Journal of Outdoor Recreation and Tourism 13 (2016) 57–65

Contents lists available at ScienceDirect

Journal of Outdoor Recreation and Tourism

journal homepage: www.elsevier.com/locate/jort

Nature-based tourism and climate change risk: Visitors' perceptions in mount desert island, Maine

Sandra M. De Urioste-Stone [a,1,*], Lena Le [b,2], Matt D. Scaccia [c,1], Emily Wilkins [d,1]

[a] 5755 Nutting Hall, #237, Orono, ME 04469-5755, USA
[b] Short Hall #133, Pullman, WA 99164-4014, USA
[c] 5755 Nutting Hall, #223, Orono, ME 04469-5755, USA
[d] 5755 Nutting Hall, #231, Orono, ME 04469-5755, USA

ARTICLE INFO

Article history:
Received 17 March 2015
Received in revised form
16 January 2016
Accepted 26 January 2016

Keywords:
Vulnerability
Protected areas
Acadia National Park
Segmentation
Risk perceptions

ABSTRACT

Climate change poses many risks for nature-based recreation and tourism, especially in protected areas and parks. This paper discusses visitor risk perceptions of climate change and its impacts, and their potential consequences for nature-based tourism destinations such as national parks. An online survey was used to assess visitor risk perception on the likelihood of climate change impacts to affect Mount Desert Island (MDI)-Acadia National Park in the next 10 years, and potential risks those impacts could pose to visitors. Environmental impacts such as extreme weather and sea level rise were perceived by respondents as the most likely effects of climate change to MDI in the next 10 years. Conversely, respondents' risk perceptions of climate change impacts as threats to visitors showed an increased importance of other environmental impacts such as increased presence of mosquitoes and ticks; with extreme events as the key risk to visitors. However, perceptions that pose potential personal risk to visitors gained in significance when considering their influence on travel behavior, including impacts such as disease outbreak and water scarcity. Factor analyses with varimax rotation identified four climate change impact factors associated with perceived vulnerability, perceptions of risk, and influence on future travel to MDI; the four factors generated were: weather patterns, impacts on wildlife, access and health, and physiological and safety needs. Results from cluster analysis yielded three segments: Skeptics, Believers, and Cautious. Segments were significantly different in how they perceived the vulnerability of the area to the effects of climate change, perceived risks, and changes that may influence travel behavior.

MANAGEMENT IMPLICATIONS

The present study has important implications for nature-based tourism management, particularly as associated to protected areas, such as national parks. Consequently, protected area managers may discuss whether the effects of climate change and visitor perceptions could be included in the overall management and monitoring efforts. Climate change most likely will influence travel behavior to national parks and other protected area categories, impact how visitors perceive potential personal risks and threats associated with their travel, and will impact the natural environment and infrastructure tourism relies on. Furthermore, diverse perceptions hold by travel segments, different visitor perceptions based on demographics (age, gender, and income), and seasonal influence in travel should be considered in the management of tourism activities within protected areas.

1. Introduction

Climate change poses a significant threat to tourism across the globe (WTO, 2008), particularly through increasingly variable weather patterns (Karl, Melillo, & Peterson, 2009). As the effects of global climate change begin to show significant effects on tourism systems, it has become increasingly relevant to examine these

* Corresponding author. Tel.: +(207)581 2885.
E-mail address: sandra.de@maine.edu (S.M. De Urioste-Stone).
[1] School of Forest Resources and Center for Research on Sustainable Forests, University of Maine.
[2] Social and Economic Sciences Research Center, Washington State University.

http://dx.doi.org/10.1016/j.jort.2016.01.003
2213-0780/

changes in terms of the perceived risks experienced by visitors to affected destinations (Huebner, 2012)—especially nature-based tourism systems connected with U.S. National Parks (Brownlee, Hallo, Wright, Moore, & Powell, 2013).

It has been argued that climate change represents a major threat to the integrity of the global protected area system (Sharp, Lemieux, Thompson, & Dawson, 2014), particularly coastal and marine protected areas. The U.S. Department of the Interior has recognized that certain resources the national parks have under their authority have been subject to the effects of climate change and will continue to be negatively impacted (National Park Service, 2012) such as rising sea-levels, increased habitat fragmentation, etc. (Parmesan & Yohe, 2003). Changes resulting from climate change are already affecting nature-based tourism assets in parks and protected areas worldwide (Brownlee et al., 2013; Jones & Scott, 2006; Sharp et al., 2014). Moreover, it has been argued that climate change will affect the timing of visitation as well as use patterns throughout the coming years (National Park Service, 2012). Research that seeks to understand how climate change will influence the nature-based tourism systems associated with national parks and how they are at risk is increasingly needed.

Future visitation modeling for national parks in Canada has found that climate change will affect nature-based tourism there (Scott, Jones, & Konopek, 2007). It has been found that from 1979–2008, the timing of visitation to national parks has been shifting and that 'peak attendance' days are expected to occur earlier in some parks due to warmer weather arriving earlier (Buckley & Foushee, 2012). Changes to national parks induced by climate change pose significant risks to both nature-based tourism systems as well as visitors. Research specifically describing the effects of climate change on nature-based tourism in U.S. National Parks has been relatively limited (Brownlee et al., 2013; Sharp, Brownlee, & Larson, 2012). Even fewer studies, however, have addressed the perceptions of consumers on vulnerability, risks, and travel behavior associated with nature-based tourism in national parks (Sharp et al., 2012).

Current literature describes that social science research on visitors perceptions of climate change could be a critical tool in effectively guiding decision-making associated with climate change and tourism in protected areas, such as national parks (Brownlee & Leong, 2011). As suggested by Huebner (2012), research on tourism and climate change may be enhanced by a greater understanding of visitors' perceptions of vulnerability, nature-based tourism risk perceptions associated with climate change, and how these perceptions of vulnerability and risk may impact behavior.

1.1. Climate change and vulnerability assessment

The United Nations World Tourism Organization (WTO) has noted that visitors' perceptions of climate change effects to the natural and cultural environments are just as important as the actual occurrence of changes (WTO, 2008). These perceptions are likely to impact travel behavior such as destination selection, activity participation, and timing of travel. According to the Intergovernmental Panel on Climate Change (IPCC), vulnerability is defined as "The propensity or predisposition to be adversely affected [and] encompasses a variety of concepts and elements including sensitivity to susceptibility to harm and lack of ability to cope and adapt" (McCarthy, Canziani, Leary, Dokken, & White, 2001, 5.). Few studies have explored visitors' perceptions of vulnerability (Huebner, 2012) of a destination to climate change. Huebner (2012) proposed a model to measure consumer perceptions of vulnerability based on ideas from health studies, whereby perceived vulnerability was to be measured in terms of the perceived likelihood of a threat to occur or develop. For this study, the authors assessed visitors' vulnerability perceptions of climate change effects as "an individual's belief about the likelihood of the occurrence of climate change impacts or the likelihood of their developing" (942) to the Mount Desert Island tourism destination —Acadia National Park, Maine.

