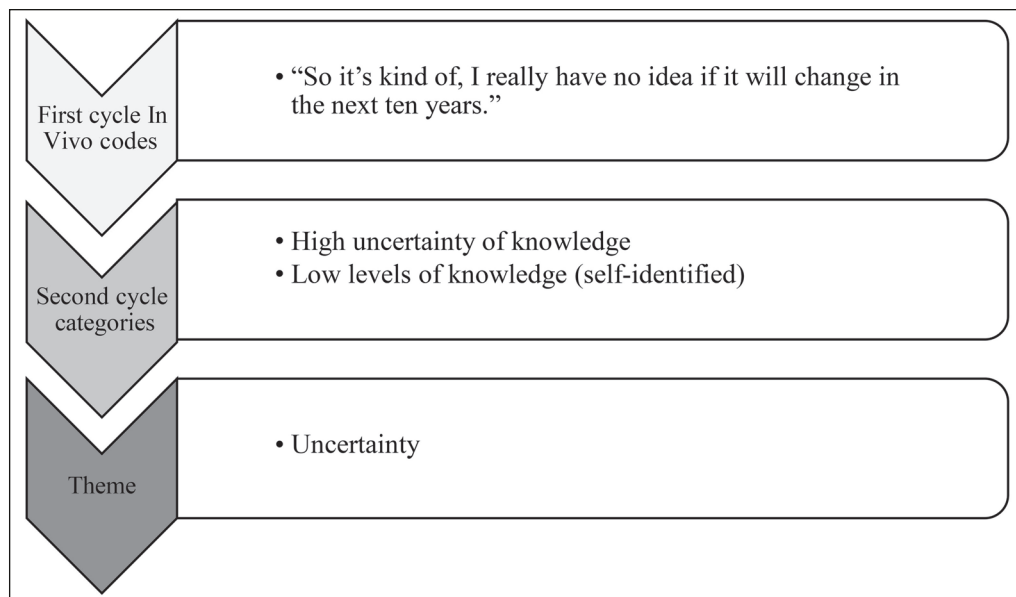
Theme
- Uncertainty

Figure 2. Overview of coding analysis where meaning units are extracted from the interview data using In Vivo codes, which are further condensed into categories and eventually themes.

clustered meaning units into categories that described the texture and structure of participants' lived experiences (Moustakas 2014). The structure of the phenomenon refers to the essence of the lived experience from the perspectives of participants while the texture captures the richness of the experience across stakeholders (Giorgi 1997). This cycle was enhanced by matrix coding queries (i.e., tabulates the intersections between codes to look for patterns and relationships) and cognitive mapping (i.e., a representation of concepts that depicts the relationships, flows, and dynamics among them) for in-depth analysis in NVivo 11 Pro$^©$ (Miles et al. 2020). By using matrices, maps, and open coding, we developed themes to integrate individual meanings and essences to construct a shared description of participants' experiences (Miles et al. 2020, Priest 2002).

Results

Uncertainty emerged as an overarching theme from participants lived experiences. Participants were uncertain about their knowledge and beliefs about climate change causation and impacts, whether or not observed changes were a result of climate change, and what behaviors they could implement to mitigate emissions and adapt to climate change impacts.

Knowledge and beliefs about causes and impacts of climate change

We asked participants to identify how well informed they felt about climate change and then how well informed they felt about climate change impacts in the study region. Many participants self-identified as informed of global impacts of climate change, citing the disappearance of polar ice caps, heat waves, and changes in air and water quality as resulting from climate change. Several participants described themselves as "generally" informed, as opposed to precisely or scientifically informed. These participants discussed how they were aware of climate change impacts but felt that they lacked scientific understanding to predict how impacts would affect the environment at a finer scale, such as the regional level; for example,

> "… I would think of myself as generally well informed, not real precisely well informed…if you asked me what's going to be the impact on trout populations on the Androscoggin River from climate change, I would probably say it's probably going to be bad or negative. But I'm not, I don't necessarily have the scientific understanding to drill down to that next level." (Thomas, Regional Manager).

We also asked participants to identify how informed they were about how climate change might be impacting the study region. In contrast to relatively high self-identified general and global knowledge, most participants lacked knowledge of climate change impacts in Maine and the study region; for example,

> "[W]e hear about the big picture but … I don't think people usually bring that down to their own, their own level." (William, Town Manager).

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This statement is illustrative of what several other participants said about not having thought about climate change impacting them on a local level.

