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Exploring visitor perceptions of the influence of climate change on tourism at Acadia National Park, Maine

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ABSTRACT

This study explores the range of perceptions about the impacts of climate change on tourism in one protected area, Acadia National Park, Mount Desert Island, Maine, US. Summer visitation to this park depends strongly on favorable weather conditions. An intercept survey was used to collect data on visitor perceptions about the role of weather and possible climate change on tourism in general, and their destination selection specifically. A total of 506 visitors participated in the study.

The majority of participants expressed that climate change will affect tourism. Weather conditions are important and influence visitors' destination selection. Statistically significant differences between age groups and gender about the effects of climate change on tourism were identified. By understanding the perceptions of the visitors, suitable adaptive strategies and early preparedness actions may be developed to cope with the impacts of climate change to the nature-based tourism industry in national parks.

MANAGEMENT IMPLICATIONS

Because nature-based tourism is highly-weather dependent, understanding visitor perceptions of destinations and their essential features will be crucial for sustainable tourism destination development. This qualitative study shows that the majority of visitors are concerned about climate change in a national park they visit, and would support agency efforts to mitigate possible climate change effects. Findings suggest public education and outreach to be relevant strategies for parks to enhance visitors' understanding of climate effects in the region and their role in reducing carbon-footprint. Management efforts, such as resource stewardship and mitigation strategies, should contemplate differences in perceptions of the effects of climate change and travel behavior according to visitor characteristics (e.g., age, gender) and market segments.

1. Introduction

Climate change is one of the most pressing global environmental issues facing the world today and one that has major social, economic and environmental repercussions (Yu, Schwartz, & Walsh, 2009). Among all economic sectors, tourism is considered one of the most vulnerable industries to climate change due to its frequent reliance on natural resources as primary assets (Lépy et al., 2014). In spite of this, research on the potential effects of climate change on tourism destinations remains scarce (Dawson & Scott, 2007). More specifically, Jones and Scott (2006) suggest that so far only few studies have assessed the implications of climate change for nature-based tourism and tourism associated with protected areas (e.g. national parks).

Changes in an area's climate conditions can have negative implications on the quality of the services provided, and may diminish the quality of climate-dependent leisure experiences (Moreno & Becken, 2009; Scott, McBoyle, & Schwartzentruber, 2004). Since it is a core goal of resource managers and suppliers of nature-based tourism opportunities to provide high quality experiences for visitors to protected areas (Brownlee, Hallo, & Krohn, 2013), it is essential to improve knowledge about visitors' perceptions about the effects of climate change on tourism, and how these relate to the quality of the tourism experience in climate-

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dependent destinations such as protected areas (Denstadli & Jacobsen, 2014; Gössling, Scott, Hall, Ceron, & Dubois, 2012). Current literature also argues that social science research on visitors' perceptions of climate change is important to inform resource managers and service providers about potential adaptation strategies needed to help destinations cope with the negative effects of climate change on visitation, and capitalize on opportunities (Fisichelli, Schuurman, Monahan, & Ziesler, 2015). Consequently, understanding visitor perceptions of climate change effects on tourism will be a critical tool in effectively guiding decision-making associated with the effects of climate change on tourism in protected areas (Brownlee & Leong, 2011), and ultimately informing policy formulation (Brownlee, Hallo, Wright, Moore, & Powell, 2013).

Important as this topic is, limited studies have focused on understanding how visitors perceive the effects of climate change on tourism in protected areas (Brownlee et al., 2013). The authors of this article believe that understanding visitors' perceptions of the effects of climate change will be crucial to inform development and implementation of education, interpretation and adaptation strategies associated with tourism in protected areas.

This article presents the results of a pilot study on visitor perceptions of the effects of climate change on tourism at Acadia National Park-Mount Desert Island (MDI), a coastal tourism destination in Maine. As an exploratory study, the research was designed to generate hypotheses about particular visitor characteristics associated with visitor perceptions of the influence of climate change on a protected area tourism destination. The following sections situate our research in the growing literature on climate change and tourism in protected areas.

1.1. Climate change and tourism

The tourism industry is highly sensitive to weather and climate (Nyaupane & Chhetri, 2009) as these determine when, why and where tourists travel (Becken & Hay, 2007; Scott, Gössling, & Freitas, 2009), the kinds of activities they participate in, and the quality of the tourism/recreation experience (Gössling et al., 2012; Moreno, 2010). Climatic events may affect the natural resources that serve as tourism assets in a destination, and potentially reduce the attractiveness of the area if events such as natural disasters preclude visitors from travelling (Moreno & Becken, 2009). It is also possible that conditions for tourism in certain areas may be enhanced due to climate change if warmer seasons are extended, such as in high latitude regions (Yu et al., 2009), thus offering a form of comparative advantage. Projected environmental changes that may impact tourism assets positively and/or negatively include sea-level rise, ocean acidification, changes in temperature and precipitation increase, change in habitat range and species distribution. These impacts could have consequences for visitors who enjoy popular seashore sites, wildlife watching, scuba diving, and other nature-based activities that are dependent on certain weather conditions (e.g. hiking, camping, mountain biking).

