Climate Change and the Sacredness of Water in Native America: A Case Study in the Keweenaw Bay Indian Community, Michigan, USA

Andrew T. Kozich, Keweenaw Bay Ojibwa Community College

Climate change is a scientific phenomenon that has recently been debated within the political arena; regardless of political viewpoint, the potential impact on communities is critical to understand and address. Andrew Kozich investigates climate change within Michigan's Keweenaw Bay Indian Community, which, like other indigenous communities worldwide, is facing potential environmental, economic, and cultural impacts from climate change, including the threat to its most sacred resources. With the objective of gaining insight into perspectives within the community on climate change, three key themes emerged from an analysis of interviews conducted, providing valuable insights for community and tribal leaders: 1) water resources are extremely valued; (2) climate change is happening and will have wide-ranging negative impacts; and (3) support for climate change planning is high and should include traditional ecological knowledge.

Introduction

There is little doubt across the scientific community that global climate change is occurring and will likely continue into the future (Intergovernmental Panel on Climate Change, 2014; National Oceanic and Atmospheric Administration, 2013; United States Environmental Protection Agency, 2014). Likewise, scientists are very certain that the climate phenomena observed over recent decades are not natural in origin but are caused by human activities such as fossil fuel combustion and land-cover change (Intergovernmental Panel on Climate Change, 2014). As trapped gases in the atmosphere cause the planet to warm, numerous weather-related events are correspondingly altered in ways that negatively impact human populations (e.g., increased storm intensity, more frequent floods, droughts and fires resulting from heat waves, and so forth). Scientists have therefore transitioned to the phrase 'climate change' over 'global warming', because the documented and anticipated changes include much more than just a warmer world (National Oceanic and Atmospheric Administration, 2013).

While negative impacts from climate change will be felt by many (in some fashion and to some degree), rural communities that are dependent on natural resources are particularly vulnerable (Karl, Melillo, & Peterson, 2009; Lal, Alavalapati, & Mercer, 2011; Thomas & Twyman, 2005). In the U.S., the rural communities that encompass 80% of the landscape have lower income, lower educational attainment, greater dependence on government programs, higher mortality rates, and fewer health and emergency services than urban centers (Lal, Alavalapati, & Mercer, 2011). These factors, combined with geographic isolation, result in a reduced capacity to overcome impacts of climate change.

Native American communities are particularly susceptible to negative impacts of climate change. Because Native worldviews and lifestyles typically include intimate relationships with the environment, impacts from ecological shifts, losses of natural and cultural resources, and losses of ancestral homelands would likely be more burdensome than for non-Native communities (Houser, Teller, MacCracken, Gough, & Spears, 2001). Many Native communities are additionally impaired by limited resources to

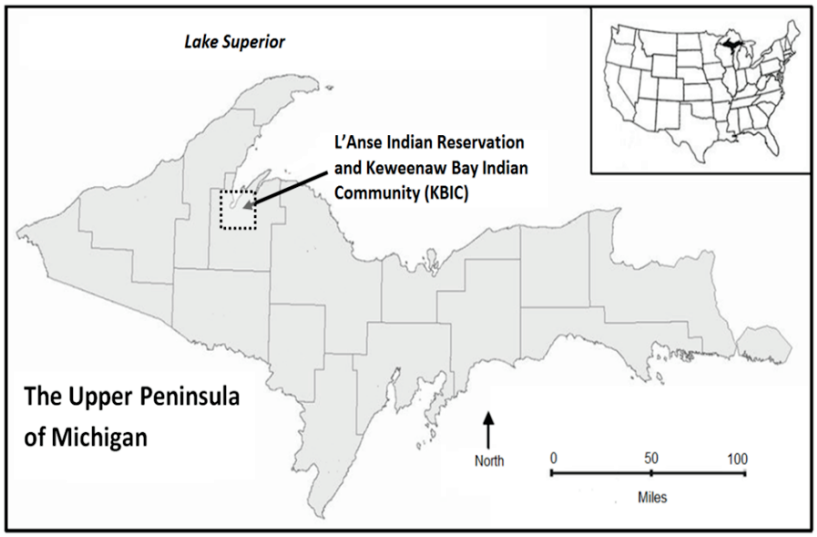
mitigate, adapt to, or cope with the consequences of climate change, particularly when issues such as health, poverty, unemployment, or substance abuse take precedence (Cozzetto et al., 2013; Lynn, MacKendrick, & Donoghue, 2011; Weinhold, 2010). This concern could particularly relate to the likelihood of increased severe weather events associated with climate change (Intergovernmental Panel on Climate Change, 2014). The marginal land bases and geographic isolation of many tribes rival that of most U.S. communities furthering risk from environmental changes and accessibility of resources to respond (Houser et al, 2011; Lynn et al, 2011). In previous generations, many Native communities could respond to environmental change by simply moving to another area. This adaptation strategy is not as feasible today, however, as tribal lands are legally-defined and not able to merely be re-located (Houser et al, 2001; Maldonado, Shearer, Bronen, Peterson, & Lazrus, 2013; Wildcat, 2013).