The majority (18/20) of participants believed climate change was occurring globally; however, some participants felt that the study region was not being impacted or would not be impacted much in the future. The following response is from a participant who believed the area is currently unaffected by climate change but was uncertain about future impacts to the region:

"[I]t's still a very good place largely unaffected by climate change but it doesn't mean that that's going to stay that way forever." (Diana, Regional Manager).

Another participant expressed similar sentiments thinking that the study region was not being impacted by climate change currently, saying

"[Climate change] may be affecting other people in other areas, hopefully it's not affecting the snow here." (Samantha, Business Owner);

however, her use of "hopefully" indicates a degree of uncertainty. These participants tended to believe in climate change but felt that it was not often occurring at a local level in Western Maine.

For those that believed in climate change, there was uncertainty about its origin as natural or man-made. For example,

"[T]o me there is no argument that the climate is changing. I'm seeing it. It's changing. You know, the argument I guess that still holds some weight for me is whether it's human-caused or it's a natural cycle." (William, Town Manager).

Several other participants believed that climate was changing in Western Maine but expressed uncertainty as to its causes. They were aware that climate cycles naturally but could not say with certainty that human actions were exacerbating the rate of warming. In addition to uncertainty regarding belief in and causes of climate change, participants expressed varying degrees of climate change knowledge (Table 1). We assessed level of uncertainty based on responses to the question, "How well-informed do you feel about climate change?" and whether claims about climate change were based on scientific facts. We categorized participants who self-identified that they knew little about climate change and described scientifically inaccurate climate-change information (e.g., climate change being caused by the rotation of the earth) into "high levels of uncertainty". In contrast, we categorized participants who self-identified as well-informed about climate change and were able to accurately describe climate change causation and impacts into "low levels of uncertainty".

Experience and risk perceptions

Participants with high self-identified knowledge discussed how first-hand experience with climate change impacts influenced their perceived risk. Participants frequently discussed environmental changes they were observing in the region

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Table 1. Quotes depicting the variation of stakeholder knowledge and belief as well as experience in terms of levels of uncertainty reflected by participants.

Codes	Uncertainty		
	High	Moderate	Low
Knowledge and belief	"I don't know if it's actually been proven if there is climate change or not." (Jack, Business Owner)	"I think it's going to take another 5–10 years to figure out if [climate change is] just a trend or a one-off." (Alan, Business Owner)	"I believe that it exists. And I guess I also think that we are creating some of that with auto emissions and all that." (Crystal, Non-profit)
Experience	"[T]here may be some businesses, individual businesses who unfortunately are dealing with climate change and the lack of rain or the lack of snow that's impacted them greatly. But I can't say I know firsthand." (Martha, Regional Tourism Planner)	"We're hotter in the summertime, grass is burning up and Maine's in a drought. I've seen that before but I think this year it's manifested itself in ways that we haven't seen in the past." (Grace, Business Owner)	"I think we live so close to nature, being outside, you know we really are tuned into it maybe more than people that are sitting at a desk or inside." (Hannah, Business Owner)

and how those changes connected back to large-scale environmental and climatic changes. Participants involved in nature-based tourism or who were regular outdoor recreators felt more informed than participants who were neither of these. This sentiment was especially pronounced in participants who ran winter nature-based tourism businesses. For example,

> "[I]t's easy for people that aren't living in as close contact with nature, that are living in a big city to not see these changes … you're just not, you're not exposed to it as much. You don't get to see how these things are shifting and the nuances, but being in the ski business, we're, you know, in the winter I've got to look at 4 different weather forecasts 2 or 3 times a day. I just, you know, it's very much part of our world so we're very much closely tied to it, we look at patterns year over year." (Shawn, Business Owner).

Through prolonged contact with nature, Shawn has noticed long-term climate trends impacting the area. Our findings suggest that stakeholders that identified as having limited exposure to some of these shifting baselines resulted in them being more uncertain in their knowledge of local climate-change impacts. The following quote from a regional tourism manager describes how climate change is largely absent from regional planning discussions:

> "… I think I'm a little embarrassed to say that we don't really talk about [climate change]. We truly don't. We only talk about it, and we don't use those words, and we probably should be using those words. We'll talk about an incident, we'll talk about a weather activity and its impact but we never connect it back or maybe we're not always certain, does it connect back to climate change?" (Martha, Regional Tourism Manager).