Climate and weather have served as push-pull factors in visitor destination selection and activity engagement (Agnew & Palutikof, 2006; Bigano, Hamilton, Maddison, & Tol, 2006; Huebner, 2012). Several studies have demonstrated that weather is an important consideration in selecting a tourism destination (Denstadli, Jacobsen, & Lohmann, 2011; Gössling, Bredberg, Randow, Sandström, & Svensson, 2006; Maddison, 2001). Specifically, tourism and outdoor recreation activities in coastal and marine environments have shown to be highly sensitive to weather conditions and climate patterns (Moreno & Becken, 2009). For this study, we will use the Environmental Protection Agency's definitions of (1) weather as the "atmospheric condition at any given time or place," whereas climate is defined "as the 'average weather,' or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands of years" (United States Environmental Protection Agency, 2013).

1.2. Climate change, protected areas and nature-based tourism

Climate change represents a major threat to the integrity of global protected areas (Sharp, Lemieux, Thompson, & Dawson, 2014). Changing environmental conditions resulting from climate change that are increasingly affecting protected area systems worldwide include shifting ranges of species and habitats, rising sea-levels and coastal erosion, increased habitat fragmentation, increased frequency and intensity of storms, coral bleaching, among others (Hannah, 2010; Parmesan & Yohe, 2003). Coastal and marine protected areas are of special concern, considering these spaces have historically been the least represented in the global network of protected areas, and are recognized as critical to maintain and restore conservation targets (Lockwood, Worboys, & Kothari, 2006). Moreover, changes resulting from a changing climate are starting to affect nature-based tourism's assets and the quality of visitor experience to protected areas (Brownlee, Hallo, Moore, Powell, & Wright, 2014; Sharp et al., 2014). Climate change implications to tourism in protected areas have just recently begun to be assessed (Jones & Scott, 2006; Scott, Jones, & Konopek, 2007).

In some destinations, climate is the major natural resource the tourism industry relies on (Scott et al., 2004); in these cases, visitors' travel decisions may be highly driven by their perceptions of climatic comfort level. More specifically, certain forms of tourism are particularly vulnerable to changes in climate; such as coastal and nature-based tourism. Nature-based tourism can be defined as "any form of tourism that relies primarily on the natural environment for its attractions and/or setting; (it) may include ecotourism and substantial portions of adventure tourism and 3S (Sun, Sand, and Sea) tourism" (Weaver, 2001: 660). Nature-based tourism is a segment of the industry that relies upon experiences that are directly related to environmental resources such as landscapes, geological landforms, wildlife, and biodiversity (Lockwood et al., 2006). It includes activities such as diving, birdwatching, trekking, camping, hunting, climbing, fishing, rafting, beach enjoyment, among others (Nyaupane & Chhetri, 2009; Weaver, 2001). This type of tourism has been highly associated with tourism and recreation activities occurring in protected areas.

Nature-based tourism is especially climate-sensitive as the natural resources it heavily relies on can be negatively affected by variability of climate (Nyaupane & Chhetri, 2009), particularly when associated with protected areas (Sharp, Brownlee, & Larson, 2012). It is expected that climate change impacts on protected areas will continue to increase, and these changes will continue to effect nature-based tourism and outdoor recreation (Brownlee et al., 2013; Sharp et al., 2014). It is likely that changes in the length and quality of nature-based tourism seasons prompted by climate change could have major implications for park visitation and management (Jones & Scott, 2006).

Research on global environmental concerns show that beliefs about climate change, and its potential impacts, are strongly related and vary according to worldviews, perceptions of risk, and value orientations (Brownlee et al., 2014, 2013). Therefore, understanding perceptions of global environmental issues such as climate change is essential to help inform natural resource management decisions, policy making, and communication strategies (Brownlee et al., 2013). Staff at parks and protected areas may feel that they do not have adequate tools and information to engage with visitors about climate change, or that discussing climate change is too depressing to share with visitors (Sharp et al., 2014).

Obviously, an enhanced understanding of visitors' perceptions on the effects of climate change on tourism would benefit resource managers who are facing these obstacles. Currently, one information gap is the lack of understanding on how visitors perceive the effects of climate change through contextually based investigations; specifically in U.S. National Parks (Brownlee et al., 2013). These types of studies are especially relevant because visitors' experiences in climate sensitive national parks may have an influence on their individual perceptions of climate change and its potential impacts to specific protected areas (Brownlee et al., 2013).

1.3. Tourism and climate change in Maine

Tourism is a key component of Maine's economy and is increasingly important to the economic development of many communities. In 2012, the industry accounted for over 20% of the state's employment (Maine Department of Labor, 2013) and an estimated 17% of state tax revenue (Maine Revenue Services, 2013). The majority of visitors to Maine participate in seasonal nature-based tourism and recreation activities—many of which are highly weather and climate dependent. Given that climate change scenarios for Maine predict increases in average annual temperature and precipitation, and a reduction in snow in course of this century (Jacobson, Fernandez, Mayewski, & Schmitt, 2009), these climatic influences will likely affect travel patterns across seasons and regions in the state (Daniel, Bell, Daigle, Gabe, & Leahy, 2009). Understanding how these environmental conditions may affect leisure travel behavior is essential as parks and rural communities strive for long-term sustainability and competitiveness in a globalized tourism market place. Important as this industry is to the economic viability of the state and its communities, to date no studies have been conducted in Maine to address visitor perceptions of the impacts of climate change on tourism.