Native Americans' interconnectedness with the environment today is most often recognized through economic dependence on natural resources (Houser et al, 2001; Krakoff, 2008; Maldonado et al, 2013). Therefore it is easy to surmise how Native communities that rely on agriculture, forests, fisheries, or tourism could be particularly sensitive to environmental change. However, climate change impacts to Native communities could extend much further. Because Native cultures evolved through deeply-intertwined relationships with their environments, entire elements of culture can be irreparably altered when the environment undergoes drastic change. For instance, generations of accumulated knowledge, based on intimate familiarity with the environment, may be lost or rendered less relevant (Cochran et al., 2013; Downing & Cuerrier, 2011; Tauli-Corpuz et al., 2009; Turner & Clifton, 2009). Significant aspects of spirituality could be impacted by losses of sacred plant and animal species or traditional food sources (Cochran et al., 2013; Dittmer, 2013; Krakoff, 2008; Lynn et al., 2013). Many words in Native languages, relating directly to features of the local environment, may lose their meaning if the environment changes or the people have to relocate (Cochran et al., 2013; Downing & Cuerrier, 2011). In all, climate change impacts may not only affect Native Americans' livelihoods but their entire ways of living.

The impacts Native communities face from climate change also represent an issue of environmental justice. Proportionally, Native lifestyles contribute little to the causes of climate change, yet their communities are often the most affected by the consequences (Cordalis & Suagee, 2008; Krakoff, 2008; Lynn et al., 2011; Maldonado, Shearer, Bronen, Peterson, & Lazrus, 2013; Thomas & Twyman, 2005; Tsosie, 2007; Whyte, 2013). For some Native communities (e.g., Arctic and other coastal tribes), climate change impacts far exceed losses of natural resources or various aspects of culture; some are facing the ultimate injustice of seeing their homelands literally disappear from the map (Cordalis & Suagee, 2008; Crump, 2008; Krakoff, 2008). Considering the rapidity of environmental changes, the cultural trauma associated with relocation, and the unique and complex legal relationship between tribes and the U.S. government, many are viewing action on this matter as requiring the utmost urgency (Krakoff, 2008; Tsosie, 2007; Whyte, 2013).

While climate change impacts to Arctic, Pacific Northwest, and Southwest Native communities have justifiably received the most attention in the scientific literature, less is known about issues facing woodlands-area tribes of the Great Lakes region. In this area, changes have already been documented in air and water temperature, hydrological patterns, timing of seasonal events, occurrence of severe weather events, changes in forest cover types, and invasion of non-native species (Pryor et al., 2014; Schramm & Loehman, 2010; Superior Watershed Partnership, 2007). In an effort to help fill an important knowledge void, the remainder of this paper focuses on climate change and the Keweenaw Bay Indian Community (KBIC), an Ojibwa tribe from northern Michigan (Figure 1).

Figure 1: ***The location of the KBIC in Michigan's Upper Peninsula (Image: Kozich).***



Climate change poses numerous potential threats to members of the KBIC, who rely on predictable environmental conditions for the continuation of sacred and traditional activities. The KBIC is located along the southern shore of Lake Superior, within a delicate climatic zone that transitions between a humid continental climate to the south and a cool boreal climate to the north. Forests in this region are characterized by the southern extent of many culturally-significant plant species that provide food and medicines. Some of the most significant tree species, including sugar maple (*Acer saccharum*), northern white cedar (*Thuja occidentalis*), and paper birch (*Betula papyrifera*), are expected to be stressed by changing hydrological patterns, warmer temperatures, and the invasion of highly competitive, warmer-climate species from the south (Dickmann & Leefers, 2003; Pryor et al., 2014; Schramm & Loehman, 2010; Superior Watershed Partnership, 2007). Maple syrup production, a sacred and traditional activity for many Ojibwa, could be impacted by changes in regional forest communities.