The difference in awareness between those who interact with nature regularly, either professionally or personally, could be explained by a daily connection to the environment through relying on weather as part of the tourism product being offered or recreating outdoors.

Increasing tick populations, changes in snowfall, and shifting seasons were experienced by nearly all participants and often linked to climate change. For example,

> "[T]icks is climate change … they're just coming further and further north. Ticks were never here 30 years ago." (James, Business Owner).

Participants were concerned about increased ticks impacting visitors' decision to participate in outdoor recreation activities and how ticks might impact their personal health, as well as the negative impacts on wildlife and wildlife-viewing tours.

The most widely experienced concern in the nature-based tourism industry was changing winters. Participants cited shorter winters, shifting seasonality, and changes in snowfall as major concerns for the future of the winter nature-based tourism industry. The following response illustrates how a participant was concerned that shifting seasons have impacted her business model, making it difficult

to plan ahead and to support her business financially as her biggest season becomes increasingly unpredictable:

> "The winters are getting shorter. We used to start guiding our trips … in early December here in Maine. Then it was mid-December, then it was the third week in December, then it was Christmas and now it's still right around Christmas but it's really marginal, like, whether the conditions are going to be OK." (Hannah, Business Owner).

This unpredictability of winters was felt by all but 1 winter tourism business and contributed to higher perceived risk from climate change. For some participants, experiencing environmental changes in the region, especially in winters, beyond what they considered to be "normal" yearly variability, led to the belief that climate change was impacting the region. Participants became aware of climate change impacts to the region and began to perceive their risk to climate change through their firsthand experiences with local impacts.

Taking action: From risk perceptions to behaviors

Our findings indicate that many adaptation and mitigation strategies enacted by participants were motivated primarily by economic decisions and a need to ensure a more certain future for their tourism business as they cope with yearly environmental fluctuations, as well as more long-term shifts. One participant mentioned investing in extensive energy-efficient snowmaking technology that reduced his business's carbon emissions by 50%. When asked whether concern for climate change factored into his decision, the business owner explained that it was a good business decision and expressed skepticism that climate change was occurring. Similarly, when asked about motivations behind the adoption of pro-environmental behavior, another participant cited structural changes to the industry, such as higher emissions standards in all-terrain vehicles (ATVs) and snowmobiles, as the driver behind mitigation rather than the motive to adopt pro-environmental behaviors.

All but 1 business owner employed adaptation strategies to adjust to unpredictable weather patterns. Strategies included snowmaking at ski resorts and diversification through product development and the timing of activities. For example, several winter tourism businesses were beginning to offer summer activities, such as mountain biking, to take advantage of the increasingly long summer and fall seasons while also offsetting the costs of a potentially poor winter. One business owner described adjusting the timing of their guided trips to adapt to a later snow season and more mild weather in early winter. Our findings indicate that tourism stakeholders are likely employing adaptation strategies to cope with climate uncertainty.

Four participants out of 20 described an environmental consciousness shared by community members throughout the study region saying that everyone has a "mentality" to recycle and conserve resources. All participants described the importance of the environment to their business or organization, and many acknowledged it as important to regional lifestyle and identity. Much of the small-scale mitigation strategies were motivated by a desire to display pro-environmental behavior, but

participants were not usually thinking specifically about reducing their climate change emissions. Despite high levels of awareness and concern for the environment, perceived risk from climate change was mixed as a result of uncertainty in climate change information.

Economic motivations, such as cutting costs by upgrading to more efficient equipment, were among the primary drivers for many mitigation strategies. For most participants, social and economic pressures motivated small-scale mitigation efforts; however, several participants in the area had made large-scale efforts specifically due to climate change concerns, such as large-scale investment in renewable energy and green building designs. In addition to environmental benefits, these businesses also saw green marketing as a means to attract visitors and boost profits. For example,

> "Obviously we've got a really big focus on the renewable energy and sustainability…To me that helps really further anchor our brand as we try to have our brand really anchored around the environment and sustainability and renewable energy … I think that's something that more and more [potential customers] are gravitating towards." (Shawn, Business Owner).

This participant believed that his business's investment in renewable energy helped appeal to environmentally minded customers. His concern for the environment and desire to address climate change, as well as grant money from Efficiency Maine, were all drivers of the decision to install renewable energy. Participants in this study utilized advertising strategies to appeal to such market segments, but not all participants felt that green marketing was an option for them despite investing in energy-efficient upgrades. As one participant stated, "we are not selling efficiency" (Alan, Business Owner).

