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Blackfeet innovation pathways to food sovereignty: sustainability through indigenous-led research partnerships

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The Blackfeet Nation in northwestern Montana, United States, is implementing its Agriculture Resource Management Plan (ARMP), an Indigenous-led, sustainable agriculture plan prioritizing economic development for Indigenous producers, intergenerational health and well-being of Amskapi Piikani Blackfeet people, and ecological and cultural sensitivities within this sovereign nation and its traditional territories. Since the passage of the American Indian Agricultural Resource Management Act of 1993, only three Tribes have drafted and finalized Agricultural Resource Management Plans (ARMPs). The Blackfeet ARMP is now being held up as a national model of Tribal sovereignty. “Blackfeet Innovation Pathways to Food Sovereignty,” an Indigenous-led research project, emerged from the Blackfeet Nation’s community-based strategic planning process identifying gaps, systemic barriers and impactful solutions for achieving Blackfeet food sovereignty through the implementation of the Blackfeet Nation ARMP, along with research influenced by the ARMP. This paper provides a community case study of the ongoing process and offers a translational model of sustainable agriculture and food sovereignty within Indigenous lands to improve the economic futures of producers and their families, as well as health outcomes for Native communities.

KEYWORDS

indigenous food sovereignty, indigenous-led research, translational, agriculture resource management plan, wholistic research approach

Introduction

After a century of struggle with dispossession of lands, misguided federal agriculture and land policies along with their ecological and social implications, this article demonstrates how the Amskapi Piikani Blackfeet Nation is engaging Piikani (Blackfeet) understandings alongside Western scientific ones as they develop their own pathways to food sovereignty. This is no trivial task as many Indigenous people now suffer from severe health disparities and persistent poverty while climate change marches on, and U.S. colonial era federal policies continue to complicate public and private land use (S. Rept. No. 106–361, 2000; Ruppel, 2008; Justice et al., 2021).

An entire segment of the U.S. population, 574+ federally recognized Tribal Nations, have yet to have their food needs met by U.S. agricultural production even though they participate meaningfully in these systems and produce 6.4 billion in revenue annually from agricultural products (USDA, 2024). Now considered an intractable problem, food-related health disparities represent life and death issues for Native people (Mailer and Hale, 2015; Sarkar et al., 2020; Kuhnlein and Chotiboriboon, 2022). The many decades of minimal access to fresh and nutritious, let alone culturally appropriate foods, compounded by a rise in dependence on federal food distribution programs due to outmoded colonial era federal policies and resulting employment inequity, have contributed to increased incidence of preventable chronic conditions such as diabetes and heart disease for tribes across North America including the Blackfeet Nation. The sovereign food system envisioned here returns control of the food production and distribution apparatus to the Blackfeet Nation and its people (Coté, 2016; Hoover, 2017; Bluebird Jernigan et al., 2021; Maudrie et al., 2021); and contributes to an expanded definition of 'sustainable agriculture' which includes access to and harvest of traditional foods and medicines—culturally significant species that are indigenous to the region—and protocols by which these species may be ethically harvested (Joseph and Turner, 2020; Vasquez-Fernandez and Ahenakew, 2020; Bluebird Jernigan et al., 2021; Domingo et al., 2021).

In 2016, Blackfeet Nation agricultural leaders initiated a stakeholder engaged strategic planning process whereby the Tribe and partners from diverse federal and state agencies, universities, and non-profit organizations—including this article's co-authors—completed 3 years of focused planning on sustainable agriculture, food sovereignty, and natural climate solutions. The outcome of this process by 2019 was the in-house production of the Blackfeet Nation Agricultural Resource Management Plan (Blackfeet Nation ARMP, 2019) as enabled under the 1993 American Indian Agriculture Resource Management Act. At the time, only three Tribal ARMPs existed, and none of these were developed with significant community involvement. Though Tribes were encouraged to develop ARMPs and were provided funding for the planning process (not implementation) through the United States Department of the Interior's Bureau of Indian Affairs, very few Tribes had the internal capacity or political will to push through the months long process of community-based strategic planning, let alone costly implementation. The "Blackfeet Innovation Pathways to Food Sovereignty" project was born out of this period of public engagement by the Blackfeet Nation, and the ensuing recognition that the implementation of any strategic plan would require a community-based commitment to developing a steady stream of public and private funding if any systemic changes were to take place. Founded in 2018, the Blackfeet non-profit Piikani Lodge Health Institute has led this charge, both figuratively and literally, conceived and led by Miisam Sai'piyi Aki, Long Time Charging Woman (Kim Paul MS, PhD). Piikani Lodge Health Institute is the lead research partner for the Blackfeet Innovation Pathways to Food Sovereignty project. Partnering with the Native Land Project at Montana State University's Department of Native American Studies, the Blackfeet Innovation Pathways project was funded for 5 years (2019–2024) by the Foundation for Food & Agriculture Research (plus a 1 year no-cost extension for COVID-related delays). Since being funded, project team members from Piikani Lodge Health Institute and the Native Land Project have been carrying out applied research projects in three distinct areas where the Blackfeet community identified challenges and possible solutions: land tenure and access; food security/sovereignty networking/coalition building; and the health-diet nexus. After providing geographic and historical context, this paper

describes the key programmatic details involved in the project's initial design along with its three areas of inquiry and major deliverables, and discusses the project's implications, lessons learned, conceptual constraints and methodological limitations.

