ASSESSING CLIMATE CHANGE, Ecotourism and Small Communities

Lorri K. Krebs
Salem State University

ABSTRACT

Many areas around the world depend on small scale recreation and tourism activities to sustain local economies. However, even the most successful tourism regions are currently, and will continue to be, confronted with climate change. How future tourism is planned and managed while considering these changes in climate will ultimately determine the sustainability of the industry. Given that many tourism businesses are indeed small or medium size enterprises (SMEs), located in smaller communities, using large scale global climate models and national Gross Domestic Product (GDP) figures may have little resonance; particularly for regions that are economically dependent on natural resources for tourism and recreation, and are fractured in terms of any cohesive planning unit that accurately represents all stakeholders. It is important to explore how they will fare as the climate changes and threatens the resources upon which they rely socio-culturally or economically. This paper examines these issues with a mixed methods approach, using surveys and interviews to identify critical resources for tourists and residents, exploring the threats to these resources through climate change models and data, and assessing the potential economic impacts. Results from the analysis can assist policymakers understand the local issues and impacts on livelihoods, cultural practices and the tourism industry, when considering climate change adaptation and mitigation strategies.

Key words: Ecotourism, climate change, local economic development, small or medium size enterprises (SMEs), Great Lakes

Introduction

As more communities around the world embrace tourism as an economic development strategy the inevitable change in climate should be considered and how it may impact the future sustainability of those businesses. Of particular importance are regions where much of the recreational and tourist activities rely on natural resources, on specific climate conditions that support these natural resources, and where the bulk of economic activity is tourism related.

Given that most tourism businesses are indeed small or medium size enterprises (SMEs), using large scale global climate models and national GDP figures may have little resonance for a community trying to plan for sustainable tourism endeavors in the face of climate change.

Conversely, there are indeed many community action plans (CAPs) that outline steps that are effective in certain situations, but rely on substantial participation rates. There are also regions that are economically dependent on natural resources for tourism and recreation, but are fractured in terms of any cohesive planning unit that accurately represents all stakeholders. These scenarios will become more challenging as the climate changes and presents new or worsening obstacles for those resources. Thus, providing information to these stakeholders is paramount for the sustainability of both the resources and the people and businesses that depend on them.

This study expands upon recent work exploring climate change, tourism and economics by focusing on smaller regional tourist areas and local impacts. Several of the first published papers in this realm had focused on climate and utilized tourism mostly as a case study. This earlier research formed the basis of tourism climate indices such as Mieczkowski's (1985) 'tourism climate index' (TCI) which has since been used extensively since it was first offered. Values for these types of indices are calculated based on 'general circulation models' (GCMs) such as in the work by Scott and McBoyle (2004) and often explore different scenarios of *comfort* levels of tourists to future temperature and precipitation changes (Amelung et al. 2007). TCI and other such indices have been widely accepted throughout the tourism and climate change literature (Scott, de Freitas, and Matzarakis 2008), but have also expanded into other realms of discussion such as biometeorology (Roshan 2016), governance and policy (Johnston et al. 2012; Leon and Arana 2014), water consumption and demand (Roson and Sartori 2014), and econometrics (Stern 2007; Nordhaus 2010) with research linking climate variables to economic impacts and focusing on "climate damage functions as reduced-form formulations" (Ciscar et al. 2011). Many of the economic-focused studies are at a macro level, employing large scale input variables such as average global temperature to gross domestic product. However, on a local level these attempts to model economic impacts and climate change may have little resonance where the economic modelling and impacts are estimations of GDP loss and often this measure, or the data needed to calculate it, is unavailable at smaller scales.

More recently, Scott, Rutty, Amelung and Tang (2016) found TCI to have limitations which their 'holiday climate index' is said to overcome and offer a more accurate representation in urban settings. While tourism comfort indices can be projected into the future so as to assess possible conditions for tourism development (Dubois et al. 2016), the purpose of this study is not to compare various climate scenarios or these models, but rather to highlight their usefulness in framing the research. There are indeed sufficient papers that compare and contrast the research in tourism and climate change realms (Hamilton 2004; Rosselló-Nadal 2013) yet there seems to be general agreement that improved indices could be useful to enhance decision-making and anticipate climate change in the tourism sector (Dubois et al. 2016), particularly in the 'ecotourism' niche (McDougall 2016).

As mentioned previously, tourism in many areas of the world relies on natural resources and is often referred to as ecotourism due to its reliance on environmental resources. Proponents of ecotourism have debated definitions, principles, guidelines, and certification requirements, and much of the published literature begins by contemplating the issues surrounding the term itself, but for the purposes of this research, the following definition from Fennell (2015, 17) has been adopted:

> Travel with a primary interest in the natural history of a destination. It is a form of nature-based tourism that places about nature first-hand emphasis on learning, sustainability (conservation and local participation/benefits), and ethical planning, development and management.

Even the most argumentative proponent of ecotourism would agree that this type of tourist activity relies on *local* natural resources and their ecosystems. Thus, the need to consider and mitigate both risks and impacts of climate change will vary based on locational features (natural resources) of destinations.

One such feature (natural resource) that is crucial to many types of tourism is water. As the air temperature will increase over time, so will the water temperature which will inevitably create changes in the ecosystem. A plethora of studies have shown that this will change the physiological processes for fish, alter freshwater and marine food webs, and increase risk for invasive species and spreading of vector-borne diseases (Marcogliese 2008; Da Silva and Soto 2009; Tranvik et al. 2009; Trumickas et al. 2015). Along with the changes in temperature then, will follow changes in marine wildlife and fisheries habitat, and small businesses must consider how they will adjust, although it has also been suggested that flora and fauna may adapt to the new conditions "in part by microevolution, even in the short term" (Jeppesen et al. 2014, 91). But whatever the changes that may occur, understanding possible outcomes and then adapting usage accordingly will be necessary.