There was no organized effort to promote mitigation behaviors within the regional tourism industry; however, some business owners were changing their entire business models to mitigate their carbon footprint (Table 2). For example, a small ski resort installed solar panels on their property to offset annual energy consumption while also recently purchasing Nivis airless snowmaking guns to increase efficiency and offset carbon. Another participant incorporated mitigation measures in their business model where buildings were off-grid to reduce their carbon footprints. The off-grid business owner was very concerned about climate change and consciously incorporated protective environmental actions into his business model. A further example from Shawn, a ski resort owner, exemplifies how high perceived risk from climate change influenced his business model:

> "You know the West Coast just suffered through 3 years of weather like we just had this past winter [low snowfall]. So all the decisions I make and the capital projects are all in preparation to handle a year like we just had and be able to do so very successfully. So I always try to make all my decisions based on that's what the weather's going to be. Based on having the worst possible weather and how do you still achieve success with the worst possible weather?" (Shawn, Business Owner).

Table 2. Quotes reflecting behavioral changes of participants describing personal/ small-scale and business-level/large-scale mitigation actions or strategies they have implemented.

Code	Stakeholder mitigation strategies	
	Personal-level/small-scale	Business-level/large-scale
Behavioral changes	"Well, I drive an electric car and I have…solar panels… I definitely think more about recycling and my carbon footprint personally." (Jack, Business Owner)	"So I do see [businesses] increasing [their] focus on making investments in energy and facilities that increase their efficiency but that also help them market their properties as green." (Thomas, Regional Tourism Planner)
	"When our guests leave in the morning, we turn down the heat…Little things like that." (Robert and Amanda, Business Owners)	"We're all off the grid. And so we use [photovoltaics] electricity, solar-thermal hot water, wood-fired gasification boilers, composting toilets." (James, Business Owner)

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For Shawn, reliance on snow for his business and previous experience with fluctuating winter temperatures, unpredictable yearly snow variation, and knowledge of climate change led to higher perceived risk. Those perceptions, coupled with awareness of challenges faced by ski resorts in other parts of the country, led to huge investments in renewable energy for his business as both a tool for climate change mitigation and adaptation through the opportunity for green marketing. Consciousness of harmful negative environmental impacts was apparent among all participants, but concern about climate change was not a strong motivator for mitigation for most participants.

Discussion

Knowledge about causes and impacts of climate change

Participants were aware of global climate-change impacts, especially melting glaciers, but remained uncertain about whether or not it was anthropogenic or natural climate change. Uncertainty surrounding the causes of climate change may influence participants' perceived efficacy and motivation to mitigate or adapt to climate change (Mase et al. 2015). Perceived efficacy is the feeling that one's actions will or will not make a difference in adapting to or mitigating the effects of climate change (Milfont 2012). Previous studies have shown that lower perceived efficacy contributes to lower perceived risk (Brownlee et al. 2012, Milfont 2012) and can result in inaction due to these feelings of hopelessness (Dillimono and Dickinson 2015). A recent study of coastal communities in Cambodia found that individuals who self-reported high levels of perceived efficacy were more likely to report better adaptation strategies (Ung et al. 2015). Perhaps providing more knowledge about climate change causes, impacts, and mitigation and adaptation strategies would help increase participants' abilities to predict future threats and opportunities to the tourism destination. Given that participants were more aware of global climate-change impacts than local impacts, we suggest increasing the knowledge of cause–effect of climate impacts at the local level to help tourism stakeholders improve destination planning.

Consistent with prior research, our study suggests that cognitive barriers to mitigation and adaptation behaviors include lack of knowledge about the causes, consequences, and potential solutions to climate change, as well as uncertainty about climate change, skepticism, and perceiving climate change as a distant threat (Gifford 2011, Lorenzoni et al. 2007). Some participants were uncertain of how, if at all, the Maine Lakes and Mountains Region was being impacted by climate change. Of those that were certain that climate change was impacting the study region, most did not feel as though they were scientifically informed about climate change. In a previous study, UK residents identified the lack of locally relevant information regarding climate change impacts and solutions as a barrier to personally connecting with the issue of climate change (Lorenzoni et al. 2007). Similarly, in Finnish Lapland, tourism business owners considered themselves to be experts in running their businesses but were not confident presenting their ideas related to

climate change, preferring to leave climate change speculation to scientists (Tervo-Kankare 2018). In Botswana, most tourism operators did not believe climate change was affecting their businesses despite observing general environmental impacts (Saarinen et al. 2012). These findings suggests that stakeholders view themselves as experts in tourism, but the lack of local climate change knowledge can create barriers to addressing climate change. Our results point to a need for more climate change information specific to Maine and the Maine Lakes and Mountains Region. Other studies have found that higher levels of knowledge are associated with higher perceived risk of climate change (van der Linden 2015), which could translate into more adaptation and mitigation behaviors being employed by stakeholders (Ortega-Egea et al. 2014, Ung et al. 2015).