1.2. Climate change and risk perception

Riesch (2013) defines risk as "the amount of uncertainty combined with the potential severity of an outcome" (31). In the context of climate change, the IPCC has defined risk as the "potential for consequences where something of value is at stake and where the outcome is uncertain…resulting from the interaction of *vulnerability, exposure, and hazard*" (McCarthy et al., 2001).

With growing concerns about global climate change and its effects on socio-ecological systems, an increasing number of studies have focused on understanding public climate change risk perceptions that could potentially influence policy development and adaptation efforts (Etkin & Ho, 2007; Leiserowitz, 2006; Smith & Leiserowitz, 2012). The study of risk perceptions of climate change has been challenging, as these perceptions have shown to be complex and multidimensional (van der Linden, 2015). Moreover, studying climate change risk perceptions has been particularly challenging due to the uncertainties of the topic as precise future environmental changes and conditions are unknown.

Very few studies have explored people's perceptions on climate change vulnerability in conjunction with risk perceptions (Safi, Smith, & Liu, 2012). Furthermore, it has been proposed that more research is needed to investigate the potential relationships between vulnerability perceptions, risk perception, and behavior (Weber, 2011). Following Huebner's (2012) research on climate change and tourism to small islands states, the present study assessed visitors' risk perceptions, defined as an individual's belief that a potential climate change impact may represent a threat to visitors/recreationists to MDI Acadia National Park.

1.3. Climate change and tourism: Vulnerability, risk perceptions, and travel behavior

Since tourism is highly dependent on climatic and natural resources (Gössling & Hall, 2006), the industry as a whole is especially vulnerable to climate change related hazards and exposure. The effects of climate change to tourism and travel has been particularly challenging as people's responses to potential conditions and scenarios are largely unknown (Gössling & Hall, 2006), and potentially mediated by perceptions of vulnerability and risk (Huebner, 2012).

A wide variety of natural and cultural climate change impacts are expected to have consequences to tourism destinations. Coastal and island destinations have been predicted to be especially vulnerable to climate change due to pressure from increased storms, extreme climatic events, coastal erosion, flooding, and even water shortages (WTO, 2008). Climate change is expected to have many negative impacts on wildlife, including shifts in species distribution, changes in phenology, species demographics, and even possible extinction or extirpation of certain species (Mawdsley, O'malley, & Ojima, 2009), which could have an effect on wildlife-related recreation and tourism activities.

These impacts of climate change may be perceived as potential risks to the visitors and their travel experience. It is believed that climate change will result in a higher frequency of extreme weather events; therefore, future tourism demand may be negatively affected since visitors may need to plan shorter holidays, or travel at different times of the year as a means of reducing associated travel risks (Bigano, Goria, Hamilton, & Tol, 2005). For example, climate change poses a risk to transportation infrastructure

because changes in the frequency or length of weather elements, such as precipitation, ice, snow cover, and extreme temperatures, affect ground and air travel.

Visitors may perceive a potential impact of climate change as a risk or threat to their travel experience or to the industry as a whole (Huebner, 2012), with diverse levels of repercussions to the overall appeal for specific destinations, impacts on transportation infrastructure and user demand, tourist satisfaction, and safety concerns (Becken & Hay, 2007). In addition to the risks that can directly affect visitor experience, climate change also has the increasing possibility of posing significant risks to travelers' health. Hazards such as Lyme disease, a vector-borne disease carried by deer ticks (*Ixodes pacificus*) that primarily affects the Northeastern U.S., has been growing rapidly in part due to climate change (Süss, Klaus, Gerstengarbe, & Werner, 2008). Exposure to Lyme disease has implications for both visitors and tourism managers (Donohoe, Pennington-Gray, & Omodior, 2015).

Research is needed to help us gain a richer understanding of visitors' perceptions of climatic change, in terms of risk and travel behavior, and how these relate to the quality of their tourism experience in climate-dependent destinations such as protected areas and national parks (Denstadli & Jacobsen, 2014; Gössling, Scott, Hall, Ceron, & Dubois, 2012). Changes in an area's climate conditions may diminish the quality of climate-dependent leisure experiences. Furthermore, current literature describes that social science research on visitors perceptions of climate change could be a critical tool in effectively guiding decision-making associated with climate change and tourism in protected areas, such as national parks (Brownlee & Leong, 2011). Finally, as suggested by Huebner (2012), research on tourism and climate change may be enhanced by a greater understanding of visitors' perceptions of vulnerability, nature-based tourism risk perceptions associated with climate change, and how these perceptions of vulnerability and risk may impact behavior.

Our study builds on this research by addressing the following research questions: (1) Which factors of destination vulnerability to climate change are evident to visitors to MDI-Acadia National Park?; (2) Which risk perceptions associated with climate change and tourism are more salient amongst visitors to MDI-Acadia National Park?; and (3) Do perceptions of vulnerability and risk, and decision to travel to a destination vary among visitor segments?

2. Materials and methods

2.1. Study area

Mount Desert Island is a 108 square mile island located in Hancock County on the coast of Maine, USA, and is home to Acadia National Park (Fig. 1). Acadia National Park is the only National Park in the State of Maine and is the primary attraction on the island. Acadia occupies over 50 square miles of natural attractions including rocky coastlines, mountains, forests, ponds, and marshlands. The park attracts 2.5–3 million visitors every year, most of whom visit during the summer months (National Park Service, 2012). In 2012, 93.6% of the 2.4 million visits that year occurred from May-October, with July and August being the most popular months. Mount Desert Island is geographically located within a transition zone between the northern coniferous forests and more temperate deciduous forests, which provides productive habitat areas for a great diversity of plants and wildlife (National Park Service, 2012). The small village-towns of Bar Harbor, Tremont, Mount Desert, and Southwest Harbor that are situated on Mount Desert Island rely heavily on nature-based tourism as the basis of their economy and many visitors to Acadia National Park also shop, dine, and lodge at businesses within these communities.

