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An Expression of Self-Determination: Incorporating Alaska Native Knowledge into Community-Driven Energy Sovereignty

Joseph P. Brewer II

Alaska Native peoples have a varied and complicated history with energy sovereignty, one that makes it difficult to generalize the region's progress toward that goal. In Fort Yukon, the Alaska Native-owned and -operated village corporation of Gwichyaa Zhee has been moving away from a reliance on fossil fuels by creating a wood-to-energy project that employs community members in harvesting biomass, that is, timber. This article presents a case study that examines the decision-making process of the Gwichyaa Zhee Corporation's wood-to-energy project as a form of Indigenous knowledge that is inextricably tied to the actions of self-determination. The project's reliance upon abundant traditional ecological knowledge (TEK) has proved essential in ensuring its success.

As TEK continuously evolves as a field, studying examples of this kind can provide deep insights into productive cross-cultural collaborations. This case study has implications, especially for those who seek to work for or with tribal nations, tribal consortia, and the like. For in addition to the idea of making local observations or being rigorous in one's application of knowledge, Alaska Natives seem to be demonstrating that community knowledge, and knowing how to access that knowledge, plays a crucial role in tribal sovereignty. Indeed, scholars have argued that TEK is an essential component of Indigenous ways of knowing and doing that is also crucial to developing Indigenous sovereignty. That is, if Indigenous peoples are to create food and energy security, it is important to make decisions that center community well-being. In this sense—reliance on the entire community in order to move toward a common goal

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of sovereignty—self-determination is an active component of TEK. The Indigenous knowledge used in the Gwichyaa Zhee Corporation's wood-to-energy project is local in that it is directly connected to important self-determination ethics of community building and knowledge transfer, and also because as a result of teamwork, it helps strengthen the fabric of society. In this sense, prioritizing and encouraging Indigenous knowledge is not only essential in planning and implementing this kind of community-based project, but is paramount to self-determination.

Thus, as Indigenous knowledge systems often operate in ways that are inextricable from self-determination, this article does not attempt to separate them.[1] After Alaska Native knowledge (ANK) is specifically situated under the umbrella of TEK, the article provides an overview of the Fort Yukon study site's geography, climate, and environment, in addition to the wood-to-energy project. The methods section provides study background and discusses literature relevant to its case studies approach. The discussion of the findings that follows organizes qualitative interview data corroborating Robin Kimmerer's conclusion that "TEK observations tend to be qualitative," given this knowledge is of a people's experiences over time in a particular place.[2] Indigenous knowledge, in this case ANK, tends to be local knowledge, and I conclude by considering how extraordinarily useful ANK is for Indigenous communities in the Arctic and beyond in shaping the planning and implementation of capacity-building projects.

Situating TEK and ANK

"Traditional ecological knowledge" has been defined in a number of ways and has been applied, as well as studied, in countless circumstances throughout the world. As Kyle Powys Whyte states, "the English language articulation of TEK—along with synonymous or closely related terms like indigenous knowledge and native science—originates in literatures on international development and adaptive management."[3] Although the international literature is important in this context, significantly, some would argue TEK, or the premise of TEK, was derived from disciplines such as anthropology and from ethnoecological studies from such scholars as Harold Conklin, Irving Hallowell, and Franz Boas. Despite the wide range and confusing variability of words, phrases, and contributing scholars that speak to Indigenous knowledge, there is much to learn about how Indigenous knowledges are structured as systems and used in modern Indigenous communities.

As Nicole Latulippe writes, TEK is a growing body of scholarship with Indigenous and non-Indigenous contributors examining the theory in four primary fields of study or "orientations": ecological, critical, relational, and collaborative.[4] One branch of this literature focuses on the ways in which that knowledge relates to or equates to natural sciences.[5] Another branch—especially with regard to TEK—attempts to better understand how Indigenous knowledge can and does contribute to local capacity-building projects. In this sense, TEK is also tied to a specific place and time. As Robin Kimmerer suggests, in order to understand the deeply rooted knowledge of Indigenous people, attention should be paid to their "record of observations," a record

that develops "from a single locale over a long period of time," as this article attempts to do.[6] I use the term "ANK" (Alaska Native knowledge) because it refers to the Indigenous people's knowledge of having been part of their environment in a relationship lasting for many millennia.[7]

Indigenous knowledge systems are alive and thriving, including those of Alaska Native communities, in spite of the settler-colonial state's repeated attempts to marginalize and delegitimize them at both local and policy levels.[8] In the modern world, Indigenous knowledges offer opportunities for Indigenous people to express their observations and lived experiences in a particular landscape over time.[9] Indigenous scholars, in particular, argue that Indigenous peoples link their knowledge systems to their self-determination, sovereignty, and self-government, in that decisions made to strengthen the community, whether large projects or small, are based on epistemological practices unique to each community.[10] They suggest that historic and contemporary TEK is useful when it is directly tied to and incorporated into community projects that strengthen self-determination.

Modifying the direction of this idea, I argue that "Indigenous knowledge" instead refers to knowledge that particular Indigenous peoples cultivate, transmit, and acquire in and of a specific place, by and for themselves, to strengthen opportunities for self-determination. Countering those who may argue that in Alaska, United States policy towards Alaska Native sovereign rights has stripped Alaska Natives of self-determination and sovereignty,[11] I assert that self-determination may be advanced by expressing the ability to make choices for the well-being of the community. Moreover, the chances of success also increase when Indigenous communities prioritize TEK in local, capacity-building projects, as this article's case study will demonstrate. The Gwich'in are not alone in incorporating TEK into such projects. Whyte cites a number of distinct, local-level projects which incorporate Indigenous knowledges into every facet of their planning, development, and practice. These projects include Iñupiat whale relationships, Karuk fire ecology, St. Regis Mohawk climate change planning, and Koyukon subsistence hunting regulations.[12]

According to Whyte, two elements are common to each project: that it is bioregionally specific to a tribe and tribally controlled, and that its creation and success are founded in local Indigenous knowledge. Importantly, Whyte examines how local knowledge is incorporated into every step of the project in ways that ensure its eventual success. Indigenous knowledge, while specific to Indigenous peoples around the world, gains specificity through location, which means knowledge will vary, sometimes dramatically, from locale to locale, based on weather and landscape, for example. Knowledge akin to that successfully employed by the Gwich'in timber harvesters previously has been discussed as being ANK, although in broad terms.[13] This article reconsiders ANK in highly specific regional terms, based on the knowledge I was able to explore with the harvesters and experiencing how their knowledge strengthened the energy project work in Fort Yukon.

