Title: Determinants of Visitor Climate Change Risk Perceptions in Acadia National Park, Maine, USA

Authors:

Lydia Horne (corresponding author)
PhD Candidate
Ecology and Environmental Sciences
University of Maine
lydia.horne@maine.edu

Sandra De Urioste-Stone
Associate Professor of Nature-Based Tourism
School of Forest Resources
University of Maine
sandra.de@maine.edu
207.581.2885

Erin Seekamp
Professor in the Department of Parks, Recreation and Tourism Management
North Carolina State University
elseekam@ncsu.edu
919.513.7407

Parinaz Rahimzadeh-Bajgiran
Assistant Professor of Remote Sensing of Natural Resources
School of Forest Resources
University of Maine
parinaz.rahimzadeh@maine.edu

Laura Rickard
Associate Professor of Risk Communication
University of Maine
laura.rickard@maine.edu
207.581.1843

Determinants of Visitor Climate Change Risk Perceptions in Acadia National Park, Maine, USA

Abstract

Nature-based tourism is one of the most economically important industries in the state of Maine, USA. Climate change impacts are projected to affect important tourism assets in Maine, which could result in behavioral shifts related to destination selection, seasonal visitation, and activity participation. Risk perceptions can be important predictors in visitor travel decisions. Recent tourism studies have focused on the effects of climate impacts on risk perceptions, but few have examined the social-psychological drivers of climate change risk perceptions. Drawing on social-psychological theories, we address this gap by understanding visitor climate change risk perceptions in Maine. We surveyed visitors to Acadia National Park in the summer of 2018 to assess the impact of socio-demographics, cognition, experience, and socio-cultural factors on visitor climate change risk perceptions. We used two-stage cluster probability sampling and intercepted 1,317 visitors on site; 480 participants completed the online follow-up survey. Using hierarchical regression, we explained 45.5% of the variance in visitors' climate change risk perceptions at a nature-based tourism destination. Visitors identifying as female, having higher levels of belief in climate change, more first-hand experience with climate impacts, and a higher altruistic values orientation amplified risk perceptions. Understanding determinants of climate change risk perceptions within an outdoor recreation setting has implications for offering high quality visitor experiences while maintaining the integrity of the natural resource base upon which visitation relies.

Highlights

- Using an on-site intercept survey, we sampled visitors to Acadia National Park to measure social-psychological factors contributing to climate change risk perceptions.
- Identifying as female, belief in climate change, experience with climate impacts, and altruistic values significantly increased visitors' climate change risk perceptions.

Keywords: nature-based tourism, coastal tourism, protected area tourism, hierarchical regression, visitor survey

1. **Introduction**

The effects of climate change are already being felt in the tourism industry worldwide, with regional impacts requiring adaptation by stakeholders. Coastal, mountain, and winter tourism destinations are especially vulnerable to climate and weather impacts (UNEP, 2008). Climate change will affect tourism demand and seasonality in many destinations, which is expected to shift based on different climate change scenarios (Amelung, Nicholls, & Viner, 2007; Gossling, Scott, Hall, Ceron, & Dubois, 2012; Kanazawa, Wilson, & Holmberg, 2018;

McCreary, Seekamp, Larson, Smith, & Davenport, 2019; Perry, Manning, Xiao, & Valliere, 2018; Smith et al., 2016). Visitor experiences in protected areas, such as national parks, can influence climate change perceptions and may vary depending on the type of visitor experience (e.g., terrestrial versus marine environment) and visitor demographics (Brownlee, Hallo, Wright, Moore, & Powell, 2013; Brownlee, Hallo, & Krohn, 2013).

Risk perceptions of climate change can influence travel behaviors of tourists. For example, Huebner found a strong association between climate change risk perceptions and visitors' changes in travel behavior, such as destination selection, activities pursued, and spending (Huebner, 2012). Additionally, a recent study in Acadia National Park (ANP) found that visitors perceived the area to be vulnerable to climate change effects that are likely to impact the natural environment and infrastructure, particularly sea level rise, extreme weather, and disruption to island access (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016). De Urioste-Stone et al. (2016) found that visitors concerned with changes that might put their personal well-being at risk were more likely to mention potential changes in their future travel behavior.

The goal of this paper is to examine what factors shape climate change risk perceptions of visitors to ANP. Climate change risk perceptions can be an important predictor of shifts in visitation to and in tourism destinations, though not all visitor segments will respond in the same manner (Dawson, Havitz, & Scott, 2011; Pröbstl-Haider, Dabrowska, & Haider, 2016; Wilkins, De Urioste-Stone, Weiskittel, & Gabe, 2018). Understanding these shifts in visitation is crucial for tourism planners and managers to cope with the negative impacts of climate change on visitation while also helping stakeholders adapt and take advantage of emerging opportunities (Haegeli & Pröbstl-Haider, 2016). With emerging evidence of a changing climate, it is essential to understand how changes in climate trends may impact visitation so that tourism managers can adapt to these shifts while continuing to meet visitor expectations and resource management goals.

1.1 Risk Perceptions and Tourism

Risk has been defined as the ‘‘things, forces, or circumstances that pose danger to people or to what they value,’’ and risk is typically described in terms of a likelihood or probability of loss occurring (McComas, 2006, p. 215). This definition of risk led early analysts to undervalue the complex, subjective way that audiences internalize and interpret information, leading to an “all we have to do is tell them the numbers” mentality when communicating risk (Fischhoff, 1995). More recently, the field of risk perception and communication has focused on understanding the nature and antecedents of subjective risk assessments (Bodemer & Gaissmaier, 2015; Slovic, Finucane, Peters, & MacGregor, 2004). Climate change risk perceptions specifically refer to subjective evaluation of climate change as a hazard, threat, or phenomenon (Shakeela & Becken, 2015).

Understanding visitors’ risk perceptions of climate change are especially important for nature-based tourism destinations and other areas that are sensitive to climate change impacts (Gossling et al., 2012). In relation to tourism, risk perceptions can be an important predictor of visitor behaviors, such as destination selection, seasonal visitation patterns (i.e., when tourists choose to visit a destination), and the activities in which visitors choose to participate (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015; Kanazawa et al., 2018; Karl, 2018; Perry et al., 2018). Conversely, some studies found that tourists’ perceptions of climate change risks are unlikely to alter visitor travel decisions (Hestetune et al., 2018; Lise & Tol, 2002; Seekamp, Jurjonas, & Bitsura-Meszaros, 2019). Awareness of climate change can impact tourist behavior due to shifts in climatic appeal and the image of the destination (Atzori, Fyall, & Miller, 2018;

Csete & Szécsi, 2015; Dillimono & Dickinson, 2015; Karl, 2018). In some cases, perceptions of climate conditions or environmental changes are just as important to consumer choices as the actual conditions (Huebner, 2012). It is therefore important to understand how tourists to climate sensitive destinations perceive their risk to climate change and what factors shape those risk perceptions.

1.2 Conceptual Foundations

Previous risk perceptions theories have described the influence of socio-demographics, cognition, experience, and socio-cultural factors on visitor climate change risk perceptions (Dunwoody & Griffin, 2015; Kasperson et al., 1988; van der Linden, 2015), and we focus on a combination of social and psychological predictors. In past studies, socio-demographic factors that influence risk perceptions include gender, political affiliation, and sometimes age. Identifying as female and being affiliated with a liberal political party often increases climate change risk perception (Safi, Smith, & Liu, 2012; van der Linden, 2015; Ziegler, 2017). A recent study conducted among visitors to Mount Desert Island (MDI) in Maine revealed that younger visitors (18-30 years of age) are more likely to believe that climate change will impact tourism in ANP compared to visitors older than 60 years (De Urioste-Stone et al., 2015), though other studies find age to be an insignificant predictor of risk perceptions (Safi et al., 2012; van der Linden, 2015).