2.2. Survey distribution and design

The survey was conducted in two phases. The first phase included an onsite face-to-face interview of visitors at major tourism attractions in Mount Desert Island-Acadia National Park. Visitors who agreed to participate in the online survey provided their email addresses. Four hundred and fifty six emails of randomly selected visitors to the area were collected between June and December 2014. One hundred and sixty nine visitors responded to the online questionnaire for a 37% response rate.

The online survey was developed to examine respondents' (1) vulnerability and risk perceptions associated with climate change; (2) behavioral response to future conditions; and (3) socio-demographic and travel patterns characteristics. The online survey was available from August through December, 2014. We administered the survey following Dillman's Tailored Design Method (Dillman, Smyth, & Christian, 2014).

Several measures were implemented to assess visitors' perception on the impacts of global climate change on tourism in Mount Desert Island-Acadia National Park including: (1) perceived likelihood of local impacts of climate change; (2) perceived threats of climate change impacts to tourism/recreation; and (3) perceived likeliness of climate change impacts to influence travel behavior. A list of 16 potential environmental and social impacts of climate change were selected based on measures previously developed by Huebner (2012), and impacts that emerged from open responses generated in a previous study conducted by the authors (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015).

To measure perceived vulnerability, respondents were to indicate how likely they perceived environmental and social impacts of climate change may be seen in the Mount Desert Island region in the next 10 years using a 5-point Likert-scale from Extremely Unlikely (−2) to Extremely Likely (2). To measure perceived risks, respondents were asked to rate the 16 impacts as a potential threat to visitors/recreationists to Mount Desert Island using a 5-point Likert scale from Strongly disagree (−2) to Strongly agree (2). This was done to explore whether perceived risks followed perceived vulnerability. To measure the potential influence on travel behavior, visitors were later requested to assess the degree to which the 16 impacts of climate change statements could influence their future decision to travel to Mount Desert Island using a 5-point Likert-scale from scale from Extremely Unlikely (−2) to Extremely Likely (2). Finally, socio-demographic measures included age, gender, income, educational attainment, ethnicity, and place of residence.

2.3. Data analysis

Descriptive statistics were generated for socio-demographics, perceived vulnerability, perceived risks, and influence for potential travel questions. Factor analyses (Johnson, 1998; Johnson & Wichern, 2002) were conducted to create statistically independent variables.

To measure non-response bias we used Pearson's chi-square test of independence. Since we collected data on visitor demographics and perceptions on weather and climate via the onsite face-to-face interview, we compared demographics and responses to the weather and climate change variables across respondents and non-respondents.

Multivariate cluster analysis was used to determine unique segments of respondents (Paudyal et al., 2015). We performed K-means cluster analysis using the risk statements. We tested two-, three-, and four-cluster solutions (Collum & Daigle, 2015). We selected the three-cluster solution as it yielded the most

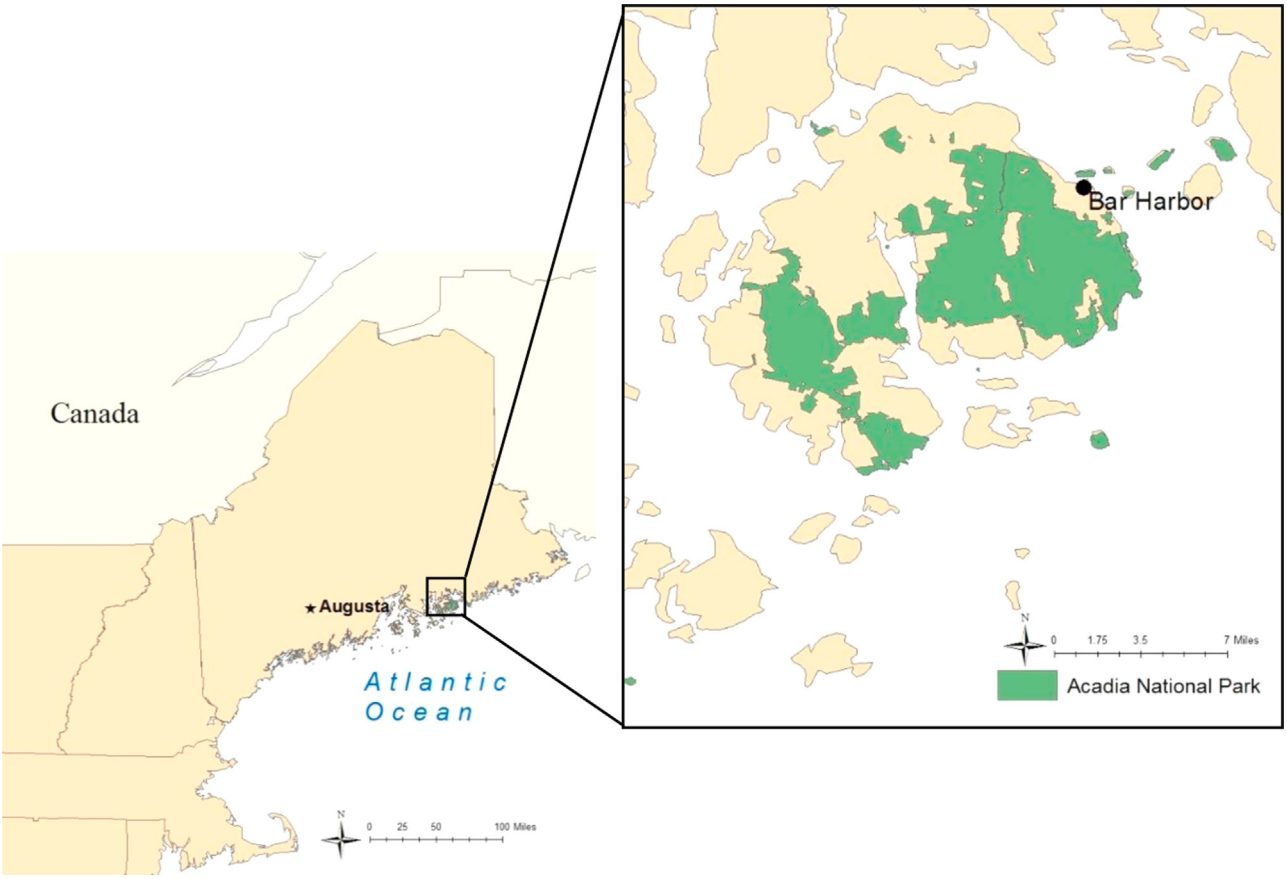

Fig. 1. Map of Study Area: Mount Desert Island and Acadia National Park, Maine.

distinct respondent segments based on the comparison cluster solutions obtained from the Ward's method (Paudyal et al., 2015). Descriptive statistics by groups, as well as Chi-square and Analysis of Variance (ANOVA) with Bonferroni post hoc were employed to examine differences in vulnerability and potential responses across segments.

