Weather Sensitivity and Climate Change Perceptions of Tourists: A Segmentation Analysis

Abstract

Many communities rely on tourism spending, so it is important to understand any potential changes to tourist flows resulting from changing climate and weather patterns. However, tourists are not a homogenous group, as they have different motivations, values, and goals. Therefore, the purpose of this investigation is to better understand potentially varying perceptions and behavior of different tourist types, specifically in regards to their weather sensitivity, climate change concern, and behavioral intention for climate change mitigation. Tourists were randomly surveyed at twenty locations throughout the state of Maine in the United States (n=704). Segmentation analysis on the activities tourists participated in yielded three segments of Maine tourists: non-nature-based tourists (50.6%), nature-based generalists (16.2%), and nature-based specialists (33.2%). Differences across segments were explored for perceptions of weather impacts, climate change concern, and mitigation intent. Additionally, weather sensitivity was analyzed based on type of overnight accommodations to better understand if this also had a role in differences. Non-nature-based tourists thought that weather variables were less influential during their travels in Maine than the other segments, while nature-based generalists perceived weather to have the highest influence. Additionally, nature-based specialists had the highest level of climate change belief, while nature-based generalists had the highest willingness to engage in climate change mitigation behavior. Results are useful to understand how segments of tourism demand may be altered with a changing climate, such as increased temperatures, precipitation, and storms, and what groups may be the most beneficial to target for marketing or educational efforts to reduce the impact of climate change.

Keywords: nature-based tourism; travel behavior; Maine; cluster analysis; outdoor recreation; civic engagement

Introduction

Tourism is important for many economies globally, supporting an estimated 292 million jobs and accounting for 10.2% of GDP in 2016 (World Travel & Tourism Council, 2017). In 2016 in the United States, tourism supported 14.2 million jobs and comprised 8.1% of GDP (World Travel & Tourism Council, 2017). Therefore, it is important to understand any potential changes to tourism flows, as these changes have real economic and social impacts for

communities. Although tourism is important globally, some communities are more reliant on tourists' spending than others, such as gateway towns into national parks and protected areas.

Tourism is one of the largest industries in the state of Maine, contributing $5.99 billion in direct expenditures in 2016 (Maine Office of Tourism, 2017, p. 19). Many communities in Maine rely on tourism to support jobs and the economy; in fact, 71% of residents believe tourism is the most important economic driver for the state (Maine Office of Tourism, 2016). Therefore, potential changes to tourism in Maine could impact residents' livelihoods. Since Maine is a heavily forested and rural state with both mountain and coastal assets, much of the tourism is nature-based. Although there are various factors that could impact tourism, such as the state of the economy, overall tourism trends, or tourism marketing, this study focuses on how weather and a changing climate could impact tourism and different tourist groups. Climate change is already impacting tourism globally (Gössling, Scott, Hall, Ceron, & Dubois, 2012), and tourists already perceive impacts of climate change to tourism in Maine (De Urioste-Stone, Scaccia, & Howe-Poteet, 2015). This study aims to better understand both weather sensitivities and climate change perceptions of different tourist groups to understand multiple facets of how tourism-dependent communities could be impacted under a changing climate.

Weather, Climate Change, and Tourism

Tourists are highly influenced by weather and climate, since these impact destination selection, trip timing, and trip satisfaction (e.g. Becken & Hay, 2007). Weather affects tourism by influencing activities participated in, travel and transportation, and the length of visitors' stays (e.g. Smith, 1993; Denstadli, Jacobsen, & Lohmann, 2011). For example, average sunshine and temperature both positively impacted domestic overnight stays in Austria during peak season, while average precipitation had a negative effect (Falk, 2014). In New Zealand, a survey found that 39% of international tourists changed their trip timing as a result of the weather, and 51% changed activities due to weather (Becken & Wilson, 2013). Additionally, many travel bloggers mention weather variables when recounting their trips (Jeuring & Peters, 2013). However, the effect of weather may be different depending on the location and the type of tourist, as one study showed that urban tourists in Hong Kong were minimally impacted by weather (McKercher, Shoval, Park, & Kahani, 2015).

Past research on weather and tourism tend to measure the influence of four core variables: air temperature, rain, sunshine, and wind (Steiger, Abegg, and Jänicke, 2016; Hewer, Scott, & Gough, 2015; Rutty & Scott, 2010; Scott, Gössling & de Freitas, 2008). The perceived importance of weather varies depending on the destination. For example, temperature tends to matter more for urban tourism (Rutty and Scott, 2010; Scott et al., 2008), while sunshine and rain are more important for beach tourism (Moreno, Amelung, & Santamarta, 2009; Scott et al., 2008), and rain is the most influential for mountain tourism (Steiger et al., 2016; Scott et al., 2008). Many studies have concluded that wind has the least importance behind sunshine, rain,

and temperature (Steiger et al., 2016; Hewer et al., 2015; Rutty & Scott, 2010; Moreno & Amelung, 2009; Scott et al., 2008).

Mieczkowski's Tourism Climate Index (TCI; 1985) also used these four variables to create an index for desirability of tourism climates, with daytime/daily comfort (measured by temperature and humidity) having the highest impact (50%), followed by precipitation and sunshine (20% each), and wind (10%). Since the impact of weather does vary based on location, Morgan et al. (2000) created an index for beach tourism, where temperature had less of an impact, and precipitation was the most important weather variable. In addition to varying based on location and type of tourism, weather sensitivity may also vary based on overnight accommodation. A recent study by Hewer et al. (2015) found that the most influential weather conditions may be different for campers, with sunshine and temperature having the highest importance for camper satisfaction, but heavy rain and strong winds most likely to cause visitors to leave early.