Background

Fort Yukon sits in a dense boreal forest and is situated in a region of Alaska known as the Yukon Flats, which is named for the ever-present ebb and flow of the Yukon River. It is surrounded by the White Mountains to the south and Brooks Range to the north (fig. 1).

Figure 1: Physical map of Alaska *(2019), www.freeworldmaps.net/united-states/alaska/map.html.*

This area of the flats has been inhabited by various bands of Gwich'in for a very long time.[14] Historically, Fort Yukon was established as a trading post and the Gwichyaa Zhee (band of Gwich'in) participated in newly established health clinics, schools, and churches, as well as the growing economic opportunities.[15] The village of Fort Yukon is located at the convergence of the Porcupine and Yukon rivers. Although considered large for a village in the Alaska interior, its infrastructure is limited (but growing), economic development is sparse, and the only way in or out of the village is by plane or boat, or by snow machine in the winter.[16]

Being so remotely located, without access to the Fairbanks electrical grid, the biomass project that is the subject of this analysis is designed to provide sustainable heating, opportunities to offset a reliance on fossil fuels, and economic development.[17] In general, financial constraints, a lack of diverse partnerships, geographic isolation, limited access to technology, and inability to manage natural resources on their own terms have compromised the ability of some interior Alaskan villages to achieve energy

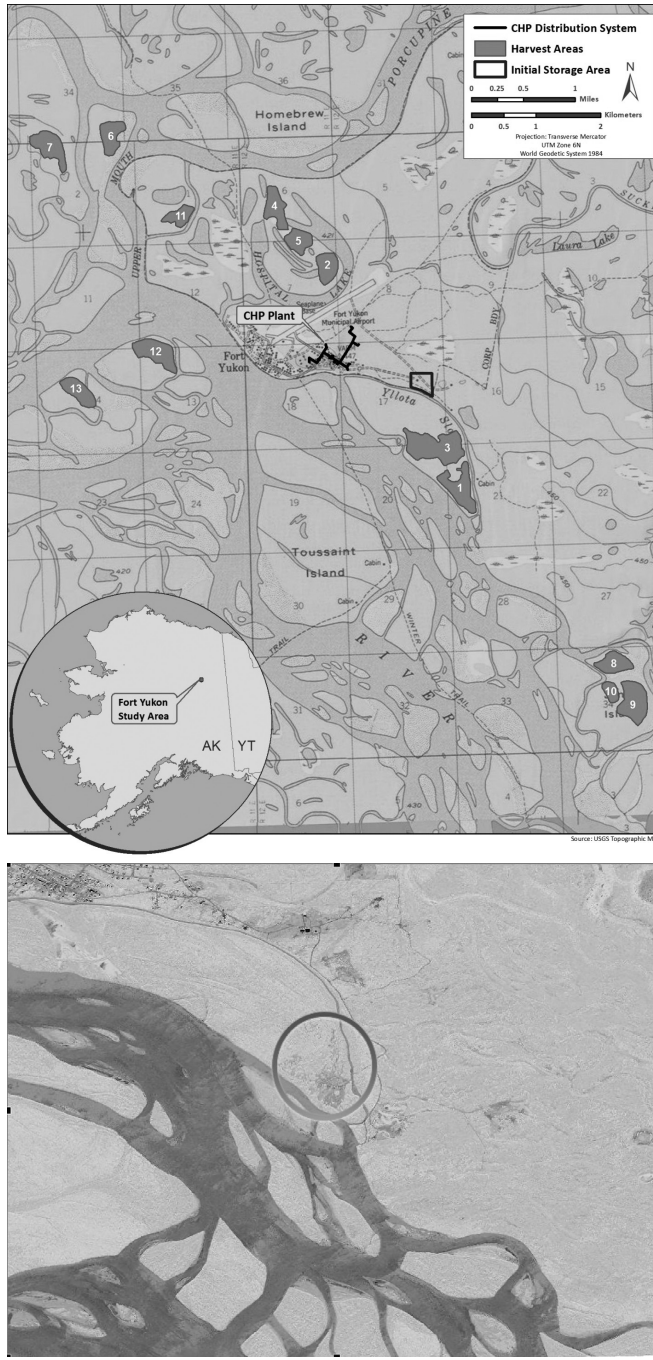

Figure 2: *Identified Harvest Areas animated and GIS image*

sovereignty. The Council of Athabascan Tribal Governments (CATG), stationed in Fort Yukon and working with Gwichyaa Zhee Corporation, was adamant that the Fort Yukon project allow the village to grow in a sustainable manner, while also exploring potential financial opportunities for the region.[18] This has been the premise for CATG to share all project information, including this research.

Methodology and Case Study

This case study research is part of a larger research project focused on pre-harvest methods and identification of biomass, as well as post-harvest revegetation studies.[19] Beginning in the summer of 2012, I initially was asked to test field methods for the wood-to-energy project and as I was invited to participate in a variety of future projects, a relationship grew with the Council of Athabascan Tribal Governments, the operators of the forestry portion of the project, as well as the Gwichyaa Zhee Corporation, the project owners. Institutional review board and CATG research protocols and compliance were met, which were finalized in concert with existing ethical research protocols articulated by the Indigenous Peoples' Working Group of the American Association of Geographers.[20] Generally rooted in Indigenous research methodologies, theories, and methods,[21] a specific conversational method of nonscripted interview questions was used, which, allowing the conversation to go where it may, respects the "culturally organic means to gather knowledge within research" and engages ANK practitioners and personnel as part of the research agenda.[22] The conversational method gives the interviewees control over what they say by allowing them to review materials, if desired, or what has been said, such as transcripts and the like.[23]

The entire cohort of five personnel from the 2013–2014 harvest participated in these semi-structured interviews, the only ones to work the project. Open-ended and exploratory questions were directed to participants' experiences, as well as their perspectives of the harvest. Of primary interest was how harvesters employed Alaska Native knowledge in daily decisions related to the harvest activities: cutting trees, dragging, and piling. The author interviewed all personnel, including operations crew and administrators. Although seemingly a small case study, it is nonetheless robust because it involved only the personnel who, as administrators or harvesters, worked directly on the harvesting project and its day-to-day operations. Of the five participants, who ranged in age from 20 to 65, one was female and four were male. Three were permanent Fort Yukon residents.

