



# Agroecology in the North: Centering Indigenous food sovereignty and land stewardship in agriculture “frontiers”

Mindy Jewell Price<sup>1</sup> · Alex Latta<sup>2</sup> · Andrew Spring<sup>3</sup> · Jennifer Temmer<sup>4</sup> · Carla Johnston<sup>5</sup> · Lloyd Chicot<sup>6</sup> · Jessica Jumbo<sup>7</sup> · Margaret Leishman<sup>6</sup>

Accepted: 28 February 2022 / Published online: 7 April 2022  
© The Author(s) 2022

## Abstract

Warming temperatures in the circumpolar north have led to new discussions around climate-driven frontiers for agriculture. In this paper, we situate northern food systems in Canada within the corporate food regime and settler colonialism, and contend that an expansion of the conventional, industrial agriculture paradigm into the Canadian North would have significant socio-cultural and ecological consequences. We propose agroecology as an alternative framework uniquely accordant with northern contexts. In particular, we suggest that there are elements of agroecology that are already being practiced in northern Indigenous communities as part of traditional hunter-gatherer food systems. We present a framework for agroecology in the North and discuss its components of environmental stewardship, economies, knowledge, social dimensions and governance using examples from the Dehcho region, Northwest Territories, Canada. Finally, we discuss several challenges and cautions in creating policy around agroecology in the North and encourage community-based research in developing and testing this framework moving forward.

**Keywords** Canada · North · Agroecology · Indigenous · Food sovereignty

## Abbreviations

NWT Northwest Territories  
KTFN Ka’a’gee Tu First Nation (alternative spelling:  
K’agee Tu First Nation)  
SKFN Sambaa K’e First Nation

## Introduction

Indigenous food systems across Canada’s northern regions depend on abundant land, waters, plants, and wildlife. Hunting, trapping, fishing, and harvesting are fundamental both

---

✉ Mindy Jewell Price  
mindy\_price@berkeley.edu

Alex Latta  
alatta@wlu.ca

Andrew Spring  
aspring@wlu.ca

Jennifer Temmer  
jtemmer@wlu.ca

Carla Johnston  
cjohnston@basillieschool.ca

Lloyd Chicot  
kaageetu\_chief@northwestel.net

Jessica Jumbo  
environment@sambakefn.com

Margaret Leishman  
m\_leishman43@yahoo.com

<sup>1</sup> Department of Environmental Science, Policy, and Management, University of California, Berkeley, 130 Mulford Hall, Berkeley, CA 94707, USA

<sup>2</sup> Departments of Global Studies, Geography and Environmental Studies, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON N2L 3C5, Canada

<sup>3</sup> Department of Geography and Environmental Studies, Laurier Centre for Sustainable Food Systems, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON N2L 3C5, Canada

<sup>4</sup> Department of Geography and Environmental Studies, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON N2L 3C5, Canada

<sup>5</sup> Balsillie School of International Affairs, 67 Erb St. West, Waterloo, ON N2L 6C2, Canada

<sup>6</sup> Ka’a’gee Tu First Nation, Box 4428, Hay River, NT X0E 1Z0, Canada

<sup>7</sup> Sambaa K’e First Nation, P.O. Box 10, Sambaa K’e, NT X0E 1Z0, Canada

to those food systems and to Indigenous cultures. Through colonization and settlement, northern Indigenous communities have become progressively more reliant on store-bought, imported foods. However, high transportation costs and remoteness means that fresh and healthy store-bought foods are often inaccessible (Leblanc-Laurendeau 2020). Household food insecurity in northern Canada is significantly higher than the national average, and one is more likely to be food insecure if they are Indigenous (Tarasuk & Mitchell 2020). Food insecurity has been heightened by a warming climate, which has brought environmental changes introducing new challenges to the traditional food systems (Cameron 2012; Pearce et al. 2015). At the same time, models suggest that climate change is creating more favorable conditions for agriculture, as changes in temperature and precipitation enable new possibilities for crop production across the region (Beck et al. 2018; Hannah et al. 2020; King et al. 2018). Northern communities and regional and territorial governments are considering agriculture as a way to enhance access to and availability of fresh foods, to promote economic opportunities, and to secure a local food supply in the face of global uncertainties (Johnston and Spring 2021; Simba and Spring 2017; Government of Northwest Territories 2017; Government of Yukon 2016). However, there is limited coordination and agreement across these groups (Altdorff et al. 2021), and Indigenous communities are often excluded from these conversations.

