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To cite this article: Lydia Horne, Sandra De Urioste-Stone, Parinaz Rahimzadeh Bajgiran & Erin Seekamp (2022): Understanding Tourism Suppliers' Resilience to Climate Change in a Rural Destination in Maine, *Tourism Planning & Development*, DOI: [10.1080/21568316.2022.2083222](https://doi.org/10.1080/21568316.2022.2083222)

To link to this article: <https://doi.org/10.1080/21568316.2022.2083222>



Published online: 31 May 2022.



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Understanding Tourism Suppliers' Resilience to Climate Change in a Rural Destination in Maine

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ABSTRACT

Supplier characteristics influence destination resilience to climate change, but there is limited research applying social resilience theories to this group. Using socio-ecological and psychology resilience theories, we examined how a group of rural, nature-based tourism suppliers enhanced their resilience to climate change. We conducted 17 interviews in the Bay of Machias, Maine, USA to examine how characteristics of tourism suppliers influenced their resilience to climate change. Despite facing socio-economic challenges, suppliers were taking action to adapt to their most pressing climate change threat, flooding, by leveraging their knowledge, skill sets, and social ties. This study suggests that leveraging resources, collaboration, and developing connections to places through livelihoods may enhance the resilience of rural tourism suppliers. We suggest that the framework used in this study has broader applicability to understanding how suppliers can build destination resilience to climate change; however, the destination life cycle phase must be incorporated into resilience considerations.

KEYWORDS

Nature-based tourism; coastal tourism; destination resilience; qualitative research; phenomenology, Tourism Area Life Cycle (TALC)

Introduction

The largest climate change threats to tourism destinations relate to loss of visitors through disappearing attractions, seasonal inaccessibility, or changes in visitor markets requiring different tourism structures and product offerings (Lew & Cheer, 2018). Some destinations, such as summer destinations in northern climates, may experience benefits from climate change as warming temperatures increase their desirability (Fischelli et al., 2015); however, climate change poses numerous challenges for tourism destination resilience globally. Preemptive climate adaptation and planning are needed in destinations, particularly for coastal tourism areas dependent on natural assets vulnerable to climate change (Hestetune et al., 2018). In this paper, we seek to understand how characteristics of tourism suppliers (e.g. business owners, government managers, outdoor recreation non-profits, protected area managers, etc.), an important component of tourism destinations, can influence their resilience to climate change.

Resilience, adaptive capacity, and vulnerability

The concepts of resilience, adaptive capacity, and vulnerability are inherently linked. Holling first defined resilience as the “persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables” (Holling, 1973, p. 14). Adaptive capacity refers to the preconditions necessary to enable adaptation and the ability to mobilize these elements (Adger et al., 2011). Vulnerability is the degree to which a system is likely to experience harm due to exposure to a hazard or stress (Chapin et al., 2009). This conceptualization of a system’s adaptive capacity enables the integration of system characteristics and resources that either heighten its vulnerability or enhance its resilience to change. For example, if a destination is vulnerable and has limited adaptive capacity, it is more likely that a shock or stressor will push the socio-ecological system into an alternative state, demonstrating less resilience (Biggs et al., 2012). Recently, scholars have suggested that adaptive capacity can be thought of as a descriptive point on a spectrum of vulnerability and resilience to climatic impacts (Jurjonas & Seekamp, 2018). While many tourism suppliers are concerned about climate change, individual, ad-hoc actions are not enough to build the adaptive capacity and resilience of a tourism destination; collective action is needed. Tourism suppliers within a destination can function as a self-organized group to collectively act to reduce climate change vulnerabilities and enhance adaptive capacity and resilience within tourism destinations.

Tourism destinations and the importance of suppliers in fostering resilience

Tourism destinations include access, gateways, attractions, one or more host communities that contain tourism suppliers, and the linkages between attractions and these communities (Figure 1) (Gunn & Var, 2002). Within tourism destinations, host communities are essential as they provide access points (i.e. transportation hubs), support services (e.g. restaurants, water supply, gas stations, telecommunications, etc.), and often contain attractions and tourism suppliers, all of which support and link the community and tourists visiting the destination (Gunn & Var, 2002). Tourism suppliers are often part of host communities as they live within the destination and provide essential attractions and services.

Nature-based tourism destinations (i.e. those that rely on natural features to attract visitors) are sensitive to climate change, especially those in winter, mountain, and coastal destinations (Bitsura-Meszaros et al., 2015). Climate change will impact tourism demand, seasonality, and destination appeal, which are expected to shift under projections of future climate change scenarios (Gossling et al., 2012; Smith & Brownlee, 2018). In some cases, perceptions of climate conditions or environmental changes are as important to consumer choices as actual conditions (Arabadzhyan et al., 2021). While individual supplier adaptation behaviors can reduce visitor risk perceptions, without larger scale, collective adaptation strategies, individual tourism suppliers will remain vulnerable to climate impacts.

There is a growing recognition of the need to adapt to climate change and adopt mitigation strategies that reduce the carbon footprint of the industry, while also supporting economic development (UNWTO, 2016). The behavioral responses of tourism suppliers to climate change have long-term implications for the resilience of tourism destinations as