Interviews were digitally recorded, professionally transcribed verbatim, and reviewed for patterns as well as themes.[24] An inductive approach was used in order to apply descriptive codes to stories in the data without a preexisting framework. These codes were then used to develop themes and patterns across participant narratives. The climate impacts and mitigation/adaption pathways spoken about in the paper were themes that came out of coding the interviews, and were prompted by, for example, the harvesters' autonomy to adapt the project to given weather and machinery issues. Semi-structured interview questions were created to address the ways harvesters adapted and indicators that forced mitigation/adaption. These questions helped to clarify not only

the decisions themselves, but how the decisions were made, including incorporation of ANK. Autonomy to adapt was a part of the original conception of the harvest plan. The interviews with all staff and the author's close working relationship with the project and staff helped to direct what project materials needed to be collected and analyzed, and to structure interview questions.

Based on participant observation,[25] the focus of this paper is how local knowledge contributes to planning and implementation of industrial projects for and by Indigenous communities. Supplemental to the interviews, the author analyzed archival material from CATG and Gwichyaa Zhee Corporation relating to operations data and logistics, such as gas receipts, hours logged, total time of operation from beginning to end, equipment failures/replacements, and time spent cutting, hauling, stacking, and harvesting for different scenarios of tree stands. The incorporation of logistical data and materials was made a part of the methods in order to measure efficiency and, in the end, success.

Following Yin's linear-analytic structuring of case studies, this article presents its research material in the way the story was told, including relevant background/literature, methods, data collection, analysis, findings, and discussion/conclusions.[26] As Yin indicates, case-study research is more likely than other forms of research to engage with diverse audiences, which is reflected in the narratives of the personnel who shared their experiences of the 2013–2014 harvest in this study's findings.[27]

Findings

This research focused on the day-to-day operations decisions during the harvest, identifying when and how ANK was part of those decisions. The project plan was to cut the trees, temporarily pile the biomass, then haul it weekly to the wood yard where drying and chipping would take place. A management plan was created, but with the understanding that changes would likely occur. Early in the planning process, the harvest team indicated that weather was an important factor in this dynamic ecosystem that impacts their day-to-day activities. With the harvest teams' input, a contingency plan was created. If the initial plan seemed unworkable (for example, if weather created loss of efficiency, such as the machinery breakdowns), the harvesters were given autonomy to adapt their activities to better suit the day-to-day operation—under the condition of ongoing communication. In order to allow crossing waterways when frozen and to have minimal environmental impact, the harvest took place in the winter months.

I emphasize here that, as an active component of TEK, self-determination is understood as the freedom to make decisions, as an individual or as a group, on a daily or weekly basis. As such, self-determination on the part of the harvesters plays a large role in moving the community toward energy sovereignty. What follows is an exploration of the harvest team's protocol associated with pre- and post-harvest decisions. Overall, three major themes that center on ANK were identified: communication between project personnel and the community, the benefit of local ANK, and the environment as an informant. Each theme was determined to have

environmental, social, and economic dimensions. The harvesters in this study were always cognizant of or trying to measure the possible impact their decisions might have on the larger community as well as on the project itself. They made decisions with the understanding that those decisions might impact or have implications for a number of important community factors such as creating a healthy environment, ensuring social well-being, maintaining cultural integrity, and encouraging economic development. In the discussion below, I highlight each of these indicators in order to unpack how they informed protocol and shaped decisions along each of the three identified themes.

Communication and Community

Expert knowledge about a particular environment is often-sought, valued information. In the winter, harvesters, fishers and hunters travel on and around frozen rivers to access fishing and hunting grounds, for instance. Whenever possible or needed, fishers, hunters, and harvesters will communicate with other community members about safe spots to cross frozen rivers. One participant speaks about how community members have their own communication network from "growing up here, knowing the environment, being out in the woods all the time, and talking to people." A valued combination of lived experience and other community members' knowledge, from the beginning of the harvest to the end, to seek out and incorporate long-term observations as verified by the participants[28] or bioregional/local ANK was a part of the preferred communication regime. Participants indicate that, as an ongoing community initiative, they were encouraged to speak to community members about the harvest, before and throughout.

Participants 1 and 4, when asked who was involved in the conversation and decisions about how to cut trees and pile on-site, identified every other member of the team. Personnel speak often about their access to a large amount of recent and detailed information. When asked about the importance of local knowledge in planning and decision-making processes, Participant 2 states:

> I think it's critically important. I think that you should start with local knowledge before you even write your plan. I think you should start there and then incorporate that into whatever plan that you decide. But I really think that having that community involvement in every aspect is so important especially in all of these rural villages. There are so many different variables that you always have to consider, and so I can't express enough how important local knowledge is for planning.

Maintaining a close connection to community knowledge and involving community, whether through chance educational encounters in the planning stages or intentional information gathering, was of great value to personnel. As Participant 3 states, "we really have to concentrate on who else in the community can really help us," adding, "and we really got to give them an attractive incentive to keep them on board." Participant 3 indicates in this remark that when the community at large was creating

economic development opportunities, the community work force needed opportunities for training to build skills and learn new ones. Also, Participant 3 is adamant that the only way to sustain this project, or any project of its kind, was through significant community involvement.

This is a small, remote, off-the-grid community that is subject to high turnover rates in employment. As it was difficult to recruit employees able to relocate to Fort Yukon, community members participated not only as employees, but local experts as well. In this participant's estimation, the community should not only be running the project, but community members should be hired in all aspects of the work due to the need for understanding valuable, community-based information. In general, employees from places other than rural Alaska rarely continue their employment in the village for very long. It's rare to find employees, other than life-long community members, who live out their careers in the village. As Participant 3 shares,

> we got to learn how to use those people once we get them [trained]. They are not going to be just there for harvesting, they are going to be there for delivering the chip product which will fuel a lot of our equipment and our boilers and they are also going to be there to actually run the heating utility once everything is put together and everything is in place. We cannot count on outside people. That's the biggest downfall to a lot of villages today. You don't try to do it from an office down in Texas for Fort Yukon just to get that person back and forth to Fort Yukon can be unrealistic. So, these are just kind of . . . [pause] we have to be practical and we have to be realistic about what are we going to do . . . [adding] if you're not from here and you're here just for the job and short duration you could make a decision that could impact the community for a long time after you leave.