In southern Canada, most producers practice “conventional” agriculture, characterized by industrialized, large-scale, intensive production and a heavy reliance on capital-intensive technologies, chemical inputs, and exploited labor (Laforge et al. 2021). The expansion of conventional agriculture into the boreal forests of sub-Arctic regions could contribute to biodiversity loss, water quality issues, and soil carbon loss that would further contribute to global climate change (Hannah et al. 2020; Unc et al. 2021). Conventional and large-scale agriculture in southern Canada has created water quality issues that are particularly felt among First Nations and importing these agriculture models to the North could further contribute to environmental injustices in northern Indigenous communities (Mascarenhas 2007). Potential broader ecosystem impacts of conventional agriculture in the North are poorly understood, including the introduction of new crop species and nutrient inputs, as well as the impacts of soil disturbance on the fragile boreal ecosystems. However, as a warning for future development, mid-twentieth century agricultural settlers in the boreal forests of the northern parts of the Canadian provinces give some indication of the pressures placed on local ecosystems by burning and clearing forests and introducing alien seed grasses (Piper and Sandlos 2007).

An influx of large-scale, conventional agriculture in the North could also have significant social and cultural

implications for Indigenous peoples and traditional food systems. Agriculture has been an effective tool of settler colonialism in North America through land dispossession and assimilation (Laforge and McLachlan 2018). Many Indigenous communities in the North continue to experience trauma from agriculture programs associated with the residential school system and forced assimilation from traditional foods to a settler diet (Rudolph and McLachlan 2013; Johnston and Spring 2021). Furthermore, Indigenous communities across the North have deep relationships with the land, waters and animals, and these connections form the basis of their food systems. Well-being comes from knowing and sustainably maintaining natural landscape, and a high-value is placed on sharing labor and food. This can contrast significantly with agriculturalists' need to fundamentally change landscapes in order to produce food, and with the value placed on individual profit maximization within capitalist agriculture (Brody 2000). In responding to calls from northern communities, farmers, and governments for increased agriculture development in the North, we contend the need for a model that addresses the colonality of agriculture in Canada, prioritizes larger ecosystem relationships, and supports the food and land sovereignty of northern Indigenous peoples. We propose agroecology as a starting point for this conversation.

Our article centers the case of northern Canada, which we define as the territory north of the zone of discontinuous permafrost, including the Yukon, Northwest Territories (NWT) and Nunavut as well as the northernmost parts of several provinces. There are commonalities across many parts of this region. The political landscape in northern Canada is largely being reshaped by the negotiation of modern land and self-government claims beginning in the 1970s and 80 s. Northern claim settlements generate political and economic contexts for land development that are markedly different from much of the rest of Canada, including sizable areas of Indigenous land tenure. In connection, experience with resource co-management institutions and revenue sharing efforts stemming from settled claims have reinforced the right for Indigenous nations to be consulted and involved in decision-making about their traditional harvesting territories. Nevertheless, some land claim and self-government negotiations are ongoing, resulting in significant degrees of uncertainty and insecurity in the face of resource development pressures. Unresolved claims also limit the autonomy of Indigenous communities to initiate their own development efforts, such as clearing land for agriculture, and can make them vulnerable to the expansion of future agriculture development by outside interests. Such is the case in the Dehcho region, where our two partner communities are located.

This paper draws from 7 years of ethnographic and Participatory Action Research (PAR) experiences with Ka'a'gee Tu First Nation (KTFN) and Samba K'e First

Nation (SKFN), located in Kakisa, NWT, and Smbaa K'e, NWT, respectively, and from the lived experiences of three co-authors of this paper who are members of these First Nations. Both First Nations have identified agriculture as a way of supporting food sovereignty and climate change adaptation in their communities (Ahmed and Wenman 2020). Our PAR relationships with SKFN and KTFN support these priorities through projects that combine both formal research activities, 'on-the-ground' actions, and capacity building and support. For example, the Northern Agriculture Futures project is a partnership of social scientists, natural scientists, and the communities that considers how agriculture can support the health of the overall food system. Northern Agriculture Futures compliments other community projects and priorities in Kakisa and Smbaa K'e, such as on-the-land youth-Elder knowledge exchange and climate change research and monitoring efforts ongoing in the region (Reid et al. 2019; Spring et al. 2019). Specific descriptions of KTFN and SKFN land-use and agricultural practices in the following pages are also informed by community workshops on environmental stewardship in 2018 and 2019.