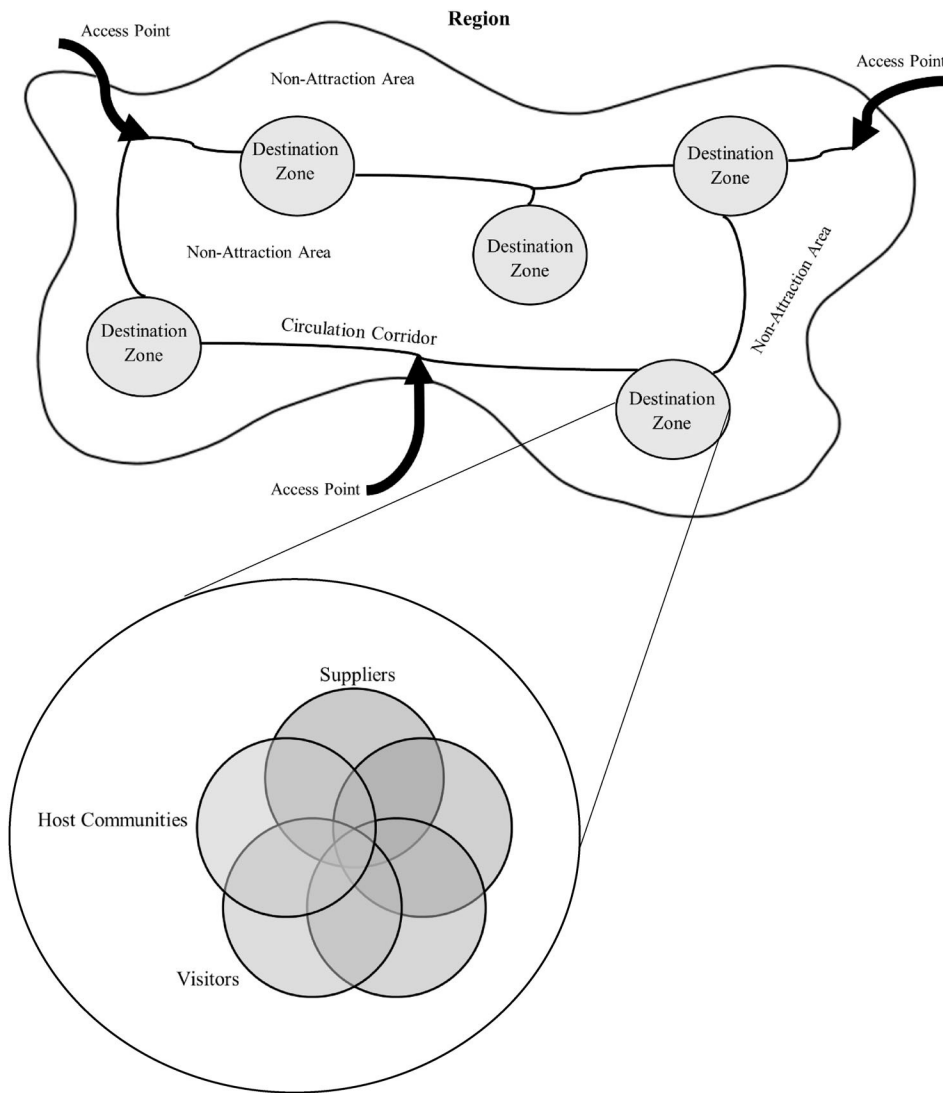


Figure 1. Conceptual figure of tourism destination region and destination zones (modified from Gunn & Var, 2002). Destination zones are comprised of attractions, services, host communities, suppliers, and visitors. All elements interact with each other and are not necessarily mutually exclusive. For example, tourism suppliers may live and recreate within the host community, thereby making them residents and visitors that utilize attractions and tourism support services.

they have the potential to disrupt supply and demand (Amelung & Moreno, 2012), which must be continuously aligned to provide satisfactory tourism products while also contributing to the destination's economy (Gunn & Var, 2002). While many tourism suppliers recognize their risk from climate change on some level, inaction is common due to a variety of reasons, such as not perceiving immediate action as necessary, not knowing how best to address climate change, or not having the resources to adapt to such a long-term, psychologically distant phenomenon (Gifford, 2011; Horne et al., 2021; Tervo-Kankare, 2018; Trawöger, 2014).

Destination adaptations can counter negative visitor perceptions and avoid undesirable shifts in visitation. For example, visitors to coastal destinations in Florida indicated high intention to travel to different destinations should climate change conditions worsen; however, they were willing to continue visiting Florida should adaptation measures, such as beach restoration and flood mitigation, be adopted by tourism suppliers (Atzori et al., 2018). It is therefore important to understand how tourism suppliers perceive climate change and what characteristics suppliers possess to enable effective responses that alleviate the negative effects from climate change while taking advantage of emerging opportunities. Despite the important role tourism suppliers play in climate change adaptation and destination resilience, few studies have looked at supplier characteristics that enable resilience-building responses. To begin to address this gap in the literature, we apply a resilience framework to identify characteristics that support or hinder supplier adaptation to climate change in a nature-based tourism destination.

Applying community resilience indicators to study supplier resilience

In this study, we apply a community resilience framework that describes attributes that enhance a groups' self-organization and agency. According to Magis, "community resilience is the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise" (Magis, 2010, p. 402). These community resources are often described as assets (Deason, 2018), and groups of stakeholders may actively build up their assets, including social, human, cultural, built, political, financial, and natural resources, so that they can respond to disturbances, create innovative solutions, identify opportunities, and shape the trajectory of the community's future (Maclean et al., 2014). For our analysis, we focus on Bay of Machias tourism suppliers as a group of stakeholders. Suppliers can act collectively to enhance resilience to climate change, live within host communities in destinations, and can be early responders to climate change.

One challenge in studying resilient communities is developing indicators of resilience that are measurable and applicable across contexts (Norris et al., 2008). For this research, we apply the framework developed by Berkes and Ross (2013) to understand how rural tourism suppliers within a nature-based destination in coastal Maine are responding to the impacts of climate change. This community resilience framework includes the following attributes: (a) social networks, (b) engaged governance systems, (c) leadership, (d) values and beliefs, (e) knowledge, skills, and learning, (f) a diverse and innovative economy, (g) people-place connections, (h) community infrastructure, and (i) a positive outlook and readiness to accept change (Berkes & Ross, 2013). Berkes and Ross (2013) developed their framework from a review of the psychological and ecological resilience literature, identifying commonly occurring characteristics of resilient individuals and ecosystems. The empirical findings that became the core characteristics of their framework indicate a robust approach to framework development. Applying core resilience characteristics from psychology and ecology to a community as a unit of analysis indicates the widespread applicability of such a framework, making it appropriate to apply these resilience characteristics to other groups of stakeholders, such as tourism suppliers. We chose

this framework due to the breadth of characteristics covered, our belief that the framework is applicable to settings beyond a community as a unit of analysis (i.e. tourism suppliers), and because it reflected the experiences and meanings generated by our study participants. The following paragraphs describe the elements present in the Berkes and Ross (2013) framework.