This participant recognizes the potential downfall in employing community members with limited skill sets, but questions, "who else is going to stay here and be committed?" while also specifically arguing that the high rate of employee turnover has a negative impact on local knowledge. If the community was going to self-determine its energy future, Participant 3 strongly believed, they then had to reinvest in the community, helping people not only to develop more skills but also reskill what they already knew. For this participant, it was greatly important to the longevity and integrity of the project that community members and their existing experience be coupled with training in how to use heavy equipment and chainsaws.

All the participants attribute the current success of the first season's harvesting to (1) team members being available on-site; (2) the communication requirement; and (3) a commitment to quality work, and hence, a commitment to the community. All three of these attributes suggest teamwork, or working with community, which in turn supports the argument that ANK is both an individual and a community's shared experiences.[29] Further, each timber harvester as a community member supports Participant 3's point that investing in community members has numerous benefits to the success of the project. When asked how important local knowledge is specifically in regard to the project's planning process, Participant 1 states, "Big. Because everybody knows that country around, been here all their life, you know."

Local Alaska Native Knowledge

Participants were asked if, given the conditions and challenges specific to this part of Alaska, they thought that a timber harvester from anywhere else worldwide could conduct this particular harvest successfully. When asked if growing up in Fort Yukon gave them an advantage over operators who were not, participants acknowledged that having access to ANK networks and their own experiences, as well as observations over time, helped them to be better harvesters. Operators were reluctant to speak about other harvesters' capabilities in addition to their own; however, they did elaborate after the interviewer redirected conversation toward topics that did not focus on the individual, but rather on broader, project-related experiences and observations. The difference between their abilities and those of other operators rested in the community's working knowledge of their environment. As Participant 1 explains, "Yeah, just talking to folks helps."

Operators generally were more willing to speak on broader topics like environment, machinery, and the social, cultural, and economic indicators that helped them make decisions, such as discussing how weather, climate, and gas consumption dictated when they would haul timber. When asked what challenges made this harvest different than a harvest in the lower forty-eight states, Participant 1 states, "you got to deal with the cold," a statement he followed by "and the darkness," referring to the winter days and months of little sunlight. Participants 1 and 4 speak more directly to the ambient temperature during the harvest; for example, the harvesters report the hydraulic hoses had reached their limits at minus 20 degrees Fahrenheit.

Each participant indicates that the factors of winter climate, the darkness of winter days and months, and reading the environment (such as anticipating snow and rainfall, or cycles of freezing and thawing) were unique to the Fort Yukon region as well as essential to operations. Participants cite how, at the harvest site, operators would read shifts in the weather such as cloud and wind movements around the river corridor and adapt the daily plan accordingly. Although operators do not indicate how other harvesters might fare in these conditions, they do speak of the unique weather at various harvest sites on the Yukon River, as well as the skills developed over a lifetime in the same place. In addition to being able to respond to the weather environment, ANK allowed participants to innovate and adapt during other unexpected circumstances. For example, cottonwoods have a large cellular structure and water content and in the winter months of Fort Yukon, the physiology of the cottonwood changes. Harvesting in winter means that harvesters are working with material that is frozen, hard to cut, and brittle.

Further, cottonwoods will die while remaining standing, creating hazardous situations when cottonwoods 3–20 inches in diameter and perhaps as tall as 100 feet in height are being harvested, as the trees can shear and break, falling on the operator's cabin. After experiencing how the trees would sheer and fall on the cab of the machine and observing the direction of the sheer given the typical height and diameter, the harvest team decided to reengineer and make alterations to some of the harvesting

equipment. For example, the team welded a roll bar onto the Kubota operator's cabin. Participant 1 shares,

> You would grab a tree and you go get ready to cut it and you shake it and the tops break off and a lot of times it'd come down on the boom. Bust the fittings off. One time I had a tree come down, I didn't have that roll bar protecting that engine. Later on, we welded it on. But it took the whole hydraulic filter and the housing (destroyed it). We're lucky that's all it took. . . . when they're (cottonwood) frozen you have to cut at it, cut at it. It was hard on everything.

Indeed, being limited to harvesting in the winter months forced the team to encounter a variety of season-specific delays: hydraulic hoses freezing and breaking, trees falling on the equipment, the overall capabilities of equipment, and the quantity of gas needed to operate and haul. Under the planned scenario—designed to avoid a massive haul over thawing ice and ground, flooding issues, and to save on operating costs—"whole trees will be temporarily piled on the harvest site to wait for hauling during an optimal winter window" on a weekly schedule, and "the optimal window is considered to be in winter when ice is thick due to the necessity of crossing bodies of water,"[30] with the contingency of harvesters adapting as needed.

Accordingly, after the first two weeks, the team reevaluated the cutting, hauling, and piling plan for the harvest and decided not to take time to haul weekly, but to cut trees and pile all wood on-site for the entire season. Each participant agrees that the small size of the equipment slowed the harvest or cutting, and gas consumption was too high. Participant 2 reflects that dragging the wood with the tractor 3.5 miles from harvest area 1 to the wood yard, which Participant 1 notes was "a beast pulling," took an hour round-trip (see fig. 2). The operations crew worked out a regime that alternated responsibilities for operating, cutting, hauling, repairing, and prepping equipment that kept the team active even absent new equipment.

Participants state that the decision to alter the hauling plan was in consideration of the overall efficiency of the harvest. Each participant states that when equipment was running well and no breakdowns occurred, they could work forty to fifty hours per week. However, with limited daylight, a daily harvest goal, and the cumbersome nature of the wood, the team decided it made more sense to cut trees and pile on-site. An interesting point is made by Participant 2 in reflecting on how operators took the community at large into consideration. Dragging cut trees to the wood yard often left behind woody debris on the roads, which community members also used to access their own woodyards and traplines. This wood debris made the roads difficult for community members to travel via snow-machine, and, in some cases, impossible. Taking community needs into account, the harvesters decided not to drag wood as often as planned in order to preserve the integrity and availability of those roads. In sum, harvester decisions to innovate and adapt during the harvest were tied to unique environmental conditions and the needs of the community, demonstrating both a need for ANK networks and an understanding of them.