Cognitive factors influence risk perceptions, including knowledge of climate change, belief in anthropogenic climate change, and perceived self-efficacy. Higher levels of climate change knowledge are often associated with higher levels of concern and perceived risk (Milfont, 2012; Pidgeon, 2012; van der Linden, 2015); however, Kellstedt's team found that knowledge was negatively associated with climate change risk perceptions (Kellstedt, Zahran, & Vedlitz, 2008). A range of cognitive barriers prevent the public from understanding climate change. These include, but are not limited to, lacking knowledge on the cause and extent of climate change, environmental numbness (feeling emotionally indifferent due to the sheer size of the problem), uncertainty of impacts and appropriate actions and the relative benefits of such actions, perceived control (how capable people feel to act in a certain way), and optimism bias, the belief you will be less likely to experience negative events (Gifford, 2011; Horne, De Urioste-Stone, & Daigle, *in review*; Slovic, 2007; Stern, 2018; Weinstein, 1989). Belief in anthropogenic climate change can also increase risk perceptions (Safi et al., 2012). Leiserowitz found that 62% of Americans believed climate change was caused mostly by human actions (Leiserowitz et al., 2020). Despite belief in climate change, climate change can often be perceived as something impacting geographically and temporally distant peoples, a phenomenon referred to as psychological distancing (Leiserowitz, 2005; Zwickle & Wilson, 2014).

Experiential processes include personal experiences and affect, and these factors shape risk perceptions. Experiencing an event that is the result of climate change first hand usually equates to higher risk perceptions, though there are challenges measuring experiences using self-reporting instruments and the attribution of impacts to climate change (Milfont, 2012; Pidgeon, 2012; Spence, Poortinga, & Pidgeon, 2012; van der Linden, 2014). The type of environmental impact may play an important role in determining risk perceptions as not all first-hand experience with climate impacts result in higher risk perceptions. For example, winter tourism stakeholders in Western Maine who experienced local climate change impacts were more likely to have higher risk perceptions than interview participants who did not feel they were experiencing climate change impacts (Horne, De Urioste-Stone, & Daigle, *in review*). In contrast, Safi et al. (2012) found that drought in Nevada did not contribute to higher perceptions of risk among farmers and ranchers, possibly because drought is viewed as a natural occurrence in the area and was thus not cognitively linked to climate change. In another instance, experience with extreme storm and flooding increased risk perceptions in UK residents (Demski, Capstick, Pidgeon, Sposato, & Spence, 2017). The type of environmental impact may play an important role in determining risk perceptions and whether or not the event is perceived as natural. In addition to personal experiences with climate change, emotions are experiential processes that determine risk perceptions. Information processing is guided by affect and emotions and was the most important predictor of personal risk perceptions of climate change in van der Linden's study of social-psychological determinants of risk (2015). Affect incorporates morals and reason to form risk perceptions that could lead to mitigation actions through altruistic emotions (Roeser, 2012).

Values can also impact risk perceptions. Cultural frameworks shape risk perceptions at a societal level, while values shape risk perceptions on an individual level (van der Linden, 2015). A value is a "transsituational goal varying in importance, which serves as a guiding principle in the life of a person" (Schwarts, 1994). Values are relatively stable and related to the core of one's identity (Heberlein, 2012). Values orientation have been traditionally divided into two dimensions, *(a)* openness to change versus conservatism and *(b)* social/self-transcendent versus egoistic/self-enhancement; however, more recent studies have distinguished three value orientations: biospheric, altruistic, and egoistic (DeGroot & Steg, 2007). Biocentric and altruistic worldviews are often associated with higher concern for environmental issues, including climate change and support for ecofriendly action (Dietz, Dan, & Shwom, 2007; Stern, 2018; Wynveen & Sutton, 2015). For example, an analysis of US citizens found that environmental values played a significant role in climate change beliefs and attitudes (Ziegler, 2017). In a recent study of UK citizens revealed altruism, not environmental values, and concern for poorer people suffering from climate impacts as a strong influence in adopting low carbon lifestyles (Howell, 2013).

1.3 Tourism and Climate Change in Maine

Tourism is one of Maine's most important industries, generating nearly 110,000 jobs (16% of employment in Maine) and $6.2 billion USD in revenue (Maine Office of Tourism, 2019). Tourism expenditures have increased in recent years, and spending associated with outdoor recreation is also increasing (Maine Office of Tourism, 2019). Almost half of overnight visitors to Maine engaged in some nature-based tourism activity, while 23% indicated that outdoor recreation was their primary reason for visiting the state (Maine Office of Tourism, 2018). Much of Maine's visitation is concentrated along the coast, with the highest numbers during summer months (Maine Office of Tourism, 2018). Maine is divided into eight tourism regions, with Downeast and Acadia, Mid-Coast, Greater Portland and Casco Bay, and the Maine Beaches covering the coastline. ANP is located in the Downeast and Acadia region. Visitation to Downeast and Acadia is increasing as 18% of 2018 visitors indicated that this region was their primary destination in Maine, an increase from 15% in 2017 (Maine Office of Tourism, 2018). The Downeast and Acadia region is tied with the Maine Highlands as the most popular destination for first-time visitors (Maine Office of Tourism, 2018). ANP is a key attraction within the Downeast and Acadia region, attracting 3.4 million visitors in 2019 (NPS, 2020b).

With a heavy economic reliance on outdoor recreation, Maine's nature-based tourism industry is – and will continue to be – altered 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. The summer season has increased by two weeks since the early 1900s and is likely to increase another two weeks by 2050 (Fernandez et al., 2020). Maine is expected to receive more precipitation in the form of rain, mainly in fall and summer, as a result of climate change (Fernandez et al., 2020). Additionally, rising sea levels, ocean acidification, rising ocean temperatures, species and ecozone shifts, changing fisheries, disappearing salt marshes, beach erosion, and increased flooding events are all impacting coastal destinations in the state (Birkel & Mayewski, 2018; Horton et al., 2014). Previous research indicates that a third of visitors to Maine will alter their plans in response to weather conditions, though visitors to ANP indicated they would not be deterred from visiting in spite of negative environmental changes due to high levels of place attachment (Wilkins & De Urioste-stone, 2018; Wilkins et al., 2018). This is consistent with a previous study predicting increased visitation to ANP under climate change conditions (Fisichelli, Schuurman, Monahan, & Ziesler, 2015).

1.4 Aim and Hypotheses

Our study aims to evaluate what factors determine ANP visitor climate change risk perceptions. Our hypotheses are as follows:

H.1. Female, younger, more politically liberal visitors will have higher risk perceptions than older, male, more politically conservative visitors.
H.2. Visitors with higher levels of climate change knowledge will have higher climate change risk perceptions than visitors with lower levels of knowledge.
H.3. Visitors who have more experience with climate change impacts will have higher risk perceptions than visitors with little experience with climate change impacts.
H.4. Visitors with higher biospheric values and higher altruistic values will perceive their risk from climate change as higher than visitors who have lower biospheric and altruistic values.

2. Methods

2.1 Study Site

Mount Desert Island (MDI) is the largest island off the coast of Maine with a year-round population of approximately 10,000 (Census, 2012). The location and extent of the study area are presented in Figure 1. ANP is the main attraction on the island, attracting over 3.4 million visitors annually (NPS, 2020b). Visitors to ANP contributed $388 million to nearby gateway communities, supporting 5,600 jobs (NPS, 2019). Key attractions in ANP include scenic coastal and mountain views, nature-based recreational activities such as hiking, biking, boating, swimming, climbing, camping, and many cultural and historical attractions, such as the carriage roads, Park Loop Road, and Jordan Pond House. Though ANP is one of the National Park Service's smallest parks, it is ranked among the top 10 in visitor numbers (NPS, 2020a). The highest visitation occurs between May and October (NPS, 2020a). Due to the seasonal influx of tourists, MDI becomes very busy between May and October, but remains relatively quiet during the winter months.