In previous studies, social capital and good relationships between stakeholders were essential for destination resilience (Dogru et al., 2019; Espiner & Becken, 2014; Kulig et al., 2013; Schuhbert, 2021; Traskevich & Fontanari, 2021). For example, strong social networks in tourism-dependent communities in China helped suppliers perceive and effectively cope with risks and changes (Guo et al., 2018). Self-organized stakeholders require leadership among individuals and/or groups to bring together diverse perspectives and facilitate decision-making and collective action (Magis, 2010). Adaptive governance adopts flexible management agendas but also refers to the processes of collaboration and cooperation across varying levels of authority (e.g. government agencies, nongovernmental organizations, individuals, etc.) (Lebel et al., 2006). Close relationships with municipal leaders are often unique to small towns that have high access to and involvement with officials compared to larger constituencies. Due to this ease of access, knowledge and concerns can “trickle up” from local stakeholders. Participation and collaboration in governance processes are associated with increased resilience and knowledge sharing across groups, and these processes are often associated with more effective adaptation outcomes (Davidson et al., 2013; Djalante et al., 2011).

Schwartz (1994) defines a value as a, “transsituational goal varying in importance, which serves as a guiding principle in the life of a person”. Values often reflect cultural frameworks and can be shared across groups of people. Biocentric worldviews are often associated with higher concern for environmental issues, including climate change and support for ecofriendly action (Dietz et al., 2007; Stern, 2018; Wynveen & Sutton, 2015; Ziegler, 2017). Values and beliefs, in combination with social capital, community networks, and shared social identity have contributed to resilience in previous literature (Berkes & Ross, 2013).

Knowledge, skills, and learning influence a group’s ability to respond to local problems through the use of information sharing and partnerships, technology and innovation, and skill development—such as financial, communication, and technical skills (Maclean et al., 2014; Schuhbert, 2021). For example, interviews with New Zealand’s “Glacier Country” suppliers indicated that participants viewed their community as a resilient one that included attributes of learning, reinvention, and self-organization (Espiner & Becken, 2014). Place-based relationships often contribute to resilience and are closely tied to lifestyle values through strong emotional bonds to a specific location or setting that influence attitudes and behaviors within place (Davenport & Anderson, 2006). Sense of place can influence social relationships, group identity, and respect for the physical features (Kaján, 2014). Previous studies found that people–place relationships are important in motivating and sustaining resilience efforts when resources, skills, and experience to implement changes are present (Amore et al., 2018; Amundsen, 2013; McElduff & Ritchie, 2018).

Livelihood and product diversification contribute to resilience at the individual, household, and community level such that if one livelihood activity collapses, others ensure access to financial capital (Biggs et al., 2012; Espiner & Becken, 2014; Jurjonas &

Seekamp, 2018; Su et al., 2016). Infrastructure is often indicative of the level of tourism development and type of destination, and destinations likely have different expectations and requirements of infrastructure depending on their position in the Tourism Area Life Cycle (TALC) model (Mandić et al., 2018). Being unable to access a tourism destination is one of the top threats posed by climate change (Lew & Cheer, 2018), which can be alleviated with climate-resilient infrastructure. A positive outlook and ability to accept change often manifest as feelings of hope, optimism, empowerment, and self-efficacy, or one's ability to influence change (Maclean et al., 2014), the lack of which can pose challenges, especially in relation to climate change adaptation (Milfont, 2012). Furthermore, a locally grounded approach that works with available resources can result in optimism and effective stakeholder action (Jurjonas & Seekamp, 2018).

Together these factors influence stakeholder agency and self-organization, ultimately shaping their resilience to shocks and stressors. Resilient groups of suppliers will possess some combination of these attributes, though not necessarily in equal quantities, and it is important to note that resilience can look different across contexts (Dogru et al., 2019). For example, a destination may possess an abundance of some Berkes and Ross attributes (relative strengths) while still developing others (relative weaknesses) as the destination builds resilience. Studying characteristics and drivers that influence supplier resilience is important for understanding how tourism-dependent destinations can respond to climate change shocks and stressors (Calgaro et al., 2014; Guo et al., 2018). Studying suppliers and the influences that enhance or detract from resilience is an important piece for understanding destination-level resilience (Amore et al., 2018; Ngin et al., 2020; Prayag et al., 2020; Tsai et al., 2016). By applying the community resilience framework by Berkes and Ross (2013), this study contributes to a deeper understanding of the factors that enhance resilience of natural-resource-dependent tourism suppliers and destinations.

Materials & methods

Study site

The Bay of Machias is home to approximately 5,500 residents, with just under 2,000 living within the town of Machias (Census, 2010). The Bay of Machias destination includes Machias and the surrounding communities of Machiasport, East Machias, Whitneyville, Marshfield, and Roque Bluffs (Figure 2). The Bay of Machias is located to the north of Mount Desert Island and Acadia National Park and is connected via coastal Route 1 highway. Unlike other coastal tourism destinations in Maine, area residents live here year-round, and the economy is reliant on wild blueberry harvesting, fisheries, and nature-based tourism. The average household income for Bay of Machias residents was \$30,093 USD in 2016, well below the average income of \$53,079 USD for all Maine residents (City Data, 2018). This area suffers from a higher rate of poverty, with 29.1% of residents living below the poverty line, as compared to 12.9% statewide (City Data, 2018). The town of Machias is also home to the University of Maine at Machias which is involved in several community-based outreach projects, including assessing the physical vulnerability of area infrastructure to rising sea level and flooding due to climate change.