Cross et al. (2012) offered an adaptation of natural resource management to address climate change. The model identifies natural resources, assesses management goals for each resource and how it is used, considers various climate change threats and future scenarios, and then suggests strategic plan action items. The 'Adaptation for Conservation Targets' (ACT) framework offers a simple step-by-step process that: 1) identifies adaptation actions for particular conservation features ranging from a specific species to ecosystems and ecological functions, 2) integrates stakeholders into the process by encouraging participation from both public and private jurisdictions, and 3) uses scenario planning to address uncertainties for various climate change threats and outcomes (Cross et al. 2012). While this has been shown to be an effective process, it may have limits in tourism due to the nature of the industry. Most businesses are small and often owned and operated by the same people who may not be willing participants in such a process. They may feel it would be taking time away from their normal work duties or participation in a process would require extra time to commit to something that they may not necessarily see the benefit of (O'Laoire and Welford 1998).

Additional problems with participation arise with varying levels of resistance by SMEs to environmental management (McKeiver and Gadenne 2005; Boiral et al. 2014). Although there have been recent studies indicating SMEs may be more apt to become involved in climate change discussions if they have seen any impacts or envision any threats to their business (Revell, Stokes and Chen 2010). McDougall (2016) examined the extent to which ecotourism operators are addressing climate change risks in their business planning, which is positive in the sense that some smaller communities and tourism businesses are thinking about climate change.

Underlying such framework, and of particular importance, is to recognize that governance and policy will differ from place to place. Thus, a model that works in one location may be completely unsuitable for implementation in another. For example, indigenous peoples in Canada have a complex range of self-governance power that often overlap other political boundaries. Research has shown that when there are different types and levels of governments, there are different preferences and expectation of both the problems and the policy measures "potentially leading to frame conflict rather than an effective mode of multi-governance" (Scholten 2013, 219).

We can find examples of this type of scenario in many tourist regions globally, whereby there are many competing interests for the same natural resources in a particular location, but different levels and types of governance and policies. It is not unheard of in a tourist area to have multiple types of tourist activities, with a variety of ownership types, sizes and governance and all relying on the same resources in one location. An example might be small families running enterprises, large corporations with hotels, chains of retail, restaurants, local government, federal government, seasonal businesses, indigenous interests, permanent residents, transients, temporary workers and other various stakeholders all vying for use of the same natural resources, but with different objectives and governed by different political networks. Couple this scenario with a discussion surrounding climate change, and one can see there will be a wide range of ideas and opinions. Moreover, the levels of interest and understanding of future changes to those natural resources will vary considerably amongst the groups. Further, in many tourism areas around the world, asking all of the stakeholders to come together to formulate a common plan for multiple resources to prepare for impacts of climate change is unrealistic. There are examples throughout the literature where CAPs are successful and provide excellent frameworks for natural resource management (Cross et al. 2013), but more recently some are also calling into question their applicability and effectiveness (Stone et al. 2012; Kosky and Siulagi 2016). Others have productively built on the CAP ideas but acknowledge the need for climate change scenarios and scientific information "to be localized in order to be ''real'', understandable, and meaningful to laypeople" (Sheppard et al. 2011, 410). This is particularly important in tourism areas where there is diverse stakeholder interest that may not have any relationship with other stakeholders, other than a common need for the sustainability of a resource from the threats of climate change.

It is reasonable then to suggest that future economic development and growth must consider possible climate change scenarios to ensure the sustainability of viable businesses, particularly in ecotourism. Already we have seen policies created for other industries (albeit much larger and on a macro-scale), such as the U.S. based Securities and Exchange Commission which requires companies to disclose their risk and preparedness for climate change in annual reports. There is a need to go beyond theorizing tourism and climate change models, to applying their principles and offering a structure for situational analysis. To this end, we will investigate the sustainability of resource-based tourism (or ecotourism for the purposes of the paper) in complex areas where there is multiple, and often conflicting, types of governance and in light of climate change, resulting in management suggestions and recommendations for sustainable future economic growth.

Methods

The tourism system is quite complex with the industry itself comprised of many separate industries of varying types of ownership and sizes of businesses. The tourism destination is equally as complex and its use and value to tourists can based on any number of factors including their preferences for different natural or built environments, biophysical or cultural resources, or activities and climate, among others. When exploring this tourism system for sustainability, it stands to reason that a more complex methodology would be helpful in ensuring that all aspects of the system are considered. As such, a mixed-methods approached was utilized to integrate data from various sources which was essential in framing the results and discussion, and has been accepted as a valid methodology throughout the literature (Scott et al. 2004; Sandelowski 2006; Heyvaert 2013). The location chosen for this research, Muskoka – Parry Sound, in Ontario Canada, provides many of the same elements that can be found in different locations globally, from the large numbers of stakeholders having shared uses for resources, to multiple types of governance and varying types of land and home ownership. The complexity of the location thus expands the applicability and usability of this research beyond the Great Lakes region to many other areas that may have one or several similar characteristics.

Three different types of data sources and analysis were considered for the study: 1) Demographic data to provide a context for the region and SMEs; 2) Climate change scenarios and climate data to frame the sustainability discussion, based on the Government of Canada's Canadian Climate Data and Scenarios (CCDS) and TCI results for the Muskoka A area (Figure 1); and 3) The tourist voice from surveys that were conducted face-to-face at various tourism facilities along the main transportation route through the study area.