The area's abundant stream and wetland ecosystems provide critical habitat for wild rice (*manomin*). This plant provides valuable nutrition and plays a central role in Ojibwa migration stories. Like maple syrup production, harvesting wild rice is considered a sacred tradition. However, wild rice abundance has already decreased in many areas, and further losses are expected as a result of the altered hydrologic patterns associated with climate change (Schramm & Loehman, 2010; Superior Watershed Partnership, 2007).

Climate change could severely disrupt the KBIC economy. The community relies heavily on healthy fisheries in nearby Keweenaw Bay and Lake Superior, but the region's waters have already experienced notable changes. Continuing warming of waters could pose serious threats to coldwater fish species, some of which are already in decline. Aquatic ecosystems are being disrupted by the invasion of numerous non-native fish, mussel, and plant species (Michigan Department of Natural Resources, 2015; National Tribal Air Association, 2009; Superior Watershed Partnership, 2007). Since non-native invasions are projected to increase with climate change, the local fishing industries that support numerous KBIC families could be severely impacted. Negative impacts to forest productivity and tourism could be equally likely and detrimental to the KBIC economy (Schramm & Loehman, 2010; Superior Watershed Partnership, 2007; Voggesser, Lynn, Daigle, Lake, & Ranco, 2013). Clearly there are reasons for the KBIC to be concerned about lifeways of the community in the face of changing climate.

Despite the challenges facing all Native communities, they possess knowledge that can uniquely qualify them to take a lead role in climate change adaptation strategies. Traditional ecological knowledge (TEK) has gained increasing merit among climate scientists and policy-makers for its value in understanding past environmental patterns, interpreting current conditions, and planning for the future (Alexander et al., 2011; Berkes & Folke, 2000; Cochran et al., 2013; Vinyeta & Lynn, 2013; Wildcat, 2009; Williams & Hardison, 2013). Many tribes view TEK as an important element of sovereignty and are now developing and adopting their own climate change adaptation plans.

On April 16 2015, the KBIC Tribal Council unanimously passed Resolution KB-016-2015, "To Establish a Climate Change Adaptation Initiative." By doing so, the KBIC joined numerous other tribes nationwide in the recognition that the consensus on climate change is clear and that it could pose substantial threats to Native lifeways. The resolution instructs the KBIC Natural Resources Department to lead a climate change vulnerability assessment as part of planning initiatives and to advise the Council on strategies and policy formulation in conjunction with relevant additional agencies.

This paper summarizes a crucial early step in the KBIC's climate change planning process. In advance of Resolution KB-016-2015, faculty and students of the Keweenaw Bay Ojibwa Community College (KBOCC) Environmental Science Department conducted semi-structured interviews with KBIC Tribal members to assess perspectives on climate change and gauge support for adaptation planning. This research represents the first phase of a broader, mixed-methods project, and to our

knowledge is the first such effort in the community. This is a critical first step because climate change will not have homogeneous effects across landscapes and therefore assessments of community-level impacts are needed (Duerden, 2004). Since understanding public views is a vital precursor to policy formulation, and policy actions are likely to be effective only if they have the support of the people they impact, this research simultaneously serves the community and adds to the literature by helping fill a notable knowledge void.

Research Design

Work began in late 2013 with the recruitment and training of a team of Keweenaw Bay Ojibwa Community College (KBOCC) student research assistants. We completed a comprehensive literature review, identified research objectives and methodology, and conducted pilot interviews. We formulated the following objectives to guide our work: (1) assess perceptions of climate change among KBIC members; (2) gain insight on how climate change could impact lifestyles of the KBIC; and (3) assess support for long-term mitigation and adaptation strategies.

Data were collected through semi-structured qualitative interviews with enrolled KBIC members. We chose this format with the goal of attaining rich insight to serve as the foundation for follow-up quantitative studies. A systematic random sample was used to invite community members to participate in interviews. With approval of the KBIC Tribal Council, we acquired a mailing list of all enrolled KBIC members age 18 or older residing in Baraga County (892 names), and sent every tenth person on the list a letter requesting participation. Fourteen letters were returned undeliverable. Thirty members agreed to be interviewed, resulting in a net response rate of 40%. Interviewees were not compensated for their participation, aside from the traditional gifting of tobacco for the sharing of their knowledge and time.