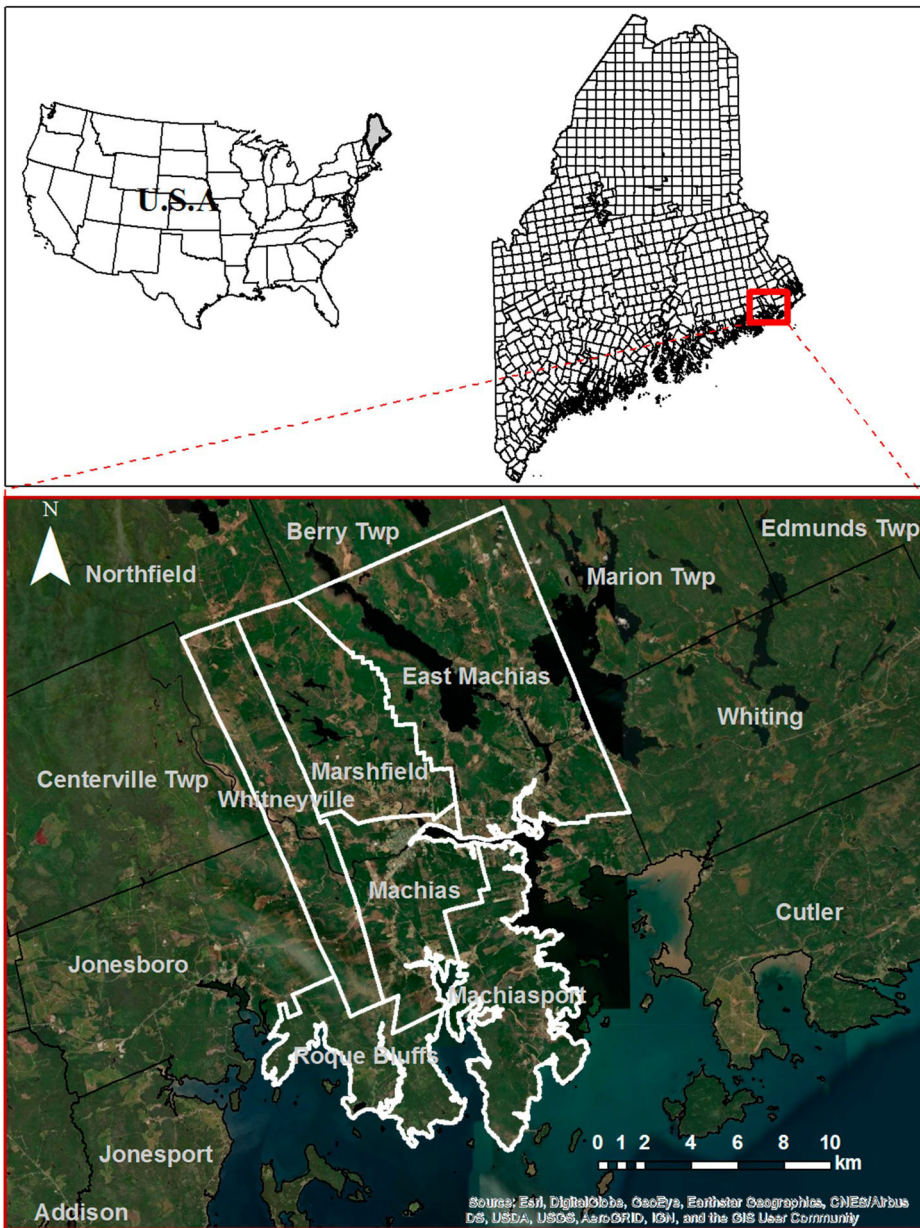


Figure 2. Map of Bay of Machias study site.

Key tourist attractions are within surrounding communities, including protected areas, public lands, and other conserved areas. Additional attractions include marine wildlife tours, historical sites, fishing culture, recreational water activities, leaf peeping, and culinary tours. The town of Machias serves as the major destination gateway as it contains the highest number of attractions and support services and the Chamber of Commerce, which provides visitor information. There is no data measuring visitation or the economic contribution of tourism to the Bay of Machias.

The Bay of Machias will experience many climate change impacts as average annual temperature continues to increase (Fernandez et al., 2020). Summers are becoming longer with more precipitation, while winters are becoming shorter with less snowfall (Fernandez et al., 2020). Scientists are observing rising sea levels, ocean acidification, rising ocean temperatures, species and ecozone shifts, changing fisheries, disappearing salt marshes, beach erosion, and increased flooding (Birkel & Mayewski, 2018) which are likely to impact the tourism industry, especially low-lying coastal destinations like the Bay of Machias.

Methodology

We used a phenomenological methodology to understand our participants' lived experiences and their subjective understandings of those experiences (Moustakas, 2014). Phenomenology studies individual experiences because behaviors are determined by the phenomena being experienced rather than an objective reality (Sloan & Bowe, 2014). Through phenomenology, we can understand the "essence" of being a nature-based tourism stakeholder in a coastal tourism host community experiencing and adapting to the effects of climate change (Sloan & Bowe, 2014). Phenomenology assumes that individuals are the vehicle through which the essence of a phenomenon is accessed and described and that researchers can access that essence through interviews or written descriptions (Giorgi et al., 2017).

We conducted semi-structured interviews with nature-based tourism stakeholders working in the Bay of Machias study site, including: business owners (6), non-profit organizations who support tourism (8), local municipal officials (1), and researchers whose work overlaps with this project (2). The study site contained the town of Machias, a county seat, which means that there is a higher number of services and non-profits in the area relative to the population. This explains why our participant sample has a high number of non-profits represented. It should be noted that these non-profits typically focus on conservation and/or community development in which tourism plays an important role, hence their opinions were important as we sought to understand climate change resilience in a natural-resource-dependent tourism destination. The number of interviews ($n = 17$) was determined by data saturation, the point at which no new data emerged (Patton, 2015).

We generated an initial list of potential interviewees that included voices from different types of suppliers; participants were further selected using chain referral whereby participants recommended other potential participants (Patton, 2015). The small size of the tourism destination and word of mouth allowed us to gain entry with destination planners and developers. Presenting the project at a regional meeting, the Downeast & Acadia 4th Annual Tourism Symposium (November, 2018) at the start of the project helped build rapport with stakeholders. Additionally, executing a small visitor survey in the area was another way to build trust.