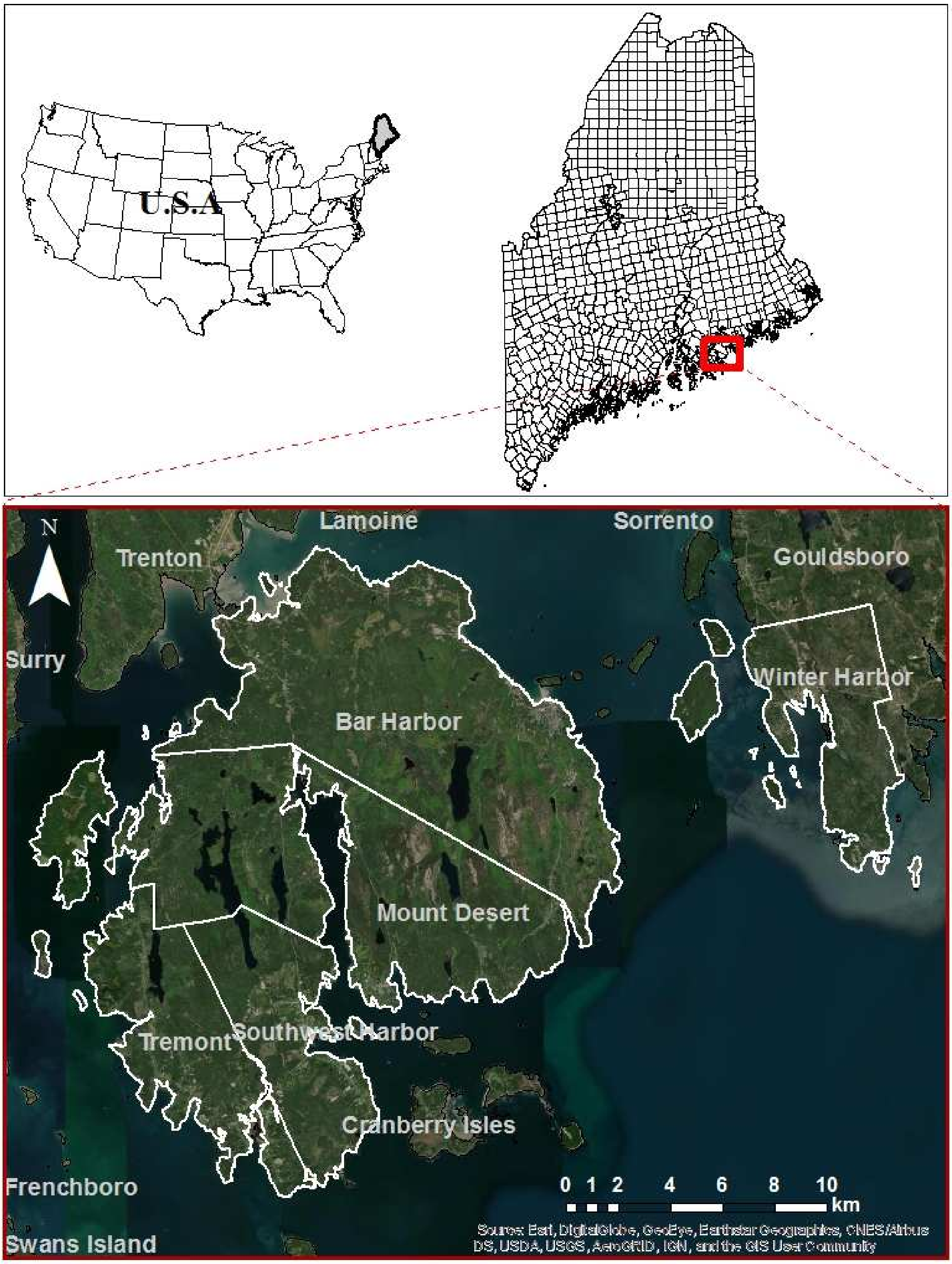

Figure 1. Acadia National Park located on Mount Desert Island, including the towns of Mount Desert, Bar Harbor, Southwest Harbor, and Tremont, and Schoodic Peninsula, including Winter Harbor.

2.2 Instrument Development, Sampling, and Data Collection

To identify factors contributing to tourist climate change risk perceptions, we used a two-stage probability cluster sampling strategy whereby survey dates were chosen at random, as were visitor groups, using interval sampling once on site (Scheaffer, Mendenhall, Ott, & Gerow, 2012; Wilkins et al., 2018). Throughout the summer and early fall of 2018, we approached tourists at visitor centers, trail heads, and key outdoor recreation attractions within the study site asking them to participate in an online survey after their visit, while conducting a short intercept survey to help increase response rate (Dillman, Smyth, & Christian, 2014). Upon making contact with participants, we asked questions related to their travel behavior and then handed them a postcard with a more detailed project description and a link to the online follow-up survey. We also asked participants for contact information so that we could send up to two follow-up postcards or e-mails to encourage survey participation (Dillman et al., 2014). To increase response rate, participants had the opportunity to enter themselves into a gift drawing at the end of the study (Dillman, Smyth & Christian, 2014). The online survey was completed by visitors after their trip to ANP consisted of close-ended questions with previously tested scales that measured socio-demographics, cognitive factors, experiential processes, and socio-cultural factors to assess risk perceptions among tourists (van der Linden, 2015).

We recoded scales such that higher numbers corresponded to higher levels of agreement or higher threat levels. Then, we used factor analysis to determine subconstructs associated with cognition, socio-cultural values, and risk perceptions, with varimax rotation and threshold values set to 0.50 (Hervé, 2003; Tabachnick & Fidell, 2013). Once subconstructs were identified, we tested each scale's reliability using Cronbach's alpha (See Table 1 for instrument description and Cronbach's alpha). Next, we created composite measures for each subconstruct by averaging item scores (non-weighted). We also included a randomized experiment in the survey to test the effects of different message frames (health message, weather message, no message) on risk perceptions. Survey participants were randomly assigned to groups that received one of three treatments: no message (control), a message about increasing tick-borne illness as habitat becomes more suitable due to climate change, and a message about increasing extreme weather events affecting visitor safety as a result of climate change. The results of the messaging experiment are not reported on here, but we controlled for these experimental groups in the analysis.

Table 1. Instrument description including example questions for each construct, scale information, and Cronbach's alphas.

Construct	Sub-Construct	Selected Items	Items adapted from original studies	No. Items	Reliability Measure	No. Scale Items	Scale Range
Cognition	Belief in Climate Change	"On average around the earth, I believe the following are happening…" The temperature of the ocean is rising. The number of flooding events is increasing. Sea level is rising.	Brownlee et al., 2013	4	$\alpha = 0.95$	6	Strongly agree-Strongly disagree; I don't know
Cognition	Actual Knowledge	Climate change is currently happening. Humans contribute to climate change. Carbon dioxide emissions contribute to climate change.	Van der Linden, 2015	3	$\alpha = 0.82$	8	Strongly agree-Strongly disagree; I don't know
Cognition	Perceived Knowledge	Climate change is caused by heat trapped in cities. I know a lot about climate change. The hole in the ozone layer causes climate change.	Van der Linden, 2015	3	$\alpha = 0.64$	8	Strongly agree-Strongly disagree; I don't know
Experience	Experience	Please check the environmental issues that you have personally experienced during your lifetime: Changes in precipitation Flooding Wildfires	Akerlof et al., 2013	-		2	Yes/No
Socio-Cultural	Biospheric Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: Preventing pollution Respecting the earth	Van der Linden, 2015	3	$\alpha = 0.85$	9	Of extreme importance-Opposed to my values
Socio-Cultural	Altruistic Values	For each value listed below, please rate the extent to which you consider it to be a	Van der Linden,	3	$\alpha = 0.83$	9	Of extreme importance-Opposed

		guiding principle in your life: Promoting peace Having social justice	2015				to my values
Socio-Cultural	Egoistic Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: Having authority Being influential	Van der Linden, 2015	3	α = 0.80	9	Of extreme importance-Opposed to my values
Risk Perceptions	Risk	Please rate the following climate change factors based on your perception of this as a potential threat to coastal Maine. Extreme weather events Higher temperatures Increased rain	Van der Linden, 2015	7	α = 0.91	4	High threat-Not a threat; Unsure

This table describes the variables used in our hierarchical regression analysis, including the number of questions (items) used to assess each sub-construct, their reliability for our sample, whether the variables were continuous or dichotomous, and the number of scale points, including whether or not there were scale options for “I don’t know” and “Unsure,” which were treated as missing data. For our risk construct, 9.1% indicated they were unsure. For all other constructs there was a less than 1% response rate for the “I don’t know” option.