Although weather is important during a vacation, overall climate, or the long-term average of weather, is influential in determining destination selection and when tourists visit (Becken & Hay, 2007). However, perceptions of what constitutes an acceptable climate differ between tourists from different areas or with varying backgrounds (e.g. Rutty & Scott, 2016; Scott et al., 2008; Gómez Martín, 2005). Nevertheless, despite these varying tourist perceptions, changing weather and climate likely does impact tourism flows globally by altering which destinations people perceive as attractive and in which season they travel (Becken, 2012; Gössling et al., 2012).

This is especially pertinent as climate is changing all around the world. From 1880-2012, average land and ocean temperatures have risen by 0.85 °C (Intergovernmental Panel on Climate Change, 2013). In addition, there has been an increase in the frequency and intensity of extreme weather events (Intergovernmental Panel on Climate Change, 2013). This is already impacting outdoor recreation and tourism globally by shifting where and when visitors decide to travel (Gössling et al., 2012). For example, a study in a Canadian national park found that when just modeling temperature and precipitation under climate change scenarios, visitation was expected to increase (Scott, Jones, & Konopek, 2007). However, when visitors were surveyed at the same park, many people said they would visit less often or not at all based on predicted environmental changes, such as wildlife population decline, fewer glaciers, and higher probabilities of wildfires (Scott et al., 2007). Additionally, based on the weather variables in the TCI and future climate models, attractiveness of destinations and seasonality is expected to shift across North America, with some destinations expected to have an increase in climate resources for tourism, while others a decrease (Scott, McBoyle, & Schwartzentruber, 2004).

Climate Change and Tourism Visitation in Maine

Over the last century, the climate of Maine has changed by becoming warmer, wetter, and having more storm variability. The mean annual temperature has increased by 1.7 °C from 1895 to 2014, and mean annual precipitation has increased by 13% (Fernandez et al., 2015). This could already be impacting visitors' travels to and within Maine. Furthermore, climate change scenarios predict Maine will continue to become warmer and wetter. Using IPCC climate change scenarios, models predict that by the middle of the 21st century, average annual temperature in Maine will increase by an additional 1.1-1.7 °C, and precipitation will increase an additional 1-7% from 2015 levels (Fernandez et al., 2015).

Additionally, climate change is predicted to have a large impact on winter tourism, since future projections show the increase in precipitation as more rain and less snow (Fernandez et al., 2015). Research suggests the snowmobile season in Maine will be reduced under climate change (Scott, Dawson, & Jones, 2008), and that only 57% of Maine alpine ski locations will be able to maintain a season length of at least 100 days by the 2050s under low emissions scenarios (Dawson & Scott, 2013). A changing climate means that weather is also changing, so it is important to understand how tourists perceive the impact of weather on their travels in order to better understand how visitation in Maine could change in the future.

Recent studies in Maine showed that tourists are already noting the impact climate change could have on tourism (De Urioste-Stone et al., 2015), and many of them would change their future visitation based on possible changing weather conditions (De Urioste-Stone, Le, Scaccia, & Wilkins, 2016). Of summer visitors to Mount Desert Island, Maine, 61% believed climate change would affect tourism in the area, with the majority thinking it would have a negative impact. Visitors expressed concern over an increase in extreme temperatures, the increased frequency of rain and storm events, and sea level rise (De Urioste-Stone et al., 2015). Understanding visitors' perceptions is important because perceptions influence behavior (e.g. Denstadli et al., 2011). Additionally, visitors' intended visitation response to climate change scenarios in Rocky Mountain National Park was not significantly different than revealed preferences from regression models (Loomis & Richardson, 2006). Therefore, investigating tourists' perceptions of their behavior can be useful to understand actual behavior. This is important so that communities and protected areas can prepare ahead for changes in spending and visitation patterns.

Tourism and Environmental Engagement

Tourism and climate change have a multifaceted relationship because tourism is a contributor to anthropogenic climate change, but climate change impacts tourists and tourism destinations as well (e.g. Scott, Gössling, & Hall, 2012). The impacts of tourism include increased energy, emissions, food, and water (Gössling & Peeters, 2015). Additionally, much research has noted the high carbon footprint of tourism (e.g. Sharp, Grundius, & Heinonen, 2016; Cadarso, Gómez, López, Tobarra, & Zafrilla, 2015).

As tourism demand continues to grow, and thus emissions from tourism likely continue increasing, it will be important to understand how to mitigate some of the negative consequences of tourism. A study by McKercher, Prideaux, Cheung, and Law (2010) found that tourists are largely not willing to change their travel behavior to reduce their carbon emissions. Additionally, previous studies have evaluated tourists' willingness to pay for carbon offsets while flying (e.g. Choi, Ritchie, & Fielding, 2016; Gössling, Haglund, Kallgren, Revahl, & Hultman, 2009; Segerstedt & Grote, 2016). Although few travellers participated in airline carbon-offsetting programs, this could be due to a lack of knowledge; more travellers indicated a willingness to pay than those who actually bought carbon offsets (Gössling et al., 2009).

Understanding beliefs and perceptions on climate change is especially important to influence environmental behavior because perceptions influence policies and decision-making (Brownlee, Hallo, & Krohn, 2013; Brownlee, Powell, & Hallo, 2012). Additionally, general beliefs and concern for an issue (such as climate change) are important to measure since belief and concern are a precursor for action (Roser-Renouf, Maibach, Leiserowitz, & Zhao, 2014).

Coupling the importance of climate change perceptions with the known weather sensitivity of tourism, the objectives of this study are to (1) explore perceptions of how weather affects different tourist groups to better understand how behavior might differ under future climate change conditions and (2) examine climate change concern and willingness to take action across tourist groups. In this study, tourists are defined as temporary visitors who stay at least twenty-four hours away from their permanent residence (Leiper, 1979). In recognition that tourists are not a homogenous group (Wight, 2001), this study utilizes segmentation analysis to compare and contrast differences among tourist groups in Maine.