3. Results

3.1. Demographic profile and trip characteristics

As presented on Table 1, the majority of survey respondents were non-residents of the state of Maine (86%), with a slightly majority female (57%). The 60–69 age group had the most respondents (28%) followed by the 50–59 group (23%), with the 30–39 having the least number of respondents (7%). Over half of the respondents that had visited Mount Desert Island-Acadia National Park mentioned participating in the following activities: Sightseeing for pleasure (70%), Food experiences (69%), Enjoying nature (66%), Backpacking/hiking (55%), and Shopping (58%).

3.2. Visitors' perceived vulnerability, risk perception and potential influence on travel

Visitors who participated in the online survey as a whole perceived Mount Desert Island (MDI)-Acadia National Park to be vulnerable to climate change impacts to the natural environment and infrastructure. Perceived likelihood was higher for environmental factors such as extreme weather, sea level rise, and increased ticks and mosquitoes. Sixty six percent of respondents perceive sea level rise will likely occur in the next 10 years (38%

Table 1
Demographics of visitors to Mount Desert Island-Acadia National Park who responded to the online survey, August-December 2014.

Variable	Subcategory	Number of responses	Percent
Residency status to State of Maine	Full time resident	18	10%
	Seasonal resident (less than 6 month/year)	6	4%
	Non-resident	145	86%
Gender	Female	85	57%
	Male	65	43%
Household income	$0-19,999	2	2%
	$20,000-39,999	15	11%
	$40,000-59,999	19	14%
	$60,000-79,999	22	16%
	$80,000-99,999	10	7%
	$100,000-119,999	18	13%
	$120,000-139,999	12	9%
	$140,000-159,999	9	7%
	$160,000-179,999	5	4%
	$180,000-199,999	7	5%
	$200,000-219,999	6	4%
	$220,000 or Greater	10	7%
Race/ethnicity	African American	2	1%
	Asian-Pacific Islander	2	1%
	Hispanic	1	1%
	Native American	2	1%
	White	139	93%
	Other	3	2%
Age	29 years old and younger	23	15%
	30–39	11	7%
	40–49	20	13%
	50–59	34	23%
	60–69	42	28%
	70 years old and older	19	13%

likely, and 28% very likely); while 75% perceive the likelihood of extreme weather events to increase (49% likely, and 27% very likely). Water and food security, and disease outbreaks, were perceived as the least likely impacts to occur as a result of climate change at MDI-Acadia National Park (Table 2).

In terms of risk perception, on average, visitors were concerned with environmental factors of risks over social related threats. These findings follow similar trends of visitors' vulnerability perceptions, with increased extreme events considered as the most salient potential threat to visitors to MDI-Acadia National Park as a result of climate change (66%, with 38% agree, and 30% strongly agree). Visitors perceived potential climate change impacts such as increased presence of mosquitoes (60% of respondents, with 37% agree, and 23% strongly agree) and increased presence of ticks (58% of respondents 34% agree, and 24% strongly agree) to be among the top three most important potential threats to visitors to MDI-Acadia National Park. Similarly to vulnerability perceptions, disease outbreaks, food and water scarcity were perceived as least risky. Comparing perceived vulnerability to perceived risks, natural threats like extreme events and sea level rise had somewhat lower means, while food and water security showed higher means when considered in light of vulnerability perceptions. Results suggest several social and environmental factors connected to personal risk (water and food scarcity, increased hurricanes) increased in significance compared to perceived vulnerability/likelihood, while the significance of most environmental factors (including sea level rise, extreme weather, wildlife changes) was reduced. Overall, perceived risks followed perceptions of destination's vulnerability to the effects of climate change. This trend was also found by Huebner (2012).

Although importance of perceived risk generally followed perceived vulnerability, greater changes in significance of factors in influence on future travel occurred, with variables considered least important in prior measures gaining significance. Respondents rated extreme weather (60%), disease outbreak (59%), hurricanes (58%) and water scarcity (57%) as the top four threats to potentially influence visitors' decision to travel to MDI in the future. Sea level rise which was perceived as the second most likely impact of climate change (66%) and the fourth most relevant risk for visitors to MDI (54%), was rated among the five least important factors to influence potential travel (34%, with 23% likely and 11% very likely).

3.3. Factor loadings and model fit

Moreover, factor analyses were conducted to explore categories for responses on perceptions of vulnerability/likelihood, perceptions of risk, and influence of potential climate change impacts on future travel. Table 3 shows loadings of variables that respondents constructed from items on risk perceptions on how climate change impacts may be a threat to visitors/recreationists to Mount Desert Island-Acadia National Park. While some of the items came from previous research by Huebner (2002), other items were generated from the field, which may have unique indication to Maine. Thus, exploratory factor analysis was conducted on risk perception items. First, the factorability of all items were examined. All items were correlated above the suggestion minimum 0.3 with at least one other item suggesting factorability. Secondly the Kaiser-Meyer-Olkin's measure of sampling adequacy was 0.929 well above the recommended value of 0.6 (Cerny & Kaiser, 1977). Bartlett's test of sphericity was significant (χ^2 (171)=2765.48, $p<.05$) indicating the adequacy of the correlation matrices (Cramer & Howitt, 2004). Principle component analysis was used as the extraction method because the primary purpose was to compute composite and identify factors underlying the visitors' risk perceptions. The original factor analysis using default eigenvalue greater than 1 revealed that two factors accounted for 65% of the variance. The items loading on the two original factors did not make theoretical sense. Varimax rotation was applied and converged after 25 iterations revealing four factors accounted for 83% of the total variance. The first factor represents perceptions that climate change may impact tourism by causing changes in weather patterns that may be associated with a destination's attractiveness, including extreme weather events. The second factor relates to the potential impact of climate change on wildlife and the potential

Table 2
Mean responses of perceived likelihood, perceived risks, and influences for potential travel of potential climate change impacts according to responses by visitors to Mount Desert Island-Acadia National Park to the online survey, from September-December 2014.