2.3 Analysis Overview

We analyzed visitor survey responses in IBM SPSS Statistics 25. Descriptive statistics were generated for socio-demographic, cognitive, experiential, socio-cultural, and risk variables. We calculated response bias using Pearson's chi-square test to compare demographics, cognitive, experiential, and values between early respondents and later respondents from the online follow-up survey (De Urioste-Stone et al., 2016). We calculated total scores for all scales (for descriptive statistics, see Tables 1, 2, and 3), winsorized univariate outliers with z-scores +/- 3.29 and transformed data that were skewed to meet the assumption of normality (Tabachnick & Fidell, 2013). Models were run with transformed (log transformation) and non-transformed variables and results were not significantly different; therefore, reported results use non-transformed variables for ease of interpretation. We used hierarchical regression analysis to determine the significance of independent variables and the variance in climate change risk perceptions explained by socio-demographics, cognitive, experiential, and socio-cultural independent variables.

Table 2. Descriptive statistics for minimum, maximum, mean, standard deviation, and sample size for each sub-construct.

Sub-Construct	Scale Range	Mean	SD	Min	Max	N
Belief	1-6	4.32	0.71	2.20	5	424
Actual Knowledge	1-8	5.89	0.95	2.75	7	445
Perceived Knowledge	1-8	4.54	1.57	1	7	425
Experience	0-13	5.98	2.60	1	12	442
Biospheric Values	1-9	7.57	1.23	3.50	9	425
Altruistic Values	1-9	7.46	1.35	3.33	9	424
Egoistic Values	1-9	5.01	1.57	2	9	423
Risk	1-4	1.97	0.50	1	3	376

We present the range of the scales for each variable and descriptive statistics, including the mean, standard deviation, minimum and maximum values, and the N for each variable.

Table 3. Intercorrelations between variables.

		Health message	Weather message	Gender	Political affiliation	Age	Belief	Actual knowledge	Perceived knowledge	Experience	Biospheric values	Altruistic values	Egoistic values
1	Health message												
2	Weather message	-0.52**											
3	Gender	0.06	-0.02										
4	Political affiliation	0.03	-0.01	0.07									
5	Age	0.03	0.02	-0.03	-0.10*								
6	Belief	0.09	-0.04	0.03	0.56**	-0.03							
7	Actual knowledge	0.03	-0.03	0.09	0.58**	-0.17**	0.74**						
8	Perceived knowledge	0.12	0.06	-0.13**	-0.38**	0.15**	-0.46**	-0.44**					
9	Experience	0.08	-0.12*	-0.02	0.31	-0.02	0.38**	0.35**	-0.11*				
10	Biospheric values	0.10*	-0.12*	0.10*	0.34*	0.10*	0.45**	0.46**	-0.15**	0.37**			
11	Altruistic values	0.12*	-0.10*	0.15**	0.41	0.04	0.44**	0.46**	-0.22**	0.32**	0.73**		
12	Egoistic values	0.04	-0.06	0.03	0.20	-0.03	0.22**	0.24**	-0.02	0.18**	0.38**	0.44**	
13	Risk	0.11*	-0.03	0.22**	0.40	-0.03	0.51**	0.48**	-0.31**	0.36**	0.46**	0.50**	0.30**

Note: *p<0.05, **p<0.01

3. Results

3.1 Visitor Profile

We intercepted 1,317 visitor groups to ANP and 480 of those intercepted took the online follow-up survey, giving us a response rate of 36.45% (See Table 4 for participant demographics). Of those who participated in the follow-up survey, 84% were traveling as a family on vacation, with a mean size of 3.30. Top visitor activities included walking, sightseeing/driving for pleasure, hiking/backpacking, and eating lobster. Our sample was 59.44% women and our sample had a mean age of 51.98. Our sample was highly educated and identified as mostly politically liberal. When testing for response bias, there were no significant differences in cognitive, experiential, and socio-demographics between early and later respondents. While there was no significant difference between altruistic or egoistic values, the chi-square test revealed a difference in biospheric values orientation. Later respondents had higher biospheric values compared to earlier respondents.

3.2 Regression Results

The hierarchical regression analysis resulted in five models that included the messaging experiment, socio-demographics, cognition, experience, and socio-cultural factors. Model five explained the most variance (adjusted R^2=0.455) in visitor climate change risk perceptions (see Table 5 for regression results). Model 1 controlled for an experiment that is not included as part of this paper. Model 2 established a baseline with socio-demographic variables. Gender (β=0.179, $p<0.01$) and political affiliation (β=0.186, $p<0.01$) were significant predictors of risk perceptions. Identifying as female and having a liberal political affiliation significantly increased visitor climate change risk perceptions. Age was not a significant predictor ($\beta<0.01$, $p=0.773$). Model 2 explained 21.9% of the variance in visitor climate change risk perceptions (*F*(5,292)=17.625, adjusted R^2=0.219, Δ adjusted R^2=0.214, $p<0.01$).

Table 4. Visitor profile for participants who took the online follow-up survey.

Visitor Profile	Respondent Composition (%)
Gender	
Female	59
Male	40
Prefer not to answer	1
Age range	
18-30	10.5
31-50	34.1
51-70	49.4
71-over	6
Education	
High school or less	3.8
Some college	9.6
College degree	35.9
Graduate degree	50.7
Political affiliation	
Conservative	24.6
Neutral	23.6
Liberal	51.8
Main purpose of visit	
Business	0.4
Passing through	1.7
Vacation	89.6
Visiting family/friends	2.6
I live here, seasonal residence	3.4
Other	2.3
Travel group	
Self	4.4
Co-workers	0.8
Family	84
Friends	10.6
Other	2.7
First time visit to ANP	
Yes	61.2
No	38.8
Primary leisure activity	
Nature-based tourism	91.2
Cultural tourism	2.5
Shopping	0.4
Other	5.8

Table 5. Hierarchical regression results for all five climate change risk perception models. Entries are standardized beta coefficients. Model 1 controlled for a messaging experiment (not part of this paper), Model 2 added socio-demographic variables, Model 3 incorporated cognitive variables, Model 4 added experience, and Model 5 incorporated values orientations.

Independent variables	Messaging	Socio-demographics	Cognition	Experience	Socio-cultural
	Model 1 (β)	Model 2 (β)	Model 3 (β)	Model 4 (β)	Model 5 (β)
Weather message	0.119	0.088	0.091	0.078	0.090
Health message	0.040	0.042	0.043	0.063	0.090
Gender	-	0.179**	0.174**	0.195**	0.172**
Political affiliation	-	0.186**	0.059*	0.047	0.027
Age	-	0.001	0.001	0.001	0.000
Belief	-	-	0.269**	0.229**	0.210**
Actual knowledge	-	-	0.060	0.040	-0.001
Perceived knowledge	-	-	-0.012	-0.016	-0.021
Experience	-	-	-	0.044**	0.038**
Biospheric values	-	-	-	-	0.023
Altruistic values	-	-	-	-	0.066**
Egoistic values	-	-	-	-	0.027
adjusted R^2	0.005	0.219	0.367	0.409	0.455
Δ adjusted R^2		0.214	0.148	0.042	0.046

*p<0.05, ** p<0.01

Model 3 incorporated three cognitive predictors, belief in climate change, actual knowledge, and perceived knowledge, to determine if additional variance in risk perceptions could be explained. Gender (β=0.174, p<0.01) remained a significant predictor. Belief in climate change (β=0.269, p<0.01) was the only significant cognitive predictor, meaning that participants with higher belief in climate change perceived their risk from climate change as higher. Actual knowledge (β=0.060, p=0.120) and perceived knowledge (β=-0.012, p=0.645) were not significant predictors of visitor climate change risk perceptions. Model 3 significantly explained more variance in climate change risk perceptions than model 2 (F(8,289)=22.567, adjusted R^2=0.367, Δ adjusted R^2=0.148, p<0.01).