Methodology

Study Site

Maine is located in the northeastern part of the United States and is the most forested state in the U.S., with about 90% of land cover being forests (Forests for Maine's Future, 2011). Tourism, along with forest products, is one of the largest industries in the state. Maine has eight tourism regions, which offer a wide array of tourism opportunities, ranging from beaches to mountains to urban tourism (Explore Maine, 2014). In 2016, Maine had a total of 18.9 million tourism-related overnight visits, most of which were from out-of-state. Summer is the most popular season for tourism, as 51.3% of overnight tourists visited in the summer (Maine Office of Tourism, 2017).

This study was conducted at twenty locations across Maine, including visitor's centers, state parks, Bangor International Airport (BIA), a chamber of commerce, and Acadia National Park (Figure 1). The large number of sampling sites was chosen because a previous study that

undertook segmentation analysis of tourists in Norway suggested future research should survey visitors at a greater number of places and at diverse locations to avoid bias (Mehmetoglu, 2007).

Figure 1. A map of the sampling sites throughout Maine. Source: Author.

Survey Design and Sampling Procedure

This study consisted of an on-site intercept questionnaire, followed by a longer self-administered online questionnaire. Participants of the on-site questionnaire were invited to complete a self-administered questionnaire online once they returned home. Those who did not have internet or computer access were mailed a paper questionnaire. The on-site survey instrument consisted primarily of demographic and weather questions and was used as a means to interact with a random sample of travelers across Maine and increase the likelihood that visitors would complete the longer self-administered questionnaire (Dillman, Smyth & Christian 2014). Demographic data and weather perceptions were collected on both the front-end and self-administered survey instruments to assess non-response bias. The self-administered questionnaire consisted of five sections: (1) basic trip information, (2) the impacts of weather on their current trip and potential future trips, (3) accommodations and spending, (4) activities and climate change beliefs, and (5) demographic information. Questions on the survey were created after reviewing the relevant literature and using the question wording of studies that were measuring similar concepts and values (De Urioste-Stone, et al, 2016; Stynes & White, 2006; Brownlee, Hallo, & Krohn, 2013).

Data were collected between May-November 2015 throughout the State of Maine. A two-stage cluster probability sampling design was utilized (Scheaffer, Mendenhall III, Ott, & Gerow, 2012), with the first phase consisting of a simple random sample of locations-times (cluster), and the second phase being the random sample visitors chosen from each cluster. First, we selected popular tourist locations throughout Maine to administer surveys, then random dates to survey were chosen, and finally random visitor groups were selected once on-site using systematic probability sampling. Trained survey administrators approached random groups walking by, and interviewed one person from each group (whoever had the most recent birthday) if willing. At the end of the survey instrument, tourists were asked for contact information in either the form of a mailing address or email address in order to send reminders about the self-administered survey instrument, as suggested by the Tailored Survey Design Method (Dillman, Smyth, & Christian, 2014). All onsite data were collected electronically on iPads using SurveyGizmo software.

After the onsite interview was completed, the visitor was given a postcard with a link to an online self-administered questionnaire and a personalized access code. All tourists who provided email or mailing addresses received up to three follow-up reminders. Reminders were sent every other week. Of 1712 onsite survey instruments completed by tourists, 704 respondents completed the self-administered questionnaire (41.1% response rate). A total of 688 responses were online

(97.7%), and 16 responses (2.3%) were returned on hard copies. Since this study has defined that a tourist is someone who stays away from their permanent residence for at least one night, day visitors were not included in this study.

Data Analysis

Using SPSS 22.0, a multivariate two-step cluster analysis was run to segment Maine visitors. Cluster analysis categorizes individuals into similar clusters based on sociodemographic characteristics, psychological factors, or behavior, so that those within a group are more similar to each other than those in other groups (Wedel & Kamakura, 2000). This analysis has been widely used in a variety of tourism and recreation contexts to understand group differences in tourist behavior (e.g. Rastogi, Harikrishna, & Patil, 2015), travel motivations (e.g. Bicikova, 2014; Chiang, Wang, Lee, & Chen, 2015), and management opinions (e.g. Hall, Seekamp, & Cole, 2010).

Clustering was based off of the number of nature-based activities visitors participated in or planned to participate in, and whether their primary recreational activity was nature-based or not. These two variables were created from a question that asked visitors: "Which recreation activities did you participate in during this trip?" Visitors were asked to circle either "participated," "planned to but could not," or "not interested on this trip" for each activity. Furthermore, respondents were asked to check which activity was their primary activity. Activities were categorized into whether they were completely nature-based, somewhat nature-based, or non-nature-based (Table 1). Activities were added to determine the number of nature-based activities visitors participated in or planned to participate in but could not.

Table 1. Categorization of types of activities listed.

This analysis yielded three segments of Maine visitors: nature-based specialists, nature-based generalists, and non-nature-based tourists. A recent study examining tourists in Norway used the terms "specialist" and "generalist" to segment nature-based tourists based on motivations. Specialists were defined as those who reported nature as the most important influence on their travel, whereas nature was not the most important factor for generalists (Mehmetoglu, 2005). This study instead segmented based on activities, and thus defined specialists as those who participated in fewer outdoor activities, and generalists as those who participated in more outdoor activities. These terms were used because the definition of a specialist is someone who is dedicated to one pursuit, while generalists are defined as those who have knowledge, skills, or interests in a variety of fields.

To test for differences between segments for weather sensitivities, the 5-point Likert scale was collapsed into 3 categories: Not influential, slightly/moderately influential, and very/extremely influential. Chi-squares were run with Cramer's V for effect size. Adjusted

standardized residuals (ASR) were used as a post-hoc, with those two standard deviations or more away from the expected mean noted.

To test for differences between the segments for climate change perceptions, eight questions on climate change perceptions were collapsed into four categories, with each category being the mean of two items (Table 2). Levene's statistic was used to first test the assumption of equal variances of groups. ANOVAs were used to compare for significant differences between the segments, and Tukey's Post Hoc were used if variances were equal, and Welch's ANOVA with Games-Howell Post Hoc were utilized for those with unequal variances (Vaske, 2008). Additionally, eta-squares (η^2) were used to examine the effect size.