PAR can be challenging for both researchers and communities alike. It requires collaboration between people of often very different backgrounds, who bring distinct aspirations and expectations to the research process. Researchers cannot easily overlook the pressure to publish, while community leaders and members must prioritize tangible outcomes (Chevalier and Buckles 2019). Our approach to adapt to these challenges includes long-term commitment from both researchers and community members to build trusting, reciprocal relationships that enable both community and scholarly objectives to be met over time (Saxinger et al. 2018; Castleden et al. 2012; Gaudry 2011). Within our practice, this has involved senior researchers maintaining long-term connections with KTFN and SKFN, and graduate students taking on small portions of broader research projects. These graduate students regularly follow a pattern of beginning their PAR work with an extended period of time in a community with no formal research objectives other than to build relationships and engage in community-based work. Based on this initial experience, students work with the communities to set research objectives that are conducted in subsequent engagements both in community and remotely. While the challenges of aligning academic and community priorities still exist, this approach has allowed for mutual learning and action around KTFN and SKFN's goals of climate change adaptation and food sovereignty.

While agriculture is being framed as a potential economic driver in the region, many barriers still exist for this growing sector, and the lack of Indigenous inclusion in policy dialog needs to be addressed. This paper considers the consequences of potential conventional agriculture on Indigenous

land and food sovereignty, and also on the sensitive northern environments they have stewarded since time immemorial. We argue that northern Indigenous environmental stewardship aligns with agroecology as an alternative framework for agriculture development in the region. To frame this argument, we first situate northern food systems in food regime theory and settler colonialism. Then, we discuss the history of agroecology in the global south and its growth as a global movement centered around food sovereignty. While agroecology is commonly used to describe sustainable crop and livestock systems, we argue that agroecology more broadly describes a relationship between humans and land centered around respect and reciprocity. Next, we consider the "fit" of agroecology in northern Canada and present a framework that is broadly defined by Indigenous environmental stewardship. Lastly, we discuss several challenges and cautions in creating agriculture policies, and we encourage further participatory testing of this framework moving forward.

## Food regimes, settler colonialism, and new frontiers for agriculture

Food regime theory and settler colonialism provide an entry point for understanding contemporary northern food systems. While food regime theory demonstrates the role of food and agriculture in the development of global capitalism, we also trace how agriculture has been an effective tool in the historical and ongoing work of settler colonialism, which reinforces and is inseparable from capitalism (Grey and Patel 2015). Settler colonization is an ongoing process, evident in the active consolidation and legitimization of settler control through federal and provincial policies (Wolfe 2006; Pasternak 2017). Friedmann and McMichael's (1989) food regime theory describes the role of food and agriculture in the development of global capitalism. Grey and Patel (2015) critically show how capitalist development accompanied increasing settler domination over Indigenous food systems in North America, beginning with conquest over Indigenous food systems as a tool of war (first food regime), forced assimilation to a settler diet (second food regime), and finally appropriation of Indigenous cuisine for settler consumption (third food regime). In the first global food regime (1870–1914), primitive accumulation in settler states created an unprecedented class of commercial family farmers that provided cheap meat and wheat to support a growing working class in Europe. While relatively competitive agricultural relationships existed between politically independent metropolises and colonies, an unequal colonial relationship was already being established. Settlers dispossessed Indigenous peoples of their land and used slave labor to augment new national economies. In the Canadian north, farmed plants and domesticated animals created an ongoing

form of eco-colonialism in Indigenous landscapes (Piper and Sandlos 2007).