Environment as Informant

An interesting discussion arose during the interviews about the potential of flooding in harvest area 1 (fig. 2). To some, it may seem that weather and knowledge about weather in a distinct geographic location are not a part of ANK or local environmental knowledge. However, a familiarity with past and current weather patterns, freeze, thaw, and resulting flooding, helped harvesters make decisions. Because specific location weather knowledge was a theme that also emerged for personnel, it is also included here.

Each harvest area identified in the 2013 Environmental Assessment is an island on the Yukon River. The Yukon is notorious for unpredictable flooding during the spring thaw. As a result, pre-harvest plans were developed to cut trees, pile, and haul during optimal winter weather. The team reports they had a very specific window during which to work and that time was of the essence. During interviews, each participant indicates that the decision to cut and pile the wood on-site instead of following the pre-harvest hauling plan was a collective one based on the above highlighted reasons. The team reports that they knew harvest area 1 would not flood in the spring of 2014. When asked how the harvesters knew harvest area 1 would not flood, participants cited valuable information obtained from community networks and local ANK. Speaking with community members gave them information about weather, climate, snowpack upriver, and ice density of surrounding areas they would not have had immediate access to otherwise. As Participant 2 states:

> You have people who aren't able to get out to the woods or they stay home, they're still aware of what's going on out there because so and so (referring to other community members) went to check traps, and this is what happened, and so and so is going to visit with Auntie, and Auntie is going to find out what happened out in the woods today, and then it's just like a telephone conversation.

Participant 5 agrees that local ANK, knowing the area and its current and past conditions, took precedence in ways they were not always aware of and could not fully measure. Participant 5 continues: "the team's knowledge is really about inclusion and continuity with the community network." The knowledge gained by having lived in Fort Yukon gave the team a unique ability to understand, predict, and adapt to shifts and potential shifts in environmental conditions, as well as knowledge of the topography and geomorphology of each harvest site. Participant 4 speaks specifically about the freezing and flooding patterns of the Yukon River around harvest area 1:

> Mm, not past couple years I think it would, not on the Yukon at least. Just whenever we get a lot of snow and ice won't freeze this thing and that's when it melts quicker too. But if it like hardly snows (on the Yukon Flats and upriver) and it freezes real thick, then it floods.

In a separate conversation referring to harvest area 1, Participant 1 communicates that "It hasn't flooded in two years." More specifically, Participant 1 understood the topography of the harvest area, and all the operators had working knowledge of the hydrology of a bend in the Yukon River near the northeastern part of the harvest area,

stating, "But you know there was a big ridge back there. . . . We stacked it with it." He adds that the winter of 2013–2014 was very mild, indicating a quick thaw of the Yukon in the spring of 2014: "Yeah. Man, it rained. Rained like two or three times, that river was just warm." In retrospect, Participant 2 evaluates the decision to cut and pile on-site in the context of a potential flood:

> I think there's always going to be a certain amount of risk in anything that you do and especially in terms of this project, and so initially, yeah, I was worried like, oh my goodness, if this island floods and we lose all our wood or if all of our wood is tied up in the trees, who is responsible for that? What are we going to do? And so, I was kind of alarmed about it. . . . [referring to community, team and administration] I think that is where it's really important to have a good communication and working relationship . . . I didn't really know. It could flood. I'm not really sure what that area is like. And so, I talked to [community and team members] and they didn't seem concerned about it because they said that area wouldn't flood and so . . . [we] relied on their expertise.

In this case, Participant 2 clearly indicates that ANK is a community process requiring connections and trust between members. While Participant 2's knowledge of the specific location of the harvest area was incomplete, the knowledge contained within the community was not. Having access to that knowledge directed the harvest by allowing the team to proceed with confidence that the work site would not flood that year.

Discussion

While Alaska Native knowledge has been studied previously, the objective of this study was to explore ANK qualitatively, using the place-based, wood-to-energy project as an example of how local Indigenous knowledge requires and encourages self-determination in order to move toward energy sovereignty.[31] Of specific interest were the ways harvesters applied local ANK to the decision-making process. The discussion is structured in such a way as to speak directly to the findings reported above to help further interpret the knowledge given by the participants. Results from this study highlight the complex flow of information and knowledge through various methods of communication which allowed the 2013–2014 harvest team members to incorporate ANK and make well-informed decisions. Additionally, local community members were extraordinarily important in the planning, delivery, and ongoing operation of the 2013–2014 harvest; awareness that complex cultural, social, economic, and environmental variables shape these communities is absolutely necessary for future planning and research.

Knowledge Is a System

Though the intent of this research was not to investigate the systems of knowledge or knowledge transmission, this emerged as a significant overlapping theme. The ways in which environmental knowledge is transmitted among the Gwich'in in Fort Yukon is

unique to that community. For example, some harvesters explained that understanding river ice requires knowledge of reading ice flows, as well as understanding that the color of ice can indicate its structural integrity. Further, there are numerous Gwich'in words that can be used to express these very detailed characteristics of ice and how to navigate it. During the winter, harvesters share, transmit, and acquire knowledge of these characteristics daily. As Mark Nuttall and colleagues explain, this local and observational knowledge is specific to those who live here and those who rely on this knowledge to access trap lines, fishing, wood yards, and hunting grounds.[32]

This research shows a general relationship between harvesters' bioregional and local ANK and the broader context defined by TEK.[33] The local systems of knowledge and knowledge transmission[34] in Fort Yukon share some common practices but are understandably different from other Indigenous knowledge systems in Alaska. For example, while there are many Koyukon and Gwich'in communities on the Yukon River, the geomorphology of the river around Fort Yukon differs from that of other river villages. Bends in the river, flow, sedimentation deposits, and fluvial distribution in general all affect the ways people interact with the river. The people of Fort Yukon understand their part of the river in ways that allow them to predict or hypothesize river behavior from year to year. For example, participants in this study understood that environmental factors such as ice density, average snowfall in high- and low-lying areas, and the duration of freeze and thaw, were all primary indicators of flooding in spring.