Context

The Amskapi Piikani Blackfeet nation

The Blackfeet—properly known as the Amskapi Piikani (also Piikuni or Southern Piegan)—have long understood the causes for widespread health and economic disparity are rooted in forced assimilation policies responsible for the severed connection to Indigenous lands and traditional lifeways along with protracted poverty and historical trauma.

Land and land tenure

The Blackfeet Nation spans both Glacier and Pondera Counties in Montana. This vast land holding encompasses 1.5 million acres and provides drinking water for millions of people downstream. These lands also comprise more than 48 percent of Montana's biodiversity as the largest intact ecosystem in the lower 48 states (Luna, 2012) (Figure 1). Due to its unique ecological and hydrologic profile, the Blackfoot Confederacy—including the four bands of Blackfoot/Blackfeet 'Niitsitapi' or 'real people' north and south of the U.S.-Canadian border—spans one of the world's most biodiverse regions, with the most ancestral native species living on these lands, many of which are now on the protected species list (Weaver, 2015). Despite their immense natural wealth, the management of these lands by Blackfeet for agriculture and food systems is heavily complicated by U.S. federal Indian land tenure policies.

One of the most vexing regulatory and policy issues among most Indigenous nations in the western United States is the federal treatment of allotted Indian 'trust' lands: lands held in trust by the federal government for Tribes and individual 'Indians' (a legal designation within U.S. federal law). The history here is long and arduous, beginning (for the sake of brevity) with the General Allotment Act of 1887, which turned collectively held Indian lands into significantly minimized, privately owned parcels held in trust for Indian landowners by the federal government. For the Blackfeet, foreign laws made in a foreign language illegitimately reduced their lands from almost the entire landscape of what became known as Montana to the 1.5 million acres pictured above. Over time, fractionation¹ of individual interests in those parcels and the federal mismanagement of Indian trust funds earned from their sale and lease were the basis for one of the largest class-action lawsuits ever brought against an agency of the U.S. federal government (Cobell v. Salazar, 2009), as well as one of the largest

1 System whereby interests in land are inherited, such that "allotted land is not divided physically, meaning heirs receive an undivided interest in the land, the children, spouses, and other relatives of the original and successive landowners inherit increasingly smaller interests in the land" (<https://www.doi.gov/buybackprogram/fractionation>).



FIGURE 1
Map of the current Blackfoot Nation.

class-action settlements in U.S. history, the \$3.4 billion Cobell Settlement of 2009. Because most of ‘Individual Indian Money’ accounts held in trust by the federal government were destroyed or lost over time, the \$3.4 billion settlement reflected a mere fraction of losses endured. Even after Blackfoot banker and rancher Eloise Cobell’s landmark case was resolved, the federal system’s Department of the Interior, Bureau of Indian Affairs remains underfunded and burdened by bureaucratic complexities, while fractionated ownership grows and individual Indian landowners continue to bear the weight of failed federal policies (Conrad, 2023).

Indian land tenure rules differ from parcel to parcel, depending on whether the land is owned in fee or federally imposed fiduciary trust, whether it is owned by the Tribe or individuals, whether it is held by a single or multiple owners (i.e., fractionated), or any combination

of the above. Although numerous scholars have studied the legal, political, and economic effects of fractionated ownership in Indian Country from various perspectives, little scholarship exists on the effects of federal regulations stemming from attempts to consolidate fractionated interests or which types of land tenure yield what results in terms of local understandings of human development and economic well-being as it is defined by Indigenous peoples themselves. Indian land fractionation has ramifying political, cultural, legal/jurisdictional and economic effects. In the Blackfoot context of food sovereignty, land fractionation and federal trusteeship make it hard for people to make decisions about their own land and its uses. Tackling these kinds of issues requires the long-term collaboration of stakeholders in a strategic process that is culturally responsive, participatory, inclusive, values based, and driven by members of each tribal community.

Food and agriculture

Within the Blackfeet Nation, agriculture is the primary industry employing the highest number of people and supplying the most earnings from lands supporting 575,256 acres of crops harvested for grain and forage production, of which 50,082 are irrigated acres. Approximately 1,014,000 acres are designated for grazing land. An estimated 704 farms and ranches are owned and operated by Blackfeet producers and their families. The Blackfeet Nation is a place of natural abundance replete with water, minerals, oil and gas, over 50,000 head of cattle, 1,000 iinnii (bison), and profound cultural and spiritual wealth (USDA, 2017). In terms of achieving food sovereignty through sustainable agriculture, the Blackfeet find themselves in exciting yet challenging times. A 2016 community food security and food sovereignty assessment revealed pervasive food insecurity and related negative health outcomes in Blackfeet Country (McElrone, 2016). The community food security and food sovereignty assessment identified problems within the existing food system such as: minimal access to fresh, local, and nutritious foods, duplication of efforts by the different food delivery programs reservation-wide, and dependency on federal food assistance programs which incentivize nutrition-poor and processed foods (McElrone, 2016).