The second food regime (1947–1973) entrenched capitalist agriculture globally and shifted power from British to US hegemony through policies of surplus food production by US tariffs, export subsidies, and domestic price supports. The US began dumping grain and pushing durable foods into global markets, changing local diets and economies of food around the world. In North America, the US and Canadian governments established reservations and residential schools, where Indigenous peoples were displaced from their territories and language base, as well as their traditional foods (Coté 2016; Laforge and McLachlan 2018; Mosby 2013). Many residential schools instituted agriculture as curriculum, and students were forced to plow, maintain, and harvest crops in school gardens for their own subsistence. Church and state thus effectively weaponized mission gardens “as tiny outposts that furthered the ecological and cultural ambition of newcomers to the North” (Piper and Sandlos 2007, p. 779). The Dominion Government also attempted to “change the hunter to husbandman” through the introduction of reindeer to the Mackenzie Delta, but the herding program largely failed to accomplish its goals by the end of the 1950s (Department of Mines and Resources 1938 in Piper and Sandlos 2007, p. 774). Traditional food systems across Canada declined as a result of loss of land, forced settlement, and wage labor, creating a long-term dependency on the government that continues to undermine local food security today (Manuel and Derrickson 2015; Alfred 2015). Many Northerners have come to rely on durable foods they can purchase at grocery stores, heavily processed ‘food from nowhere’ that is transported more easily and cheaply than fresh produce (Rudolph and McLachlan 2013).

There is some debate over the existence of a third food regime. Friedmann argues for the possibility of an emergent “corporate-environmental food regime,” or “green capitalism,” but she does not believe this constitutes a “full-scale (hegemonic) establishment of a food regime” framed by stable social forces that govern the production and consumption of global foods (McMichael 2009, p. 147, p. 148, p. 151). McMichael argues that the third food regime has arrived, dovetailing with the rise of neoliberalism and the degradation of social and political barriers to the flow of capital into food and agriculture, institutionalized through international trade agreements like NAFTA and the TPP (Fairbairn 2010). Corporate consolidation of seeds, agricultural technology, production, and processing mean that fewer and fewer people control a growing percentage of the world’s food (McMichael 2012). When agriculture moves into new areas through large-scale land grabs, it is often corporate farms that purchase and work the land (Fairbairn 2010). The corporate food regime also contains a new component: selective appropriation by transnational corporations of activists’

demands, such as food quality or environmental standards. Corporations co-opt such demands and use them to generate more capital, such as through organic foods certification or commodification and industrial cultivation of “wild” rice (Friedmann 2005; Grey and Newman 2018). Even agrifood activism may inadvertently reinforce neoliberal thinking, such as fair trade, locally produced, and organic food that relies on the neoliberal discourse of consumerism (Allen and Guthman 2006; Fairbairn 2010). As an agricultural export-oriented country, the Canadian government promotes corporate models of agriculture in domestic and international forums (Laforge et al. 2021; Margulis, 2015). It is in the midst of this third food regime, and in the context of rapid climate change, that a new agricultural agenda has begun to take shape around the circumpolar north.

A growing body of literature is projecting increases in crop and animal agriculture in the circumpolar north as the growing season warms and lengthens with climate change (Altdorff et al. 2021; Beck et al. 2018; King et al. 2018; Tchebakova et al. 2011; Unc et al. 2021). Climate scientists Lee Hannah et al. (2020) introduced the concept of “climate-driven agricultural frontiers,” which they define by increasing crop suitability from temperature and precipitation. For critical scholars, however, frontiers are more than geophysical lines on a map. Frontiers are discursive and material (Eilenberg, 2014). They are key sites of accumulation, where capital accesses new resources such as land, energy, and labor (Harvey, 2004; Moore, 2017). Frontiers are also zones of social experimentation and innovation, where new governance structures and hybrid politics arise (Cons and Eilenberg 2018). Agriculture frontier rhetoric has been used in Canada and globally to justify Indigenous land dispossession and territorialization (Eilenberg 2014; Peluso and Lund 2011; Piper and Sandlos 2007). In Bangladesh, Kasia Paprocki (2018, p. 296) demonstrates how climate change alters the conditions and possibilities of frontier agriculture, which investors use to anticipate the “ruination” of local livelihoods and shape the construction of new ones.