The extraordinarily descriptive nature of the Gwich'in vocabulary reflects lived experience; distinct words are assigned almost every kind of circumstance. To characterize the specific flow of the river during spring thaw, a number of Gwich'in words and descriptions, as well as experiences, are used to describe how the current moves on a bend in the river and if the current will form back-eddies and erode the bank. Indigenous words and experiences descriptively express where the back-eddy may have formed from an iceberg, and of riverbank interactions during high river flow or current time of the day, as Karim-Aly Kassam and others indicate in *Biocultural Diversity and Indigenous Ways of Knowing: Human Ecology in the Arctic*.[35] Moreover, the event can be expressed in detail, including all the indicators that led to the development of that back-eddy and locations where other back-eddies may have formed under different circumstances. Communication between community members or those who speak the Gwich'in language would inform others of not only that history, but also the integrity of the bank next to the back-eddy. The specificity of language, by suggesting whether the bank will be stable when spring comes, implies a probable future with important information for those who use the river for a variety of activities. Gwich'in language systems are tied to Gwich'in knowledge about their environment—the two cannot be separated—and while not directly observed in this study this research demonstrates the success of projects such as the wood-to-energy project rely on access to this knowledge.

The literature documents how knowledge is transmitted through Indigenous communities,[36] and also speaks to how important access to those knowledge systems is as a representation of the larger community consciousness.[37] The harvest team understood

the way knowledge flowed through their community. They seamlessly practiced knowledge transmission on a daily basis through networks of environmentally based interests. For example, if the team was interested in the land history of a particular harvest location, they would first share information about the area amongst themselves. If that information was not sufficient, they knew which community members were most likely to have the answer. As community insiders, they also know the community-specific protocols to use when asking for that knowledge.[38] Access to daily knowledge about river ice changes and weather was essential, but harvesters explained that knowing who to ask about these things was just as important.

The information the harvest team sought encompassed everything from winter weather conditions, river hydrology, topography, and geomorphology, to habitat succession. In interviews, each team member noted the importance of the relationship between knowledge and the transmission of knowledge. For this study, the practice of transmitting ANK broke down into three basic categories: (1) systems of transmission, such as community protocols; (2) the knowledge itself, as in the example of flooding; and (3) how that knowledge was treated, i.e., created, valued, and practiced. All are complex and all were extraordinarily valuable to the harvest team members.

An Observed and Experienced Environment

This section examines the harvest team members' ANK contributions as a unique skill set. Gleaned from discussions with harvest team members, supported by Alaska, Arctic, and international research about Indigenous knowledge acquisition and practice, the author concludes that observed and experiential or lived experiences of the harvesters was a key component to the success of the 2013–2014 harvest.[39] Gwich'in team members spoke about working in cold and dark winter conditions as a way of life. Non-Gwich'in team members spoke about their struggle to adapt to the cold and dark. While it helped non-Gwich'in team members adapt to have access to Gwich'in practices shared by their Gwich'in team members, it did not fully relieve their struggle. In winter weather conditions like those of Fort Yukon, life is a matter of survival; adaptation over time through the observations and experiences of local knowledge is the only method that perpetuates survival.[40] ANK equipped Gwich'in team members with what they needed to survive the harvest during a Fort Yukon winter.

Being able to read environmental conditions requires both lived and learned experience,[41] and significantly, some are occurrences that non-Gwich'in residents, or those not born in Fort Yukon, cannot learn within a single harvest season. For example, the harvesters chose to pile wood where flooding might have caused substantial damage. As previously mentioned, to measure how susceptible the harvest area was to flooding harvesters used personal and community observations of current and past snowpack upriver, winter weather, and fluctuations in temperature, as well as ice density. It may seem an ambiguous task to identify the length of time available toward the end of the harvest season in order for all of the wood to be hauled while the ground is still frozen, but harvesters were confident in their ability. The idea that local observations and experiences are inextricable from day-to-day operations is central to

the team's ability to successfully conduct a harvest under extreme weather and environmental conditions. Possessing two core abilities, they are able to run an efficient harvest and adapt as needed, staying ahead of schedule to keep up with the demand for wood even when breakdowns occurred; and observe and experience their environment themselves while also enhancing their knowledge by talking to other community members. The lived experiences of the Gwich'in made the likelihood of a successful harvest possible, due to their existing ANK and the ability to maintain an active role in adaptation and innovation.

Conclusions

This research explored how valuable local Alaska Native knowledge was during a timber harvest for a wood-to-energy project that worked to prioritize self-determination in pursuit of energy sovereignty in Fort Yukon, Alaska. The success of the harvest demonstrates the ability of Gwich'in people to navigate the challenges of harvesting in remote locations. The practice of adaptation through the incorporation of local ANK is the precursor to the project's integrity. This research provides a way forward in the discussion of local knowledge, by not only demonstrating the abilities of the harvest team, but by suggesting Indigenous community-based projects that center on contributions of ANK are not only necessary, but foundational. While Alaska Native sovereignty for some may be politically tied to the ways in which Alaska Natives were incorporated, the Gwich'in seem to be demonstrating one way in which self-determination is very much at work.

Two limitations of this study are its short time period and that the research is focused on a single community's experience. Topics addressed here may continue to influence those who study the specific relationships between TEK, local knowledge, and self-determination. It may also resonate with Indigenous communities interested in pursuing wood-to-energy projects or community-based resource projects in general. This research aids in identifying ways to incorporate local knowledge to more efficiently and responsibly harvest resources. Additionally, it demonstrates why it is socially responsible to do so. The end goal for the wood-to-energy project is energy sovereignty, which would allow the community to move away from fossil fuels. Further research could expand on this work to include other communities' experiences incorporating Alaska Native knowledge into self-determination projects that work to reshape and change their energy futures. Thus, it is paramount to acknowledge a community's contributions and inherent right to shape and reshape capacity-building initiatives in their own spaces.

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Notes

1. Energy sovereignty for and in Indigenous communities is a growing area of research that has natural links to the politics of energy; that research area is not the subject of this article.