Trapped in extractive commodity markets for decades, Tribal producers have become accustomed to selling raw product into markets, receiving a fraction of value, mere pennies on the food dollar compared with value added products (NAAF, 2022). This is partially due to lack of investment in regional Tribal operations and food processing infrastructure. There has long been interest in expanding the “Golden Triangle” of Montana to finally be inclusive of Tribal enterprises and operations so they can access the same resources as their non-Native counterparts (Crossroads Resource Center, 2017). Up until this point, this vision has yet to be realized due to lack of federal and private investment. The “Golden Triangle” is an area of significant agricultural productivity in wheat, cattle and calves, and barley in Northwest Montana. The Golden Triangle encompasses a landscape including cities of Great Falls, Havre, and Shelby, contains more than 15 million acres of farmland, and is a major economic engine for the State (Crossroads Resource Center, 2017). In spite of significant challenges, Native producers within the Golden Triangle participate in the agricultural economy and are now re-defining agriculture, and especially sustainable agriculture, a topic of international importance (Institute of Medicine and National Research Council, 2015; National Academies of Sciences, Engineering, and Medicine, 2018).

Key programmatic elements

Blackfeet agricultural resource management plan (ARMP) process and resulting Blackfeet Innovation Pathways project

In 2016, the Blackfeet Nation hired Loren BirdRattler as its new agriculture resource plan manager. Under BirdRattler’s leadership, a small team began coordinating monthly meetings among partners to discuss priorities, challenges, and goals of their respective organizations. As per the norm for any large, community-based process, there were also frequent meetings outside of the planning format between the many partners. During the agriculture resource planning meetings, members

joined sub-committees focused on water, policy, agriculture, or land. Earlier meetings were spent discussing foundational reports and resource inventories that would inform the process (Blackfeet Environmental Office, 2018; O’komi, 2019). BirdRattler’s team members and supporting partners (including this article’s co-authors) took notes, and meetings were recorded in audio files that were uploaded to a publicly available google drive for access by community members.

The monthly agriculture resource planning meetings culminated in an intensive two-day strategic planning meeting facilitated by third party Indigenous planning experts Kauffman and Associates. Convened on January 10–11, 2018 by the Blackfeet Nation ARMP team, over 50 participants gathered to identify strategic pillars and objectives for the ARMP through Technology of Participation (ToP©) methods of structured facilitation (Holman and Devane, 1999; Oylar and Harper, 2007; Stirling et al., 2023). Out of this gathering emerged the Blackfeet Nation’s ARMP Strategic Plan which details five strategic pillars and their objectives (see Figure 2), each tied to human capacity, resources, and a timeline, as well as the shared mission:

By 2028, we envision the Blackfeet Nation fully engaged, informed, and actively involved in the development of holistic agriculture resource management for economic, environmental, and health [sic] of the people, land, flora, fauna, and water. Together, we will work to embrace our natural laws, values, and relationships based on respect, trust, and healing. The ARMP will provide a means for establishing reciprocal partnerships among producers, businesses, and landowners to increase international access and availability of quality Blackfeet agriculture products. Our Piikani youth will have mentoring opportunities to learn from elders, producers, and leaders to contribute their voice to a quality Blackfeet way of life (Blackfeet Nation ARMP, 2019).

This vision is for a Blackfeet led holistic approach to the further development of Piikani food systems specifically and intentionally grounded in Piikani values.

Centering Piikani values in the planning process

The Blackfeet ARMP’s management practices are guided by a set of Piikani Core Values as identified by Blackfeet community members (Blackfeet Community College, 2000). These values, in turn, drive the manner in which the Blackfeet Innovation Pathways team members—the co-authors of this article— approach the research process and everything that undergirds it. Piikani values are a reminder of how language informs conduct at every level. For example, Tsi-ksi-ka-ta-pi-wa-tsin is translated as the “Blackfeet Way of Knowing: Blackfeet culture/spirituality in philosophy, thought, and action” (Blackfeet Community College, 2000, Vision Statement). Taken as a guiding principle for research, tsi-ksi-ka-ta-pi-wa-tsin is the basis for a holistic—or wholistic (Absolon, 2010)—methodology that builds place-based ways of being, knowing and doing into the project’s very research design (see Figure 2).