Experience and risk

Previous research indicates that with a general lack of climate change knowledge, the public's experience with weather impacts can temporarily influence climate change perceptions (Egan and Mullin 2012, Hamilton and Stampone 2013). This appears to be the case for some participants in our study. Climate change is a global phenomenon and can remain a temporally and spatially distant issue. Psychological distancing is a process in which climate change is viewed as a threat to other people in other places or those born in the future (Spence et al. 2012). Experiencing an event firsthand that is the result of climate change can equate to higher perceived risk (Milfont 2012, Pidgeon 2012, van der Linden 2015), though observed events are not always cognitively connected to broader phenomena (Safi et al. 2012). Our findings are consistent with prior research, as some participants felt climate change was happening elsewhere but remained skeptical of climate change impacting the study region despite stating they observed environmental changes during their lifetime. The different levels of self-reported knowledge expressed between those who interact with the natural environment more frequently and those who interact with nature less often could be explained by differing levels of experience with climate change impacts. In a recent study, van der Linden found that personal experience with climate change was a predictor of climate change risk perceptions and an important factor influencing actions taken to reduce climate change (van der Linden 2014). Experiencing climate change impacts influenced perceptions of vulnerability and risk, especially among winter nature-based tourism stakeholders, and these participants were more likely to adopt large-scale mitigation and/or adaptation strategies. In contrast, participants who were less reliant on winter weather for their businesses did not implement large-scale responses to climate change.

Taking action: From perceptions to behaviors

Our findings suggest that stakeholder perceptions of climate change somewhat influence behavioral responses of adaptation and mitigation. Whether or not participants thought climate change was impacting the region, most participants employed at least 1 adaptation strategy in response to observed environmental change. Our results are similar to Bicknell and McManus's finding that high levels

of perceived climate change risk caused ski resort managers in Australia to adapt by relying heavily on snowmaking to overcome the unpredictability of the season (2006). Similarly, tourism suppliers in Hungary recognized their risk from climate change and were involved in individual adaptation initiatives given the lack of government-led strategies (Csete and Szécsi 2015). In our study, winter businesses were more likely to implement extensive adaptation strategies and small-scale mitigation behaviors; however, there were relatively few large-scale mitigation strategies despite generally being aware and concerned about climate change. The participants who implemented mitigation initiatives were largely motivated by economic incentives rather than concerns about their carbon footprint. These findings are consistent with other research that found participants were more likely to mitigate the risk of flooding if there are financial subsidies and high perceived response-cost (Poussin et al. 2014).

The disconnect between concern about climate change and adopting mitigation behaviors in our study could be explained by the influence of barriers and facilitators on behaviors. For example, economic incentives were a strong motivator of climate change behaviors. Participants who talked about economic payoffs, such as increased efficiency and green branding, were more likely to adopt mitigation strategies, such as investing in new technology, upgrading heating and cooling systems, and selling green products. The lack of perceived financial benefit and the presence of significant barriers to mitigation may explain why some stakeholders were less likely to mitigate than to adapt to climate change on a large scale. Case studies in Vietnam and Indonesia found that the lack of financial resources posed a barrier to adopting climate change mitigation and adaptation strategies. For example, in Vietnam, the lack of financial gain caused local communities and officials to discontinue a reforestation mitigation project (Thuy et al. 2014). In contrast, the REDD+ initiative in Indonesia was positively received by some because of the high potential to gain financially (Thuy et al. 2014). Participants in our study recognized the economic incentive to adapt to climate change but did not usually discuss financial rewards in relation to mitigation actions. The recent growth of ecotourism and visitors' desire to minimize their impact while traveling could provide more economic incentive to reduce businesses' carbon footprints by adopting mitigation strategies. Green branding and marketing provide a means to differentiate businesses according to their environmental ethic and to attract members of fast-growing alternative tourism niche markets (Wei 2012). Emphasizing these business benefits could be a way to encourage mitigation strategies in the Maine Lakes and Mountains Region.