Model 4 added experience as a predictor of climate change risk perceptions. Gender (β=0.195, $p<0.01$) and belief in climate change (β=0.229, $p<0.01$) remained significant predictors. Experience was also a significant predictor of visitor risk perceptions (β=0.044, $p<0.01$). This means that as a visitor's level of experience with climate change impacts increased, their climate change risk perceptions also increased. As in the previous models, identifying as female and having higher belief in climate change increased visitor risk perceptions. This model explained significantly more variance in visitor climate change risk perceptions than the previous model ($F(9,288)$ =23.803, adjusted R^2=0.409, Δ adjusted R^2=0.042, $p<0.01$).

Model 5 incorporated value orientations (biospheric, altruistic, and egoistic). Gender (β=0.172, $p<0.01$), belief in climate change (β=0.210, $p<0.01$), and experience (β=0.038, $p<0.01$) remained significant predictors. Altruistic value orientation was a significant predictor in model 5 (β=0.066, p=0.007). Visitors with higher altruistic values had higher risk perceptions. Model 5 significantly explained more variance in visitor risk perceptions ($F(12,285)$=21.633, adjusted R^2=0.455, Δ adjusted R^2=0.046, $p<0.01$). Our fifth model explained the most variance in visitor climate change risk perceptions.

Based on the results of these analyses, we partially accept Hypothesis 1 as identifying as female was associated with increased risk perceptions; however, political affiliation was not significant in later models. We partially accept our second hypothesis as higher belief in climate change was significantly associated with increased risk perceptions, but actual knowledge and perceived knowledge were not significant predictors. We accept Hypothesis 3 as more experience with climate change impacts was associated with higher risk perceptions. We partially accept our fourth hypothesis as a higher altruistic values orientation was a significant predictors of risk perceptions; however, having a higher biospheric altruistic values orientation did not significantly increase visitor climate change risk perceptions.

4. Discussion

The goal of this study was to estimate the role that socio-demographics, cognitive, experiential, and socio-cultural factors have in determining climate change risk perceptions in visitors to ANP. Our results indicate that gender, belief in climate change, experience, and altruistic values are all significant predictors of climate change risk perceptions (Model 5) and accounted for 45.5% of variance in visitor climate change risk perceptions. Consistent with prior studies, female participants had higher climate change risk perceptions than male participants (S. De Urioste-Stone et al., 2015; Scannell & Gifford, 2011; van der Linden, 2015). Surprisingly, political affiliation was not a significant predictor in the final model. This could be related to participants weakly identifying with a political affiliation, thereby reducing the importance of political orientation on climate change perceptions. Previous studies have found that a liberal political affiliation increases climate change risk perceptions (Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015; Safi et al., 2012), though not always (Kellstedt et al., 2008).

4.1 Higher Climate Change Belief Increases Risk Perceptions

Unsurprisingly, higher levels of anthropogenic climate change belief resulted in higher risk perceptions (Lee et al., 2015). Knowledge of climate change and perceived knowledge were non-significant predictors. Previous work by van der Linden (2015) delineated between cause, impact, and response knowledge, all of which significantly predicted climate change risk perceptions in his sample of UK residents. Informing the public about the consequences of climate change (impact knowledge) was more effective in promoting mitigation behaviors among an environmentally active sample than communicating cause knowledge or response knowledge (Ortega-Egea, García-de-Frutos, & Antolín-López, 2014). Conversely, knowledge of climate change has resulted in lower concern for its effects and lower feelings of responsibility in taking climate action (Kellstedt et al., 2008). Though not within the context of climate change, Masuda and Garvin (2006) also noted the relationship between cultural world views, norms, and participants' risk perceptions. Their findings indicate that individual place-based experiences and cultural worldviews impacted risk perceptions (Masuda & Garvin, 2006). While norms were not included in our survey, these studies suggest a potentially complex connection between knowledge, norms, culture, and risk perceptions that merits further study.

4.2 Experience with Climate Change Impacts Increases Risk Perceptions

While climate change cannot be directly experienced, climate change impacts offer an indirect way to experience this large-scale, global phenomenon. Consistent with previous work, experience with climate change impacts was a significant predictor of climate change risk perceptions (Demski et al., 2017; Spence, Poortinga, Butler, & Pidgeon, 2011; van der Linden, 2015). The role of experience with climate change impacts is reliant on participants being able to connect events with climate change as a cause (Brügger, Dessai, Devine-Wright, Morton, & Pidgeon, 2015; Safi et al., 2012). Experience with climate impacts can increase the saliency of climate change for individuals, and perceived issue saliency can be important in predicting climate change risk perceptions (Yang, Rickard, Harrison, & Seo, 2014).

4.3 Visitors with Altruistic Values Orientation have Higher Risk Perceptions

Previous studies found that participants with high biospheric values tend to have higher climate change risk perceptions (Gifford & Nilsson, 2014; van der Linden, 2015; Yang et al., 2014). In our study, a high biospheric value orientation was not a significant predictor of climate change risk perceptions. This is perhaps because biospheric values were very high among all participants, as you might expect of visitors to a national park. We did find that having a more altruistic values orientation increased climate change risk perceptions. This could perhaps be explained by recent studies unpacking psychological distancing. Psychological distancing previously assumed that making a hazard more salient or psychologically closer to an audience (e.g., geographically local, personally impacted, more immediate time scale, and high likelihood of occurring) would increase the perception of risk associated with it (Zwickle & Wilson, 2014). More recent studies have highlighted that psychologically close threats do not necessarily translate into high perceived risk (Brügger et al., 2015; Schuldt, Rickard, & Yang, 2018; Spence, Poortinga, & Pidgeon, 2012). In relation to altruistic values orientation, some studies suggest that highlighting the risks to other people (more psychologically distant) increases risk perceptions and willingness to act (Spence et al., 2012), though not all studies agree (Schuldt et al., 2018). Based on our results, it may be that altruistic emotions related to ANP caused visitors to care about the area.

4.4 Limitations and Future Research

Future research could examine the influence of affective response or social norms on visitor climate change risk perceptions. Affect has been an important predictor of climate change risk perceptions in previous studies (Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011; Shakeela & Becken, 2015) and would likely increase the predictive power of our model. People typically feel obligated to act in accordance with their values, and thus normative behaviors arise from values if norms are activated (DeGroot & Steg, 2007; Stern, 2018).

Visitation has been increasing to ANP in the fall season, and we believe that visitor demographics for fall visitors are different from summer visitors (i.e., older, fewer families, more Maine residents, etc.), which could result in differences in visitor risk perception (especially if comparing residents to non-residents). Our sample includes primarily summer visitors; future research could concentrate on increasing the sample of fall visitors, especially to explore if differences between residents and non-residents visiting ANP exist. Additionally, we had a response bias in our biospheric values construct where later respondents had higher biospheric values than earlier respondents, indicating that our study was not comprehensively generalizable to all ANP visitors. Given that no other constructs had a response bias, the significant predictors of climate change risk perceptions in our model are likely representative of visitors to ANP.

4.5 Management Implications

We applied theories from risk studies and social psychology to add to the body of outdoor recreation and tourism literature on climate change risk perceptions. Consistent with other studies in different contexts, our findings indicate that gender, belief in climate change, experience with climate impacts, and altruistic values increase visitor risk perceptions. Tourism is expected to continue to increase in the coming decades (UNWTO, 2020) and visitation to ANP is also predicted to increase (Fisichelli et al., 2015). It is important to understand visitor climate change risk perceptions to manage visitor use and provide a satisfactory tourism experience. It seems unlikely that visitation will decrease to protected areas in the short-term regardless of visitor climate change risk perceptions (Coombes, Jones, & Sutherland, 2009; Dillimono & Dickinson, 2015; Fisichelli et al., 2015; Hestetune et al., 2018; Seekamp et al., 2019). Visitor management is therefore key as protected areas experience climate impacts (e.g., extreme weather events, increased presence of ticks, and disease outbreaks) that are likely to impact visitor experiences and resource management.

Implications of our study suggest that if park managers and other tourism stakeholders want to convey information about climate change with the goal of influencing perceptions and behaviors, we suggest that they focus on visitor experiences with climate change impacts and appeals to altruistic values. For example, managers could draw attention to changes being observed, such as warmer fall seasons and increased extreme weather events, to illustrate ideas about changing climate in their educational outreach campaigns. Communication appealing to visitors' sense of altruism, such as emphasizing "we're all in this together" messages, might be effective in increasing climate change risk perceptions and possibly encouraging climate friendly behavior, such as riding the bus instead of driving in the park.