Table 2. Categorization of questions on climate change perceptions and willingness to engage.

Non-response bias was assessed by using Pearson's chi-square test of independence (x^2) to compare those who responded to the intercept survey (n=1712) with those who responded to the self-administered survey (n=704). These comparisons yielded no significant differences between those who completed the onsite and the self-administered survey instruments for age (x^2=4297.16, 4347 df, p=.70), gender (x^2=.02, 1 df, p=.89), education (x^2=40.52, 42 df, p=.54), number of people in the travel party (x^2=211.47, 288 df, p=1.00), number of nights (x^2=653.15,675 df, p=.72), and the importance of the expected weather (x^2=12.14, 16 df, p=.73).

Results

Segmentation

Visitors were segmented into three groups based on their activities participated in, with a silhouette of 0.6. As outlined in Table 3, the first group was labeled "non-nature-based tourists," who tended to participate in fewer outdoor activities (mean = 2.71) and have their primary activity not nature-based. "Nature-based generalists" were individuals who participated in many nature-based activities (mean = 7.01) and the majority had a nature-based activity as their primary activity. Finally, "nature-based specialists" are those who participated in fewer outdoor activities (mean = 3.19), but everyone had a primary activity that was entirely nature-based. Slightly over half of Maine tourists were non-nature-based (50.6%), while the nature-based tourists were more specialists (33.2%) than generalists (16.2%).

Table 3. Descriptions and characteristics of the three clusters. The first input is on a scale from 0-2, 0 meaning not nature-based, and 2 representing entirely nature-based.

Visitor Profile

Tourists in Maine surveyed were predominately female (58.8%) and well educated (74.3% having a bachelor's degree or higher) (see Table 4); this fits with the general profile of Maine tourists found by the Maine Office of Tourism (Maine Office of Tourism, 2017, p. 109). Additionally, 46.0% of visitors were from the northeast region (See Figure 1), and 11.5% were Maine residents.

Table 4. A profile of tourists who responded to the self-administered survey, broken down by group. Numbers for the segments and sample average are expressed as percentages.

ANOVA elicited no statistically significant differences between the segments for education, and chi-square elicited no significant difference in gender at $\alpha = 0.05$. Region was significantly different between non-nature-based tourists and nature-based specialists, with the specialists having more Maine residents. The length of stay was different between non-nature-based tourists and nature-based generalists and specialists, with the non-nature-based tourists tending to have shorter trips. Additionally, nature-based generalists and specialists tended to have higher rates of overnight accommodation in RV and tent campgrounds, while non-nature-based tourists had higher rates of staying in hotels/motels/lodges. Age is also significantly different between non-nature-based tourists and generalists and specialists ($p<0.001$), with the non-nature-based tourists being slightly older.

Weather Sensitivity

When asked to rate the influence of five different weather conditions on their current trip, nature-based generalists perceived all weather conditions to be the most influential (Table 5). Nature-based specialists and non-nature-based tourists had similar responses, and were only significantly different for the influence of precipitation, with specialists reporting that it is more influential than non-nature-based tourists. Results show a relatively low influence of weather across all segments. However, when asked about the importance of the weather on their trip in general, only 13.7% of tourists believed weather was unimportant or very unimportant. Additionally, 22.2% of non-nature-based tourists, 35.1% of nature-based generalists, and 28.2% of nature-based specialists changed their travel or recreation plans on their trip due to weather.

Table 5. Perceived influence of weather on Maine tourists' trips by cluster.

When looking at tourist by lodging type rather than recreational activities, tent campers were significantly more likely to say the overall weather was very or extremely influential in choosing their destination and during their travels (Table 6). Those who were staying at the

residence of friends/family or their own seasonal residence thought the overall weather during their trip and the expected weather were less important. Additionally, tent campers thought precipitation was very/extremely influential at a higher rate than those in other accommodations, but there were no significant differences in the influence of temperature, sunshine, or wind by overnight accommodations.

Table. 6. Perceived influence of weather on Maine tourists' trips by type of overnight accommodations.

Climate Change Perceptions

Most of the tourists to Maine tended to believe in climate change and be concerned about it (mean of 3.87, on a scale from 1-5, with 1 being strongly disagree and 5 being strongly agree). Additionally, many tourists were concerned about climate change in Maine as well (mean of 3.36). Overall, nature-based specialists and nature-based generalists had the highest belief and concern about climate change in general and in Maine, while non-nature-based tourists had lower belief and concern (Table 7).

Additionally, some tourists indicated they would be willing to participate in education outreach (mean of 2.85, on a scale from 1-5, with 1 being strongly disagree and 5 being strongly agree) or donate money (mean of 2.73) to help local climate change. Although levels of belief and concern for climate change were not statistically different between nature-based generalists and specialists, generalists had statistically higher willingness to engage in climate change civic action for both donating money and education outreach.

Table 7. Climate change concern and willingness to engage in civic action. Items represent a mean of two questions measuring the same concept. Scale: 1 (strongly disagree) - 5 (strongly agree).

Discussion and Conclusions

The goal of this study was to understand differences in weather sensitivities and climate change perceptions across different types of tourists to the same area. Climate change is already impacting tourism globally, and is predicted to continue altering where and when visitors travel (Gössling et al., 2012). Since tourism is a significant contributor to many economies, potential future changes to tourism are important to understand. However, tourists are not a homogenous group and could respond differently to changes in weather and climate.

Across all five weather variables, generalists were the most impacted by the weather, and non-nature-based tourists the least. Although nature-based generalists perceive the weather to be

the most influential, they were also adapting the most by changing the activities they participated in. Overall, when asked about individual weather factors, tourists reported a small influence across all variables, with sunshine being the most influential across all groups, and wind being the least influential. The findings that wind is the least important weather variable fits with previous studies, although depending on the location, others have found rain or temperature to be more influential than sunshine (Steiger et al., 2016; Hewer et al., 2015; Scott et al., 2008).