Academics who contemplate the northern agriculture frontier often discuss its potential to contribute to local or global food security but omit its ties with settler colonialism and large-scale capitalist agriculture. In recent years, governments across northern Canada have begun developing policies to support the northern expansion and intensification of agriculture (Government of Northwest Territories 2017; Government of Yukon 2016; Government of Newfoundland and Labrador, 2017). At this time, the northern agriculture “frontier” is still an imagined future, since climatic, political, and infrastructural factors continue to impede the development of large-scale, industrial agriculture in much of the circumpolar north. In Russia, Chinese investors have begun to purchase large pieces of land for northern agriculture, altering land and labor relations (Zhou

2016). In the NWT, however, governmental policies do not readily support the production and processing of large-scale agriculture, and new land leases for agriculture have been difficult to access since 1975 due to unsettled Indigenous land claims. However, new policies are being considered to expand small-scale agricultural production across the territory as the Government of the Northwest Territories works to develop its agricultural industry (Government of Northwest Territories 2017). How these policies take shape will either entrench settler colonialism and the neoliberal food regime or open towards an alternative future of Indigenous and northern food sovereignty.

We argue that agroecology offers a conceptual perspective on northern agriculture that challenges the dominant paradigm of the third food regime and breaks with the legacy of frontier agriculture. Additionally, it offers a framework for how new practices and policies can reflect social and cultural values of the region, while responding to the global climate crisis. In the next section, we review the global agroecology movement and then consider how environmental stewardship offers an expanded model for agroecology in the northern context.

## Agroecology

### A global movement for alternative food systems

Agroecology has many definitions, making it a multidimensional construct. American agroecologist Steve Gliessman defines agroecology as “the science of applying ecological concepts and principles to the design and management of food systems” (p. 510 in Wezel et al. 2009). Meanwhile, Francis et al. (2003) describes it as “...the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions” (p. 100). This definition is deliberately expansive to address questions of the need to balance productivity, sustainability, and livability. Emphasizing broader system motivations, Isaac et al. (2018) call agroecology “a transformative and science-based movement that aims to radically counter a history of policies, practices, and ideologies that have prioritized maximum agricultural yields over other socioeconomic, environmental, and biocultural objectives” (p. 2). With its roots in both scientific inquiry and political activism, agroecology thus embodies three dimensions: science, movement, and practice (Wezel et al. 2009). Moreover, it is the indivisible nature of agroecology across these three domains that is of particular importance in Canada’s north. As Sevilla-Guzman and Woodgate (2013) suggest, this unity of dimensions protects agroecology from co-optation by the capitalist agro-industrial complex. This threat is apparent in corporate discourses like “climate-smart agriculture” and “precision agriculture”,

and also in the promotion of GMOs and large-scale organic farms as sustainable practices, even as they undermine small-farmers and Indigenous food sovereignty (Isaac et al. 2018; Kepkiewicz and Dale 2019).

As a global movement, agroecology is practiced and championed by actors working at the grassroots. In these spaces, agroecology has advanced slowly, gradually gaining voice as a criticism of and an alternative to the impacts of conventional agriculture and the Green Revolution (Wezel et al. 2009; Norder et al. 2016; Isaac et al. 2018). For example, members of La Via Campesina, the world-wide social movement of peasants, Indigenous peoples, and landless agricultural workers, assert that, “Agroecology is the answer to how to transform and repair our material reality in a food system and rural world that has been devastated by industrial production” (Nyéléni 2015 in Pimbert 2018, p. 15). Through the activism of social movement and civil society actors such as La Via Campesina, agroecology has been brought into international food governance spaces, such as the UN Food and Agriculture Organization, and the UN Committee on World Food Security, as a transformative approach to the structural challenges of global industrial food systems (Gaarde 2017).

In Canada, the agroecology movement is only now emerging in response to issues such as rising levels of food insecurity, rights for migrant farm workers, corporate and foreign agriculture land purchases, and the dismantling of marketing boards (Isaac et al. 2018; Kepkiewicz and Dale 2019; Laforge et al. 2021). Agroecology as a science and practice has emerged across Canada’s rural landscape primarily in the form of organic, biodynamic and other sustainable agriculture practices (Laforge et al. 2021). With agroecology in Canada still growing and developing, we see an opportunity to broaden this movement through an alignment of the ethos of ecological food production in both agroecology and Indigenous food systems. While Indigenous peoples in northern Canada have limited historical involvement in agricultural practices, other forms of traditional food provisioning, such as fishing, harvesting, hunting and trapping connect land, animals, ecosystems and humans together, similar to agroecological principles (Isaac et al. 2018). As such, Traditional Knowledge of local food systems bridge culture with nature and will play an essential role in developing new agroecological food production practices in the North.