Interviews commenced in early 2014. Most were conducted in public meeting places such as the KBIC library, senior citizen center, or KBOCC campus (although some interviews with elders were conducted in interviewees' homes for their comfort and convenience). The semi-structured format promoted full engagement of interviewees, most of whom included stories at their own will to elaborate on points of interest, expertise, or concern. Interviews contained fifteen questions plus several probing-follow-ups, all correlated to the broader research questions of the project (see Appendix 1 for list of questions). Introductory questions were very conversational in nature and were designed to examine interviewees' cultural perspectives and general environmental values and beliefs before delving into topics specifically related to climate change. Interviews averaged 26 minutes in length and were digitally recorded. Interviewees supplied demographic data on a single-page written form at the conclusion of interviews. Student assistants took written notes to supplement audio recordings. Audio files were later

transcribed verbatim using GearPlayer 4 transcription software. Transcriptions were then analyzed at the item and pattern level to code into the three key themes described in this paper.

We interviewed sixteen males and fourteen females, with an age range of eighteen to eighty-four (Table 1). Ten interviewees identified themselves as tribal elders. The majority (63%) possess a high school education or less, while six (20%) completed a Bachelor's degree or higher. Twenty-one (70%) reported an annual income of $30,000 or less and twenty (67%) claimed full or part-time employment. Most employed interviewees work for the Tribe in some capacity, which is not a surprise since the KBIC is the largest employer in Baraga County. Interviewees included current and former Tribal Council members, education/social service professionals, and casino/resort employees. We also interviewed professionals whose day-to-day work puts them in direct contact with the environment, including foresters/loggers, commercial fishermen, wildland firefighters, and employees of the KBIC Natural Resources Department. All unemployed interviewees described themselves as either retired or tribal college students. Half of interviewees described their political identification as "independent," with the remaining favoring Democratic/liberal identification (40%) over Republican/conservative (10%). We inquired about political identification as a matter of standard demographic data-collecting protocol but did not frame climate change topics in terms of politics at any point in interview discussions. Since we anticipate conducting a follow-up, quantitative mail survey in the community (with a much larger sample size), potential relationships between demographic variables and change perspectives will be examined at that time.

Table 1: ***Descriptive statistics of interviewees.***

Category	N	Percent of interviewees
Gender		
Male	16	53%
Female	14	47%
Age		
18-30	8	27%
31-45	8	27%
46-60	8	27%
61 or older	6	20%
Education		
Some high school	3	10%
High school diploma	16	53%
Associate/trade degree	5	17%
Bachelor's degree	3	10%
Master's degree or higher	3	10%
Annual income		
Below $10,000	7	23%
$10,000 to $20,000	6	20%
$20,000 to $30,000	8	27%
$30,000 to $40,000	2	7%
$40,000 to $50,000	6	20%
$50,000 to $75,000	1	3%
Employment		
Employed full or part-time	20	67%
Unemployed/student/retired	10	33%
Political identification		
Democrat/liberal	12	40%
Republican/conservative	3	10%
Independent/other	15	50%

Due to the relatively small sample size (30), we do not assert that interviewees' views are wholly representative of the greater population. However, we are confident that through our sample we captured the diversity of perspectives anticipated from individuals across a wide range of demographic and socio-economic factors (Table 1).

Results

Analysis of transcripts resulted in the identification of three key themes expressed by interviewees: (1) water resources are extremely valued; (2) climate change is happening and will have wide-ranging negative impacts; and (3) support for climate change planning is high, and planning should include traditional ecological knowledge. Each theme is elaborated upon in the following paragraphs.

Water Resources are Extremely Valued

Perspectives on the region's water resources are very relevant considering the numerous potential impacts to them that could result from climate change. We began interviews with a series of open-ended questions about the local environment and asked interviewees to elaborate on anything that is particularly special to them. Many interviewees described the area as their ancestral homeland or discussed the significance of its forest resources. However, interviewees focused most intently on the area's water resources, including Lake Superior and the region's numerous streams and wetlands. Twenty-two interviewees (73%), like the one below, named water as the most important natural feature of our area, describing its sacredness to them personally and to the broad community:

> Just the beauty of it, the lake, the waterfalls, and all the streams. There's just so much nature here. We go out walking by the bay and we also have these beautiful tall trees and it's all remarkable. And the fresh air; you can feel a difference in the air when you go down by the water. I just spend time with the Creator in the outdoors a lot, laying tobacco down by the water and praying, so that's where I go for my therapy in a sense. I love water. It's definitely my spirituality. It helps me to connect. The water is most important. Our sacred animals and plants rely on it, and it is a big part of our culture. (Interviewee #4)