However, when asked about the importance of the weather on their trip in general, only 13.8% believed weather was unimportant. So although tourists may perceive the weather to be influential as a whole, individual components of the weather may not be seen as particularly important. Almost a third of tourists to Maine changed their plans due to the weather, and a previous study in Norway also found that a third of visitors changed plans because of the weather (Denstadli et al., 2011). While nature-based generalists reported the largest influence of weather, they also may be the most adaptable, since they participated in more activities and changed the activities they participated in the most. This is important because there are micro-climates within a single tourism destination, which provides tourists some capacity to adapt to weather; for instance, moving to the beach when temperatures are hotter than desired (Rutty and Scott, 2014). Although findings suggest that a changing climate could impact the visitation and satisfaction of nature-based generalists the most, they may be more adaptable than nature-based specialists. Thus, it may be beneficial to advertise a wide range of recreational activities available at the destination so tourists, particularly nature-based specialists, have an awareness of options to adapt to negative conditions.

People who were tent camping for their overnight accommodations were more likely to state the importance of the weather when selecting their destination, and also the importance of the actual weather during their trip. Thus, this group would be the most likely to change future behavior due to the weather. However, the only weather variable that had more influence on campers was precipitation. With increased precipitation expected in Maine due to climate change, particularly during popular camping seasons, fewer campers may choose to visit the area. Campgrounds could adapt to this weather sensitivity by adding more awnings, sheltered camp spots, or sheltered picnic areas so visitors who prefer camping are less influenced by increased precipitation. Those who were staying with friends/family thought the weather was the least important when selecting their destination and during the actual trip. This analysis also showed the difference between tent and RV campers, as RV campers reported lower levels of influence of weather than tent campers. However, Hewer et al. (2015) found that the weather's impact on campers even varied based on location, with beach campers tending to be more sensitive to weather than forest campers. This study did not ask people where they were camping, and based on the landscape of the state it is likely a mix of forest and coastal campers.

These findings are relevant for tourism destinations as well as those interested in climate change mitigation. Across all three groups, tourists tend to be concerned about the impacts to tourism and recreational activities in Maine. Climate change perceptions and beliefs among different groups can be important to understand in trying to influence behavior (Brownlee, Hallo,

Wright, Moore, & Powell, 2013; Brownlee, Powell, & Hallo, 2013). Additionally, some tourists indicated they would be willing to donate money or participate in educational efforts to help local climate change. The mean responses of 2.73 (donating money) and 2.85 (education) by Maine tourists were very similar to results found when surveying visitors to a botanical garden in South Carolina, USA (Brownlee, Hallo, & Krohn, 2013). Although specialists have slightly higher belief/concern in climate change, generalists have the highest stated willingness to donate money or educate others about climate change. Since nature-based generalists already report the highest level of willingness to donate money and educate, these tourists would be the best group to target for civic engagement on climate change. However, studies have shown that visitors' concern and awareness of climate change is positively correlated with their willingness to participate in civic action, so long-term it may be beneficial to target climate change information at non-nature-based tourists, who show the lowest levels of climate change belief and concern (e.g. Brownlee, Hallo, & Krohn, 2013).

This study does have limitations, namely that tourists were not given specific weather conditions to evaluate, so respondents may have interpreted weather questions differently. Additionally, tourists were not asked directly about future climate and weather scenarios. Rather, this study aimed to look at tourist groups and begin investigating differences in weather and climate change perceptions. Future research could embed choice experiments based on climate change scenarios (e.g. Pröbstl-Haider & Haider, 2013; Pröbstl-Haider, Haider, Wirth, & Beardmore, 2015) and segment based on intended behavior changes to better understand the characteristics of tourists who will be most impacted by climate change. Segmenting visitors on intended behavior, values, and motivations could provide further insight into different tourist types and how behavior might differ with future climate change. Segmenting tourists was advantageous to explore differences in weather sensitivities and climate change perceptions and could be useful to further investigate the affect of climate change on tourism.

References

Becken, S. (2012). Measuring the effect of weather on tourism: A destination- and activity-based analysis. *Journal of Travel Research*, *52*(2), 156–167. doi:10.1177/0047287512461569

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

Becken, S., & Wilson, J. (2013). The impacts of weather on tourist travel. *Tourism Geographies, 15*(4), 620-639. doi: 10.1080/14616688.2012.762541

Bicikova, K. (2014). Understanding student travel behavior: A segmentation analysis of British university students. *Journal of Travel & Tourism Marketing*, *31*(7), 854–867. doi:10.1080/10548408.2014.890154

Brownlee, M. 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. doi: 10.1080/13606719.2013.752209

Brownlee, M. T.J., 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. doi: 10.1007/s00267-013-0153-2

Brownlee, M. T.J., Powell, R. B., & Hallo, J. C. (2013). A review of the foundational processes that influence beliefs in climate change: opportunities for environmental education research. *Environmental Education Research, 19*(1), 1-20. doi: 10.1080/13504622.2012.683389

Cadarso, M-Á, Gómez, N., López, L-A, Tobarra, M-Á, & Zafrilla, J-E. (2015). Quantifying Spanish tourism's carbon footprint: the contributions of residents and visitors: a longitudinal study, *Journal of Sustainable Tourism, 23*(6), 922-946. doi: 10.1080/09669582.2015.1008497

Choi, A. S., Ritchie, B. W., & Fielding, K. S. (2016). A mediation model of air travelers' voluntary climate action. *Journal of Travel Research, 55*(6), 709-723. doi:10.1177/0047287515581377

Dawson, J., & Scott, D. (2013). Managing for climate change in the alpine ski sector. *Tourism Management*, *35*, 244–254. doi:10.1016/j.tourman.2012.07.009

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*. http://dx.doi.org/10.1016/j.jort.2016.01.003i

De Urioste-Stone, S. M., 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. doi:10.1016/j.jort.2015.07.001

Denstadli, J. M., Jacobsen, J. K. S., & Lohmann, M. (2011). Tourist perceptions of summer weather in Scandinavia. *Annals of Tourism Research*, *38*(3), 920–940. doi:10.1016/j.annals.2011.01.005

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method* (4th ed.). New Jersey: John Wiley & Sons Inc.