	Mean		
	Perceived likelihood (vulnerability)	Perceived risks/threats	Influence for potential travel
Extreme weather	0.87	0.76	0.59
Sea level rise	0.73	0.47	0.04
Increased mosquitoes	0.67	0.65	0.55
Increased ticks	0.65	0.64	0.44
Damage to roads	0.61	0.40	0.34
Power outages	0.52	0.40	0.38
Heat waves	0.53	0.34	0.24
Wildlife migrate in	0.47	0.10	−0.05
Increased ice storms	0.45	0.50	0.11
Wildlife migrate out	0.45	0.27	0.01
Reduced snow	0.29	0.15	−0.31
Hurricanes	0.30	0.42	0.61
Species extinction	0.20	0.04	−0.04
Disease outbreaks	0.07	0.31	0.68
Water scarcity	−0.03	0.34	0.57
Food scarcity	−0.27	0.21	0.52

Scales range from (−2) to (2).

Table 3
Items loading on factors that measure respondents' rating of perceived risks/threats of climate change impacts to visitors to MDI-Acadia National Park.

Rate the extent that these climate change factors are a threat to tourism/ recreation on Mount Desert Island	Factor			
	Weather patterns	Impact on wildlife	Access and health	Physiological and safety needs
Heat Waves MDI	.766	.358	.354	.222
Increased rain	.765	.268	.378	.268
Increased Temps	.755	.402	.258	.207
Sea Level Rise MDI	.659	.475	.178	.291
Reduced Temps MDI	.654	.340	.295	.365
Extreme Weather MDI	.572	.469	.402	.341
Hurricanes MDI	.509	.489	.354	.323
Wildlife Migrate Out MDI	.310	.806	.267	.249
Wildlife Migrate In MDI	.351	.776	.267	.217
Species Extinction MDI	.358	.775	.275	.251
Reduced Snow MDI	.476	.620	.174	.278
Increased Ticks MDI	.258	.247	.884	.167
Increased Mosquitos MDI	.266	.205	.875	.208
Increased Ice Storms MDI	.414	.298	.635	.358
Power Outages MDI	.399	.300	.551	.505
Damage to Roads MDI	.352	.423	.501	.441
Food Scarcity MDI	.249	.243	.209	.880
Water Scarcity MDI	.297	.245	.207	.859
Disease Outbreaks MDI	.218	.297	.520	.618

Scale −2 to 2.

risk to affecting visitors to MDI. The third factor reflects variables of perceived threats associated with access to the destination and health. The fourth and final factor reflects threats that may impact visitors' physiological and safety needs.

Two other sets of items were used to measure (1) the perceived impact of climate change on Mount Dessert Island (perceived vulnerability), and (2) likely influence visitors' decision to visit the area. The same factor analysis procedure as described in the above section was applied. The Kaiser-Meyer-Olkin's measure of sampling adequacy for *perceived vulnerability* was 0.906, and Bartlett's test of sphericity was significant (χ^2 (120)=1452.54, $p < .05$) indicating the adequacy of the correlation matrices. The four factors that measure perceived vulnerability/likelihood accounted for 76% of the overall variance.

Factor analysis for items measuring the perceptions on how climate change may affect participants' decision to visit Mount Desert Island revealed four variables at 80% of the overall variance. The Kaiser-Meyer-Olkin's measure of sampling adequacy for was 0.896, and Bartlett's test of sphericity was significant (χ^2 (171)= 2489.72, $p < .05$). While the scale items that measured the different concepts were worded differently with different scale indicators, the factor loading were consistent and indicated similar theoretical structure. Table 4 shows the variables extracted as the results of factor analyses and their reliability test. All Cronbach's alphas were at 0.845 or above indicating internal consistency of the scale items within each factor.

3.4. Vulnerability perceptions, travel decision, and demographic characteristics by segment

The cluster analysis yielded three segments, referred in this study as: Skeptics, Believers, and Cautious. *Skeptics* were the smallest segment (13%) of our sample. These visitors perceive a low risk of climate change effects to represent a threat to recreation/tourism in MDI-Acadia National Park (Table 5). This segment included older visitors, a higher proportion of males, and the lowest annual household income. Skeptics consider unlikely the effects of climate change to occur at the destination in the next 10 years; their decision to travel to MDI might be the least influenced by climate change with visitors believing it would be unlikely that climate change effects could influence their decision to travel to MDI-Acadia National Park (Table 6).

In contrast, the *believers* (25%) expressed higher agreement than the average visitor in terms of the effects of climate change representing a threat to outdoor recreation/tourism in MDI-Acadia National Park (Table 5). This group included younger visitors, a higher proportion of females, with a similar annual household income than the average visitor. Visitors in this segment consider weather patterns, impacts on wildlife, and access factors as likely effects of climate change to occur at the destination; while they were neutral in terms of the effects associated with physiological and safety needs effects. Believers perceive likely that physiological and safety needs, as well as access and health could influence their decision to travel to MDI-Acadia National Park (Table 6).

The *Cautious* segment (62%)—named after the segment identified by the Global Warming Six America's study (Roser-Renouf et al., 2014)—are neutral in their belief that climate change effects might represent a threat to outdoor recreation/tourism in MDI-Acadia National Park (Table 5). The segment includes average age, split in terms of gender, and had the highest annual household income of all groups. Cautious were neutral in their perceptions about the likelihood of weather patterns, impacts on wildlife, and access factors to occur at MDI-Acadia National Park in the next 10 years, and considered unlikely that physiological and safety needs effects would occur in the near future. Cautious were neutral in their belief that climate change effects might influence their decision to travel to MDI-Acadia National Park (Table 6).

ANOVA tests with post hoc analyses showed that segments were significantly different in their perceptions of MDI's climate change vulnerability and risk, and in their potential decision to travel to MDI. All post hoc analyses, except for (1) likelihood of hurricanes to occur, wildlife migrate in, species extinction, food scarcity; and (2) decision to travel to MDI-Acadia National Park influenced by occurrence of hurricanes, species extinction, reduced snow, and increased ice storms, showed significant differences between all three segments.

4. Discussion and conclusion

The present study has important implications for nature-based tourism management, particularly as associated to national parks and other protected areas. This study advances our understanding on risk perceptions associated with nature-based tourism and climate change, and potential threats that are most likely to influence travel behavior to national parks and other protected area categories. Furthermore, findings suggest climate change impacts that pose potential personal risks/threats to visitors may be important factors influencing travel behavior, such as the selection of a tourism destination.

Visitors to Acadia National Park perceived the area to be vulnerable to climate change effects that are likely to impact the natural environment and infrastructure; on the contrary, issues like water and food security, were perceived as the least likely impacts to occur as a result of climate change at MDI-Acadia National Park. Similar results were found by Huebner (2012), with

Table 4
Cronbach's alphas of multiple item variables.