We used semi-structured interviews to understand (1) belief and knowledge of climate change, (2) experiences with climatic change, (3) challenges and opportunities to their organization/business posed by these changes, (4) peer awareness and concern regarding climate change, and (5) planned and in-place adaptation and mitigation strategies. Interviews were recorded and transcribed verbatim to be as close to participant's meanings as

possible (Giorgi et al., 2017). We interviewed participants from fall of 2017 to spring of 2020. Interviews were typically 60–90 min in length. Interviews were conducted face-to-face (10) and via phone (7). Due to the COVID19 pandemic, the last six interviews occurred over the phone (one pre-pandemic interview was over the phone due to inclement weather). This certainly influenced interview responses. Data were stored and analyzed in NVivo 11 Pro ©.

Analysis

We used interpretive phenomenological analysis (IPA) to explore interview transcripts, using an iterative process of constructing themes and sub-themes from the data (Giorgi, 1997). We began the analysis by reading through each transcript in full before coding, allowing us to grasp the description holistically (Giorgi et al., 2017). Researchers bracketed previously held knowledge regarding the phenomenon (climate change impacts to the tourism industry) to ensure that we considered “what [was] given precisely as it [was] given” by participants (Moustakas, 1994). First cycle coding identified patterns emerging from in vivo codes (codes in the exact words of participants) (Miles et al., 2020), which we later clustered into pattern codes (categories) where participant ideas were connected to meaning units (Giorgi et al., 2017). Using phenomenological reduction, these preliminary in vivo codes were condensed into descriptive nodes (horizontalization) (Giorgi, 1997; Miles et al., 2020). We used multiple iterative rounds of coding, concept maps, quotations, and memoing to draw conclusions and understand participants’ lived experiences as tourism stakeholders experiencing and adapting (or not) to climate change impacts (De Urioste-Stone et al., 2018; Moustakas, 2014). As a final cycle of IPA, and using the phenomenological reductive approach to data analysis, we aggregated the meaning units (codes) into themes to understand the psychology behind participants’ experiences, moving beyond description to include interpretation (Giorgi et al., 2017; Sloan & Bowe, 2014).

Results

We have organized our results by describing nature-based tourism stakeholders’ experiences with and responses to climate change impacts. We then use the Berkes and Ross framework to interpret the data to understand what assets contribute to tourism suppliers’ climate change resilience.

Tourism stakeholders’ experiences with climate change

Participants experienced and were aware of many climate change impacts. Increased ticks, changing winters, changing oceans, and flooding were most frequently mentioned. Other impacts included shifting seasons, changing wildlife, more storms and extreme weather events, and warming temperatures. Tourism suppliers noted increasing tick populations and the risk of Lyme disease for themselves and visitors, as well as the impact of tick-borne illness on moose (a key tourism attraction). Tick abundance is indeed increasing in Maine, with milder winters resulting in increased tick survival and higher rates of moose mortality (Jones et al., 2019). Despite accurately describing the

increased threat from ticks to tourism as a result of climate change, almost no adaptation actions were described, the exception being warning visitors of tick-borne illnesses.

Changing winters were remarked upon by eight participants who described the yearly fluctuations in snowfall and the unpredictability of snowfall amounts. Average annual snowfall has been decreasing in Maine since 1896; however, the rate of change has been nearly zero since 1960 despite several recent low snow years (Fernandez et al., 2020). The near stagnant rate of decline over several decades is difficult to detect and could explain the variation in participant observations. While not a winter destination, the Bay of Machias has the Sunrise Trail that is popular with snowmobilers and skiers. The only adaptation response described by participants to variable winter conditions was canceling outdoor recreation activities from lack of snow or ice.

Changing oceans covered a multitude of climate impacts, including ocean acidification, warmer water temperatures, sea level rise, changing fisheries and marine food webs, bigger tidal events, more frequent storms causing infrastructure damage, and erosion. Data supports supplier observations. Sea level is rising (7.5 in. since 1912 in Portland, the longest recording station in place along Maine's coast), flooding is increasing, ocean temperatures and chemistry are changing, and ecosystems are shifting as a result (Fernandez et al., 2020). While 9/17 participants described climate change impacts to the Gulf of Maine, few changes were being made as a result. Changing business offerings, such as changing kayak routes, was mentioned by two business owners, while one marine tourism business owner said climate change has not impacted his business.

Sea level rise was a contributing factor to flooding, along with tidal events, storms, and extreme precipitation. In addition to damaging stores and homes, flooding cuts off transportation. A lot of tourism infrastructure is located on the water and in danger of flooding, including the downtown Machias area that connects the Bay of Machias to tourism markets via Route 1. The most discussed climate change adaptation strategy was improving infrastructure to be more resilient to flooding, such as through the exploration of a seawall, replacing culverts to improve water flow, and creating bridges on flood-prone recreation trails.

Supplier traits within the Bay of Machias will influence climate change resilience and adaptation actions. The next sections examine what attributes from the Berkes and Ross framework contribute to supplier climate change resilience. Data have been paraphrased and categorized according to Berkes and Ross (2013) resilience attributes, and example quotes from participants can be found in Table 1.

Social networks, engaged governance, and leadership

Sense of community was demonstrated in partnerships between tourism stakeholders. Interviewees mentioned working with different economic development agencies, tourism organizations, town offices, and the University of Maine at Machias. Working relationships were described in terms of information generating and knowledge sharing between groups and in terms of interpersonal relationships that formed the backbone of collaborations. A history of working together resulted in strong interpersonal connections within and across suppliers enabling participants to leverage skillsets to accomplish more complex tasks than would be achievable if working alone. Climate

Table 1. Illustrative quotes for each resilience framework characteristic.