This article aims to contribute to the understanding of multiple perceptions visitors have about the effects of climate change on tourism. The study addresses the following research questions: (1) Is weather a factor visitors consider during their travel; (2) What is the range of perceptions that visitors have about the effects of climate change on tourism at Acadia National Park-MDI, Maine; and (3) What differences exist among visitors regarding their perceptions of the effects of climate change on tourism? Research on climate change risk perception has shown that gender (Huebner, 2012; Safi, Smith, & Liu, 2012; Soares & Murillo-Licea, 2013) and age (Maibach, Bloodhart, & Zhao, 2013) play an important role in shaping people's beliefs about climate change, as well as the perceptions of risk associated with potential negative effects that may derive from a changing climate (Safi et al., 2012). Thus, we hypothesize that differences in the perceptions of visitors about the effects of climate change to Acadia National Park as a tourism destination can be observed, and that these perceptions differ by age and gender.

2. Study design

2.1. Mount Desert Island (MDI), Maine, United States of America.

The MDI Region is located in Hancock County on Eastern Maine's Atlantic coastline (Fig. 1). It is the second largest island on the eastern seaboard of the United States with an area of 108 square miles. The area is located in the Downeast & Acadia tourism region of Maine which accommodates around 3 million visitors each year (National Park Service, 2012).

Bar Harbor is the main community on MDI, with a population of 5235 residents (United States Census Bureau, 2010). Acadia National Park is the region's most prominent attraction with over 50 square miles of mountains, lakes, trails, views and dramatic coastline (National Park Service, 2012). In 2014 Acadia NP was the ninth most visited park in the United States (National Park Service, 2015a), with 2.56 million visitors (National Park Service, 2015b). Popular attractions within the park include: Sand Beach, Otter Cliffs, and Cadillac Mountain, all of which are natural assets. Summer visitors participate in recreational activities such as camping, kayaking, tide pooling, bird-watching, hiking, and biking, among others. The region has a well-established nature-based tourism industry, an essential contributor to the economy of its four towns: Bar Harbor, Mount Desert, Southwest Harbor and Tremont. The majority of visitors travel to the area from June through September, with July and August as the most popular months (National Park Service, 2014).

The MDI region is located in the coastal climate division of Maine (Jacobson et al., 2009). It experiences a maritime climate, with frequent rain year round. The average annual rainfall is

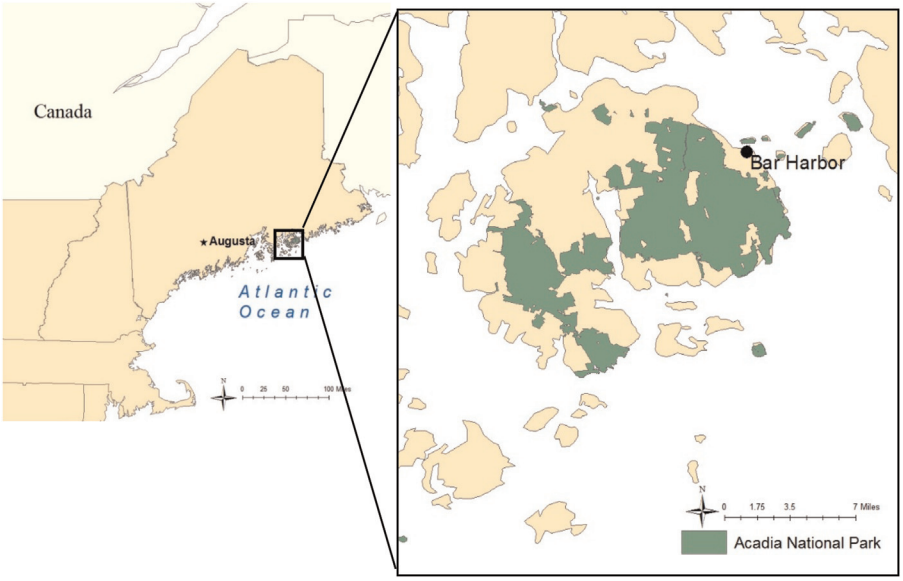

Fig. 1. Map of Mount Desert Island (MDI), and Acadia National Park, Maine.

approximately 62 in.; November receives the highest monthly rainfall (National Oceanic Atmospheric Administration, 2010). During winter and early spring, snow and ice storms are frequent. The summer months of June, July, and August are warmest with fog and temperatures averaging mid-70s to high- 80s (National Oceanic Atmospheric Administration, 2010). Predicted climate-driven changes at MDI may include sea-level rise, coastal erosion, increase in extreme precipitation events, increased temperature across seasons (Fernandez et al., 2015), and changes in the phenology of plants that may affect bird migratory patterns (Miller-Rushing, Evenden, Gross, Mitchell, & Sachs, 2011).

2.2. Research design

A short intercept survey with both closed-ended and open-ended questions was used to collect data on visitor perceptions of the influence of climate change on tourism, travel behavior, and demographic information. Data were entered electronically into an IPad device by surveyors using SurveyGizmo, which allowed for immediate database creation and display. Data collection occurred from June to August 2014.

A total of 685 visitors were asked to participate in this study; 506 in-state and out-of-state visitors completed the interviews (74%), for a 98% confidence interval and $\pm$4% margin of error. The low number of individuals who refused to participate referred to poor weather conditions, not having enough time, only just arriving at their destination, or not knowing enough about the area as reasons for not participating in the survey.