Case in point: the five “Piikani Strategic Pillars” shown in Figure 2 are an example of Piikani community-based leadership in action, emerging from the ARMP strategic planning sessions described above. Then Agriculture Resource Planning Director Loren BirdRattler had pushed back against a suggestion that the community

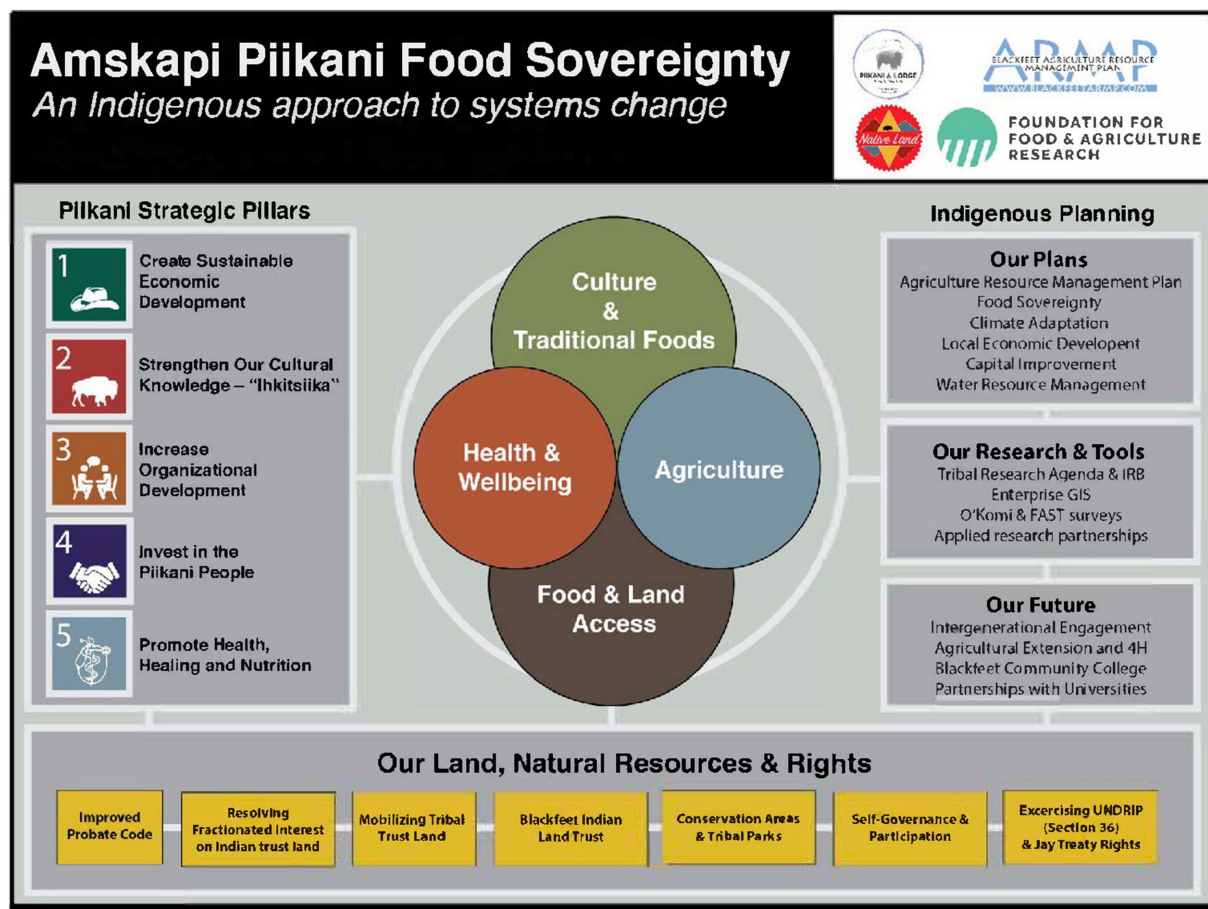


FIGURE 2
Amskapi Piikani Food Sovereignty - an Indigenous Approach to Systems Change.

could adopt the top five Sustainable Development Goals advanced by the United Nations Department of Economic and Social Affairs as part of its 2030 Agenda for Sustainable Development (<https://sdgs.un.org/goals>), saying he would be “laughed out of the community” if he suggested as much. Instead, community-members actively engaged in the facilitated strategic planning sessions came up with the five Piikani Strategic Pillars shown on the left side of Figure 2. The Blackfeet Innovation Pathways team then used these Pillars—the top priorities expressed by Piikani community members—as the driving force for a systems change theory using a Piikani concept of food sovereignty as its lens. Piikani food sovereignty—the ‘whole’ represented by the graphic’s central circle and its overlapping fields of health and wellbeing, access to food and land, agriculture, and culture and traditional foods—connects priorities of the community to the land itself along with its layers of political and legal obstacles and opportunities (the yellow blocks at the bottom of the graphic), on the one hand, and to a selected list of strategic plans, research tools and tactics as well as a growing network of capacity building institutions, on the other.