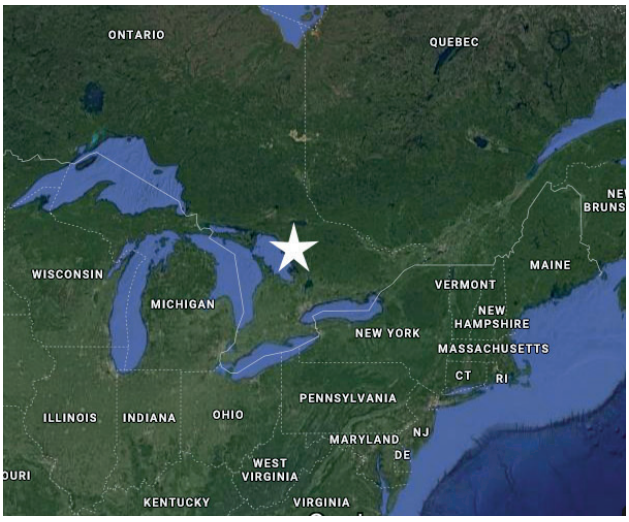

Figure 1. Muskoka – Parry Sound Map. (source: adapted from Google maps)

1) Demographic Data

Demographic data was obtained from the 2016 Census of Population, Statistics Canada; Indigenous and Northern Affairs Canada, Government of Canada; and where permission was not given for Canadian government enumeration of data, Association of Iroquois and Allied Indians and individual First Nations Bands provided data through online sources.

2) Climate Data and Climate Change Scenarios

The Canadian Centre for Climate Modelling and Analysis creates models to study climate change and variability, and make quantitative projections regarding future climate scenarios. For this study, the AGCM4/CanAM4 model output was used to generate long-term climate scenarios. In addition, TAR/AR4 climate scenario, using statistical downscaling input from the predictand - Muskoka A region - was used to generate data for the TCI indices. The results were then used to estimate changes in natural resources relevant to this paper.

The conceptual and methodological development of the TCI is explained in detail in the original paper by Mieczkowski (1985) and, as noted previously, has been validated by many other researchers. The results from the Tourism Climate Index used in this paper builds upon this model by incorporating survey data results into the discussion. The TCI results themselves were compared against the results from Scott and McBoyle's (2001) Toronto TCI score to ensure validity. The use of TCI along with the input variables remained constant with Scott and McBoyle (2001) and Mieczkowski (1985), employing the same combination of five sub-indices, three of which are independent and two in a bioclimatic combination (total of seven climate variables). For this paper, the input data was generated from TAR/AR4 as follows:

$$TCI = 4 \cdot CID + CIA + 2 \cdot P + 2 \cdot S + W$$

Where CID is a daytime comfort index, consisting of the mean maximum air temperature Ta, max (°C) and the mean minimum relative humidity RH (%) CIA is the daily comfort index, consisting of the mean air temperature (°C) and the mean relative humidity (%), over the full 24 hour period, P is the precipitation (mm), S is the daily sunshine duration (in hours), and W is the mean wind speed (m/s). The CID was weighted at 40 percent as it represents the thermal comfort levels of both temperature and humidity during the time when maximum tourist activities occur. Whereas the CIA, although important, is weighted at 10 percent due to its reflection of the whole 24-hour period, including sleeping hours. The levels of sunshine would be very important during the summer months to tourists as many activities are outside and although at risk for sunburn, more enjoyment from sunny days for outdoor activities are expected. Sunshine may become less important during the winter when precipitation in the form of snow is more important for activities such as skiing, snowmobiling and snow shoeing. As such, both are weighted at 20 percent. Other climate indices do not always consider how each variable contributes to activity enjoyment levels so may not weight them differently. However, in this model every contributing parameter is assessed and results in a final score with a maximum value for TCI of 100. Using this weighting factor scale, values from 90-100 are ideal, and 80-89 are excellent, while values between 60 and 79 are regarded as good to very good. The lower the value, the less acceptable tourists find the conditions.

3) Tourism Surveys

The surveys were administered in person over the course of one year (winter 2016 through fall 2017) at publicly accessible locations within the study area, asking for their participation, and whether or not they were staying overnight, or had stayed overnight within the Muskoka-Parry Sound area. The researcher had both paper copies (handed out) and digital (completed on an iPad in person), but was also asked by several people to read the 10-question multiple choice survey aloud and then type in the participants choices. Five locations along the Trans-Canada highway were chosen, including two gas stations with restaurants, a Trading Post (retail store), marina, and visitor center which also houses an education/interpretive center. A total of 435 surveys were validated (out of 700 – resulting a 62% response rate) which is considered good, particularly since the majority of those who did not participate were dismissed due to transient travel (i.e. not including an overnight in the area), rather than an unwillingness to respond. The questions in the survey explored demographics, activity choices and perceived impacts of climate change.