A two stage-cluster probability sampling design (Scheaffer, Mendenhall III, Ott, & Gerow, 2012) was used to randomly select (1) locations, and (2) visitors. The first stage included a random selection of dates/sampling locations at MDI, using a list of day and locations as the sampling frame. Sampling locations included visitor centers, key tourism attractions, and places with high visitor traffic inside Acadia National Park and the town of Bar Harbor. The second stage included the systematic selection of visitors on each site by using an interval of every other approaching visitor group (Scheaffer et al., 2012).

The questionnaire was pre-tested on-site to reduce measurement error (Visser, Krosnick, & Lavrakas, 2000), and included questions on demographics (age, gender, level of education), travel motivations, role of weather in destination selection, and perceptions of the effects of climate change to tourism (Table 1). Pre-testing was conducted in May 2014 by surveying out-of-state and in-state visitors to Acadia National Park and Bar Harbor. The final sampling procedures and protocols ensured standardization of data collection and management, including how to ask questions, how to select potential visitors, and how to manage and store data onsite.

The data were analyzed with SPSS 20, with Chi-square tests, *t*-tests, and One-Way ANOVAs. Open-ended responses on visitor perceptions of the effects of climate change to the tourism industry were also collected, and transcriptions were later transferred to NVivo 10 for analysis. Content-analysis was used for the first coding phase; commonly used words and rate of occurrence were identified using the word frequency query option in NVivo 10 (Bazeley & Jackson, 2013). Following, categorizing (Merriam, 2009) was conducted by using open and pattern coding (Miles, Huberman, & Saldaña, 2014; Saldaña, 2013). Text and Boolean searches were conducted for in-depth analysis using NVivo 10 (Bazeley & Jackson, 2013).

3. Results and discussion

3.1. Visitor profile

Table 2 shows that the visitor sample was slightly more female (54%) than male (46%). Most visitors were mature adults between 31–50 (40%) and 51–70 (40%) years of age (Table 2). Visitors were highly educated with the majority holding a college degree (46%), and graduate degrees (35%). The majority of visitors were not residents of Maine (88%); international visitors accounted for 13% of all participants. Most commonly mentioned nationalities were Canada (51%), Germany (15%), Great Britain (11%) and France (7%). US visitors accounted for 87% of the total out-of-state visitors, originating from 37 different US states with the majority from the New England region.

3.2. Weather, travel and destination selection (R.Q.1)

Using an open-ended question, visitors were asked to list the top two most important reasons for visiting Acadia National Park-MDI. Most respondents listed nature-based tourism activities and the natural setting as the main drivers for selecting MDI as their travel destination (Table 3). Participants most frequently cited visiting Acadia National Park (24%), the scenery (17%), participating in outdoor recreation activities (16%), sightseeing (6%), and the ocean/beaches (6%) as their top reason for choosing to visit MDI. All of these natural assets could be directly or indirectly affected by changing weather and climatic patterns (Daniel et al., 2009; Fernandez et al., 2015). Some visitors (7%) explicitly mentioned weather as their primary or secondary reason for visiting the area, and further described their selection of MDI because it had: “favorable climate”, “cooler summer climate”, “cooler weather”, “good weather”, “get away from heat”.

To address research question 1 (Is weather a factor visitors consider during their travel?) we asked visitors to rate the

Table 1
List of questions and scales used to address each research question.

Research Question	Question(s) Included in the Questionnaire
(R.Q.1) Is weather a factor visitors consider during their travel?	(Q.11) Please rate the importance of the weather to you when selecting to visit MDI? Use of a 5-point Likert scale (1= Very unimportant, 2=Unimportant, 3=Neutral, 4=Important, 5=Very important)
(R.Q.2) What are the range of perceptions that visitors have about the effects of climate change on tourism at Acadia National Park-MDI, Maine?	(Q.12) Do you believe climate change will affect tourism on Mount Desert Island? (1=No, it will not affect tourism; 2=Yes, it will affect tourism; 3=Not sure). (Q.13 a) Why do you believe climate change **will not affect** tourism on MDI? (Q13b)Why do you believe climate change **will affect** tourism on MDI? (Q13c) Are there any reasons you are **unsure** about climate change affecting tourism on MDI?
(R.Q.3) What differences exist among visitors regarding their perceptions of the effects of climate change on tourism?	(Q. 12) Do you believe climate change will affect tourism on Mount Desert Island? (1=No, it will not affect tourism; 2=Yes, it will affect tourism; 3=Not sure). (Q.9) Age (Q.10) Level of education

Table 2
Profile of visitors to Acadia National Park-MDI tourism destination, June-August 2014.

Visitor Profile	Percent (%)
Gender	
Female	54
Male	46
Age range	
18–30	15
31–50	40
51–70	40
71–over	5
Education level	
High school	9
Some college	10
College degree	46
Graduate degree	35
Residency	
Maine resident	12
Out-of-state resident	88
Main purpose of visit	
Business	1
I live and recreate here	2
Vacation, recreation, pleasure	91
Visit friends, relatives	2
Other	4
First time visitor to Maine	
First time visitor	37
Return visitor	63
First time visitor to MDI	
First time visitor	56
Return visitor	44
Travel Group	
Self	5
Couple	53
Group of family and/or friends	41
Organized group	0
Business associates	1

Table 3
Most important reasons for choosing to visit MDI region in Maine, June–August 2014.