### From agroecology to Indigenous guardians

Underscoring agricultural practices and a socio-political agenda for food system change, the agroecology movement grows out of worldviews and value systems rooted in Indigenous and peasant cultures. In the face of imposed Western notions of progress and development based on



human domination and management of nature (Blaser et al. 2010), agroecology reasserts deep relationships between humans and nonhumans as the basis for Indigenous and peasant land-use, knowledge and practice. In one example, Saylor et al. (2017) underline the way Quechua and Aymara agricultural knowledge is embedded in sacred relationships with Pachamama (Mother Earth), “an intimate relationship in which social, cultural, and ecological are all part of a single web of knowledge, symbols, meanings, and survival” (p. 154). In another example from the Andean region, Boillat et al. (2013) identify the way these relationships are indexed by traditional place names, which “integrate biotic, non-biotic and human elements of the landscape” (p. 665), ultimately signaling “pathways towards a holistic understanding of social-ecological interactions” (p. 676).

Rosset et al. (2021) see such ontological foundations as characteristic of a particularly Latin American agroecology, bundled into larger socio-ecological concepts like *Buen Vivir* or *Sumak Kawsay* that have been central in Indigenous and peasant political mobilizations in the Andean region. Research by Steinhäuser (2020) and others suggest that such ontological commitments are more widespread in the global agroecological landscape. Comparing an Indigenous case-study context in Argentina with a case study in northern Italy, Steinhäuser identifies common intangible values around the “reciprocal well-being” of humans and nature in the narratives of agroecological farmers. She argues that elevating the importance of traditional and local knowledge is about “understanding people as rooted on earth again and cultivating bonds between living beings...” (p. 373). Huambachano (2018) similarly ties together Traditional Knowledge and philosophies of “good living” in a comparison across Peruvian Quechua and Māori of Aotearoa – New Zealand. Through these ties, local understandings of the food system are underpinned by cosmovisions “expressed in a kinship system (human and nonhuman) for the love of, respect for, and gratitude toward the land – Mother Earth” (p. 1013).

It is significant that these efforts to trace the worldviews, values, and philosophies behind agroecology all place emphasis on cultural and social dimensions. As Steinhäuser (2020) argues, “transition to agroecology can only take place when there is a regeneration of both landscape and society” (p. 373). This brings us back to the socio-political agenda of agroecology, which has become strongly linked with food sovereignty as a key dimension of Indigenous and peasant struggles against the broader implications of the neocolonial global economic order. We can see this in Copeland’s (2019) analysis of the overlap between food sovereignty and broader movements for defense of territory in Guatemala, in Guzmán and Martínez-Alier’s (2006) discussion of agroecology’s articulation with anti-globalization movements in Mexico

and India, and in the assertion by Laforge et al. (2021) that one of the key tasks of the agroecology movement in Canada is defending Indigenous food sovereignty by addressing the injustices of settler colonialism.

We draw special attention to agroecology’s links with broader decolonizing movements in defense of territory, local livelihoods, and food sovereignty because they underline philosophies of care and reciprocity in human-land relationships. This is significant in the northern Canadian context, where Indigenous Peoples have limited histories with agriculture. Indigenous worldviews and values of the webs of mutual care between humans and ecosystems inform careful stewardship that also provides fish, game, and other wild foods. For instance, drawing on examples from his own Anishinaabe heritage of central Canada, Borrows (2018) describes how Indigenous laws are literally “earth bound”, providing teachings and lessons for implementing an ethic of care towards the land. McGregor (2014), also speaking from the Anishinaabe tradition, explains this ethic in relation to Traditional Ecological Knowledge of water: “Water, according to First Nations peoples, has cleansing and purifying powers...It is imperative in our traditions to keep the water clean so it can continue to fulfill its purpose” (p. 501). In many cases, such teachings rest on extended notions of kinship. In one example of this, Prosper et al. (2011) assert that for the Mi’kmaq People of Atlantic Canada, “consumption of all life forms, such as plants, trees or mammals, is considered as a celebration of their ancestors, as all deceased are integrated into and with the land, water and air” (p. 6).