Concept	Variable	Number of items	Cronbach's alpha
Effect of climate change on tourism	Tourism1: Change in weather pattern	7	0.951
	Tourism 2: Impacts on wildlife	4	0.927
	Tourism 3: Access and health	5	0.939
	Tourism 4: Physiological and safety need	3	0.924
Effect of climate change on the area	Area 1: Access and Health	5	0.883
	Area 2: Impact on wildlife	4	0.845
	Area 3: Change in weather pattern	4	0.864
	Area 4: Physiological and safety need	3	0.845
Effect of climate change on decision to visit MDI	Decision 1: Change in weather pattern	6	0.911
	Decision 2: Physiological and safety need	4	0.921
	Decision 3: Impact on wildlife	4	0.911
	Decision 4: Access and health	5	0.926

Table 5
Average response scores of climate change factors that represent a threat to outdoor/recreation/tourism on Mount Desert Island-Acadia National Park. Responses are presented by segment.

Statement	Sample average	Segments		
		Skeptics (13%)	Believers (25%)	Cautious (62%)
Risk statements				
Extreme weather	0.76	−1.53	1.87	0.81
Sea level rise	0.47	−1.53	1.63	0.41
Increased mosquitoes	0.65	−0.94	1.57	0.60
Increased ticks	0.64	−0.94	1.67	0.55
Damage to roads	0.40	−1.41	1.40	0.40
Power outages	0.40	−1.18	1.47	0.33
Heat waves	0.34	−1.47	1.53	0.27
Wildlife migrate in	0.10	−1.59	1.17	0.06
Increased ice storms	0.50	−1.29	1.43	0.48
Wildlife migrate out	0.27	−1.59	1.33	0.25
Reduced snow	0.15	−1.47	1.33	0.08
Hurricanes	0.42	−1.59	1.53	0.39
Species extinction	0.04	−1.59	1.30	−0.06
Disease outbreaks	0.31	−1.47	1.23	0.33
Water scarcity	0.34	−1.53	1.40	0.34
Food scarcity	0.21	−1.59	1.20	0.20
Demographics				
Age	52	55	46	53
Gender	Female	Male	Female	Male/Female
Household income	$60,000-$79,999	$40,000-59,999	$60,000-$79,999	$80,000-$99,999

Scale −2 to 2.

extreme weather events and sea level rise being mentioned as the top two most likely effects of climate change to island destinations in the Caribbean, and disease outbreak as the least likely. Although importance of perceived risk generally followed perceived vulnerability, as found by Huebner (2012), greater changes in the significance of impacts occurred in terms of the influence of these changes on future travel. Variables considered least important in prior measures of vulnerability and risk—such as disease outbreak, hurricanes, water scarcity and food security—gained significance once visitors were requested to evaluate their potential influence in future travel to the destination. Huebner (2012) suggested that risks such as extreme events, disease outbreaks, water and food scarcity, and infrastructure damage may have direct implications on visitors' experiences. As mentioned in prior studies, climate itself has been discussed as a tourism resource, important for fulfilling the needs of visitors, and a factor in travel motivation. It has been found that natural beauty and climate are "universally important" in defining the attractiveness of a given destination (Hu & Brent Ritchie, 1993). Gómez Martín (2005) proposed the application of Maslow's Hierarchy of Needs model to the understanding of tourism satisfaction in terms of climate, and in conceiving climate as a natural resource, and therefore part of the tourism product. Climate, within this approach, is regarded as highly important in fulfilling physiological and safety needs of visitors (Gómez Martín, 2005). Results from this study suggest that perceptions of potential threats to one's personal safety and well-being are important when considering potential travel. This reflects Gómez Martín's (2005) argument that climate is highly important in satisfying physiological and safety needs of visitors while traveling; hence suggesting, Maslow's Hierarchy of Needs to be relevant when studying climate change and tourism. Moreover, studies on climate change perceptions have suggested that when impacts are expected to harm something a person values, concerns regarding the issue may increase (Miller-Rushing, Evenden, Gross, Mitchell, & Sachs, 2011; Stern, Dietz, Abel, Guagnano, & Kalof, 1999).

The three segments identified in this study showed statistically significant differences in terms of visitor perceptions on the likelihood of climate change factors to occur in the next 10 years, the extent that those factors represent a threat to outdoor recreation/tourism at MDI-Acadia National Park, and the potential for those factors to influence visitors' decision to travel to the destination. As found in prior studies differences in perceptions occur across age and gender groups (Becken, 2004; De Urioste-Stone et al., 2015; Paudyal et al., 2015), with female and younger visitors more likely to recognize the likelihood of impacts of climate change to occur and how these may represent a threat to visitors.

In terms of non-response, comparisons revealed no statistically significant differences between respondents and non-respondents on age (χ^2=9.983, 8 df, p=.266), first time or return visitors (χ^2=.752, 1 df, p=.386), resident of Maine (χ^2=.432, 1 df, p=.573), gender (χ^2=.184, 1 df, p=.668), level of education (χ^2=3.86, 7 df, p=.795), role of weather (χ^2=7.34, 4 df, p=.119), and beliefs on climate change impacts on tourism (χ^2=8.30, 5 df, p=.140). Therefore, we believe that using the online platform did not affect the generalizability of study results to visitors to Acadia National Park.

Authors recognize vulnerability and risk perceptions may vary across seasons. MDI-Acadia National Park is heavily visited during the summer, with most of the visitors being non-residents of Maine. This study, conducted from August-December 2014 heavily represents views of summer and fall visitors; and hence does not represent views of visitors to the area in spring, while partially representing views of winter visitors to MDI-Acadia National Park.

Future research on climate change and tourism would benefit from incorporating risk perception models, such as the socio-psychological model proposed by van der Linden (2015), whereby cognitive, affect, personal experience and socio-cultural dimensions of risk are operationalized and assessed. Additional constructs from the Social Amplification of Risk Framework (SARF) could also be incorporated into future research about visitors risk perceptions. Variables such as informal social networks, international media, external politics, and governmental policies could be incorporated (Shakeela & Becken, 2014). Furthermore, future research may benefit from embedding choice experiments (Pröbstl-Haider & Haider, 2013; Pröbstl-Haider, Haider, Wirth, & Beardmore, 2015) to measure visitor perceptions about destination climate change vulnerability, risk perceptions, and the likelihood of these climate change effects to potentially influence visitors' travel behavior. As suggested by Huebner (2012), studies on visitor's vulnerability and risk perceptions may benefit from incorporating both on-site and off-site perceptions as they are both likely to influence travel behavior. Further research on the association between perceived vulnerability, risk perception, and travel behavior is needed to inform management of nature-based tourism destinations such as national parks and protected areas.