Attraction	Most Important (%)	Second most important (%)
Acadia National Park	24	16
Scenery	17	18
Outdoor recreation	16	24
Visit family/friends	7	5
Ocean/beach	6	13
Sightseeing	6	3
New place to visit	5	2
Other	5	3
Weather	4	3
Location	4	3
Food	2	3
Shopping	2	2
Bar Harbor	1	3
Wildlife	1	2

importance of the weather in their decision to visit MDI using a 5-point Likert scale (1=Very unimportant, 2=Unimportant, 3=Neutral, 4=Important, 5=Very important). A total of 73% of visitors rated the weather as important (28% rated it as very important), with only 20% not considering it relevant. Based on the importance of the area's natural attractions and outdoor recreation opportunities as key destination pull factors, this relative importance of the weather for visiting Acadia National Park, MDI, is to be expected. The following quote from a study participant may serve as an example of visitor perceptions regarding the importance of weather in destination selection and its potential influence on decisions to revisit the area in the future.

> "I think that people who visit here take the weather very much into account when they are choosing whether or not they will come here, or whether they will return here." (Male, out-of-state visitor, MS degree, 21–30 age range)

3.3. Visitor perceptions of the effects of climate change on tourism (R. Q. 2)

To address research question 2 (What is the range of perceptions that visitors have about the effects of climate change to tourism at Acadia National Park-MDI, Maine?) we asked visitors to respond to one close-ended question, followed by an open-ended question. First, visitors were asked the question: Do you believe climate change will affect tourism on Acadia NP-Mount Desert Island? (1=No, it will not affect tourism; 2=Yes, it will affect tourism; 3=Not sure). The majority of visitors (61%) expressed their belief that climate change will indeed affect the tourism industry in the region while only 23% of visitors did not believe in this effect. Fewer visitors (15%) were unsure about the potential impacts of climate change on tourism in Acadia National Park-MDI.

Once participants had responded to the closed-ended question on their belief of the potential effects of climate change to tourism in Acadia National Park-MDI, the open-ended questions further requested visitors to explain their perceptions (Table 1). The vast majority of respondents (98%) provided open-ended responses (Table 4).

3.3.1. Theme 1: Yes, climate change ***will affect*** the tourism industry at Acadia-MDI

The majority of visitors who stated climate change will affect Acadia-MDI (61% of all visitors), believe it will have negative consequences to tourism in the region (87%). Most common modifications expected by visitors included colder temperatures, volatile weather patterns, increase in the amount of rainfall, and overall environmental degradation. Other alterations cited were increasing numbers of insects, increasing frequency of flooding, and changes in wildlife viewing patterns.

Considering that MDI is an island, and many of its key attractions are coastal/ocean related, it was to expect that many participants (27%) would be concerned about potential sea level rise as a result of global climate change. Respondents expected sea level rise will damage coastal attractions, facilities, access, and tourism assets, potentially change the scenery and beauty of the area, and therefore, negatively impact the recreational experience. Given that the ocean, seascape, and beaches are central tourism assets that draw many visitors to the area, visitors perceived sea level rise as a key concern, and confirmed by the following three quotes.

> "It will affect things over here [in Acadia-MDI] the next 20 or more years. Sea level rise, increased insects, coastal islands being flooded, town being flooded are my main concerns [for this region]." (Male, out-of-state visitor, MS degree, 61–70 age range)

> "Climate change will affect coastal towns in Mount Desert Island with rising sea levels; this place might be more vulnerable to losing visitors if its natural attractions are changed as a result of coastal changes." (Male, Maine resident, college graduate, 31–50 age range)

> "The beaches and some of the natural features of the land will be changing so people might not visit/hike on spots that are usually popular here at Acadia National Park." (Male, Maine resident, college graduate, 31–50 age range)

Of all the visitors who stated climate change will affect tourism in Acadia-MDI, 16% were concerned about the negative effects of

Table 4
Themes, categories and coded responses from the open-ended questions about visitor perceptions of the potential effects of climate change to tourism at Acadia-MDI, Maine, U.S.

Theme	Category	Code	Number of coded responses
Climate change will affect the tourism and recreation in MDI	Perceptions of negative effects of climate change at MDI	Negative environmental effects	211
		Sea level rise (coastal erosion, increased ocean temperatures, reduced access, impact to coastal resources)	98
		Temperature change—extreme cold or hot temperature	56
		Negative effects of climate change in general	53
		Negative impacts of climate change to wildlife	25
		Extreme weather events	22
		Negative impacts to fishing/lobster industry	12
		Precipitation increase	10
	Perceptions of positive effects of climate change at MDI	Positive effects of temperature (relief from extreme heat)	11
		Positive effects on the overall natural environment	2
		Wildlife (new species migrating to the region)	2
	Statement on climate change in general	Believe CC is occurring	41
		Travel decisions impacted	7
		Climate change will affect everything	5
		Pollution increase	2
Climate change will NOT affect tourism	Believe in climate change	Resilient—capacity to adapt	59
		Long-term	17
		Unsure about the potential effects to MDI	8
		Nothing we can do	1
	Do not believe in climate change	Not happening	28
		Invention by government, media, politicians/science	8
Unsure of the effects of climate change to tourism in MDI	Believe in climate change	Unsure about how it will affect MDI	46
		It is happening	12
		Long-term effects	3
	Not enough information; would like to have information		26
	Do not believe in climate change		4

changing temperatures to the region, with extreme hot or cold temperatures possibly deterring visitor experience and enjoyment. A few participants said that if extremely high temperatures occur in the future, the area may not be an adequate relief from the heat for visitors coming from southern regions, as visitors will likely select destinations further north (e.g. Canada, Alaska). It should be mentioned that several sampling days recorded temperatures close to 100 °F, impacting visitor experiences and leading visitors to use indoor facilities more often. In addition, several sampling dates in August included abnormally cold temperatures for the season. These most likely influenced some of the responses regarding extreme temperatures.