Grounded in this approach, by 2019 the Blackfeet Innovation Pathways team—comprising a cross-section of people from the Blackfeet Nation’s ARMP team, Piikani Lodge Health Institute, and the MSU Native Land Project team (see Figure 3 for a visual of these research relationships in context)—was able to attract funding from the Foundation for Food and Agriculture Research. Foundation for

Food and Agriculture Research is a non-profit organization established by the 2014 U.S. Farm Bill to advance public-private partnerships that can bring innovative research to bear on urgent or intractable challenges within the food and agriculture sectors. Foundation for Food and Agriculture Research does this, in large part, by requiring a 1:1 non-federal match for every dollar it awards. Besides the research partnership between Piikani Lodge Health Institute (a Blackfeet led and founded non-profit within the Blackfeet Nation) and the Native Land Project (a project of the Native American Studies Department at Montana State University), the Blackfeet Innovation Pathways project brought matching funding from a diverse array of partners, including the Blackfeet Nation itself, a number of other non-profits small and large, and a for-profit online retailer specializing in regeneratively grazed bison meat. Foundation for Food and Agriculture Research provided Piikani Lodge Health Institute first relatively large grant, and in so doing created a foundation of much-needed support for growing research capacity within the community.

In turn, the Blackfeet Innovation Pathways project is co-producing knowledge through three Work Areas of inquiry and practice: (1) Land tenure, well-being, and access; (2) Tribal and rural research priorities and collaborations related to food systems; and (3) The influence of traditional Indigenous foods and foodways (where diet and cultural practices intersect) on Native health. Each of these areas has produced an array of deliverables which, at the time of this writing, are in various stages of completion, as discussed below.

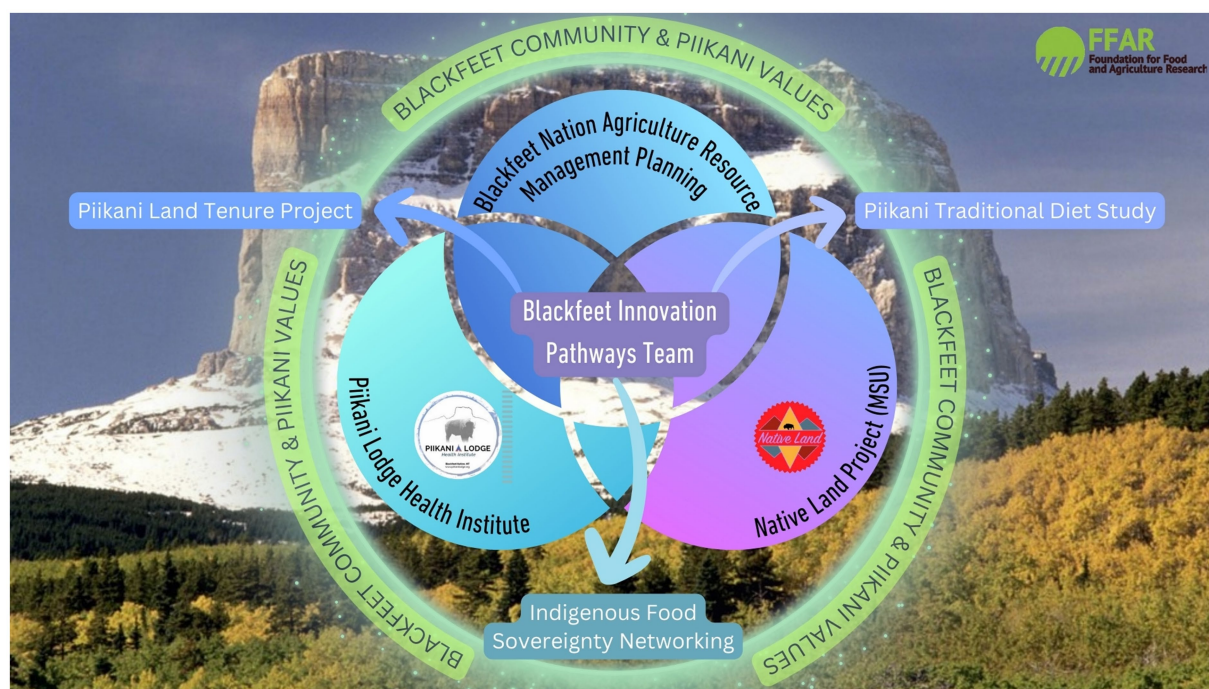


FIGURE 3
Blackfeet Innovation Pathways Research Relationships in Context.

Work area 1: land tenure and access

Landowner roadmaps

An original deliverable for the Blackfeet Innovation Pathways project, the ‘Landowner roadmaps’ are part of a “Trust Land Owners Guide” that includes a series of visuals developed around individual trust land management processes such as land exchange, rights-of-way, gift deeding, fee-to-trust, and probate (see Figure 4 for one example). This aspect of the Blackfeet Innovation Pathways project provides much needed educational materials for landowners and others engaged in land management within the boundaries of the Blackfeet Nation. This resource: (1) works to identify economic costs and egregious time delays related to the individual (as distinguished from Tribal) landowner’s or producer’s negotiation of each process, especially as compared to similar processes outside of the Blackfeet Nation; (2) supports the Tribe and Bureau of Indian Affairs in identifying gaps and duplications in processes in order to increase efficiencies through procedural adjustments; and (3) helps the Tribe identify areas where new tribal policies could supplant federal regulations and eventually reduce production costs for landowners by simplifying the processes while also increasing landowner capacity to negotiate bureaucratic processes through education and advocacy.