Site Analysis and Results

The District Municipalities of Muskoka and Parry Sound, are regional municipalities located in Central Ontario, Canada (Figure 1). The area falls under multiple overlapping government political jurisdictions, with thirty towns, both federal and provincial electoral districts, nine indigenous (Indigenous People) districts (nine referred to as First Nations, and 12 as Indian Reserves), two economic regions, and part of Ontario Tourism Region twelve. It is approximately a two-hour car drive north of Toronto, and spans 14,602 km^2 (5,638 sq. mi.) (Census Canada 2016). The region borders on the Great Lakes, specifically Georgian Bay, but also over 2,000 smaller lakes, making it a popular recreation and tourist destination. This area, often referred to as "cottage country", sees over 4.3 million visitors annually (Ontario Ministry of Tourism, Culture and Sport 2016). Muskoka-Parry Sound has 103,423 permanent residents (Census Canada 2016), but there are more than 200,000 additional seasonal property owners/renters (Royal LePage 2016). Tourism Ontario (2016) estimates that visitors spend over $598 million annually this region, supporting 1,666 tourism-based businesses. It is considered a desirable destination to visit for tourism and recreation, was ranked #1 for best trips of 2011 by National Geographic, and also among the best trips of 2012 by National Geographic calling it “a natural playground with 8,699 miles of shoreline…countless waterfalls and lakes to the east and the 30,000 islands of Georgian Bay Islands National Park to the west” (National Geographic 2012). But because of climate, and the desire to vacation in this area, much of the housing is only occupied during the summer with a mix of rentals and second homes occupied by the owners only seasonally. In fact, just over half of the private dwellings are occupied by the usual (same) residents year-round (Table 1). This leaves over 37,320 housing units available for weekend, vacation and seasonal tourists.

Population	103,423
Private Dwellings	81,433
Private Dwellings occupied by usual residents	44,110
Median Income total per household (CAN$)**	38,175

Table 1. Selected Muskoka-Parry Sound District Demographics
(sources: Census 2017; **Census Household Survey 2011)

Similar ratios were reflected among the survey respondents with 42 percent staying in their own cottages, cabins or properties with a further 33% renting cottages or cabins (Figure 2). Of the respondents, only 5 percent (21people) listed the Muskoka-Parry Sound District as their primary residence, with almost three-quarters (73 percent) hailing from elsewhere in Canada, 20 percent from the United States. and less than 2 percent other international visitors.

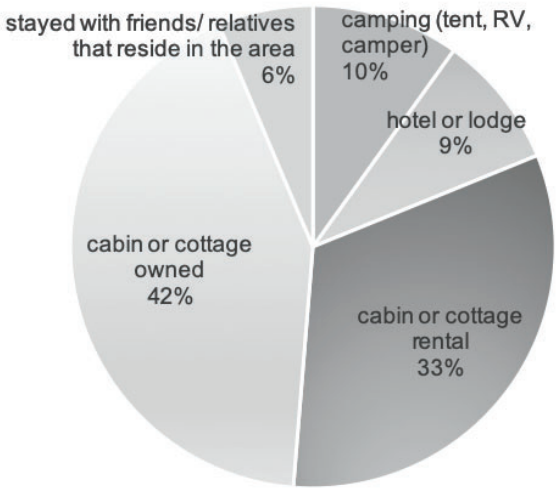

Figure 2. Accommodation choices

The population in Muskoka-Parry Sound districts is currently recorded as 103,423, but the Census population figures do not consider the First Nations communities as many do not give permission for the Canadian government enumeration of data. However, population numbers of residents in the indigenous communities located within this study area were approximated from a variety of online sources and checked against reported numbers for each First Nations on their own websites (Table 2). Each community listed in Table 2 has its own political jurisdiction with local as well as a regional governance structure.

		Population
Wahta Mohawk Territory in Muskoka		819
Wasauksing First Nations		1303
Shawanaga First Nations		660
Moose Deer Point		497
Henvey Inlet First Nations		835
Magnetewan		267
Chippewas of Rama First Nations		1912
Dokis		1224
Beausoleil (2017)		2488
	Total	10005

Table 2. Indigenous Population

Although the region has over 100,000 residents, the density is a mere 4.5 (persons/km^2) in the northern area of Parry Sound and 15.3 in the south-east Muskoka. The towns themselves are relatively small and even though this region has many different types of industry they are predominantly small tourism based businesses. Indeed, the residents of the area have a wide array of employment (Figure 3), but many relate to recreation or tourism, as support or spin-offs. In most communities there are gas stations, restaurants, boat rentals, fishing, and some type of lodging offered. Most communities have businesses competing with each other for tourists seeking local handicrafts, native-made products, retail, restaurants and gas stations. In fact, in every First Nations along the Trans-Canada highway that transects the study region, there is a gas station, and most offer some retail as well.

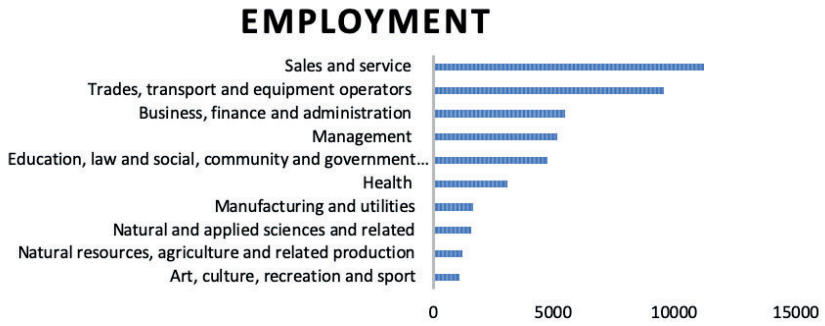

Figure 3: Occupations of residents in Muskoka-Parry Sound districts
(Source: Statistics Canada 2011 National Household Survey, Statistics Canada Catalogue no. 99-014-X2011017)

The types of occupations listed in Figure 3 are very broad and may not reflect the extent to which the economy is based on tourism and recreation although they can almost all certainly relate to recreation or tourism activities. For example, sales and service jobs surround retail, marine sales, gas stations (which also house retail, rental and fishing supplies), accommodation services etc. Restaurants and their employees fall under business, service, and management. While construction falls into several categories with a focus on cottages, decks, docks and general repairs. Also, important to note that these occupations do not include the First Nations communities, which separately publish their industry endeavors, summarized and listed below:

- Lodges/housekeeping cottages/camps
- Trail maintenance and supplies for hiking, cycling, ATV, snowshoeing, cross country skiing, snowmobiling
- Boat launches, rentals, sales and supplies
- Pharmacies, beer and liquor stores, grocery stores, other retail
- Special events, tournaments, fishing derbies, Pow-wows
- Trading Post retail store, visitor center, art galleries

All of these businesses rely on tourists, the majority of whom travel to the area for the natural resources and the activities they provide. It would be a stretch to suggest that residents don't also take part in the same activities and utilize the same amenities. The infrastructure that is in place certainly supports residents and tourists alike. Table 3 summarizes the activity choices for tourists from the surveys administered in spring, summer and fall.