Understanding how visitors process climate change risks will help protected area managers understand how to effectively communicate changes affecting the park that might also impact visitor experiences (e.g., safety, access, etc.) (Wang & Pfister, 2008) and resource management. For example, a recent study found that communicating increased hazard from extreme weather events did little to discourage outdoor recreation among visitors to Minnesota's north shore (Kanazawa et al., 2018). This suggests that managers need to find different ways to appeal to visitor risk perceptions other than providing official warnings and that risk perceptions do not necessarily translate into behavioral outcomes (Kanazawa et al., 2018). Protected area managers will have to increasingly communicate climate change risks to visitors at different stages of their trip (Jonas & Mansfeld, 2017), and understanding how to motivate compliance with park policies will be critical in maintaining positive visitor experience.

Additionally, adaptation initiatives within ANP could alleviate any negative shifts in visitor perceptions and behaviors, such as perceived loss of scenery, unappealing climatic image, or belief that the destination is no longer safe (Atzori et al., 2018; Bujosa, Torres, & Riera, 2018; McCreary et al., 2018). In a recent study at Acadia National Park, visitors who engaged in a greater number of nature-based tourism activities (nature-based tourism generalists) were more willing to engage with climate change mitigation behaviors (Wilkins et al., 2018). Visitors aware of climate change are likely to demand more infrastructure and climate adaptation policies and might be more willing to pay for those initiatives (McCreary et al., 2018). Understanding visitor risk perceptions and expectations could help tourism stakeholders in coastal destinations, and national parks adapt to continue to meet visitor expectations, ultimately maintaining the long-term competitiveness of the tourism industry and maintain the integrity of the natural and cultural resources even as climate conditions continue to change.

5. Conclusions

Climate change risk perceptions can predict shifts in visitation, including spatial and temporal patterns to tourism destinations. In this study, we assessed the underlying psychological and social factors that explain climate change risk perceptions of visitors to a protected area destination, Acadia National Park. Using a hierarchical regression analysis, we explained 45.5% of the variance in visitor climate change risk perceptions. Identifying as female, belief in climate change, experience with climate change impacts, and a high altruistic values orientation significantly predicted climate change risk perceptions. This study contributes to the growing body of literature on visitor risk perceptions by applying theories from risk studies and social psychology. Our findings may help inform visitor management by suggesting ways to communicate with visitors to alleviate negative perceptions associated with climate change impacts within national parks and protected areas while also motivating compliance with natural and cultural resource management regulations.

6. References

Amelung, B., Nicholls, S., & Viner, D. (2007). Implications of global climate change for tourism flows and aeasonality. *Journal of Travel Research*, *45*, 285–296. https://doi.org/10.1177/0047287506295937

Atzori, R., Fyall, A., & Miller, G. (2018). Tourist responses to climate change: Potential impacts and adaptation in Florida's coastal destinations. *Tourism Management*, *69*, 12–22. https://doi.org/10.1016/j.tourman.2018.05.005

Birkel, S. D., & Mayewski, P. A. (2018). *Coastal Maine climate futures*. Orono, ME.

Bodemer, N., & Gaissmaier, W. (2015). Risk perception. In C. Hyunyi, R. Torsten, & K. McComas (Eds.), *The Sage handbook of risk communication* (pp. 10–23). Thousand Oaks, CA: SAGE Publications, Inc. https://doi.org/10.4324/9780203712979

Brownlee, Matthew T J, Hallo, J. C., & Krohn, B. D. (2013). Botanical garden visitors' perceptions of local climate impacts: Awareness, concern, and behavioral responses. *Managing Leisure*, *18*(2), 97–117. https://doi.org/10.1080/13606719.2013.752209

Brownlee, Matthew Tyler James, Hallo, J. C., Wright, B. A., Moore, D., & Powell, R. B. (2013). Visiting a Climate-Influenced National Park: The Stability of Climate Change Perceptions. *Environmental Management*, *52*, 1132–1148. https://doi.org/10.1007/s00267-013-0153-2

Brügger, A., Dessai, S., Devine-Wright, P., Morton, T. A., & Pidgeon, N. F. (2015). Psychological responses to the proximity of climate change. *Nature Climate Change*, *5*(12). https://doi.org/doi:10.1038/nclimate2760

Bujosa, A., Torres, C., & Riera, A. (2018). Framing decisions in uncertain scenarios: An analysis of tourist preferences in the face of global warming. *Ecological Economics*, *148*, 36–42. https://doi.org/10.1016/j.ecolecon.2018.02.003

Census. (2012). *Maine: 2010, summary population and housing characteristics*.

Coombes, E. G., Jones, A. P., & Sutherland, W. J. (2009). The implications of climate change on coastal visitor numbers: A Regional analysis. *Journal of Coastal Research*, *254*(4), 981–990. https://doi.org/10.2112/07-0993.1

Csete, M., & Szécsi, N. (2015). The role of tourism management in adaptation to climate change – a study of a European inland area with a diversified tourism supply. *Journal of Sustainable Tourism*, *23*(3), 477–496. https://doi.org/10.1080/09669582.2014.969735

Dawson, J., Havitz, M., & Scott, D. (2011). Behavioral adaptation of alpine skiers to climate change: Examining activity involvement and place loyalty. *Journal of Travel and Tourism Marketing*, *28*(4), 388–404. https://doi.org/10.1080/10548408.2011.571573

De Urioste-Stone, S. M., Le, L., Scaccia, M. D., & Wilkins, E. (2016). Nature-based tourism and climate change risk: Visitors ' perceptions in mount desert island, Maine. *Journal of Outdoor Recreation and Tourism*, *13*, 57–65. https://doi.org/10.1016/j.jort.2016.01.003

De Urioste-Stone, S., Scaccia, M. D., & Howe-Poteet, D. (2015). Exploring visitor perceptions of the influence of climate change on tourism at Acadia National Park, Maine. *Journal of Outdoor Recreation and Tourism*, *11*, 34–43. https://doi.org/10.1016/j.jort.2015.07.001

DeGroot, J., & Steg, L. (2007). Value orientation and environmental beliefs in five countries: Validity of an instrument to measure egoistic, altruistic and biospheric value orientations. *Journal of Cross-Cultural Psychology*, *38*(3), 318–332. https://doi.org/10.1177/0022022107300278

Demski, C., Capstick, S., Pidgeon, N., Sposato, R. G., & Spence, A. (2017). Experience of extreme weather affects climate change mitigation and adaptation responses. *Climatic Change*, *140*, 149–164. https://doi.org/10.1007/s10584-016-1837-4

Dietz, T., Dan, A., & Shwom, R. (2007). Support for climate change policy: social psychological and social structural influences. *Rural Sociology*, *72*(2), 185–214. https://doi.org/10.1526/003601107781170026

Dillimono, H. D., & Dickinson, J. E. (2015). Travel, tourism, climate change, and behavioral change: travelers' perspectives from a developing country, Nigeria. *Journal of Sustainable*