Piikani well-being index

Per discussion above around land and land tenure, capacity building within the Amskapi Piikani Blackfeet Nation involves designing an Indigenous framework to measure well-being from a Piikani perspective. Called the Piikani Well-being Index, this framework helps to increase internal capacity through the identification of community indicators of well-being based on Piikani values; it helps to answer the question of what it means to be well in

Piikani Country, particularly with regard to land ownership, land use, and the elements of food sovereignty that spring from a community’s relationship to land and place (see Figure 4). The Piikani Well-being Index also paves the way for data collection efforts that reflect the priorities and concerns of the community by identifying domains and 80 measurable indicators of importance to the Piikani people as opposed to broader measures such as the US Census which are based on western values and informed by western ideologies. The Blackfeet Innovation Pathways team’s 2023 article “The Piikani Well-being Project: Indigenous-led metrics and mapping to improve human and agricultural system health within the Amskapi Piikani Blackfeet Nation” describes this aspect of the Blackfeet Innovation Pathways project in detail [see Paul et al. (2023)].

Current work on the Piikani Well-being Index is focused on first developing the agricultural sector of the measure. This includes collecting farm level data on the health and well-being of the producer’s family, the economic inputs and resulting income from farm production, and measures of land and biosystem health. These measures go far beyond reductionist perspectives on agricultural economics. Economics alone are not able to take into account for instance, whether there is intergenerational sharing and co-management of the agricultural systems, one of the core stated Piikani values. This complex understanding of well-being is nuanced, and born of the local realities, and will help to deliver a more holistic understanding of the health of Piikani food systems (Figure 5).

Access options for traditional gatherers

Western models of agriculture, an important aspect of current Blackfeet realities today, only represent part of a sustainable food system. Traditionally, Blackfeet relied heavily on hunting and gathering. The Innii and other hoofed animals were hunted and sustained Blackfeet families who used all parts of the animal to

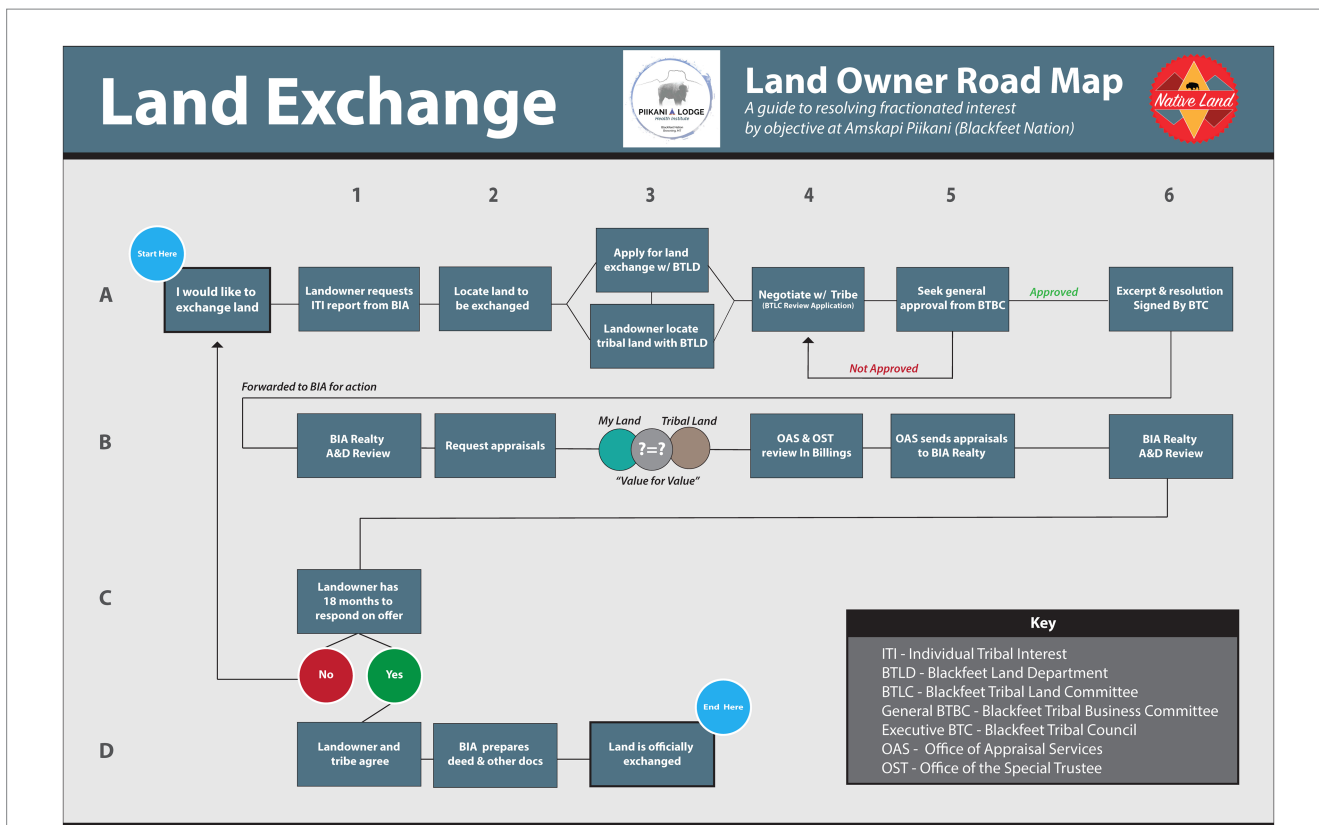


FIGURE 4 Example of a "landowner roadmap" in the Trust Land Owner's Guide.