2. Robin Wall Kimmerer, "Weaving Traditional Ecological Knowledge into Biological Education: A Call to Action," *BioScience* 52, no. 5 (2002): 432–38, 433, https://doi.org/10.1641/0006-3568(2002)052[0432:WTEKIB]2.0.CO;2.

3. Kyle Powys Whyte, "On the Role of Traditional Ecological Knowledge as a Collaborative Concept: A Philosophical Study," *Ecological Processes* 2, 7 (2013), https://doi.org/10.1186/2192-1709-2-7. Whyte cites David W. Brokensha, Dennis M. Warren, and Oswald Werner, *Indigenous Knowledge Systems and Development* (Washington, DC: University Press of America, 1980); Gregory Cajete, *Native Science: Natural laws of Interdependence* (Santa Fe: Clear Light Books; 1999; Arun Agrawal, "Dismantling the Divide between Indigenous and Scientific Knowledge," *Development and Change* 26, no. 3 (1995): 413–39, https://doi.org/10.1111/j.1467-7660.1995.tb00560.x; *The Cultural Dimension of Development: Indigenous Knowledge Systems*, ed. D. Michael Warren, L. Jan Slikkerveer, and David Brokensha (London, UK: Intermediate Technology Publications; 1995); and Fikret Berkes, *Sacred Ecology: Traditional Ecological Knowledge and Resource Management* (Philadelphia: Taylor & Francis; 1999).

4. Nicole Latulippe, "Situating the Work: A Typology of Traditional Knowledge Literature," *AlterNative: An International Journal of Indigenous Peoples* 11, no. 2 (2015): 118–31, 118, https://doi.org/10.1177/117718011501100203.

5. A term commonly used and preferred in the areas that this work took place is "traditional and customary practices," whereas popular terms like *TEK* and *subsistence* have been forced onto Indigenous peoples, primarily by scholars, policymakers, lawyers, and various natural resources professionals. See ibid., as well as several articles by Deborah McGregor: "Traditional Knowledge and Water Governance: The Ethic of Responsibility, *AlterNative*: *An International Journal of Indigenous Peoples* 10, no. 5 (2014): 493–507, https://doi.org/10.1177/117718011401000505; "Coming Full Circle: Indigenous Knowledge, Environment, and Our Future," *The American Indian Quarterly* 28, no. 3/4 (2004): 385–410, https://doi.org/10.1353/aiq.2004.0101; and "Towards Coexistence," in *In the Way of Development: Indigenous Peoples, Life Projects, and Globalization*, ed. Mario Blaser, Harvey A. Feit, and Glenn McRae (London, UK: Zed Books, 2004), 72.

6. Kimmerer, "Weaving Traditional Ecological Knowledge," 433.

7. Ray Barnhardt and Angayuqaq Oscar Kawagley, "Indigenous Knowledge Systems and Alaska Native Ways of Knowing," *Anthropology & Education Quarterly* 36, no. 1 (2005): 8–23, https://doi.org/10.1525/aeq.2005.36.1.008.

8. McGregor, "Traditional Knowledge and Water Governance," 493–507; Leroy Little Bear, "Naturalizing Indigenous Knowledge," Aboriginal Learning Knowledge Centre synthesis paper (Saskatoon: Canadian Council on Learning, July 2009), https://www.deslibris.ca/ID/222635.

9. *Our Common Future*, United Nations General Assembly, Report of the World Commission on Environment and Development, 1987, https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf; United Nations Convention on Biological Diversity, "Convention on Biological Diversity," 1992, http://www.cbd.int/doc/legal/cbd-en.pdf; United Nations, "United Nations Declaration on the Rights of Indigenous Peoples," March 2008, http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf.

10. Linda T. Smith, "Kaupapa Maori Research," in *Reclaiming Indigenous Voice and Vision*, ed. Marie Battiste (Seattle: University of Washington Press, 2000), 225–47; Kyle Whyte, "Indigenous Climate Change Studies: Indigenizing Futures, Decolonizing the Anthropocene," *English Language Notes* 55 (2017): 4–5, https://doi.org/10.1215/00138282-55.1-2.153; Vine Deloria, *Spirit*

and Reason: The Vine Deloria, Jr., Reader (Golden, CO: Fulcrum Publishing, 1999); José Barreiro, *Thinking in Indian: A John Mohawk Reader* (Golden, CO: Fulcrum Publishing, 2010); and McGregor, "Towards Coexistence."

11. Both the Alaska Native Claims and Settlement Act of 1971 and the Alaska National Interests Lands Conservation Act of 1980 are cited frequently as having marginalized, disenfranchised, and relieved or limited the sovereignty of Alaska Natives, but as you see here, there are many exceptions to this common misconception.

12. Kyle Whyte, "Indigenous Climate Change Studies," 153–62.

13. Barnhardt, "Indigenous Knowledge Systems," 8–23.

14. Ernest S. Burch Jr and Craig W. Mishler, "The Di'hąįį Gwich'in: Mystery People of Northern Alaska," *Arctic Anthropology* 32, no. 1 (1995): 147–72.

15. Cornelius Osgood, *Contributions to the Ethnography of the Kutchin* (New Haven and Oxford: Yale University Press/Oxford University Press, 1936).

16. Todd Brinkman, Karonhiakta'tie Maracle, James Kelly, Michelle Vandyke, Andrew Firmin, and Anna Springsteen, "Impact of Fuel Costs on High-Latitude Subsistence Activities," *Ecology and Society* 19, no. 4 (2014), 18, https:/doi.org/10.5751/ES-06861-190418.

17. Gwichyaa Zhee Corporation, based in Fort Yukon, oversees the project, but the broader community generally benefits from it. The corporation has shareholders, a chief executive officer, and a board of directors.

18. In Alaska, tribal villages and village corporations have attempted to create biomass facilities. Fort Yukon faces unique challenges in shipping heavy machinery because it is completely off the grid and the only way into the village is by boat, plane, or snow machine.

19. The research for "Biomass: A Sustainable Approach to Unsustainable Times in Interior Alaska" was supported by Kansas NSF EPSCOR funds, PI, Joseph P. Brewer II.

20. Indigenous Peoples Specialty Group of the Association of American Geographers, "Declaration of Key Questions about Research Ethics with Indigenous Communities," http://www.indigenousgeography.net/ipsg/pdf/IPSGResearchEthicsFinal.pdf.