Category name	Description of category	Illustrative quotes
Social networks	Networks of collaboration and cooperation	<p>"It's a close-knit community".—Kathy</p> <p>"And the sense of community, everybody knows everybody and as much as a deterrent those low population numbers can be, sometimes that sense of community creates is invaluable. Let there be a disaster and everybody pulls out all the stops to help".—Molly</p>
Engaged governance	Social and institutional structures and processes that engage citizens with decision-making processes	<p>"[T]he flood resilience stuff is big. One of the great things about how [Machias is] doing [flood mitigation] is that it's incorporated, they're incorporating it into their long-term plans for rebuilding and improving their downtown".—Nancy</p> <p>"I know these municipal officials very well and they know me. And so when I need to, ya know, get support letters for a regional request [...] they were like "Absolutely, I am right behind you, what do you need?"</p> <p>—Beth</p>
Leadership	Leadership among individuals and/or community groups to bring together diverse perspectives and facilitate decision-making and collective action	<p>"The town was able to get the grant, look at the planning process of doing that. We don't have any money to actually construct it, but I think it's really forward thinking. The town revitalization committee brought up the issue to the selectmen and said that we really need to start looking at something".—Molly</p> <p>"We have an intricate, intricate state and federal system that supports [the lobster fishery management] but is largely managed by the community and has done an incredible job of stewarding the resource".—Greg</p>
Values and beliefs	Shared beliefs, values, and ideas within a community	<p>"It is tough because [the area] is very conservative and really low income, but they know what is going on in their hearts. They know what is going on, so we can work with that if we are smart about it".—Tony</p> <p>"We're pretty well supported. Our public, you know, perception is really strong. You know, people really, sort or believe in our mission and what we do".—Ethan</p>
Knowledge, skills, and learning	Knowledge sharing, partnerships, technology and innovation, skill development, such as financial, communication, and technical skills; creation of new knowledge	<p>"I have thirty-five years of experience as a professional and have learned a hell of a lot in the last decade, and I feel that it's time to, to try out some new management things".—Seth</p> <p>"We discovered that Machias downtown, most of the large employers are very, very vulnerable to storm surge and sea level rise related flooding. And they weren't aware of that before [the mapping work], and they were literally doing nothing about it".—Nancy</p>
People-place relationships	Strong emotional bonds that influence attitudes and behaviors within a place; lifestyle values	<p>"I hope that's a reversing trend, you know, that our best and our brightest aren't all going out, that some of them are going to stay here because the Machias area of Washington County is a unique place".—Kathy</p> <p>"[W]e have richness, and people, and their richness and values. It seems to be lacking in some other places ... [W]e are not going to be the richest financially. So? [...] We can be the</p>

(Continued)

Table 1. Continued.

Category name	Description of category	Illustrative quotes
Diverse and innovative economy	Ample economic opportunity; diversified livelihood activities	richest when it comes to human values and I think that is really important".—Mary "We were dependent on fishing, lobstering, forestry, those are sort of the Maine, blueberries and agriculture and things. So those are kind of in the realm of to support your livelihood for the future".—Ethan "I said when I started this business, the one thing I learned was be diversified".—Patrick
Community infrastructure	Built infrastructure and tourism superstructure	"[M]ost bridges in Maine are at least a hundred years old. So the chances of getting that changed are probably little to none because [Maine Department of Transportation] can't afford to replace the ones that they need to replace, right. Never mind one that's functioning right. So we're probably 50 or 60 years out from seeing any chance of change".—Dianne "[A] lot of money is going to put into bring [infrastructure] up to a standard that can withstand this level of water rising. So those are resources that we are not able to put into other things as well".—Mary
Positive outlook	Ability to accept change often manifest as feelings of hope, optimism, empowerment, and self-efficacy	"I mean the opportunities are endless [...] I think anything that I can dream can become an opportunity. I mean I can make my dreams happen".—Emily "I went to lots of selectmen's meetings and other meetings and everybody at these meetings always said, 'Oh, well we can't do that. We've never done that before'. Now I see a shift and it is a shift in optimism. First of all, they are not waiting for Augusta to come and help us but they are doing it themselves and they are making changes on their own, they are not waiting for someone to come in on a white horse and save us".—Molly

change concerns were being incorporated into municipal projects because of partnerships between tourism suppliers and government representatives. For example, a small leadership team of tourism suppliers, comprised of non-profits, a municipal leader, and a researcher, had recently successfully acquired a grant to explore seawall construction to reduce flooding.

Belief in climate change

Most participants (13/17) were aware that climate change was impacting the destination, especially in connection to downtown flooding, though some argued that flooding was a normal event that was not worsening or becoming more frequent. Having experienced events first-hand, in combination with knowledge about their causes through flood maps, most participants were concerned about climate change impacting the Bay of Machias (12/17); however, not all felt this was a pressing issue or that flooding was connected to climate change, indicating mixed levels of supplier concern.

Knowledge, skills, and learning

The University of Maine at Machias is propelling climate change conversations among local leaders and tourism planners. Through an online participatory GIS mapping tool, planners can understand future flood projections for the Bay of Machias, connecting their first-hand experiences with flooding to local data. In addition to flood knowledge, participants relied on guest speakers brought in via the University of Maine at Machias and local organizations, direct contact with scientists, scientific reports, and their own observations for climate change knowledge.

People-place relationships

An environmental ethos was described by several participants. This relationship was illustrated by the close connection to livelihood strategies reliant on lobsters and fishing, long-term stewardship practices, and a history of land protection, resulting in numerous protected areas. While certainly not all individual action reinforces sustainable resource use, participants agreed that a strong connection to the natural resource base resulted in a largely shared environmental ethos throughout the region; however, low population numbers and difficulty retaining youth were described as challenges (e.g. difficulty finding employees) related to place. Suppliers saw both positive and negative aspects of place, and we therefore categorized people-place relationships as “mixed” in our evaluation of the strength of supplier resilience to climate change.