> "It would definitely affect visitors like me who motorcycle here as I would be unable to ride in the rain." (Male, out-of-state visitor, college graduate, 18–30 age range)

> "I think that in the future we will have stronger and more frequent storms that could potentially cause more damage. I think that the summer season would be most affected because of this increase in rain." (Female, out-of-state visitor, high school graduate, 31–50 age range)

Visitors alluded to higher temperatures and increased frequency of rain as changes that will make recreational activities more physically challenging and potentially dangerous. Consequently, participants suggested travel patterns at Acadia-MDI in the years to come are likely to be modified, with temperature and precipitation as key drivers of change. Of particular concern was the potential change in travel behavior, which may include not traveling to the region. Participants also said that increased precipitation could reduce the number of visitors to the region, or force visitors to participate in indoor activities as rainy conditions could make recreation (such as hiking) dangerous or uncomfortable. With beaches, oceans, and other natural landscape and seascape features changing with climate, several visitors suggested currently popular hiking and recreational sites will not be used as often. A potential change may be in the visitor demographics, with more experienced outdoor recreationists being the ones able to adapt to changes and continue to visit the region.

> "Changing temperatures will make some of the recreation here harder than before. Since that's one of the big things that draw people to the area it also might affect the numbers of people who come here." (Male, Canadian, college graduate, 31–40 age range)

Visitors expressed concern that climate change will negatively affect endemic or charismatic wildlife (7%), and therefore erode key tourism attractions in the region such as whale watching and puffin tours. Of those who stated climate change will affect tourism in Acadia-MDI, three percent revealed that other industries important to the economy of the region (i.e., fishing and lobstering), and related to the tourism in Acadia-MDI, may likely be impacted negatively by climate change.

> "I believe that it [climate change] is going to change the ecology here [in Acadia-MDI]. I have heard that some of the main food sources for puffins are moving to colder waters putting puffins at risk." (Male, Maine resident, college graduate, 31–40 age range)

> "I think that climate change will affect recreation and tourism here. I think that if the temperature warmed only a few degrees, that would not be a huge problem for most people. It will be all of the other problems such as storms, lobster and whale habitat, and natural disturbance that will negatively affect visitors' experience." (Male, out-of-state visitor, PhD degree, 41–50 age range)

Close to six percent of the visitors were concerned about the vulnerability of the region to potential negative effects from storms they anticipate. Participants were particularly concerned

about the effects of extreme weather events, and the associated lack of access to the area. Visitors shared their concern that these factors may negatively affect tourism demand while reducing visitation.

> "Mount Desert Island is vulnerable to climate change because it is an island. Worse storms could affect access to the island given that this area is already pretty remote." (Female, out-of-state visitor, college graduate, 31–40 age range)

> "It will affect coastal towns with rising sea levels so this place might be more vulnerable to losing visitors if its natural attractions are changed." (Male, out-of-state visitor, college graduate, 21–30 age range)

It should be noted that 53 participants (10%) who said climate change will affect tourism at Acadia-MDI, when prompted about their belief on the effects of climate change to tourism, provided descriptions of general impacts rather than Acadia-MDI specific tourism impacts resulting from climate change. Most of these respondents were first time visitors to Acadia-MDI, and likely had limited information about the area, and the predicted changes expected from climate change at Acadia-MDI (e.g., changes in temperature, precipitation, sea level rise).

Fewer participants believe climate change will create positive effects in the region (3%). Possible reasons included a cooler and more pleasant climate (2%) compared to other regions in the US or abroad. It was also mentioned that new species may migrate to Acadia-MDI or expand their habitat range, and therefore increase the attractiveness of the region as a tourism destination.

> "As the climate warms, people will be more attracted to places like this because it is cooler than other places." (Female, out-of-state visitor, college graduate, 31–40 age range)

> "I think that if the climate warms, more people will want to come here to get away from the heat. We came to Maine specifically to get away from the heat that we have been experiencing in Washington DC." (Female, out-of-state visitor, college graduate, 41–50 age range)

*3.3.2. Theme 2: Climate change **will not affect** the tourism industry at Acadia-MDI*

Less than a quarter of participants conveyed their belief that climate change will not affect tourism in the area (23%). The majority of visitors who expressed that climate change will not affect tourism claimed the region to be resilient to any effects of a changing climate (65%). Most respondents perceive that Acadia is a big tourism spot, containing a high diversity of tourism attractions, which will likely not be negatively impacted by alterations resulting from climate change. Several participants (10%) believe that although climate change may be happening, people will adapt, and therefore tourism will not be affected. People's capacity to adapt to changing conditions will allow for continued visitation to the Acadia-MDI region regardless of changes in biophysical conditions or weather patterns, particularly with the belief that gradual climatic changes will allow people to easily adapt. Participants also mentioned that the variety of attractions available at Acadia-MDI would allow people to adapt and find other things to do.