In conclusion, the results of this study indicate that risk perceptions vary across visitor segments, as well as visitor perceptions on the likelihood of climate change effects to impact MDI-Acadia National Park, and may influence their decision to travel to the destination. Education, communication, and outreach efforts should consider these group differences and incorporate them into their interpretive programming.

Table 6
Average response scores of vulnerability and likely influence on visitor's decision to travel to Mount Desert Island-Acadia National Park. Responses are presented by segment.

Statement	Sample average	Segments			ANOVA
		Skeptics	Believers	Cautious	
"How likely do you perceive the following impacts of climate change may be seen on Mount Desert Island in the next 10 years"					
Extreme weather	0.87	−0.29	1.52	0.84	28.81***
Sea level rise	0.73	−.059	1.37	0.70	23.01***
Increased mosquitoes	0.67	−.06	1.37	0.56	19.32***
Increased ticks	0.65	0.00	1.27	0.54	13.55***
Damage to roads	0.61	−0.18	1.20	0.51	18.48***
Power outages	0.52	−0.12	1.13	0.41	14.48***
Heat waves	0.53	−0.71	1.23	0.49	34.15***
Wildlife migrate in	0.47	−0.06	0.93	0.37	7.86***
Increased ice storms	0.45	−0.24	1.13	0.34	21.60***
Wildlife migrate out	0.45	−0.47	1.20	0.32	21.67***
Reduced snow	0.29	−0.71	1.07	0.20	21.79***
Hurricanes	0.30	−0.35	0.97	0.11	12.95***
Species extinction	0.20	−0.59	1.07	−0.06	19.56***
Disease outbreaks	0.07	−0.82	0.53	0.01	13.75***
Water scarcity	−0.03	−1.12	0.57	−0.06	19.43***
Food scarcity	−0.27	−1.00	0.30	−0.35	12.66***
"To what degree would the following factors influence your decision to travel to Mount Desert Island"					
Extreme weather	0.59	−0.24	1.41	0.48	17.17***
Sea level rise	0.04	−1.06	0.90	−0.04	25.57***
Increased mosquitoes	0.55	−0.35	1.36	0.48	17.13***
Increased ticks	0.44	−0.47	1.28	0.34	20.44***
Damage to roads	0.34	−0.59	1.00	0.26	16.82***
Power outages	0.38	−0.47	1.32	0.21	24.40***
Heat waves	0.24	−0.59	1.11	0.14	21.36***
Wildlife migrate in	−0.05	−0.76	0.79	−0.21	21.31***
Increased ice storms	0.11	−0.53	0.68	0.04	9.08***
Wildlife migrate out	0.01	−0.76	0.86	−0.12	21.28***
Reduced snow	−0.31	−0.88	−0.04	−0.27	4.95***
Hurricanes	0.61	−0.12	1.32	0.53	9.97***
Species extinction	−0.04	−0.76	0.96	−0.23	26.46***
Disease outbreaks	0.68	−0.24	1.46	0.63	15.57***
Water scarcity	0.57	−0.47	1.46	0.44	22.43***
Food scarcity	0.52	−0.38	1.44	0.35	17.98***

*** Indicates difference among segments was significant at p-value < 0.001.

Acknowledgements

The authors of this article would like to thank staff at Acadia National Park for their support during data collection. Special acknowledgements to Dr. Abe Miller-Rushing, the Science Coordinator at National Park Service, Schoodic Education and Research Center and Acadia National Park in authorizing and providing feedback to conduct the study at Acadia. Authors are grateful to Jacob Foster, Dimitrje Howe-Poteet, and Amy Scaccia for their contribution in data collection. This project was supported by the USDA National Institute of Food and Agriculture, McIntire-Stennis project number 1003857, and by University of Maine Rising Tide/NSF ADVANCE Award. "Maine Agricultural and Forest Experiment Station Publication Number 3465".

References

Becken, S. (2004). How tourists and tourism experts perceive climate change and carbon-offsetting schemes. *Journal of Sustainable Tourism*, *12*(4), 332–345. http://dx.doi.org/10.1080/09669580408667241.

Becken, S., & Hay, J. E. (2007). *Tourism and climate change: Risks and opportunities*. Clevedon: Channel View Publications.

Bigano, A., Goria, A., Hamilton, J., & Tol, R. (2005). *The effect of climate change and extreme weather events on tourism*, *WP 1*, 24.

Brownlee, M., Hallo, J., Wright, B., Moore, D., & Powell, R. (2013). Visiting a climate influenced National Park: The stability of climate change perceptions. *Environmental Management*, *52*(5), 1132–1148.

Brownlee, M., & Leong, K. (2011). Climate change, management decisions, and the visitor experience: The role of social science research. *Park Science*, *28*(2), 43–47.

Buckley, Lauren, & Foushee, Madison (2012). Footprints of climate change in US national park visitation. *International Journal of Biometeorology*, *56*(6), 1173–1177. http://dx.doi.org/10.1007/s00484-011-0508-4.

Cerny, C. A., & Kaiser, H. F. (1977). A study of a measure of sampling adequacy for factor-analytic correlation matrices. *Multivariate Behavioral Research*, *12*(1), 43–47.

Collum, K., & Daigle, J. (2015). Combining attitude theory and segmentation analysis to understand travel mode choice at a national park. *Journal of Outdoor Recreation and Tourism*, *9*, 17–25. http://dx.doi.org/10.1016/j.jort.2015.03.003.

Cramer, D., & Howitt, D. (2004). *The SAGE dictionary of statistics*. Thousand Oak, CA: Sage Publications, Inc.

De Urioste-Stone, S., Scaccia, M., & 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*, http://dx.doi.org/10.1016/j.jort.2015.07.001.

Denstadli, J., & Jacobsen, J. (2014). More clouds on the horizon? Polar tourists' weather tolerances in the context of climate change. *Scandinavian Journal of Hospitality and Tourism*, *14*(1), 80–99. http://dx.doi.org/10.1080/15022250.2014.886096.

Dillman, Don A., Smyth, Jolene D., & Christian, Leah (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method* ((4th ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Donohoe, H., Pennington-Gray, L., & Omodior, O. (2015). Lyme disease: Current issues, implications, and recommendations for tourism management. *Tourism Management*, *46*, 408–418. http://dx.doi.org/10.1016/j.tourman.2014.07.006.