Like the Indigenous and peasant philosophies underlying agroecology, the worldviews, values, and laws of Indigenous nations with a non-agricultural history of land use provide a vision of mutual human and non-human well-being. Where agricultural peoples practice such worldviews in methods of cultivation, non-agricultural peoples put them into practice through what Western science calls “natural resource management” or “conservation”. While a Western worldview might initially conceive of such stewardship practices simply in terms of limits on human action, for example, in the basic laws for hunters to take only what is needed, Legat’s (2012) description of Tłıchǫ Traditional Knowledge reveals a conviction that humans actively contribute to the well-being of the animals they hunt. “It is said by the most senior elders that if caribou are not needed and used appropriately, their spirit will die” (p. 84), but conversely, “if respected and used properly, the caribou spirits will thrive” (p. 85). Turner (2020) describes how ethnobotanists, wildlife biologists and others working with Indigenous peoples along Canada’s Pacific Northwest coast have gradually come to understand over the past half-century that Indigenous stewardship practices are about much more than simply limiting what humans “take” from the environment. As she puts it, Indigenous land users actually “tend” to the landscapes on

which their livelihoods depend, helping to shape the complex relationships between human and non-human life.

In light of such examples, the assumed distinctions between agricultural and hunter-gatherer modes of livelihood seem arbitrary. Indeed, as Laforge et al. (2021, p. 199) stress, “if agroecology is pursued too narrowly, it will risk perpetuating an agrarian-centric vision of land stewardship that does not take into account the need for a decolonized food system. Indigenous foodways, including small-scale fisheries, traditional systems of harvest and trade, need to be part of a holistic understanding of agroecology.”

In non-agricultural settings, where spatially extensive land use for fishing, hunting, and gathering have been the basis for Indigenous ways of life, Western environmental management has played a colonizing role similar to that of industrial agriculture in relation to Indigenous and peasant agricultural food systems. As described by Berkes (2012), “Western resource management, and reductionist science in general, [was] developed in the service of a utilitarian, exploitative, dominion-over-nature worldview of colonists and industrial developers” (p.266). Berkes and other scholars emphasize the ontological dimension of colonial relationships around the use and management of “natural resources”, where Indigenous Peoples are obliged to operate within Western anthropocentric assumptions and bureaucratic rationalities in order to participate in the governance of human–non-human interactions in their territories (Nadasdy 2003; Wilson and Inkster 2018; Howitt and Suchet-Pearson 2006).

While environmental management has acted as a framework for colonization, it is also becoming a crucial location for Indigenous resistance. Drawing on their land-based knowledge, legal systems, and environmental monitoring practices, Indigenous Peoples around the world are increasingly reclaiming their rightful roles as environmental stewards, as part of asserting sovereignty and legal authority in their traditional territories (see Muller et al. 2019; Kirby et al. 2018; Hemming and Rigney 2008). The terminology of Indigenous Rangers (Australia), and Watchmen or Guardians (Canada), has been increasingly used to formalize the roles of Indigenous land users in environmental stewardship (Reed et al. 2020), and their contributions to environmental management and conservation are receiving global attention (Artelle et al. 2019; Ens et al. 2016; Zurba et al. 2012). In Canada, there are numerous examples of increasingly formalized practices for Indigenous-led environmental stewardship and conservation (Young et al. 2020; Zurba et al. 2019; Lee et al. 2019; Indigenous Circle of Experts 2018; Trant et al. 2012).

It is at the intersection of Indigenous environmental stewardship and agroecology that we locate our central argument. As the agricultural “frontier” moves northward, and northern communities expand their agricultural activities,

conventional agricultural assumptions and practices threaten to come with it, promising further incursion of settler colonial land and food systems into the North. Agroecology offers an alternative model that is uniquely suited for Indigenous-led agricultural practice because, as stewards of their lands and waters, Indigenous peoples in the NWT and elsewhere have been practicing a form of agroecology for millennia.