Diverse and innovative economy

Economic development and diversification are central to many Bay of Machias agencies. Participants acknowledged a lack of economic opportunities, resulting in emigration of locals to areas with more jobs. Though once home to a bustling harbor for timber shipments, the mills have since closed, resulting in livelihood shifts. Fishing remains strong, though participants raised concerns about climate change impacting lobsters. The closing of nearby canneries was another economic blow for the area. With the loss of traditional industries, the Bay of Machias began developing nature-based tourism. The destination has numerous economic development agencies tasked with furthering livelihood options, including tourism expansion; however, even with tourism success stories, participants described how locals remain skeptical of tourism as a livelihood option. The area remains economically underdeveloped, in part due to resistance to tourism development, creating vulnerability to climate change in the destination even while some are increasing their individual resilience through livelihood diversification.

Community infrastructure

Participants viewed destination infrastructure as aged and underdeveloped. This was the most discussed weakness regarding tourism and economic development. Infrastructure was a problem but addressing the issue remained outside the scope of what tourism suppliers could address. Old and underbuilt infrastructure, poor roads, limited transportation, and the overall lack of infrastructure (especially in terms of housing stock for residents and

bed base for tourism) were cited as major problems. There is no public transportation and no car hire services. Road conditions are poor along Route 1, and there are few places safe for bicycling. Limited housing stock was a challenge for attracting long-term residents and tourists, as was limited internet access. Infrastructure problems were connected to financial concerns and the acknowledgement that towns within the destination did not have money to address infrastructure problems. There was little destination-level control over adapting infrastructure to cope with climate change. As participants described, financial resources are scarce and issues of poverty, food insecurity, opioids, and lack of healthcare are widespread; therefore, allocating resources for infrastructure is a huge burden that takes away funds from other projects.

Positive outlook

There were a handful of proactive, highly engaged tourism suppliers central to destination development who were promoting tourism as a tool for economic development. Many participants acknowledged that they could not stop climate change, but they could adapt to climate impacts. As one participant describes, instead of waiting for the state to resolve local problems, tourism suppliers felt as though they could explore climate change solutions that also address other local challenges, such as economic development and infrastructure maintenance. This empowerment resulted in the exploration of novel solutions and taking the initiative to build resilience into policies and programs without waiting for oversight from higher levels of government.

Discussion: destination size creates trade-offs in resilience and vulnerability

Despite being often described as a geographically isolated, resource-poor destination, Bay of Machias suppliers exhibited many resilient characteristics (Table 2). Social networks, engaged governance, leadership, knowledge, skills, and learning, and a positive outlook were all strengths possessed by suppliers. Little economic diversity and development and limited infrastructure were the most pressing vulnerabilities. People-place relationships and beliefs and values contributed to both resilience and vulnerability of tourism suppliers and the Bay of Machias destination. In this discussion, we reflect on the trade-offs to resilience and vulnerability in relation to the Berkes and Ross framework (2013), destination size, and TALC stage.

Table 2. Summary of Berkes and Ross (2013) resilience attributes in Bay of Machias tourism suppliers.

Community resilience Attribute	Bay of Machias assessment
Social networks	Strong
Engaged governance	Strong
Leadership	Strong
Values and beliefs	Mixed
Knowledge, skills, & learning	Strong
People-place relationships	Mixed
Diverse & innovative economy	Weak
Community infrastructure	Weak
Positive outlook	Strong

Strong social networks across tourism suppliers are not a given, especially as suppliers compete to attract visitors. While there were tourism suppliers that offered overlapping products within the Bay of Machias, competition for visitors was not discussed by participants. It may be that the small number of both suppliers and visitors in the Bay of Machias fostered cooperation rather than competition. While smaller numbers enhanced social networks, engagement with governance processes, and leadership, a lack of economic diversity (i.e. system redundancy) can result in destination vulnerability to shocks and stressors (Davidson, 2010). For example, the closure of one of only two hotels in the Bay of Machias would halve the lodging capacity of the destination whereas a more developed destination with multiple lodging facilities would be more resilient to such a loss.

The smallness of the destination (in terms of number of people) also played a role in limiting infrastructure. A smaller tax base and fewer residents resulted in limited infrastructure development. While limited infrastructure can be a positive attribute in rural, nature-based tourism destinations (e.g. sense of wilderness, “roughing it,” escapism, etc.), participants described the lack of infrastructure as limiting for tourism development and the ability to support local needs. In a similar study, an assessment of destination resilience and vulnerability in coastal Vava’u, Tonga found that limited infrastructure, especially transportation, communication, and physical infrastructure, was a key vulnerability to shocks and stressors (Veeken et al., 2016). It may be that tourism infrastructure development would increase the Bay of Machias’ resilience to climate change, especially given that natural resources are abundant and infrastructure development would likely not interfere with such attractions. Were the destination to grow in size and popularity (as suppliers believe is occurring slowly), economic development and financial capital would likely increase in the destination, enabling infrastructure vulnerabilities to be addressed; however, an increase in visitors would likely demand an increase in suppliers, creating redundancies that could augment resilience while increasing competition, which could attenuate resilience.

Visitor interactions with suppliers and other members of the host community will change as the Bay of Machias moves through the TALC (Butler, 1980). At present, tourism in the Bay of Machias is slowly increasing, some locals are embracing tourism as a livelihood strategy, and the destination is being advertised as a means to increase visitor numbers; however, interactions between tourists and the host communities remain limited and will need to be thoughtfully managed to avoid future conflict as the destination develops (Mandić et al., 2018). Increased visitation might result in tourism becoming more accepted as a livelihood strategy, creating much needed economic development; however, with larger visitor numbers, the potential for resident-tourist conflict also increases (Goeldner & Ritchie, 2012; Martin et al., 2018). Increasing visitation could also widen a fissure within the host community between those who embrace and benefits from tourism and those who continue to resist and do not receive benefits. Our results indicate that this division in values already exists within the Bay of Machias and could become a greater source of vulnerability should tourism development continue.