Etkin, D., & Ho, E. (2007). Climate change: Perceptions and discourse of risk. *Journal of Risk Research*, *10*(5), 623–641.

Gómez Martín, M. B. (2005). Weather, climate and tourism: A geographical perspective. *Annals of Tourism Research*, *32*(3), 571–591. http://dx.doi.org/10.1016/j.annals.2004.08.004.

Gössling, S., Scott, D., Hall, C. M., Ceron, J. P., & Dubois, G. (2012). Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research*, *39*(1), 36–58. http://dx.doi.org/10.1016/j.annals.2011.11.002.

Gössling, S., & Hall, C. M. (2006). Uncertainties in predicting travel flows: common ground and research needs. *A reply to Bigano et al.*, *Vol. 79*, 181–183.

Hu, Y., & Brent Ritchie, J. R. (1993). Measuring destination attractiveness: A contextual approach. *Journal of Travel Research*, *32*(2), 25–34. http://dx.doi.org/10.1177/004728759303200204.

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. http://dx.doi.org/10.1080/09669582.2012.667107.
Johnson, E. D. (1998). *Applied multivariate methods for data analysts*. Pacific Grove, CA: Brooks/Cole Publishing Company.
Johnson, Richard A., & Wichern, Dean W. (2002). *Applied multivariate statistical analysis* ((5th ed.). Delhi, India: Pearson Education.
Jones, B., & Scott, D. (2006). Climate change, seasonality and visitation to Canada's national parks. *Journal of Park & Recreation Administration*, *24*(2), 42–62.
Karl, T., Melillo, J., & Peterson, T. (Eds.). (2009). *Global climate change impacts in the United States*. Cambridge, MA: Cambridge University Press.
Leiserowitz, A. (2006). Climate change risk perception and policy preferences: The role of affect, imagery and values. *Climatic Change*, *77*, 45–72. http://dx.doi.org/10.1007/s10584-006-9059-9.
Mawdsley, J. R., O'malley, R., & Ojima, D. S. (2009). A review of climate-change adaptation strategies for wildlife management and biodiversity conservation. *Conservation Biology*, *23*(5), 1080–1089. http://dx.doi.org/10.1111/j.1523-1739.2009.01264.
McCarthy, J. J., Canziani, O. F., Leary, O. F., Dokken, D. J., & White, K. S. (Eds.). (2001). *Climate Change 2001: Impacts, adaptation, and vulnerability*. Cambridge, MA: Cambridge University Press.
Miller-Rushing, A., Evenden, A., Gross, J., Mitchell, B., & Sachs, S. (2011). Parks use phenology to improve management and communicate climate change. *Park Science*, *28*(2), 65–71.
National Park Service. (2012). *A guide's guide to Acadia National Park*. U.S. Department of the Interior: National Park Service.
Parmesan, C., & Yohe, G. (2003). A globally coherent fingerprint of climate change impacts across natural systems. *Nature*, *382*, 765–766.
Paudyal, R., Poudyal, N., Bowker, J. M., Dorison, A. M., Zarnoch, S. J., & Green, G. T. (2015). A value orientation approach to assess and compare climate change risk perception among trout anglers in Georgia, USA. *Journal of Outdoor Recreation and Tourism*, *11*, 22–33. http://dx.doi.org/10.1016/j.jort.2015.06.004.
Pröbstl-Haider, U., & Haider, W. (2013). Tools for measuring the intention for adapting to climate change by winter tourists: some thoughts on consumer behavior research and an empirical example. *Tourism Review*, *68*(2), 44–55. http://dx.doi.org/10.1108/TR-04-2013-0015.
Pröbstl-Haider, U., Haider, W., Wirth, V., & Beardmore, B. (2015). Will climate change increase the attractiveness of summer destinations in the European Alps? A survey of German tourists. *Journal of Outdoor Recreation and Tourism*, *11*, 44–57. http://dx.doi.org/10.1016/j.jort.2015.07.003.
Riesch, H. (2013). Levels of uncertainty. In: Roeser S., Hillerbrand R., Sandin P., & Peterson M. (Eds.), *The Essentials of Risk Theory*. Dordrecht: Springer.
Roser-Renouf, C., Maibach, E., Leiserowitz, A., Feinberg, G., Rosenthal, S., & Kreslake, J. (2014). *Global Warming's Six Americas, October, 2014: Perception of the health consequences of global warming and update on key beliefs*. New Haven, CT: Yale University and George Mason University.
Safi, A., Smith, W., & Liu, Z. (2012). Rural Nevada and climate change: Vulnerability, beliefs and risk perception. *Risk Analysis*, *32*(6), 1041–1059. http://dx.doi.org/10.1111/j.1539-6924.2012.01836.x.
Scott, D., Jones, B., & Konopek, J. (2007). Implications of climate and environmental change for nature-based tourism in the Canadian Rocky Mountains: a case study of Waterton Lakes National Park. *Tourism Management*, *28*(2), 570–579. http://dx.doi.org/10.1016/j.tourman.2006.04.020.
Shakeela, A., & Becken, S. (2014). 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. http://dx.doi.org/10.1080/09669582.2014.918135.
Sharp, R.L., Brownlee, M.T., & Larson, L.R. (2012). *Visitors' climate change beliefs and perceptions of climate-sensitive resources at Great Sand Dunes National Park.* Paper presented at the Northeastern Recreation Research Symposium, Cooperstown, NY.
Sharp, R. L., Lemieux, C., Thompson, J., & Dawson, J. (2014). Enhancing parks and protected area management in North America in an era of rapid climate change through integrated social science. *Journal of Park and Recreation Administration*, *32*(4), 1–18.
Smith, N., & Leiserowitz, A. (2012). The rise of global warming skepticism: Exploring affective image associations in the United States over time. *Risk Analysis*, *32*(6), 1021–1032. http://dx.doi.org/10.1111/j.1539-6924.2012.01801.x.
Stern, P., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, *6*(2), 81–97.
Süss, J., Klaus, C., Gerstengarbe, F., & Werner, P. C. (2008). What makes ticks tick? Climate change, ticks, and tick-borne diseases. *Journal of Travel Medicine*, *15*(1), 39–45. http://dx.doi.org/10.1111/j.1708-8305.2007.00176.x.
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. http://dx.doi.org/10.1016/j.jenvp.2014.11.012.
Weber, E. (2011). Psychology: Climate change hits home. *Nature Climate Change*, *1*(1), 25–26. http://dx.doi.org/10.1038/nclimate1070.
WTO (2008). *Climate change and tourism: responding to global challenges* (p. 268), 268.