> "I don't think we will see a change in our lifetime or enough change as a whole to make an impact. People and animals have adapted and evolved for millions of years and will continue to do so." (Male, out-of-state visitor, college graduate, 51–60 age range)

Other visitors conveyed that changes in the next 20–100 years will not be as extreme to really have an effect on tourism in the short-medium term (22%). Some expressed climate change will not occur in our lifetime, but probably in several hundred years. A few visitors mentioned that even if sea level rise occurs, several attractions will still be in place and attract visitors to the area; such is the case of Cadillac Mountain at Acadia National Park, the highest point along the North Atlantic seaboard.

> "I believe that it will probably not be severe enough to affect recreation. Bar Harbor will be busy no matter what the effects could be in the future." (Female, out-of-state visitor, MS degree, 51–60 age range)

Furthermore, some of these visitors (35%) who stated that climate change will not affect tourism in Acadia-MDI, in fact were doubting the existence of climate change. Hence, their responses reflect their overall beliefs towards climate change in general and not necessarily about the likely effects of climate change on tourism. Some were skeptical of the climate change concept, doubting the legitimacy of these climate change statements (10%); fewer indicated that they distrust information regarding climate change provided by the media, science or politicians. Some even believed that climate change was an invention of and an exaggeration by the media, or a concept invented by the government or scientists.

> "I think the public concern is caused by political hype not physical changes." (Female, out-of-state visitor, MS degree, 51–60 age range)

*3.3.3. Theme 3: **Unsure of the effects** of climate change to tourism at Acadia-MDI*

Some visitors (15%) expressed uncertainty about whether or not climate change could affect tourism in Acadia-MDI either positively or negatively. The key reason for this uncertainty was the lack of knowledge and information they had about Acadia-MDI and the specific impacts climate change could have in the destination (58%). Many were first time visitors, who did not know much about the place, how it has changed over time, and how it may change into the future.

> "[Climate change] Could affect things in the future. I am very concerned about the effects of climate change worldwide, but I am unsure about how it will affect Maine." (Female, European, PhD degree, 51–60 age range)

Several study participants (15%) suggested they would like to have more information about climate change, its effects to biophysical features at Acadia National Park, and likely impacts to tourism in the region. Some visitors suggested being extremely interested in having access to facts that could help them understand how things have changed or are likely to change in the future at Acadia National Park and MDI.

3.4. Visitor characteristics and differing perceptions of the effects of climate change on tourism (R.Q. 3)

To respond to research question 3 (What differences exist among visitors regarding their perceptions of the effects of climate change on tourism?) a series of *t*-test and one-way ANOVA analyses were conducted to explore differences across gender, age, and education groups. Independent samples *t*-tests revealed a significant difference in visitor perceptions of the impacts of climate change on the tourism industry at Acadia-MDI, based on gender ($t=.971$, $p=.042$). Women (73%) were more likely than men (57%) to express that climate change will in fact affect the tourism industry in the region. A significant effect of age on visitor perceptions of the impacts of climate change on tourism was observed ($F=4.24$, $p=0.006$). Post-hoc tests using the Bonferroni

correction revealed that perceptions are statistically significantly different between visitors 18–30 and visitors over 60 years of age ($p=.011$), with the younger age group being more likely to believe that climate change will impact tourism in Acadia-MDI (76%). No statistically significant difference between education groups was detected using one-way ANOVA.

4. Conclusions

Overall, this study provides insights into the range of visitors' beliefs concerning perceived impacts of climate change to nature-based tourism destinations such as Acadia National Park. We address the importance of weather to visitors traveling to national parks such as Acadia National Park, and whose recreational experiences are heavily dependent on natural attractions, outdoor activities, and coastal resources. Results from this study confirm other findings about the importance of weather and climate to visitors traveling to natural heritage oriented protected areas, and engaging in nature-based tourism activities (Brownlee et al., 2014; Sharp et al., 2014; Jones & Scott, 2006). Study participants referenced natural assets as top motivators to visiting the region, even referring to the weather as important in their decision to travel to the region (e.g., "good weather", "cooler summer weather") as mentioned in prior studies (Gómez Martín, 2005; Gómez Martín, Armesto-López, & Martínez-Ibarra, 2013; Nyaupane & Chhetri, 2009).

Furthermore, our findings show that perceptions of climate change impacts on tourism differ between age and gender groups; no difference was found between education groups. Women and younger people (18–30) are more likely to believe climate change will affect tourism. According to Soares & Murillo-Licea (2013), gender differences influence social constructions and perceptions about climate change impacts and risk vulnerability. Moreover, a survey conducted in Virginia (U.S.) also showed gender and age to influence climate change perceptions, with women and young adults more likely to believe in climate change and be concerned about its potential impacts (Maibach et al., 2013). In terms of visitor perceptions about the effects of climate change on tourism, Huebner (2012) found a relationship between gender and perceived social risks.