Activities	**n=393**	**percent**
Dining out	390	99
Power boating	354	90
Swimming	300	76
Fishing	296	75
Shopping (excluding food)	280	71
Canoeing/kayaking	241	61
National/Provincial nature parks	180	46
Wildlife/bird watching	84	21
Waterskiing/tubing	62	16
Sports tournament	41	10
Pow Wow	26	7
Sailing	4	1
Hunting	3	1

Table 3. Survey responses for activity choices spring, summer and fall.

Climate Change Scenarios

From Figure 4, the current TCI rating for both June and August were above 80, which is deemed as having 'excellent' tourism climates. However, "under the CGCM2 climate change scenario, the number of days where the maximum temperature exceeds 32°C increases from four (1961-90) to 19 in the 2050s and 32 in the 2080s. Under the same scenario, the maximum daily temperature extreme in August increases from 35°C (1961-90) to approximately 46°C in the 2050s" (Scott and McBoyle 2001). These increases would see June as the only month with an above 80 rating in 2050s and May as the only month with an 'excellent' rating in 2080s. This is not to say that the other months would be unacceptable, rather, the summer season would expand from predominantly June to August seeing the bulk of tourists, to a May-September summer season, with May and June being optimal, July less so due to excess highs in temperature and humidity but September rebounding with near 'excellent' rating.

With the predicted TCI ratings, it is possible that more international visitors may be drawn to the area in May and September, rather than domestic tourists who currently take much of their holiday time in July and August to follow school break.

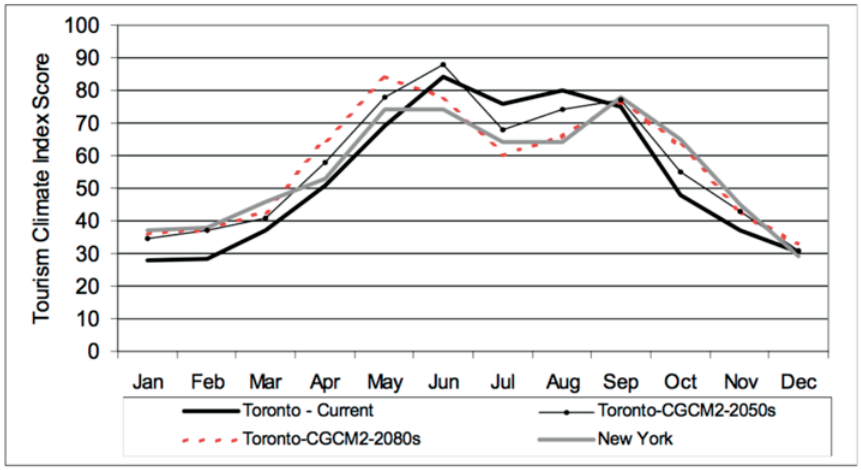

Figure 4. TCI current, 2050, and 2080
(source: Scott and McBoyle 2001)

What the TCI also offers is a look into how each separate index will change and we can extrapolate that data and explore how these changes will impact the resources upon which the tourists currently rely. For the purposes of this paper, we will focus on the increases in air temperature and the consequences to the natural resources in the study region. Using the AGCM4/CanAM4 model, data was generated to compare the temperature profile baseline (station years 1961-1990) in Figure 5 with a projection for 2041-2070 in Figure 6. The mean monthly temperatures, seasonal averages, extreme minimum temperatures and extreme maximum temperatures were graphed to illustrate the predicted differences.