Explore Maine. (2014). Explore Maine by tourism region. Retrieved from http://www.exploremaine.org/region/index.shtml

Falk, M. (2014). Impact of weather conditions on tourism demand in the peak summer season over the last 50 years. *Tourism Management Perspectives*, *9*, 24–35. doi:10.1016/j.tmp.2013.11.001

Fernandez, I.J., Schmitt, C.V., Birkel, S.D., Stancioff, E., Pershing, A.J., Kelley, J.T., … Mayewski, P.A. (2015). Maine's Climate Future: 2015 Update. Orono, ME: University of Maine.

Forests for Maine's Future (2011). FAQ's about Maine's forests. Retrieved from http://www.forestsformainesfuture.org/forest-facts/

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

Gössling, S., Haglund, L., Kallgren, H., Revahl, M., & Hultman, J. (2009). Swedish air travellers and voluntary carbon offsets: towards the co-creation of environmental value? *Current Issues in Tourism, 12*(1), 1-19. doi:10.1080/13683500802220687

Gössling, S. & Peeters, P. (2015). Assessing tourism's global environmental impact 1900-2050. *Journal of Sustainable Tourism, 23*(5), 639-659. doi: 10.1080/09669582.2015.1008500

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. doi:10.1016/j.annals.2011.11.002

Hall, T. E., Seekamp, E., & Cole, D. (2010). Do recreation motivations and wilderness involvement relate to support for wilderness management? A segmentation analysis. *Leisure Sciences*, *32*(2), 109–124. doi:10.1080/01490400903547096

Hewer, M. J., Scott, D., & Gough, W. A. (2015). Tourism climatology for camping: A case study of two Ontario parks (Canada). *Theoretical Applied Climatology, 121*(3-4), 401-411. doi: 10.1007/s00704-014-1228-6

Intergovernmental Panel on Climate Change. (2013). Summary for Policymakers. In *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex & P.M. Midgley (Eds.).

Jeuring, J. H.G., & Peters, K. B.M. (2013). The influence of the weather on tourist experiences: Analysing travel blog narratives. *Journal of Vacation Marketing, 19*(3), 209-219. doi: 10.1177/1356766712457104

Leiper, N. (1979). The framework of tourism: Towards a definition of tourism, tourist, and the tourist industry. *Annals of Tourism Research*, *6*(4), 390-407.

Loomis, J. B., & Richardson, R. B. (2006). An external validity test of intended behavior: Comparing revealed preference and intended visitation in response to climate change. *Journal of Environmental Planning and Management, 49*(4), 621-630. doi: 10.1080/09640560600747562

Maine Office of Tourism. (2016). 2015 Maine tourism highlights. Retrieved from https://visitmaine.com/assets/downloads/2015_FactSheet.pdf.

Maine Office of Tourism. (2017). Maine office of tourism visitor tracking research: 2016 Calendar Year Annual Report. Retrieved from https://visitmaine.com/assets/downloads/2016-MOT-Annual-Report.pdf.

McKercher, B., Prideaux, B., Cheung, C., & Law, R. (2010). Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism, 18*(3), 297-317. 10.1080/09669580903395022

McKercher, B., Shoval, N., Park, E., & Kahani, A. (2015). The [limited] impact of weather on tourist behavior in an urban destination. *Journal of Travel Research*, *54*(4), 442–455. doi:10.1177/0047287514522880

Mehmetoglu, M. (2005). A case study of nature-based tourists: Specialists versus generalists. *Journal of Vacation Marketing*, *11*(4), 357–369. doi:10.1177/1356766705056634

Mehmetoglu, M. (2007). Nature-based tourists: The relationship between their trip expenditures and activities. *Journal of Sustainable Tourism*, *15*(2), 200–215. doi:10.2167/jost642.0

Mieczkowski, Z. (1985). The Tourism Climate Index: A method of evaluating world climates for tourism. *The Canadian Geographer 29*(3), 220–233.

Moreno, A. & Amelung, B. (2009). Climate change and tourist comfort on Europe's beaches in summer: A reassessment. *Coastal Management 37*, 550-568.

Moreno, A., Amelung, B., & Santamarta, L. (2009). Linking beach recreation to weather conditions: A case study in Zandvoort, Netherlands. *Tourism in Marine Environments, 5*(2-3), 111-119.

Morgan, R., Gatell, E., Junyent, R., Micallef, A., Ozhan, E. & Williams, A. T. (2000). An improved user-based beach climate index. *Journal of Coastal Conservation, 6*, 41–50.

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.

Rastogi, R., M., H., & Patil, A. (2015). Segmentation analysis of domestic tourists — A case study. *KSCE Journal of Civil Engineering*, *19*(5), 1509–1522. doi:10.1007/s12205-015-0673-9

Roser-Renouf, C., Maibach, E.W., Leiserowitz, A., & Zhao, X. (2014). The genesis of climate change activism: from key beliefs to political action. Climatic Change, 125, 163-178. doi: 10.1007/s10584-014-1173-5

Rutty, M. & Scott, D. (2010). Will the Mediterranean become "too hot" for tourism? A reassessment. Tourism and Hospitality Planning and Development, 7(3), 267-281. DOI: 10.1080/1479053X.2010.502386

Rutty, M. & Scott, D. (2014). Thermal range of coastal tourism resort microclimates. *Tourism Geographies, 16*(3), 346-363. doi: 10.1080/14616688.2014.932833

Rutty, M. & Scott, D. (2016). Comparison of climate preferences for domestic and international beach holidays: A case study of Canadian travelers. *Atmosphere, 7*(30), 1-12. doi:10.3390/atmos7020030

Scheaffer, R. L., Mendenhall, W., III, Ott, R. L. & Gerow, K. G. (2012). *Elementary survey sampling* (7th ed). Boston, MA: Brooks/Cole.