21. Margaret Kovach, *Indigenous Methodologies: Characteristics, Conversations, and Contexts* (University of Toronto Press, 2009).

22. Margaret Kovach, "Conversation Method in Indigenous Research," *First Peoples Child & Family Review* 5, no. 1 (2010): 40–48, https://doi.org/10.7202/1069060ar.

23. Kovach, *Indigenous Methodologies*, chs. 5 and 6.

24. Virginia Braun and Victoria Clarke, "Using Thematic Analysis in Psychology," *Qualitative Research in Psychology* 3 (2006): 77–101, https://doi.org/10.1191/1478088706qp063oa.

25. James P. Spradley, *Participant Observation* (Long Grove, IL: Waveland Press, 2016).

26. Robert K. Yin, *Case Study Research: Design and Methods* (Thousand Oaks, CA: Sage Publications, 2013).

27. Ibid.

28. Kimmerer, "Weaving Traditional Ecological Knowledge."

29. Barnhardt, "Indigenous Knowledge."

30. Internal business memorandum, Harvest Operation Planning, Fort Yukon Biomass Project, 2011.

31. Per Olsson and Carl Folke, "Local Ecological Knowledge and Institutional Dynamics for Ecosystem Management: A Study of Lake Racken Watershed, Sweden," *Ecosystems* 4, no. 2 (2001): 85–104, https://doi.org/10.1007/s100210000061.

32. Mark Nuttall, Fikret Berkes, Bruce Forbes, Gary Kofinas, Tatiana Vlassova, and George Wenzel, "Hunting, Herding, Fishing and Gathering: Indigenous Peoples and Renewable Resource

Use in the Arctic," ch. 12 in *Arctic Climate Impact Assessment* (Cambridge University Press, 2005), 649–90, https://www.amap.no/documents/download/1093/inline.

33. Fikret Berkes, *Sacred Ecology*, 3-6; Ryan K. Danby, David S. Hik, D. Scott Slocombe, and Andrew Williams, "Science and the St Elias: An Evolving Framework for Sustainability in North America's Highest Mountains," *The Geographical Journal* 169, no. 3 (2003): 194–204, 203, https://doi.org/10.1111/1475-4959.00084n; David A. Gruenewald, "The Best of Both Worlds: A Critical Pedagogy of Place," *Educational Researcher* 32, no. 4 (2003): 3–12; Barnhardt, "Indigenous Knowledge"; Annette Watson and Orville H. Huntington, "They're Here—I Can Feel Them: The Epistemic Spaces of Indigenous and Western Knowledges," *Social & Cultural Geography* 9, no. 3 (2008): 257–81, https://doi.org/10.1080/14649360801990488.

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36. Tristan Pearce, Harold Wright, Roland Notaina, Adam Kudlak, Barry Smit, James Ford, and Christopher Furgal, "Transmission of Environmental Knowledge and Land Skills among Inuit Men in Ulukhaktok, Northwest Territories, Canada," *Human Ecology* 39 (2011): 271–88, https://doi.org/10.1007/s10745-011-9403-1; McGregor, "Coming Full Circle"; Fikret Berkes, "Indigenous Ways of Knowing and the Study of Environmental Change," *Journal of the Royal Society of New Zealand* 39, no. 4 (2009): 151–56, https://doi.org/10.1080/03014220909510568.

37. Chantelle Richmond and Katie Big-Canoe, "The Social Determinants of Health: Defining a Research Agenda for Canada's Urban Aboriginal Population," *Aboriginal Policy Research Consortium International*, 39 (2010): 227–41, https://ir.lib.uwo.ca/aprci/39/; Angayuqaq Oscar Kawagley and Ray Barnhardt, "Education Indigenous to Place: Western Science Meets Native Reality," ch. 6 in *Ecological Education in Action: On Weaving Education, Culture, and the Environment*, ed. Gregory A. Smith and Dilafruz R. Williams (State University of New York Press, 1999), https://www.uaf.edu/ankn/publications/collective-works-of-ray-b/index.php; Keith H. Basso, *Wisdom Sits in Places: Landscape and Language among the Western Apache* (Albuquerque: University of New Mexico Press, 1996); *A People's Ecology: Explorations in Sustainable Living*, ed. Gregory Cajete (Santa Fe: Clear Light Publishers, 1999).

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39. Fikret Berkes, Johan Colding, and Carl Folke, "Rediscovery of traditional ecological knowledge as adaptive management," *Ecological Applications* 10, no. 5 (2000): 1251–62, https://doi.org/10.2307/2641280; Jay T. Johnson, Garth Cant, Richard Howitt, and Evelyn Peters, "Creating Anti-Colonial Geographies: Embracing Indigenous Peoples' Knowledges and Rights," *Geographical Research* 45, no. 2 (2007): 117–20, https://doi.org/10.1111/j.1745-5871.2007.00441.x; David Turnbull, *Masons, Tricksters and Cartographers: Comparative Studies in the Sociology of Scientific and Indigenous Knowledge* (London, UK: Taylor & Francis, 2000); Kayo Ohmagari and Fikret Berkes, "Transmission of Indigenous Knowledge and Bush Skills among the Western James Bay Cree Women of Subarctic Canada," *Human Ecology* 25, no. 2 (1997): 197–222; McGregor, "Coming Full Circle"; Renee Pualani Louis, "Can You Hear Us Now? Voices from The Margin: Using Indigenous Methodologies in Geographic Research," *Geographical Research* 45, no. 2 (2007): 130–39, https://doi.org/10.1111/j.1745-5871.2007.00443.x.

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41. Berkes, "Indigenous Ways of Knowing"; Patricia Cochran, Orville H. Huntington, Caleb Pungowiyi, Stanley Tom, F. Stuart Chapin III, Henry P. Huntington, Nancy G. Maynard, and Sarah F. Trainor, "Indigenous Frameworks for Observing and Responding to Climate Change in Alaska," *Climatic Change* 120, no. 3 (2013): 557–67, https://doi.org/10.1007/s10584-013-0735-2; David C. Natcher, Susan Davis, and Clifford G. Hickey, "Co-management: Managing Relationships, Not Resources," *Human Organization* 64, no. 3 (2005): 240–50.