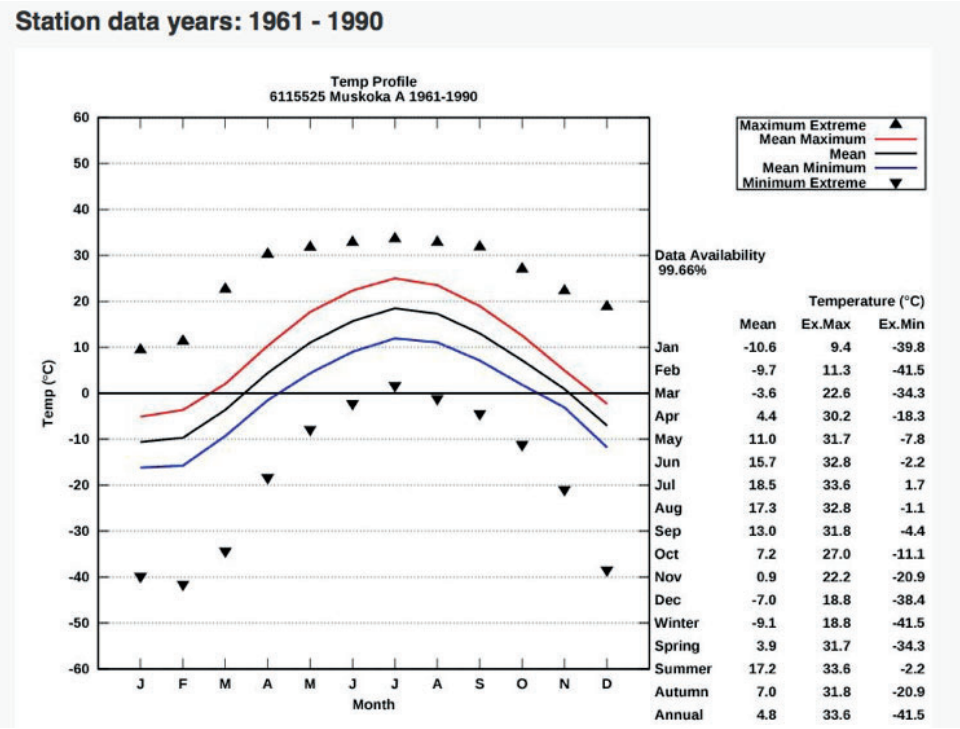

Figure 5: Temperature profile baseline 1961-1990

These models found that TCI rating declined in eastern Canada (Toronto and Montreal – the closest metropolitan areas) and although the TCI suggests that should result in fewer visitors, perhaps they would instead expand the time frame for visitation one or two more months of the year for summer recreation activities. More specifically for individual variables, the mean temperature will increase 3.1C by 2050s, 4.9C by 2080 and precipitation will increase 1.5 percent.

Discussion

From the TCI results it appears that the area's climate will dip from "excellent" but will continue to be very good for tourists' comfort and that the tourism-based businesses may continue to thrive in response to the desirability of the location. However, we need to explore how the changes in climate will impact the resources upon which tourism is based before sustainability can truly be ascertained.

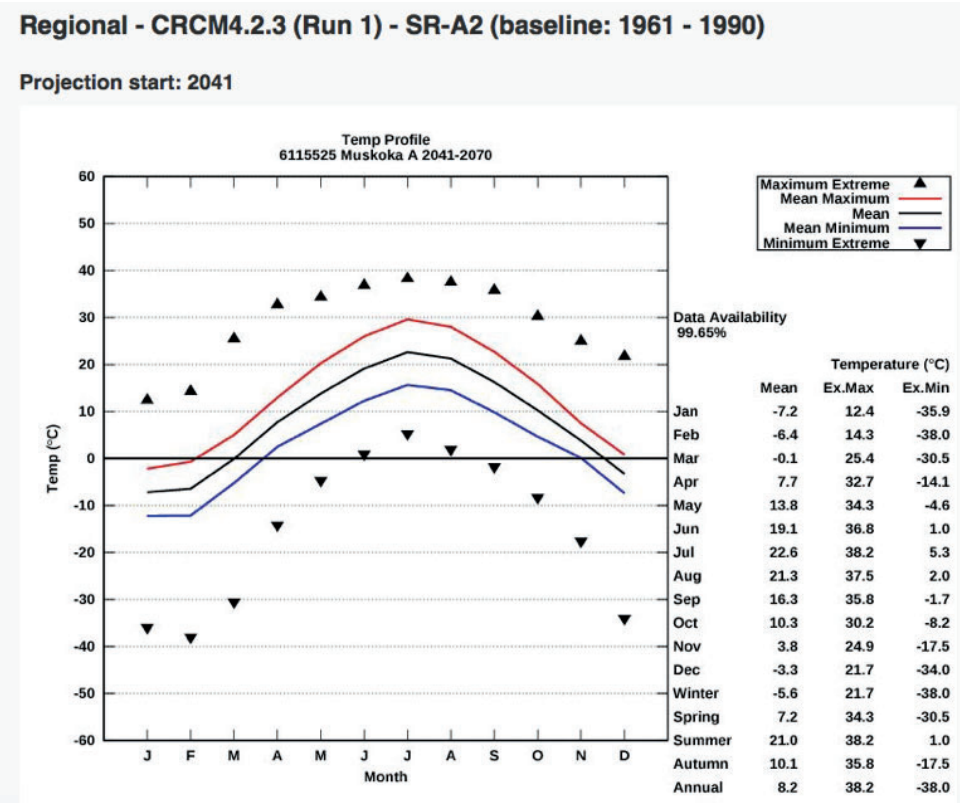

Figure 6: Temperature projection 2041- 2070

As was discussed previously, tourism in the Muskoka-Parry Sound regions can be considered ecotourism due to the reliance on natural resources for the pleasure and activity choices of the visitors. The visitor centers in the area are quite expansive with educational components, displays, artifacts and interpretive signage on trails. Most of the activities surround water, whether that is water-based activities such as swimming or boating, or wildlife viewing and/or harvesting (such as fishing or hunting) whose ecosystem depends on water, and any changes which will impact the temperature, quality, or quantity thereof, will threaten the sustainability of its use. The survey results illustrated a particular need to ensure long-term viability of water-based activities as they comprised the vast majority of all activities undertaken in the study region.

From the climate change scenario, we saw that the temperatures will continue to increase, and as the air temperature increases, the water temperatures will also rise. It is far beyond the scope of this paper to predict the exact impacts on freshwater ecosystems, but what is important

is to understand that there has and will continue to be changes, and businesses must be prepared to shift their practices accordingly if necessary. While some aquatic species may not be capable of withstanding water temperature increases, there is evidence to suggest that other's may be able to adapt. Understanding which species become more tolerant will be critical. Also important will be understanding the impacts on vegetation and other components of the ecosystem. This is not to say the changes will be predominantly negative. Warmer temperatures will extend the summer season on both ends (beginning earlier and stretching into the fall) allowing boating, swimming and some fishing activities to be enjoyed for longer periods of time. Although potentially shortening the winter season, an increase in precipitation may produce more snow (until a certain temperature rise) which would benefit other industries such as skiing and snowmobiling.