Scott, D., Dawson, J., & Jones, B. (2008). Climate change vulnerability of the US northeast winter recreation - tourism sector. *Mitigation and Adaptation Strategies for Global Change, 13*(5-6), 577-596. doi: 10.1007/s11027-007-9136-z

Scott, D., Gössling, S., & de Freitas, C. (2008). Preferred climates for tourism: case studies from Canada, New Zealand and Sweden. *Climate Research*, *45*(December), 61–73. doi:10.3354/cr00774

Scott, D., Gössling, S., & Hall, C. M. (2012). International tourism and climate change. *WIREs Climate Change, 3*, 213-232. doi: 10.1002/wcc.165

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. doi:10.1016/j.tourman.2006.04.020

Scott, D., McBoyle, G., & Schwartzentruber, M. (2004). Climate change and the distribution of climatic resources for tourism in North America. *Climate Research, 27*, 105-117.

Segerstedt, A., & Grote, U. (2016). Increasing adoption of voluntary carbon offsets among tourists. *Journal of Sustainable Tourism, 24*(11), 1541-1554. doi:10.1080/09669582.2015.1125357

Sharp, H, Grundius, J, & Heinonen, J. (2016). Carbon footprint of inbound tourism to Iceland: A consumption-based life-cycle assessment including direct and indirect emissions. *Sustainability, 8*(1147). doi: 10.3390/su8111147

Smith, K. (1993). The influence of weather and climate on recreation and tourism. *Weather, 48,* 398-404.

Steiger, R., Abegg, B., & Jänicke, L. (2016). Rain, rain, go away, come again another day. Weather preferences of summer tourists in mountain environments. *Atmosphere, 7*(63), 1-12. doi:10.3390/atmos7050063

Stynes, D. J., & White, E. M. (2006). Reflections on measuring recreation and travel spending. *Journal of Travel Research, 45*, 8-16. doi: 10.1177/0047287506288873

Vaske, J. J. (2008). *Survey Research and Analysis: Applications in Parks, Recreation and Human Dimensions*. State College, PA: Venture Publishing, Inc.

Wedel, M., & Kamakura, W. A. (2000). *Market segmentation: Conceptual and methodological foundations.* US: Springer.

Wight, P. A. (2001). Ecotourists: Not a homogeneous market segment. In Weaver, D. B. (ed.), *The Encyclopedia of Ecotourism* (pp. 37-62). New York, NY: CABI Publishing.

World Travel & Tourism Council. (2017). Travel & tourism: Economic impact 2017 United States. Retrieved from https://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2017/unitedstates2017.pdf.

Tables

Table 1. Categorization of types of activities listed.

Categories	Activities
Not nature-based (0)	Arts or cultural activity, concert or festival, nightlife, shopping
Somewhat nature-based (0.5)	Golfing, picnicking, sightseeing/driving for pleasure
Nature-based (1)	Backpacking/hiking, biking, bird watching, boating, camping, canoeing/kayaking, climbing, fishing, hunting, viewing wildlife

Table 2. Categorization of questions on climate change perceptions and willingness to engage.

Category	Statements	∝
General climate change belief/concern	I believe climate change is happening I am concerned about climate change	0.923
Concern over the impact of climate change to tourism in Maine	I am concerned about the impacts of climate change to tourism in Maine The recreational activities that I enjoy in Maine would be at risk if local climate conditions were to change	0.599
Civic engagement: education outreach	I am interested in learning more about the impacts of local climate change in Maine I would be willing to educate others about local climate change	0.817
Civic engagement: donating money	I would be willing to donate money to reduce my carbon footprint when traveling to Maine I would be willing to donate money to help deal with the impacts from climate change in Maine	0.958

Table 3. Descriptions and characteristics of the three clusters. The first input is on a scale from 0-2, 0 meaning not nature-based, and 2 representing entirely nature-based.

Cluster	**1**	**2**	**3**
Label	Non-Nature-Based Tourists	Nature-based Generalists	Nature-based Specialists
Description	Tourists who tended to participate in fewer nature-based activities, and have primary recreational activities that were not nature-based	Tourists who participated in the most nature-based activities, and the majority's primary activity was nature based	Tourists who did not participate in as many nature-based activities as the nature-based Generalists, but all had a nature-based primary activity
Size	50.6% (356)	16.2% (114)	33.2% (234)
Inputs	Primary activity nature-based: 0.73	Primary activity nature-based: 1.89	Primary activity nature-based: 2.00
	Mean number of nature-based activities: 2.71	Mean number of nature-based activities: 7.01	Mean number of nature-based activities: 3.19

Table 4. A profile of tourists who responded to the self-administered survey, broken down by group. Numbers for the segments and sample average are expressed as percentages.

Demographic and trip characteristics	Sample Average (n=704)	Non-Nature-Based (n=356)	Generalists (n=114)	Specialists (n=234)	Chi Square	ANOVA F	Sig
Gender					0.15		.93
Male	41.2	40.8	40.4	42.2			
Female	58.8	59.2	59.6	57.8			
Age in years						13.97	<.01
Mean	54.2	56.9	50.9	51.6			
Travel group size						7.84	<.01
Mean	2.75	2.58	3.37	2.68			
Education					0.29		.75
High school or less	6.9	8.1	4.5	6.2			
Some college	9.8	8.4	9.1	12.3			
2-year degree	8.9	8.1	14.5	7.5			
Bachelor's degree	33.1	32.5	28.2	36.6			
Graduate degree	41.2	42.9	43.7	37.4			
Overnight Lodging							
Hotel/motel	65.4	76.7	50.9	55.3	72.70		<.01
Friends/seasonal	20.0	18.7	17.3	23.2			
RV camping	6.7	3.2	11.8	9.6			
Tent camping	7.9	1.4	20.0	11.8			
Length of Stay					12.05		<.01
1-3 Nights	41.9	50.6	19.3	39.7			
4-7 Nights	43.9	39.3	64.9	40.6			
8-14 Nights	10.8	7.0	10.5	16.7			
15+ Nights	3.4	3.1	5.3	3.0			
Region From					7.17		<.01
Maine	11.5	7.5	9.3	18.8			
Northeast	46.0	44.2	50.9	46.4			
South	21.4	23.7	19.4	18.8			
Midwest	9.6	10.7	9.3	8.0			
West	5.5	6.6	5.6	3.6			
International	6.0	7.2	5.6	4.5			

Table 5. Perceived influence of weather on Maine tourists' trips by cluster.