We then asked interviewees to discuss the importance of outdoor recreation, expecting that lifestyles and the environment are intertwined for most residents in the community. Because climate conditions could potentially affect a wide range of outdoor activities, interviewees' responses could help assess broad, lifestyle-altering impacts of climate change. The typical interviewee described several examples of important outdoor recreational activities, and many included stories to emphasize their points. Twenty-five interviewees (83%), such as this one, specifically identified water-related recreation as the most important:

> We go out we do river walks and stuff like that and we'll will find a waterfall that we've never seen before. And there's usually brook trout so I always carry my pole. Fishing is a big one. I love fishing the rivers, and one of my favorite things to do to do is find a nice little bank and get a fire going and cook outdoors. We're always at the beach and swimming. I enjoy boating and look for any opportunity to go out with someone. Collecting black ash in the swamps for baskets, harvesting wild rice, and stuff like that is important too. (Interviewee #1)

When asked about their greatest local environmental concerns, twenty-two interviewees (73%) discussed water-related issues as the most pressing. Interviewees shared concern for water quality, surface water levels, water temperature changes, impacts to fish and wildlife, impacts to wetland ecosystems, and reduced snowpack or winter ice cover. Several interviewees described the traditional sacredness of water in Ojibwa culture, supporting their statements with examples from Ojibwa creation or migration stories. Interviewees also discussed contemporary issues involving water that are

intertwined with culture, including its importance in ceremonies that carry on today and its role as providing habitat for wild rice, a significant food source. The interviewee below related global water problems to potential local cultural impacts:

> Water is going to be a really big issue coming up here. I'm afraid of more people wanting our fresh water because there's more and more of a shortage around the rest of the country. And clean water — that is the other part too. Lake Superior is still one of the cleanest large fresh water bodies. I'm concerned about the Lake Superior fisheries, our rivers, our wild rice, and being able to keep doing all our cultural activities related to water. (Interviewee #2)

It is important to note that in none of our interview questions did we specifically prompt interviewees to discuss water. Responses involving water arose through the context of initial, open-ended questions that were broad in design and intended to gain background insight on interviewees' general relationships with the environment. These topics also occurred early in interview conversations before the topic of climate change was mentioned. Through numerous examples, interviewees illustrated the inseparable relationships between water and Ojibwa culture. Overall, 18 of 30 interviewees made connections between water and the sustainability of sacred plants and animals or traditional activities such as wild rice harvesting, maple syrup collecting, and fishing.

Climate Change is Happening and Will Have Wide-Ranging Negative Impacts

Interviewees were near-unanimous in the belief that climate change is already happening in the region; 29 of 30 interviewees agreed it is already underway while one was unsure. As a follow-up, we asked interviewees if they believe climate change will *continue* happening in the future; 23 said "yes" and seven were unsure. Put another way, none of the 30 interviewees disagreed that climate change is happening or that it will continue into the future.

Climate change awareness appears largely based on observation, as all 30 interviewees stated that they have personally witnessed long-term environmental changes during their lifetimes. Interviewees' responses on this topic were deep and insightful, particularly among tribal elders. Nineteen interviewees, like the one below, specifically described changes they've noted in the intensity or frequency of precipitation events in the region:

> Well for starters, the weather just seems weird now. The U.P. [Upper Peninsula] is known for getting huge amounts of snow in the winter but I noticed the last two winters we didn't get that much. We've had some heat waves and we've had some mild winters now, but I think the first winter I was here it was like 30 below. Last year alone the rain patterns were really weird through the summer, like we had some really long dry spells, then we just got dumped on with rain all at once. It seems like we didn't have any just normal kind of rain. When it rained it poured. (Interviewee #14)

Interviewees also described how seasonal patterns in recent years are different from what they recall from their childhood. Several interviewees described the changes they've noticed in the timing of

seasonal events, discussing both winter and summer weather. Like many interviewees, this one related observations to popular outdoor activities such as swimming:

> The lengths of the seasons seem different now. I remember winter being much longer, with huge amounts of snow. It doesn't seem as intense anymore and the timing seems to be off. Recent years have been really weird. I remember as a kid we couldn't swim in the lake until mid-to-late August, but now by June the water's warm enough to swim. (Interviewee #13)

Several interviewees made similar comments about seasonal weather patterns and added observations related to corresponding ecological changes. This interviewee linked warmer temperatures to invasions of insects that previously didn't inhabit the region (likely referring to the recent "tick boom" in Michigan noted by researchers):