Conclusions

Participants in the region are aware of environmental changes and their role in protecting the environment to sustain tourism and the regional economy; however, there was a lot of uncertainty surrounding knowledge of climate change and uncertainty about whether or not observed environmental changes were a result of climate change. This uncertainty led to mixed perceptions of climate change risk. Many participants were not aware of what mitigation strategies, and, to a lesser

extent, adaptation strategies, could be implemented to reduce climate change impacts on both the environment and their businesses and organizations. Despite this uncertainty, participants were adapting to environmental change through strategies such as artificial snowmaking, product development, and changing the timing of activities. Participants observed environmental changes and therefore had to adapt despite lack of information surrounding regional climate-change impacts. Though there were some large-scale mitigation efforts, most stakeholders were adopting small-scale mitigation practices.

Providing more climate change information specific to the study region through trusted communication channels could help participants overcome uncertainty as a barrier to adopting pro-climate actions. Specifically, providing information about climate change causes and impacts to the region could help tourism stakeholders increase their understanding of climate change (Ung et al. 2015). Local stakeholders' ability to adapt to climate change depends on their understanding of key issues, short- and long-term impacts, and their level of involvement in developing adaptation strategies to cope with the effects of climate change (Ross et al. 2015). With more knowledge of local climate-change impacts, tourism stakeholders may feel more empowered to act in the face of climate change (Milfont 2012).

Previous projects addressing climate change found that a participatory approach involving municipal, local, and/or community stakeholders increased understanding of climate change impacts, increased networks of collaboration and ownership of the adaptation planning process, facilitated the co-production of knowledge between stakeholder groups, and resulted in diverse, locally relevant management solutions that built upon existing priorities and initiatives (Dupuis and Knoepfel 2013, Lepy et al. 2014, Lopez-Marrero and Tschakert 2011, Moser and Ekstrom 2011, Wilbanks and Kates 2010). For example, climate change was not a priority for rural Maine municipal planners in Washington County; however, climate-related concerns, such as heating costs, aging infrastructure, emergency response challenges, and major weather events, were top issues for the region (Johnson 2015). By connecting climate change interventions with existing priorities, tourism stakeholders are more likely to gain local support (Johnson 2015).

Tourism professionals across the Maine Lakes and Mountains Regions could further create a sense of agency and self-organization among stakeholders by learning from each other and enhancing networks of collaboration to co-develop mitigation and adaptation strategies with their peers (Berkes and Ross 2013). Fostering collaborative mitigation and adaptation efforts via strategic planning and reinforcing pro-environmental social norms will likely lead to a more climate-resilient tourism destination. Policies to alleviate the financial burden of adopting large-scale mitigation efforts, such as renewable energy, could help encourage tourism stakeholders to focus more on reducing their greenhouse gas emissions; however, it is important to note that motivation to adopt mitigation actions is challenging for planning as it is often difficult for businesses to plan 20–30 years ahead. Furthermore, adaptation results in more immediate and local benefits, while mitigation produces long-term benefits and may provide no locally discernable impacts.

Our study has limitations related to its qualitative approach. While phenomenology yields rich data about participants' lived experiences, the data are inherently subjective and represent the personal views of study subjects. Our results therefore have limited generalizability; however, we might expect to produce similar results in a study within a similar context (e.g., rural winter tourism destinations). Further research could compare subjective perceived risk from climate change among tourism stakeholders with scientific data on climate change impacts to better understand the gap between perceptions and scientific data.

These qualitative results could be enhanced by conducting a stakeholder survey to test place attachment, risk perceptions, and trust constructs. Several participants mentioned observing environmental changes over their time living in Maine. This could be integrated as part of the survey to see if there could be a link between length of residency, observed changes, and climate change risk perceptions. Further study of context-specific barriers and facilitators to mitigation and adaptation is needed for the Maine Lakes and Mountains Region to bolster destination resilience (Matasci et al. 2014). Finally, measuring visitor risk perceptions could help stakeholders anticipate visitor responses and decide upon appropriate mitigation and adaptation strategies. A recent study of visitors to Acadia National Park, ME, found that perceived risk and vulnerability were likely to influence future visitation to the area (De Urioste-Stone et al. 2016), which will have implications for future management decisions. Given Western Maine's reliance on nature-based tourism, studying visitor climate change risk perceptions is important for predicting future visitation and expectations, while helping inform ongoing tourism-planning efforts in the study region.

Acknowledgments

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