Weather variable		Avg (%)	Non-nature (%)	Gene-ralists (%)	Speci-alists (%)	Chi-Square	Sig	Cramer's V
Precipitation	Not influential	43.2	49.3*	29.8*	40.6	17.962	.001	.113
	Slightly/moderately	40.0	35.8*	54.4*	39.3			
	Very/extremely	16.8	14.9	15.8	20.1			
Sunshine	Not influential	37.3	40.6	26.3*	37.8	10.282	.036	.086
	Slightly/moderately	40.8	36.4*	49.1*	43.3			
	Very/extremely	21.9	23.0	24.6	18.9			
Max temperature	Not influential	39.7	41.6	26.8*	42.9	9.630	.047	.083
	Slightly/moderately	42.5	41.3	50.0	40.8			
	Very/extremely	17.8	17.1	23.2	16.3			
Min. temperature	Not influential	47.4	48.6	36.8*	50.9	7.568	.109	
	Slightly/moderately	42.1	42.3	50.0	37.9			
	Very/extremely	10.5	9.1	13.2	11.2			
Wind speed	Not influential	58.7	60.5	50.4	59.9	8.943	.063	
	Slightly/moderately	35.7	34.7	46.0*	32.3			
	Very/extremely	5.6	4.8	3.5	7.8			
Importance of the actual weather (general)	Unimportant	13.8	13.8	11.4	15.0	9.741	.045	.118
	Neither important nor unimportant	28.3	32.7*	20.2*	25.8			
	Important	57.8	53.5*	68.4*	59.2			
Importance of the expected weather in choosing destination	Unimportant	24.5	23.0	22.1	28.0	8.980	.062	
	Neither important nor unimportant	34.7	38.2*	26.5*	33.2			
	Important	40.8	38.8	51.3*	38.8			

Degrees of freedom = 4 for all chi-square tests.

* Indicates Adjusted Standardized Residual (ASR) >1.96

Table. 6. Perceived influence of weather on Maine tourists' trips by type of overnight accommodations.

Weather variable		Hotel, motel (%)	Friends /seasonal (%)	RV camp (%)	Tent camp (%)	Chi-Square	Sig	Cramer's V
Precipitation	Not influential	44.2	48.2	41.3	29.6*	17.009	.009	.111
	Slightly/moderately	40.8	38.7	43.5	35.2			
	Very/extremely	15.0	13.1	15.2	35.2*			
Sunshine	Not influential	37.3	39.7	41.3	33.3	5.209	.517	
	Slightly/moderately	41.3	39.7	41.3	33.3			
	Very/extremely	21.3	20.6	17.4	33.3*			
Max temperature	Not influential	38.3	50.4*	39.1	28.8	10.309	.112	
	Slightly/moderately	43.8	32.3*	45.7	50.0			
	Very/extremely	17.9	17.3	15.2	21.2			
Min. temperature	Not influential	49.2	50.4	43.5	35.2*	7.024	.319	
	Slightly/moderately	41.6	36.3	45.7	50.0			
	Very/extremely	9.2	13.3	10.9	14.8			
Wind speed	Not influential	58.5	63.7	56.8	55.6	8.728	.189	
	Slightly/moderately	37.0	27.4*	40.9	37.0			
	Very/extremely	4.5	8.9*	2.3	7.4			
Importance of the actual weather (general)	Unimportant	11.9*	20.6*	17.4	13.0	16.549	.011	.110
	Neither important nor unimportant	29.5	31.6	23.9	13.0*			
	Important	58.6	47.8*	58.7	74.1*			
Importance of the expected weather in choosing destination	Unimportant	21.5*	36.5*	23.9	22.2	23.073	.001	.130
	Neither important nor unimportant	34.5	38.0	37.0	24.1*			
	Important	43.9*	25.5*	39.1	53.7*			

Degrees of freedom = 6 for all chi-square tests.

* Indicates Adjusted Standardized Residual (ASR) >1.96

Table 7. Climate change concern and willingness to engage in civic action. Items represent a mean of two questions measuring the same concept, on a scale from 1 (strongly disagree) - 5 (strongly agree).

	Avg.	Non-nature	Gene-ralists	Speci-alists	Levene Stat (sig)	ANOVA F/Welch's F (sig)	Effect Size
General climate change belief/concern	3.87	3.73[a]	4.00[a,b]	4.02[b]	6.97 (.001)	Welch: 6.05 (.003)	ω^2 .015
Concern over the impact of climate change to tourism in Maine	3.36	3.24[a]	3.51[b]	3.46[b]	0.48 (.619)	F: 6.38 (.003)	η^2 .019
Civic engagement: education outreach	2.85	2.70[a]	3.24[b]	2.88[a]	0.67 (.514)	F: 12.92 (<.001)	η^2 .038
Civic engagement: donating money	2.73	2.56[a]	3.09[b]	2.80[c]	1.15 (.318)	F: 12.42 (<.001)	η^2 .036

[abc] Means followed by different letters are statistically significant at α= 0.05 found using Tukey's Post Hoc test for equal variances, and Games-Howell when variances were unequal.