> The past five years I would say were so noticeably different than they used to be. Lately we haven't really had winter start until December. Then when summer comes it's like 90 degrees tomorrow and then it stays like that throughout the whole summer. I don't remember that from when I was a kid. And now the different types of bugs we see that come with the hotter weather that we never had before…It's all very concerning to me. (Interviewee #15)

Fishing is an extremely popular activity in the community, and for many KBIC members it holds cultural, recreational, and economic significance. One of our interviewees has been a commercial fisherman for over 30 years, and he provided a powerful, detailed account of changes affecting the Lake Superior whitefish and lake trout fisheries:

> The lake's pretty warm and right now there's no fish out there. By this time, usually the fish are cold and you can go out there for days. Usually right now you'd get the bottom turning up. Those southwest winds come and start stirring it up and all of a sudden the fish head north. And that's when you get the washing machine effect. It gets all stirred up and gets back to normal at 50 degrees. But it's not happening now. Right now it's 58 and that's too warm for the fish. And we've got northeast winds warming it up even more, dragging down the thermocline. You can tell month-by-month from what you're getting in your nets. I look at my records at what I was getting back in 1994 or 1995 at this exact time of year. It's unbelievable the amount of fish I was getting back then at this time. It's been changing, and it makes it tough for me to break even. (Interviewee #27)

A long-time recreational fisherman provided a similar account of changes over time in the region's smelt streams. As indicated in this passage, smelting traditions, which are very popular among the KBIC, appear to be affected by environmental changes:

> I don't know if it's the water temperatures, but back in the day we'd go smelting and we wouldn't even have to work at it. You could dip a couple nets and have a couple 10-gallon buckets ready in about an hour at the most. And then you could sit there and party it up all night. But nowadays you have to go look hard for them. You have to look everywhere and hope to be at the right stream at the right time. It's so unreliable. Back then you could count on them like clockwork, but now you have to chase them down. (Interviewee #21)

We asked interviewees to identify specific negative impacts that they anticipate the community could be facing from climate change. Responses were wide-ranging and included cultural, economic, and human health-related impacts in addition to ecological ones (Table 2). Many interviewees described more than one impact they anticipate, like this one who summarized several in a concise response:

> It's not just going to be tree species; it's not just going to be wildlife; it's not just going be fisheries. It's going to affect housing, roads, and drainages too. Public works is going to have to be aware of these changes so they can incorporate them into their projects moving forward. It's going to affect everything to some degree. Health too. And economic development will be hit. If no one wants to come here to hunt or snowmobile or whatever, we're going to be losing revenue. So it's a tough one. It's not going to be business as usual. (Interviewee #1)

Table 2: ***Community-level climate change impacts anticipated by interviewees (note that many interviewees listed more than one response).***

Response	N	Percent of interviewees
Negative impacts to outdoor recreation	14	47%
Negative impacts to fisheries	13	43%
Reduced surface water levels	10	33%
Loss of medicinal plant species	9	30%
Human health impacts	7	23%
Negative impacts to culture (nonspecific)	7	23%
Negative impacts to wild rice	6	20%
Negative impacts to significant wildlife species	6	20%
Negative impacts to maple syrup	6	20%
Impacts to tourism-dependent businesses	6	20%

Support for Climate Change Planning Is High, and Planning Should Include Traditional Knowledge

One of the primary objectives with this research was to gain insight on interviewees' opinions related to long-term climate change planning. Across interviewees, we found the overall level of support to be high, as 29 of 30 provided examples of planning strategies the KBIC should consider. Respectively, interviewees tended to focus on one example of a strategy and then go into substantial depth on it. As a result, support for specific strategies was fairly evenly divided across three areas: increasing awareness, investing in renewable energy, and consulting with scientists or other tribes for advice. The interviewee below was one of several who believe the Tribe should focus primarily on educational and outreach activities to increase awareness and influence lifestyle norms across the community:

> I don't think people are going to change if they don't see other people doing it too. The main thing right now is to be proactive and look into the future, get people involved and get people knowledgeable about it. I think that is the first step definitely. Then the second step would be like promoting the change and actually getting people buying in and doing it. It would be huge. (Interviewee #3)

Several interviewees, like the one below, focused on research and investment in renewable energy sources. Many described examples of renewable energy developments that they believe the Tribe should consider:

> Alternate energies, solar power, wind energy, all those need to be researched more heavily. There's also ways to produce fuel for our cars using wood. And there are plenty of ways to sustainably manage forests. There are plenty of ways to produce energy that would make a difference. Put some geothermal heat here or something over there just to show that we're trying to incorporate this. Maybe not to fully sustain the place on green energy, but why not put a couple things in? A couple solar panels would help cut costs plus it would show that we're trying to do this. And a lot of people don't realize how hilly this region is. We're set up pretty good for wind power. There are areas around here where the wind blows like crazy. It doesn't take much of a breeze to turn those propellers. They build them pretty light. Blow on it and it will be spinning. (Interviewee #8)

Collectively, interviewees elaborated much more on mitigation strategies than adaptation strategies; few described steps specifically related to planning for adjustments to inevitable changes (and those who did typically only made reference to the management of KBIC Tribal forests or fisheries operations). However, 29 of 30 interviewees indicated that traditional ecological knowledge (TEK) has an important role in the planning process. Of these, 18 described how efforts to promote and share TEK could help re-connect the community with its traditional environmental values and behaviors. Many interviewees, like the one below, alluded to the traditional regard for future generations as being a necessary component of climate change planning:

> We didn't call natives the stewards of the land for no reason. And if you look back, all of the centuries and thousands of years that we've been here, we've always believed in sustaining our resources, no matter what they are. We always believed in only taking as much as we need, and you make sure you do it in a way that you promote the continued growth for future generations. We need to get back to that. But as American people now we are selfish, and it's about politics and money, and because of that we might screw ourselves in the future by not supporting the seven generations theory. (Interviewee #21)

Nine interviewees discussed how the Tribe's collective TEK, particularly that of elders, should be combined with modern science to create effective strategies for the community. One interviewee emphasized the importance of listening to those whose knowledge could contribute meaningfully to solutions:

> First, I think our council should just be listening. I think they should listen to the scientists and to our people at natural resources that are studying this. And listen to the elders who have noticed a lot more than the rest of us. Maybe then they can lead the way and make sure we can all adapt and survive. If you think about history, we should be the ones with the understanding of how to do stuff like this. We should be the ones who can figure this stuff out. (Interviewee #30)

Overall, 25 of 30 interviewees stated that they are concerned about the impacts climate change could have on the community. As a concluding question, we asked interviewees what sources of information they rely on for information on climate change. The top responses were roughly evenly split between television, the internet, and general word-of-mouth. Although interviewees appeared reasonably informed on climate change topics, only eight stated that they receive climate change information from science journals, government reports, or local scientists or educators. Nonetheless, as the preceding section illustrates, interviewees had considerable insights to share on the topic.

Discussion and Conclusion

Although the effects of climate change may not yet be as obvious in the Great Lakes region as they are in other Native American communities, findings show that interviewees in the KBIC are keenly aware of climate change concepts and possible impacts to the community despite relatively low levels of educational attainment across our interview sample. In keeping with traditional knowledge, it appears that interviewees' perspectives on climate change are formed largely through direct interaction with the environment, observation, and word-of-mouth information sharing. The insight they shared provides richness that speaks to all three of our initial research objectives.

Assess Perceptions of Climate Change among the KBIC.

Interviewees were in near-agreement that climate change is occurring, as evidenced by the 29 of 30 who stated so in interviews. Interviewees drew from numerous lines of evidence to support their beliefs, mostly based on personal observation of environmental changes they've noticed in the area. Interviewees were typically long-term residents who spend substantial amounts of time outdoors engaged in a variety of recreational, cultural, and professional activities, and the stories they shared indicate that their beliefs were based on personal observation and stories of others' observations. Many, for example, cited changes they've noticed in weather patterns, features of water bodies, or involving the plant and animal species of the area (e.g., many shared observations involve fish). This body of knowledge, collected through accumulated direct observations and shared by word-of-mouth across the community, is reflective of traditional ecological knowledge. Many researchers agree that this type of insight from Native communities could be extremely valuable in broader climate change planning initiatives (Alexander et al., 2011; Berkes & Folke, 2000; Cochran et al., 2013; Vinyeta & Lynn, 2013; Wildcat, 2009; Williams & Hardison, 2013).

While interviewees were very aware that climate change is happening, few cited scientific reports or spoke in scientific language to support their beliefs. For example, phrases like "greenhouse gases" or "fossil fuel emissions" were rarely spoken in interviews. While many admitted that they didn't fully understand the scientific details involved, most attributed climate change to human activities and

effectively linked warmer temperatures to altered weather patterns and disturbed ecological processes. The fact that many interviewees proposed mitigation solutions involving alternative energy sources indicates the awareness of a link between energy consumption and climate change, even if most interviewees did not explicitly describe it.