Tourism business operators should begin to consider expanding their options beyond reliance on one specific use of a resource. For example, a fishing camp may expand its offering to different species of fish, rather than relying on promoting one type or event (i.e. do not limit promotions and events to only bass fish). Hunting camps could expand the game licenses they seek to other specific of game that have and may continue moving into the area. Additionally, they may want to consider integrating types of activities that span several seasons rather than simply one.

Winter tourism operations should acknowledge that the amount of snow will decrease as a larger proportion of precipitation will fall as rain thereby decreasing the duration of snow cover and the depth of snow on the ground (Davidson-Arnott 2016), and also consider other possible activities to promote beyond renting huts for ice fishing and snowmobile rental to perhaps more all-season rentals such as "winter-friendly" cabins and recreational vehicle and boat rentals that are capable of bridging seasons.

Because many tourism areas are fractured in terms of governance, ownership and management practices, as we saw here, they cannot rely on complete collaboration with all stakeholders and thus a macro solution such as blanket policies may not be the most effective strategy. Each individual community needs to consider the resources that they rely on and examine where there may be overlaps with neighboring communities and where they could work together on a small scale. While this is not ideal and certainly not as effective as larger scale cooperation, best practices can still be applied and local solutions that are nimble and adaptable may prove more sustainable in the long run.

Conclusion

This study sought to explore climate change issues among ecotourism businesses and assess potential impacts on a local level. By utilizing a case study location with a high level of complexity, the difficulties that confront policymakers were illuminated. Trying to balance the needs of communities whose livelihoods rely on natural resources and the influx of tourists, but are not under the same governance structure is only one facet within this complex relationship. Factors such as differing cultural practices and competing uses for the same resources are compounded by the fact that the fragile economies are comprised mostly of small businesses,

often family-owned, and based on climate conditions that support seasonal tourism, recreation and the cottage industry.

Future research and conversations that surround climate change should consider a three-dimensional approach as was utilized here, to ensure all aspects are taken into consideration. It is imperative that we not only have reliable climate change scenario models for the physical environment, but that the economic and socio-cultural landscapes are intertwined within them. Additionally, the local voice from both the supply and demand perspectives can keep us abreast of changes and be the check points along the way. There are certainly many regions around the world with a similarly complex economic, sociocultural and environmental structure that could benefit from comparing situations. Thus, it may be up to future researchers to continue to share and compare case studies to ultimately achieve sustainability in the face of climate change.

Lorri K. Krebs is a Professor in the Geography and Sustainability Department at Salem State University. Email lkrebs@salemstate.edu. Her research interests center around environmental and economic sustainability, tourism, and community identity.

References

Amelung, B., Nicholls, S., and D. Viner. 2007. Implications of global climate change for tourism flows and seasonality. *Journal of Travel Research* 45: 285–296.

Boiral, O., Baron, C., and O. Gunnlaugson. 2014. Environmental leadership and consciousness development: A case study among Canadian SMEs. *Journal of Business Ethics* 123(3): 363-383.

Ciscar, J. C., Iglesias, A., Feyen, L., Szabó, L., Van Regemorter, D., Amelung, B., and L. Garrote. 2011. Physical and economic consequences of climate change in Europe. *Proceedings of the National Academy of Sciences* 108(7): 2678-2683.

Cross, M.S., Zavaleta, E.S., Bachelet, D., Brooks, M.L., Enquist, C.A., Fleishman, E., and G.M. Tabor. 2012. The adaptation for conservation targets (ACT) framework: A tool for incorporating climate change into natural resource management. *Environmental Management* 50(3): 341–351. doi.org/10.1007/s00267-012-9893-7

Cross, M.S., McCarthy, P.D., Garfin, G., Gori, D., and C.A. Enquist. 2013. Accelerating adaptation of natural resource management to address climate change. *Conservation Biology* 27(1): 4–13. doi.org/10.1111/j.1523-1739.2012.01954.x

Davidson-Arnott, R. 2016. *Climate change impacts on the Great Lakes*. http://www.abca.on.ca/downloads/Climate-change-impacts-on-coastal-processes-affecting-shoreline-of-ABCA-DRAFT-March-31-2016_1.pdf (last accessed 5 November 2019).

de Freitas, C. R., Scott, D., and G. McBoyle. 2008. A second-generation climate index for tourism (CIT): specification and verification. *International Journal of Biometeorology* 52(5): 399-407.

De Silva, S. S., and D. Soto. 2009. Climate change and aquaculture: potential impacts, adaptation and mitigation. *Climate change implications for fisheries and aquaculture: overview of current scientific knowledge. FAO Fisheries and Aquaculture Technical Paper* 530: 151-212.

Dubois, G., Ceron, J. P., Dubois, C., Frias, M. D., and S. Herrera. 2016. Reliability and usability of tourism climate indices. *Earth Perspectives* 3(1): 2.

Fennell, D. A. 2014. *Ecotourism*. London: Routledge.

Hall, M.C., Scott, D., and S. Gössling. 2013. The primacy of climate change for sustainable international tourism. Special issue: Critical perspectives on sustainable development. *Sustainable Development* 21: 112-121.

Hamilton, J. M. and R.S. Tol. 2004. *The impact of climate change on tourism and recreation* (No. FNU-52).

Heyvaert, M., Maes, B., and P. Onghena. 2013. Mixed methods research synthesis: definition, framework, and potential. *Quality and Quantity*: 1-18.

Jeppesen, E., Meerhoff, M., Davidson, T. A., Trolle, D., SondergaarD, M., Lauridsen, T. L., and A. Nielsen. 2014. Climate change impacts on lakes: an integrated ecological perspective based on a multi-faceted approach, with special focus on shallow lakes. *Journal of Limnology* 73(1): 88-111.