Tourism, *23*(3), 437–454. https://doi.org/10.1080/09669582.2014.957212
Dillman, D., Smyth, J., & Christian, L. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method* (4th ed.). Hoboken, NJ: John Wiley & Sons, Inc.
Dunwoody, S., & Griffin, R. J. (2015). Risk Information Seeking and Processing Model. In *The SAGE Handbook of Risk Communication* (pp. 102–116). Thousand Oaks, CA: SAGE Publications, Inc.
Fernandez, I., Birkel, S., Schmitt, C., Simonson, J., Lyon, B., Pershing, A., … Jemison, J. (2020). *Maine's climate future*. Orono, ME. Retrieved from climatechange.umaine.edu/climate-matters/ maines-climate-future/
Fischhoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis*, *15*(2), 137–145.
Fisichelli, N. A., Schuurman, G. W., Monahan, W. B., & Ziesler, P. S. (2015). Protected area tourism in a changing climate: Will visitation at US national parks warm up or overheat? *PLoS ONE*, *10*(6), 1–13. https://doi.org/10.1371/journal.pone.0128226
Gifford, R. (2011). The dragons of inaction: Psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, *66*(4), 290. https://doi.org/10.1037/a0023566
Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour : A review. *International Journal of Psychology*, *49*(3), 141–157. https://doi.org/10.1002/ijop.12034
Gossling, S., Scott, D., Hall, C. M., Ceron, J.-P., & Dubois, G. (2012). Consumer behavior and demand response of tourists to climate change. *Annals of Tourism Research*, *39*(1), 36–58. https://doi.org/10.1016/j.annals.2011.11.002
Haegeli, P., & Pröbstl-Haider, U. (2016). Research on personal risk in outdoor recreation and nature-based tourism. *Journal of Outdoor Recreation and Tourism*, *13*, 1–9. https://doi.org/10.1016/j.jort.2016.02.001
Heberlein, T. (2012). *Navigating environmental attitudes*. New York, NY: Oxford University Press.
Herve, A. (2003). Factor rotations in factor analyses. In M. Lewis-Beck, A. Bryman, & T. Futing (Eds.), *Encyclopedia of Social Sciences Research Methods* (pp. 1–8). Thousand Oaks, CA: Sage.
Hestetune, A., McCreary, A., Holmberg, K., Wilson, B., Seekamp, E., Davenport, M. A., & Smith, J. W. (2018). Research note: Climate change and the demand for summer tourism on Minnesota's North Shore. *Journal of Outdoor Recreation and Tourism*, *24*(October), 21–25. https://doi.org/10.1016/j.jort.2018.10.003
Horne, L., De Urioste-Stone, S., & Daigle, J. (*In review*). Climate change adaptation and mitigation in the face of Local uncertainty: A phenomenological study. *The Journal of Tourism and Hospitality Management*.
Horton, R., Yohe, G., Easterling, W., Kates, R., Ruth, M., Sussman, E., … Lipschultz, F. (2014). *Ch. 16: Northeast*. (J. Melillo, T. Richmond, & F. Yohe, Eds.), *Climate change impacts in the United States: The third national climate assessment*. U.S. Global Change Research Program.
Howell, R. A. (2013). It's not (just) '"the environment, stupid!"' Values, motivations, and routes to engagement of people adopting lower-carbon lifestyles. *Global Environmental Change*, *23*(1), 281–290. https://doi.org/10.1016/j.gloenvcha.2012.10.015
Huebner, A. (2012). Public perceptions of destination vulnerability to climate change and

implications for long-haul travel decisions to small island states. *Journal of Sustainable Tourism*, *20*(7), 939–951. https://doi.org/10.1080/09669582.2012.667107
Jonas, A., & Mansfeld, Y. (2017). Exploring the interplay between the use of risk-related information, risk perception formation, and the stages of travel product consumption. *Current Issues in Tourism*, *20*(14), 1470–1488. https://doi.org/10.1080/13683500.2015.1024104
Kanazawa, M., Wilson, B., & Holmberg, K. (2018). Local consequences of climate change: State park visitations on the north Shore of Minnesota. *Water Resources and Economics*, *22*(January), 50–61. https://doi.org/10.1016/j.wre.2018.01.003
Karl, M. (2018). Risk and uncertainty in travel decision-making: Tourist and destination perspective. *Journal of Travel Research*, *57*(1), 129–146. https://doi.org/10.1177/0047287516678337
Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., … Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, *8*(2), 177–187.
Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Analysis*, *28*(1), 113–126. https://doi.org/10.1111/j.1539-6924.2008.01010.x
Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C., & Leiserowitz, A. A. (2015). Risk perception around the world. *Nature Climate Change*, *5*, 1014–1020. https://doi.org/10.1038/NCLIMATE2728
Leiserowitz, A. A. (2005). American risk perceptions: Is climate change dangerous? *Risk Analysis*. 350 Main Street , Malden , MA 02148 , USA , and 9600 Garsington Road , Oxford OX4 2DQ , UK: Blackwell Publishing, Inc. https://doi.org/10.1111/j.1540-6261.2005.00690.x
Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Berquist, P., Ballew, M., … Wang, X. (2020). *Climate change in the American mind: April 2020*. New Haven, CT.
Lise, W., & Tol, R. S. J. (2002). Impact of climate on tourist demand. *Climatic Change*, *55*(4), 429–449. https://doi.org/10.1023/A:1020728021446
Maine Office of Tourism. (2019). *Maine Office of Tourism visitor tracking research 2018 calendar year*. Retrieved from https://motpartners.com/wp-content/uploads/2019/06/2018-Annual-Report.pdf
Masuda, J. R., & Garvin, T. (2006). Place, culture, and the Social Amplification of Risk. *Risk Analysis*, *26*(2), 437–454. https://doi.org/10.1111/j.1539-6924.2006.00749.x
McComas, K. A. (2006). Defining moments in risk communication research: 1996 – 2005. *Journal of Health Communication*, *11*(1), 75–91. https://doi.org/10.1080/10810730500461091
McCreary, A., Fatoric, S., Seekamp, E., Smith, J. W., Kanazawa, M., & Davenport, M. A. (2018). The influences of place meanings and risk perceptions on visitors' willingness to pay for climate change adaptation planning in a nature-based tourism destination. *Journal of Park & Recreation Administration*, *36*(2), 121–140.
McCreary, A., Seekamp, E., Larson, L. L., Smith, J. W., & Davenport, M. A. (2019). Predictors of visitors ' climate-related coping behaviors in a nature-based tourism destination. *Journal of Outdoor Recreation and Tourism*, *26*, 23–33. https://doi.org/10.1016/j.jort.2019.03.005
Milfont, T. L. (2012). The interplay between knowledge, perceived efficacy, and concern about global warming and climate change: A one-year longitudinal study. *Risk Analysis*, *32*(6), 1003–1020. https://doi.org/10.1111/j.1539-6924.2012.01800.x

NPS. (2019). Tourism in Maine to Acadia National Park creates $387.7 million in economic benefits. Retrieved from https://www.nps.gov/acad/learn/news/acadia-benefits-local-economy-in-2018.htm

NPS. (2020a). Recreation visitors by month Acadia NP. Retrieved from https://irma.nps.gov/STATS/SSRSReports/Park Specific Reports/Recreation Visitors By Month (1979 - Last Calendar Year)?Park=ACAD

NPS. (2020b). Visitation numbers. Retrieved from https://www.nps.gov/aboutus/visitation-numbers.htm

Ortega-Egea, J. M., García-de-Frutos, N., & Antolín-López, R. (2014). Why do some people do "more" to mitigate climate change than others? Exploring heterogeneity in psycho-social associations. *PLoS ONE*, *9*(9). https://doi.org/10.1371/journal.pone.0106645

Perry, E., Manning, R., Xiao, X., & Valliere, W. (2018). Multiple dimensions of adaptations to climate change by visitors to Vermont state parks. *The Journal of Park and Recreation Administration*, *36*(2), 13–30. https://doi.org/10.18666/jpra-2018-v36-i2-8308

Pidgeon, N. (2012). Climate change risk perception and communication: Addressing a critical moment? *Risk Analysis*, *32*(6), 951–956. https://doi.org/10.1111/j.1539-6924.2012.01856.x

Poortinga, W., Spence, A., Whitmarsh, L., Capstick, S., & Pidgeon, N. F. (2011). Uncertain climate: An investigation into public scepticism about anthropogenic climate change. *Global Environmental Change*, *21*(3), 1015–1024. https://doi.org/10.1016/j.gloenvcha.2011.03.001

Pröbstl-haider, U., Dabrowska, K., & Haider, W. (2016). Risk perception and preferences of mountain tourists in light of glacial retreat and permafrost degradation in the Austrian Alps. *Journal of Outdoor Recreation and Tourism*, *13*, 66–78. https://doi.org/10.1016/j.jort.2016.02.002

Reser, J. P., & Bradley, G. L. (2020). The nature, significance, and influence of perceived personal experience of climate change. *WIREs Climate Change*, 1–28. https://doi.org/10.1002/wcc.668

Roeser, S. (2012). Risk communication, public engagement, and climate change: A role for emotions. *Risk Analysis*, *32*(6), 1033–1040. https://doi.org/10.1111/j.1539-6924.2012.01812.x

Safi, S., James, W., & Liu, Z. (2012). Rural Nevada and climate change: Vulnerability, beliefs, and risk perception. *Risk Analysis*, *32*(6), 1041–1059. https://doi.org/10.1111/j.1539-6924.2012.01836.x

Scannell, L., & Gifford, R. (2011). Personally relevant climate change: The role of place attachment and local versus global framing in engagement. *Environment and Behavior*, *45*(1), 60–85. https://doi.org/10.1177/0013916511421196

Scheaffer, R., Mendenhall, W., Ott, R., & Gerow, K. (2012). *Elementary survey sampling* (7th ed.). Boston, MA: Cengage Learning.