The stage of development may play a role in influencing a destination’s ability to recover from shocks, thereby influencing the destination’s resilience; however, it is unclear if a more developed destination is insulated from shocks and stressors and therefore more resilient. For example, a study comparing the recoveries in Singapore (consolidation phase) and Vietnam (involvement phase) to SARS disease found that, while

both tourism markets were proportionally impacted by the outbreak initially, Vietnam's tourism economy recovered more quickly (Bojanic, 2003). This difference in recovery rates was explained by the quantity of visitors needed to reach previous visitation levels in Singapore and the novelty (e.g. limited willingness/ability to substitute destination, more rapid innovations occurring) associated with a more developing destination, such as Vietnam (Bojanic, 2003). In contrast, a comparison of Grenada (more developed destination) and Barbados (less developed destination) found that Grenada recovered more quickly from shocks (e.g. economic recessions, the September 11 terrorist attacks) (Bangwayo-Skeete & Skeete, 2020). This was attributed to multiple contextual factors associated with Barbados, including the higher cost of vacations, more restrictive visa requirements, and a less cohesive advertising strategy (Bangwayo-Skeete & Skeete, 2020). Development comes with trade-offs. For example, more visitors will require more suppliers. This will likely result in increased resilience as the supply side of the destination becomes more robust and the destination can withstand shocks through this redundancy; however, increased competition may reduce individual supplier's resilience even as the destination as a whole will likely become more resilient to climate change impacts. Additionally, if increased development erodes the social fabric of the Bay of Machias, weakening social networks, partnerships, and the ability of suppliers to engage in decision-making processes, gains in economic development and infrastructure may not improve resilience to climate change.

Future research directions

Future research should focus on finding further ways to apply resilience frameworks to different elements of tourism destinations. Based on our discussion, we suggest that the Berkes and Ross (2013) community resilience framework is imperfect when applied to tourism destinations as it fails to account for dynamic tourism life cycle events. For example, as tourism development increases in the Bay of Machias, economic development will also develop and lead to increased resilience; however, there are likely negative tradeoffs to economic diversity, such as increased competition and potential degradation of social relationships between suppliers. We suggest that the Berkes and Ross (2013) framework could be usefully applied to tourism destinations if paired with the TALC model (Butler, 1980). The TALC is similar to the concept of the adaptive cycle in that destinations adapt and evolve in response to changing market conditions (Pearce, 2014). Combining the Berkes and Ross (2013) resilience framework with the TALC would offer a more nuanced understanding of how characteristics of suppliers and a destination can enhance or reduce resilience depending on the state of destination development.

This theoretical combination of the Berkes and Ross (2013) resilience framework and the TALC (Butler, 1980) could be especially helpful for developing destinations located in rural areas and/or developing countries that rely on natural features as tourism planners, managers, and suppliers consider the tradeoffs associated with tourism development. Considering development and resilience tradeoffs would also be important for destination planning where rifts exist between stakeholder groups regarding tourism development (e.g. between residents and visitors, between tourism industry and non-tourism industry workers. etc.), as these conflicts have the potential decrease destination resilience even as visitation and economic development increases. As such, future

research should also incorporate the perceptions of tourists and residents as consumers in a supply chain undergoing alterations from climate change, as value co-creation is occurring across a broader value ecology in these destinations (Tham et al., 2015). These studies should assess diverse consumer and supplier perceptions about pathways to curb climate emissions within the tourism supply chain, by simultaneously seeking “high value-low carbon-resilient” destination management strategies (Gössling & Higham, 2021, p. 1168). Furthermore, future research should situate the Bay of Machias destination in the broader context of tourism suppliers including collaborations and competition to regional and state tourism planners and their impact to supply chain resilience (Tasnim et al., 2021).

The current study focused on a small, nature-based tourism destination. Considering the theory of panarchy and the nested, interactive natures of resilience across scales (Holling, 2001), further testing of resilience concepts at different scales is needed. Specifically, it is unclear if concepts related to the Berkes and Ross (2013) community resilience framework will be applicable in larger, more developed tourism destinations. Future research should consider the destination development stage and its influence on available assets and pathways to climate resilience. Studying Bay of Machias residents and visitors was beyond the scope of this project. Further study on resident attitudes could gauge support for tourism in the Bay of Machias and contribute valuable information for destination planners and developers by potentially alleviating negative impacts from tourism while ensuring that costs and benefits are equitably distributed across tourism stakeholders. In addition to providing baseline data, studying visitor numbers and behaviors in the Bay of Machias could help determine how vulnerable visitation is to climate change.

Conclusions

This study adds to the growing body of literature connecting tourism research with resilience concepts. By applying the Berkes and Ross (2013) framework to a group of tourism suppliers, we were able to relate concepts from the community resilience literature to a tourism setting. From this study we learn how tourism suppliers in a rural, under-built destination can collectively deploy their resources to enhance their resilience to climate change. Our study reveals how social, natural, human, and political assets can bolster tourism suppliers’ agency even when other assets (e.g. financial and built) are lacking. Suppliers experienced a range of climate change impacts, including increased ticks, changes to winter, and changing oceans. While aware of these impacts and accurately linking them to climate change as a cause, adaptation actions were limited. This is perhaps a result of only recently observing impacts or a lack of knowledge to adopting effective adaptations. It may be that the characteristics that foster resilience present in Bay of Machias suppliers will facilitate more widespread adoption of adaptation actions as continued and emerging climate change impacts are experienced across the tourism destination.

Being resilient to climate change will be different across destinations, with no “one size fits all” approach, especially as actions may reflect the stage of destination development. Additional research about how consumers—that is, tourists—will respond to a changing climate in any particular destinations will advance understanding on the role of value co-creation in the broader tourism ecology of destinations. Nevertheless, rural, nature-based

tourism-dependent suppliers should consider their strengths, available assets, and most pressing concerns, as well as their ability to leverage assets through partnerships and networks, when determining actions to build climate resilience.

Acknowledgement

The authors thank MacKenzie Conant, Nick Ferrauolo, Nathaniel Burke, and Asha DiMatteo-LePape for transcription and Alyssa Soucy for her map making skills. Finally, thank you to all study participants.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the National Oceanic and Atmospheric Administration (Grant Number NA17OAR4310249); the National Science Foundation (Grant Number 1828466); the USDA National Institute of Food and Agriculture (McIntire-Stennis project number ME0-42017).

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