provide food, shelter, clothing, and other raw materials for daily life. The gathering of plants and medicines was a critical part of Piikani food systems. As noted earlier, current land tenure policies, combined with the catastrophic reduction in traditional Piikani territories, has drastically impacted the ability for Piikani to hunt and gather. The formation of Glacier National Park, Yellowstone National Park and the National Forest system were only possible through the theft of these critical hunting and gathering lands from the Blackfeet. Regaining access to traditional Piikani hunting and gathering territory is critical to a sovereign Piikani food economy.

Increasing access to traditional Native food system resources, including lands outside the current Blackfeet Nation boundaries, helps address the ways that land theft occurred and forced "reservation" placement have profoundly uprooted a land-based way of life and the social, spiritual and cultural well-being that nurtured and maintained good health for the Amskapi Piikani (Tobias and Richmond, 2014). Maintenance of strong connections to the land has been shown to result in increased self-esteem, cultural pride, and overall improved physical health (Tobias and Richmond, 2014). Whereas the traditional Native food system is a community-based and adaptive model of sustenance, which considers the needs of the entire community as extended to the environment, the replacement food system is fragmented by conflicting policies and interests. In addition to the negotiation of cultural easements with public and private landholders to increase access to traditional hunting and harvesting sites within Amskapi Piikani homelands, additional work focuses on the ability for Piikani to access now held federal lands for traditional practices. Current engagement with Glacier National Park, Waterton National

Park, Yellowstone National Park, Grand Teton National Park, National Forests and other federal lands aims to uphold current treaty rights, as well as expand these rights. In some cases, there are current rights, but they are logistically difficult to realize, and in other cases new policies and practices need to be put into place.

Work area 2: tribal/rural research priorities and collaborations

Food sovereignty networking

This aspect of the Blackfeet Innovation Pathways project surveyed food related research priorities for Montana tribes and selected rural communities, identifying food sovereignty collaborators at local, regional, national and international levels. Though conducted at the height of COVID restrictions, an advisory council of Indigenous educators and food system practitioners from around the 'Buffalo Nations' region gathered virtually for near-monthly video conference calls to explore research priorities. These facilitated conversations with advisory council members established the need for the development of a seasonal-ecological model of education favoring Indigenous knowledge and land-based education; and, a natural resources-trained workforce. These advisory council dialogs over the course of almost a year and a half resulted in development of the vision for an Indigenous-led research and education initiative in support of Indigenous food systems and proactive, collaborative capacity building for Indigenous food sovereignty. As a result, the Buffalo Nations Food System Initiative was established at Montana State



University. An Indigenous vision springing from the Blackfeet Innovation Pathways project, the Buffalo Nations Food System Initiative aligns itself with the Buffalo Treaty (<https://www.buffalotreaty.com/treaty>), a modern-day treaty signed by Native Nations of the biocultural region who have committed to bringing themselves back to the buffalo. Articles of the Buffalo Treaty specifically note the need for education and research of this sort.

The Buffalo Nations Food System Initiative (see <https://www.montana.edu/ehhd/bnfsi/index.html>) is being designed to credential Indigenous food systems professionals and develop a robust research agenda in collaboration with the Indigenous nations of the biocultural region of the Northern Plains and Rockies. The Indigenous advisory council developed a guiding document and oversaw the development of an interactive map of the biocultural region that permits users to see the relationship between peoples and place with fresh eyes. In addition, a Buffalo Nations Food Sovereignty networking website (at <https://buffalo-nations.net/>) was developed to provide support to Native communities and others interested in engaging with local and Indigenous food systems.

Influence of Piikani diet and practices on health

Piikani traditional diet study

This ongoing part of the Blackfeet Innovation Pathways project is intended to build research capacity and understandings about traditional foods as a component of health while incorporating direct community knowledge and experience of Piikani first foods. Research participants are an active part of the knowledge generation process, navigating a 100-day interventional diet approximating what would have been available to Piikani people prior to the imposed high-carbohydrate, beef and grain based Euro-American diet. Community members are at the heart of the implementation of this project as participant researchers discovering firsthand the impacts of reclaiming a traditional diet through quantitative biomarker sampling intermittently throughout diet intervention and qualitative self-reporting on their individual experience. Participants are provided with a suite of informational materials, infographics and a support group to ensure high comprehension and completion among

participants. Post-pilot study, participants will be able to teach traditional diet fundamentals to family and friends. In this way, learning is expanded out to participant spheres of influence, to their families, friends and professional colleagues through peer-to-peer learning, a method widely documented to be highly effective in the transmission, mobilization, and translation of new research findings.