Johnston, A., Johnston, M., Stewart, E., Dawson, J., and H. Lemelin. 2012. Perspectives of decision makers and regulators on climate change and adaptation in expedition cruise ship tourism in Nunavut. *Northern Review* 35: 69-95.

Koski, C. and A. Siulagi. 2016. Environmental harm or natural hazard? Problem identification and adaptation in U.S. municipal climate action plans. *Review of Policy Research* 33: 270–290. doi:10.1111/ropr.12173

Leon, C. and A. Jorge. 2014. The economic valuation of climate change policies in tourism. *Journal of Travel Research* 55(3): 283-298. doi.org/10.1177/0047287514559034

Marcogliese, D. J. 2008. The impact of climate change on the parasites and infectious diseases of aquatic animals. *Revue Scientifique et Technique* 27(2): 467-484.

McDougall, G. 2016. *Consideration of climate change risks for ecotourism operators in business planning in Tofino, British Columbia* (Doctoral dissertation, Royal Roads University, Canada).

McKeiver, C., and D. Gadenne. 2005. Environmental management systems in small and medium businesses. *International Small Business Journal* 23(5): 513-537.

Mieczkowski, Z. 1985. The tourism climatic index: a method of evaluating world climates for tourism. *The Canadian Geographer* 29: 220-33.

Nordhaus, W.D. 2010. Economic aspects of global warming in a post-Copenhagen environment. *Proceedings of the National Academy of Sciences of the United States of America* 107(26): 11721–11726.

O'Laoire, D., and R. Welford. 1998. The EMS in the SME. In *Corporate Environmental Management: Systems and Strategies*, 2nd edition, ed. R. Welford, 199-209. London: Earthscan.

Revell, A., Stokes, D., and H. Chen. 2010. Small businesses and the environment: turning over a new leaf? *Business strategy and the environment* 19(5): 273-288.

Roson, R., and M. Sartori. 2014. Climate change, tourism and water resources in the Mediterranean: A general equilibrium analysis. *International Journal of Climate Change Strategies and Management* 6(2): 212-228.

Rosselló-Nadal, J. 2014. How to evaluate the effects of climate change on tourism. *Tourism Management* 43: 334-340.

Roshan G, Yousefi, R, and J.M. Fitchett. 2016. Long-term trends in tourism climate index scores for 40 stations across Iran: the role of climate change and influence on tourism sustainability. *International Journal of Biometeorology* 60(1): 33–52.

Royal Lepage. 2016. *Canadian Recreational Housing Report*. https://muskokalakesrealestate.com/wp-content/uploads/2016/06/Royal_LePage_2016_Canadian_Recreational_Housing_Report.pdf (last accessed 19 December 2019).

Sandelowski, M., Voils, C. I., and J. Barroso. 2006. Defining and designing mixed research synthesis studies. *Research in the schools: a nationally refereed journal sponsored by the Mid-South Educational Research Association and the University of Alabama* 13(1): 29.

Scholten, P. W. 2013. Agenda dynamics and the multi-level governance of intractable policy controversies: The case of migrant integration policies in the Netherlands. *Policy Sciences* 46(3): 217-236.

Scott, D., de Freitas, C., and A. Matzarakis. 2008. Adaptation in the tourism and recreation sector. In *Biometeorology for adaptation to climate variability and change*, ed. Ebi, K, Burton, I. and G. McGregor, 171–194. Dordrecht, Netherlands: Springer.

Scott, D., and C. Lemieux. 2010. Weather and climate information for tourists. *Procedia Environmental Sciences* 1: 146-183.

Scott, D., and G. McBoyle. 2001. Using a 'tourism climate index' to examine the implications of climate change for climate as a tourism resource. *Meteorologischen Institut Universität Freiburg*, 69-88.

Scott, D., McBoyle, G., and M. Schwartzentruber. 2004. Climate change and the distribution of climatic resources for tourism in North America. *Climate Research* 27(2): 105-117.

Scott, D., Rutty, M., Amelung, B., and M. Tang. 2016. An Inter-Comparison of the Holiday Climate Index (HCI) and the Tourism Climate Index (TCI) in Europe. *Atmosphere* 7(6): 80.

Sheppard, S. R., Shaw, A., Flanders, D., Burch, S., Wiek, A., Carmichael, J., and S. Cohen. 2011. Future visioning of local climate change: a framework for community engagement and planning with scenarios and visualisation. *Futures* 43(4): 400-412.

Statistics Canada. 2011. *Canadian Business Patterns*. http://www5.statcan.gc.ca/cansim/a26?lang=engandid=5510001 (last accessed 2 April 2019).

---. 2017. Muskoka, DM [Census division], Ontario and Canada [Country] (table). Census Profile. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released August 2, 2017.

Stern, N. 2007. *The stern review of the economics of climate change*. Cambridge, UK: Cambridge University Press.

Stone, B., Vargo, J., and D. Habeeb. 2012. Managing climate change in cities: will climate action plans work? *Landscape and Urban Planning* 107(3): 263-271.

Tranvik, L. J., Downing, J. A., Cotner, J. B., Loiselle, S. A., Striegl, R. G., Ballatore, T. J., and

P.L. Kortelainen. 2009. Lakes and reservoirs as regulators of carbon cycling and climate. *Limnology and Oceanography* 54(6 part 2): 2298-2314.

Trumpickas, J., Shuter, B.J., Minns, C.K. and H. Cyr. 2015. Characterizing patterns of nearshore water temperature variation in the North American Great Lakes and assessing sensitivities to climate change. *Journal of Great Lakes Research* 4: 53-64.