The majority of visitors who believed climate change will affect tourism in Acadia-MDI, considered the changes to potentially have negative effects to the destination. Visitors cited a wide variety of tourism assets they believed would be impacted negatively by climate change, with mostly environmental features perceived to be affected. Similarly, Huebner (2012) suggested that visitors were more likely to identify negative outcomes predominantly related to the environment. Participants in our study were concerned with rising sea-levels, devastation of tourism resources, and limited access to recreational areas as a result of flooding and coastal erosion.

Considering that visitors have the largest adaptive capacity within the tourism system due to their ability to easily substitute activity, place and timing of their travel, it is imperative that evidence be generated to understand visitor perceptions about climate change effects, how these impacts may affect travel experiences, and ultimately change travel behavior (Gössling et al., 2012). This information is essential to anticipate potential changes in tourism demand and shifts in market segments, while aiding managers and service providers in developing effective educational, programming, and promotional strategies that consider visitors' perceptions about climate change effects to tourism and likely behaviors.

Brownlee (2012) suggests awareness of climate change impacts, resulting biophysical changes, and recreation-specific impacts, to be directly related to the nature-based recreation experience in national parks. Given that visitor perceptions of climate change impacts are directly related to nature-based tourism experience, and that the majority of visitors to Acadia National Park-MDI believe that climate change will affect tourism in the region, managers could integrate these findings into their visitor strategic planning efforts.

The results indicate that the majority of visitors to Acadia National Park-MDI are concerned with the negative effects that unpredictable weather may have on the region, and the reduction in visitor numbers. Furthermore, visitors expressed extreme weather could potentially affect summer visitation if unusually warmer or cooler/rainy days become frequent at Acadia National Park-MDI. As mentioned earlier, unusually warmer or colder temperatures during several sampling dates most likely influenced some of the responses regarding extreme temperatures. The literature shows visitor perceptions are associated with experiences of past/current weather conditions, and therefore can influence visitor responses to survey questions (Gössling et al., 2012).

In addition, as mentioned by several visitors, lack of information about climate change, or limited understanding of the Acadia National Park-MDI's biophysical factors seriously affected some visitor perceptions of the influence of climate change to tourism in the region. This finding on visitors' concern about the lack of information could be used as an educational opportunity for managers, who may capitalize on this concern and inform visitors about current biophysical changes to destinations as a result of climate change, visitors' role in reducing their carbon footprint, climate-friendly services offered by the park, adaptation strategies in place, and potential behaviors to encourage. As suggested by several studies (Brownlee, 2012; Brownlee et al., 2013; Brownlee, Powell, & Hallo, 2013; Manning, 2011), assessing visitor perceptions about climate change is essential to develop appropriate management and interpretation strategies, and outdoor recreation programming. Furthermore, research could help inform resource management decisions and aid in the development of targeted climate change education and interpretation programs in protected areas (United Nations, 1992) using tools that may enhance their ability to effectively communicate climate change information (Evans, Hicks, Fidelman, Tobin, & Perry, 2013).

Our findings reflect the perceptions of summer visitors. Additional research may be needed to explore the range of perceptions about the effects of climate change to tourism across seasons. Although Maine relies heavily on summer visitation, particularly Acadia National Park-MDI, we believe perceptions of visitors in other seasons will likely differ from the results presented here. This discrepancy may be further exaggerated as the visitors' place of residence and recreation activities differ in winter, with a heavy visitation by in-state recreationists. Moreover, results could further be enhanced by (1) utilizing social science theories associated with risk perceptions and how these perceptions might explain visitor beliefs, attitudes and behaviors associated with climate change vulnerability and behavioral adaptation (Leiserowitz, 2006); (2) applying travel substitution frameworks to model potential changes in travel behavior in light of changing conditions at the destination (Gössling & Scott, 2008); and (3) employing tourism climate indices to understand visitor climate preferences and predict potential changes in visitor profiles and demands at national parks (Perch-Nielsen, Amelung, & Knutti, 2010). Results from this study could be strengthened via incorporating additional previously tested and reliable psychometric scales.

Findings suggest climate change will likely impact tourism behavior at Acadia National Park-MDI; future research is needed to confirm this conclusion and determine the extent to which the perceptions of climate change and climate change impacts may affect visitation, particularly in protected areas. Rating and Likert-

scales should be used to assess visitor perceptions of the likelihood of climate change induced impacts to occur, and potential travel behavior changes (such as destination selection, travel season, activity participation) in response to climate change impacts on tourism destinations. Scales should incorporate meteorological data to test visitor perceptions of the effects of climate change to tourism and potential behavioral changes, using different climate change scenarios. We observed that visitors were more likely to mention sea level rise as a potential impact when interviewed on a sampling site facing the ocean. Future research may benefit from embedding choice experiments (Pröbstl-Haider and Haider, 2014; Pröbstl-Haider et al., 2015) that integrate photographs portraying potential changes (based on climate change scenarios) prior to inquiring about the likelihood of specific climate change impacts, and the likelihood of these changes to potentially influence visitors' travel behavior. The use of visual cues or interpretive materials in natural settings may also be valuable as an interpretation tool to communicate to visitors about the impacts of climate change on specific resources of parks. Future research on visitors' perceptions on mitigation strategies and resource stewardship in parks and protected areas is highly needed, especially those that reflect visitors' potential support for management strategies that address climate change. Overall, research to understand visitor perceptions about the influence of climate change to tourism should continue, as well as on the likely changes in travel behavior as a result of climate change to help bridge the informational gap, and influence management decisions in protected areas.

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