Schuldt, J. P., Rickard, L. N., & Yang, Z. J. (2018). Does reduced psychological distance increase climate engagement ? On the limits of localizing climate change. *Journal of Environmental Psychology*, *55*, 147–153. https://doi.org/10.1016/j.jenvp.2018.02.001

Schwarts, S. H. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues*, *50*, 19-45.

Seekamp, E., Jurjonas, M., & Bitsura-Meszaros, K. (2019). Influences on coastal tourism demand and substitution behaviors from climate change impacts and hazard recovery responses recovery responses. *Journal of Sustainable Tourism*, *27*(5), 629–648.

https://doi.org/10.1080/09669582.2019.1599005
Shakeela, A., & Becken, S. (2015). Understanding tourism leaders' perceptions of risks from climate change: an assessment of policy-making processes in the Maldives using the social amplification of risk framework (SARF). *Journal of Sustainable Tourism*, *23*(1), 65–84. https://doi.org/10.1080/09669582.2014.918135
Slovic, P. (2007). If I look at the mass I will never act: Psychic numbing and genocide. *Judgement and Decision Making*, *2*(2), 79–95. https://doi.org/10.1007/978-90-481-8647-1_3
Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, *24*(2), 311–322.
Smith, J. W., Seekamp, E., McCreary, A., Davenport, M., Kanazawa, M., Holmberg, K., … Nieber, J. (2016). Shifting demand for winter outdoor recreation along the North Shore of Lake Superior under variable rates of climate change : A fi nite-mixture modeling approach. *Ecological Economics*, *123*, 1–13. https://doi.org/10.1016/j.ecolecon.2015.12.010
Spence, A, Poortinga, W., Butler, C., & Pidgeon, N. F. (2011). Perceptions of climate change and willingness to save energy related to flood experience. *Nature Climate Change*, *1*(March). https://doi.org/10.1038/nclimate1059
Spence, Alexa, Poortinga, W., & Pidgeon, N. (2012). The psychological distance of climate change. *Risk Analysis*, *32*(6), 957–972. https://doi.org/10.1111/j.1539-6924.2011.01695.x
Stern, M. (2018). *Social science theory for environmental sustainability*. Oxford, England: Oxford University Press.
Tabachnick, B., & Fidell, L. (2013). *Using Multivariate Statistics* (6th ed.). New York, NY: Pearson.
UNEP. (2008). *Climate change and tourism-Responding to global challenges*. Retrieved from https://webunwto.s3-eu-west-1.amazonaws.com/imported_images/30875/climate2008.pdf
UNWTO. (2020). *World tourism barometer excerpt* (Vol. 18).
van der Linden, S. (2014). On the relationship between personal experience, affect and risk perception: The case of climate change. *European Journal of Social Psychology*, *44*(5), 430–440. https://doi.org/10.1002/ejsp.2008
van der Linden, S. (2015). The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *Journal of Environmental Psychology*, *41*, 112–124. https://doi.org/10.1016/j.jenvp.2014.11.012
Wang, Y., & Pfister, R. E. (2008). Residents' attitudes toward tourism and perceived personal benefits in a rural community. *Journal of Travel Research*, *47*(1), 84–93. https://doi.org/10.1177/0047287507312402
Weinstein, N. (1989). Optimistic biases about personal risks. *Science*, *246*, 1232–1233.
Wilkins, E., & De Urioste-stone, S. (2018). Place attachment, recreational activities, and travel intent under changing climate conditions. *Journal of Sustainable Tourism*, *26*(5), 798–811. https://doi.org/10.1080/09669582.2017.1417416
Wilkins, E., De Urioste-Stone, S., Weiskittel, A., & Gabe, T. (2018). Weather sensitivity and climate change perceptions of tourists: a segmentation analysis. *Tourism Geographies*, *20*(2), 273–289. https://doi.org/10.1080/14616688.2017.1399437
Wynveen, C. J., & Sutton, S. G. (2015). Engaging the public in climate change-related pro-environmental behaviors to protect coral reefs: The role of public trust in the management agency. *Marine Policy*, *53*(1), 131–140. https://doi.org/10.1016/j.marpol.2014.10.030

Yang, Z. J., Rickard, L. N., Harrison, T. M., & Seo, M. (2014). Applying the Risk Information Seeking and Processing model to examine support for climate change mitigation policy. *Science Communication*, *36*(3), 296–324. https://doi.org/10.1177/1075547014525350

Ziegler, A. (2017). Political orientation, environmental values, and climate change beliefs and attitudes: An empirical cross country analysis. *Energy Economics*, *63*, 144–153. https://doi.org/10.1016/j.eneco.2017.01.022

Zwickle, A., & Wilson, R. S. (2014). Construing risk Implications for risk communication. In J. Arvai & L. Rivers (Eds.), *Effective Risk Communication* (pp. 190–203). London: Routledge.

7. Acknowledgements

Thank you to Acadia National Park for permission to survey on location. This material is based upon work supported by the National Oceanic and Atmospheric Administration under Grants NA17OAR4310249. The researchers would like to thank Nathaniel Burke, MacKenzie Conant, Asha DiMatteo-LePape, Hope Kohtala, and Morelys Rodriguez Alfonso for their help with data collection.

Appendix A

Several response options were modified for Actual Knowledge, Perceived Knowledge, Experience, and Risk constructs to make them more appropriate for the context of this study. Additionally, the stem of the Risk survey question was modified to focus specifically on the risk to tourism in Acadia National Park.

Construct	**Items**
Belief	On average around the earth, I believe the following are happening: 1. Drought is becoming more common 2. Air temperature is increasing 3. Ice in the Arctic is now thawing 4. The amount of snow in mountains is decreasing 5. The number of flooding events is increasing 6. Sea level is rising
Actual Knowledge	Please indicate the extent to which you agree or disagree with the following statements: 1. Humans contribute to climate change 2. Climate change is happening 3. Tourism contributes to climate change 4. Carbon dioxide emissions contribute to climate change
Perceived Knowledge	Please indicate the extent to which you agree or disagree with the following statements: 1. We are not experiencing climate change because not all places are getting hotter 2. Climate change is caused by heat trapped in cities 3. Climate change is just a natural fluctuation in Earth's temperatures 4. The hole in the ozone layer causes climate change 5. I know a lot about climate change
Experience	Please check all of the environmental issues you have experienced during your lifetime: 1. Air pollution 2. Changes in precipitation 3. Changes in temperatures (heat waves, more severe winters, etc.) 4. Climate change 5. Flooding 6. Hurricanes/tropical storms 7. Infectious disease 8. Overpopulation (of the earth by humans) 9. Pollution of rivers and seas 10. Rising sea levels 11. Tornadoes 12. Wildfires
Biospheric Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: 1. Preventing pollution

	2. Protecting the environment 3. Respecting the earth 4. Being unified with nature
Altruistic Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: 1. Having equality 2. Having social justice 3. Being helpful 4. Promoting peace
Egoistic Values	For each value listed below, please rate the extent to which you consider it to be a guiding principle in your life: 1. Having social power 2. Having authority 3. Being influential 4. Being wealthy
Risk	Please rate the following climate change factors based on your perception of this as a potential threat to tourism in Acadia National Park: 1. Extreme weather events 2. Species extinction 3. Increased presence of ticks 4. Increased presence of mosquitoes 5. Increased ice storms 6. Higher temperatures 7. Lower temperatures 8. Increased rain 9. Heat waves 10. Disease outbreaks