Discussion

The Blackfeet Innovation Pathways to Food Sovereignty project was born out of intimate, long-lasting and Indigenous-led research relationships. These relationships bloomed during the Blackfeet Nation's development of its Agriculture Resource Management Plan, a community-based strategic planning process that provided many hours of opportunity to listen closely with Piikani community members as they came, time and again, to values-based consensus over their priorities for systemic change in their communities. Their decision to place a multi-dimensional understanding of food sovereignty—encompassing the people's health and well-being, culture and traditional foods, agriculture, and access to food and land—at the center of their agricultural resource strategic planning is what drove the way this project team thought (and thinks) about the wholistic nature of food sovereignty. A nation's sovereignty over its food system is built on and helps build its political, legal, economic and cultural (including linguistic) sovereignty. A sustainable food system supports and is supported by a nation's economic development, cultural knowledge, organizational development, health and well-being, four out of the five pillars of Piikani strategic planning. The other strategic pillar—investing in Piikani people—is the one that drives Piikani Lodge Health Institute as an Indigenous-led and founded non-profit. The continued work of the ARMP as seen through the Blackfeet Innovation Pathways project was enabled by outside funding, a flexible and ever adaptive work plan, and its core objectives being ones that come from the community itself.

Present and future applications

Just as the food sovereignty networking part of the project sprouted spinoff projects in education, the landowner roadmaps are being used as prompts for in-depth conversations with landowners about their experiences, adding qualitative dimensions to the Piikani Well-being Index which will find expression in story maps and future publications. Additionally, in-field research and collaboration with Blackfeet ranchers has grown substantially over the course of the Blackfeet Innovation Pathways project. This has largely been accomplished through the Piikani Lodge Health Institute Regenerative Grazing Initiative, an effort which was identified as a priority during the ARMP development process. Since the General Allotment Act of 1887 and forced transition to individualized farming and ranching, rangeland biodiversity has decreased regionally and internationally (Augustine et al., 2021). Competitive management practices replaced Piikani stewardship which was for the collective good, inter-reliant on rest-rotation of linnii (bison) grazing, supporting habitat for cultural plant and animal relatives, and with an emphasis on mobility and climate adaptation across the seasons. Through collaborative research, the Piikani Lodge Health Institute Regenerative Agriculture program

addresses these Piikani values in the context of contemporary tribal agriculture. Future publications will reflect upon these changes.

Acknowledgment of any conceptual or methodological constraints

Because of constraints noted below, in early 2024, the Blackfeet Innovation Pathways to Food Sovereignty project team had to request a no-cost extension from the funder to make good on two of its promised deliverables: following up on its Landowner Roadmaps and their utility to landowners; and conducting its Piikani Traditional Diet Study. These two areas of inquiry are under active investigation as of this writing.

One methodological constraint of the project resulted from early attempts toward research approval and implementation during a global pandemic. Determined to uphold the values, ethics, and sovereignty of the Tribe's/Nation's Institutional Review Board and their imposed moratorium on all research within the Blackfeet Nation during the first years of the pandemic, two out of this project's three work areas were at a standstill for over 2 years. At the time of this writing, the Blackfeet Nation's IRB has been reconstituted post-pandemic and has emerged as a stronger, more effective, and resilient bulwark in assuring that the research conducted within the Nation and its areas of concern are consonant with the Nation's values.

Immersed as PLHI staff and partners—co-authors included—are, in the ongoing work described here and elsewhere (Paul et al., 2023), the overriding and *felt* conceptual and methodological constraint for this project would be the wholistic nature of the research (Absolon, 2010). Concern for the individual as well as the community has put a focus on the creation of jobs, and not just jobs, but meaningful work which also supports the cultural development of the individual as well as the community. In wholistic terms, this requires constant attention to the four-dimensional (spiritual, emotional, mental, physical) context in which the research is being conducted along with the concern for the development (aka “capacity building”) of the individual, family, community, nation, and ecosystem. All of this needs to be considered even as the research is being conducted. Piikani Lodge Health Institute itself was being developed as a non-profit (501(c)(3)) organization even as the research for Blackfeet Innovation Pathways was getting underway. While project team members agreed that this was the priority, it meant that PLHI was being built even as it was flying.

Data availability statement

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding authors.

Ethics statement

Ethical review and approval were obtained from the Blackfeet Nation Institutional Review Board for the study with human participants in accordance with the local legislation and institutional requirements. Written informed consent from the [patients/

participants OR patients/participants legal guardian/next of kin] was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

KP: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing, Supervision. KR: Conceptualization, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing, Investigation. MY: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing. LC: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – review & editing. JR: Conceptualization, Methodology, Writing – review & editing. CC: Conceptualization, Data curation, Formal Analysis, Methodology, Visualization, Writing – review & editing. WS: Investigation, Methodology, Writing – original draft. CF: Investigation, Methodology, Writing – original draft. AB: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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