Gain Insight on How Climate Change Could Impact Lifestyles of the KBIC.

Interviewees cited many examples of the ways that climate change could negatively impact lifeways within the community, and most were very concerned about how these changes could affect future generations. Interviewees discussed numerous ecological impacts, threats to human health, and negative impacts to the community's economy that relies largely on fishing, recreation, and tourism. Many interviewees' concerns integrated cultural aspects, typically involving traditional foods, sacred plant and animal species, or impacts to traditional outdoor activities that persist as important aspects of life across the community.

Perhaps most notably, interviewees' deeply-held values towards water emerged at numerous points throughout many interviews. A key finding from this research is the extent to which the region's water resources characterize lifestyles for traditional and non-traditional community members alike. While some focused on fishing, outdoor recreation, or day-to-day activities to illustrate the importance of water resources, others emphasized its sacred place in traditional Ojibwa culture. Many used examples from traditional stories to link changing water conditions to disruptions of deeply-held Ojibwa cultural values. Some remarked that if climate change continues, changes to water resources would affect Native communities such as the KBIC more than typical non-Native communities, considering the cultural impacts involved. Sentiments of this sort speak to the many environmental justice aspects of climate change, agreeing with numerous researchers who believe Native communities will bear a disproportionate burden of future climate change scenarios (Cordalis & Suagee, 2008; Krakoff, 2008; Lynn et al., 2011; Maldonado et al., 2013; Thomas & Twyman, 2005; Tsosie, 2007; Whyte, 2013; Wildcat, 2013).

Assess Support for Long-Term Mitigation and Adaptation Strategies.

Speaking to this objective, we found most interviewees well-versed in examples of ways that the Tribe could emerge as a leader in climate change response strategies. The development of renewable energy sources drew considerable attention among interviewees, with many expressing particular support for the implementation of wind and solar technologies on the reservation. Others discussed their support for educational/outreach efforts by the Tribe to increase climate change awareness among the community. The strongest theme to emerge related to this objective, however, is that nearly all interviewees discussed the need to incorporate traditional knowledge in the Tribe's planning process.

Many interviewees, agreeing with researchers nationwide, suggested that traditional knowledge holds an important place alongside modern science in the search for solutions. The engagement of elders was identified repeatedly as a necessary component. These insights will prove most valuable to the KBIC Tribal Council as they develop a climate change adaptation plan for the community.

On the local scale, findings from this work will serve as a foundation for ensuing research by providing richness to help guide the development of a follow-up mail survey in the community. The survey will involve a sample size large enough to be considered representative of the population and will allow for statistical analysis of results. By combining qualitative and quantitative ("mixed-methods") research, we will equip the KBIC Tribal Council with the insight necessary to confidently go forth with long-term climate change planning. A thorough awareness of the community's perspectives will help ensure that policy actions will be supported and effective.

On the global and national scales, and perhaps most importantly, our findings help fill a notable knowledge gap related to climate change and indigenous communities. At the time of this research, few articles in the scientific literature were found to examine climate change through the voice of woodlands-area cultures. Our efforts help introduce Native communities, particularly the KBIC, to conversations on this important topic. Other tribes may certainly benefit from outcomes of the KBIC's upcoming climate change planning process. Since climate change is a global phenomenon, a greater number of voices will more thoroughly illustrate challenges and can potentially help develop culturally-relevant adaptation strategies.

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APPENDIX A: *KBIC Climate Change Interview Protocol.*

1. How long have you lived in the area?
2. What do you like about the area? What makes it special?
3. What kinds of things do you do outdoors?
4. To you, what's important about our environment? What makes it important to the community? Please include anything that comes to mind.
5. From what sources do you typically hear information about the environment?
6. Do you have any concerns for our local environment?
7. Tell us about any changes you've observed in our environment during your lifetime.
8. Tell us what you've heard about climate change. What comes to mind when you hear people talking about it?
9. Do you believe climate change is already happening? Do you believe it will happen in the future?
10. [If yes to previous questions] What do you think is causing it?
11. Are you concerned about it? [If yes] Please share any concerns you may have about possible effects from climate change.
12. How do you think it could affect lifeways within our community?
13. How do you think it could affect you personally?
14. Do you think our community leaders should be taking action to address climate change? What should we be doing? Can you think of any solutions or strategies the KBIC leaders should consider? Would you support these types of actions?
15. Tell us about anything you think is important about traditional ecological knowledge. Do you think it should have a role in climate change planning?
16. Is there anything else you'd like to add? Do you have any questions for us?