## Agroecology in the North

As northern Canada becomes a new “climate-driven agriculture frontier” (Hannah et al. 2020) we have considered two global agriculture frameworks. The first is a conventional agriculture paradigm that has developed within food regimes and settler colonialism, and has globally contributed to ecological destruction, Indigenous land dispossession, and corporate control (Grey and Patel 2015; Holt-Giménez et al. 2012; Patel 2012). The second framework is agroecology, which began in Indigenous and peasant fields of Latin America and has come to be identified with radical movements for land and food sovereignty around the world (Copeland 2019; Laforge et al. 2021). In conjunction with scholars that offer a food sovereignty framework to guide agriculture discussions in the North (Keske 2021; Rudolph and McLachlan 2013), we argue that agroecology is the more favorable framework for northern agriculture for several reasons.

First, in light of our arguments in the previous section, we see alignment between northern Indigenous peoples’ environmental stewardship and agroecological principles, suggesting that agroecology is already being practiced in the North. Broadening the definition of agroecology to include non-agricultural stewardship relationships allows for the movement to accommodate hunter-gatherer societies and not just agricultural ones. Second, agroecology encompasses political movements in defense of territorial and political sovereignty, with sovereignty over food systems being a crucial aim and outcome of such struggles. Without this emphasis on Indigenous sovereignty, the advancement of agriculture in the North risks repeating settler colonial patterns. As such, agroecology is an important framework for Indigenous and non-Indigenous farmers as well as government, as it can incorporate Indigenous sovereignty and sustainable agricultural practices. Third, agroecology provides a framework for practicing agriculture in the North beyond conventional agriculture’s reductionism, anthropocentrism and capitalist relations. This framework is supported by the global agroecology movement, with established solidarity networks that could facilitate shared learning, practice, and political power for agroecological growers in the North. And finally, some Indigenous communities in the North, such as SKFN and KTFN, are already actively growing their own food, and

food production is integrated into community strategies of environmental stewardship and climate change adaptation (Ahmed and Wenman 2020). Agroecology provides a framework for these agricultural activities that more fully aligns with Indigenous worldviews than conventional paradigms.

In this section, we draw on our participatory research and lived experiences to outline a set of principles of agroecological practice in the North. These principles should not be considered a definitive recipe for northern agroecology, but rather a starting point for conversations with communities about developing agroecological frameworks that draw on their own values and traditional food systems to develop locally appropriate approaches to agriculture. The following figures show resonances between a more general agroecology model and a regionally adapted model for agroecology in the North. Figure 1., adapted from a figure produced by the International Panel of Experts on Sustainable Food Systems (IPES-Food 2020), depicts agroecology from a global perspective and emphasizes that food is grown in ways that work with local ecologies, using agricultural practices that promote biodiversity, provide for local livelihoods, uphold Traditional Knowledge, defend land rights, and support food sovereignty. Figure 2 is an adaptation of the global agroecology model to northern food systems.

## Stewardship

Crucially, agroecology in the North sees agriculture within, not superseding, the traditional food system. Rather than a narrower focus on sustainable and regenerative agricultural practices as in Fig. 1., this principle is broadened to *stewardship* that sustains healthy lands and healthy people. This includes the practices of fishing, hunting, gathering, and growing, as integrated into sustainable, resilient food systems to provide a more holistic understanding of agroecology (Laforge et al. 2021). For SKFN and KTFN, health and well-being come from connection to the land, including consumption of land-based food and medicine. Respect for the land is given through offerings of tobacco and other gifts, prayers, and caring for the plants and animals, among other practices. Conservation activities, such as not taking more than what is needed and monitoring for forest and wildlife health, are practiced to maintain a strong connection to the land. Developing agriculture according to these stewardship relationships generates social and environmental benefits, while avoiding many problems associated with conventional agriculture in southern Canada (Rudolph and McLachlan 2013).

There are Indigenous priority initiatives in the NWT that already align with this stewardship principle in northern agroecology, such as Indigenous-led Protected Areas and Guardian Programs. For example, in the Dehcho region, Dehcho First Nations declared the establishment of the

Edézhzhíe Protected Area in 2018, a product of close collaboration with the federal government, which will also provide protection for Edézhzhíe as a National Wildlife Area. Edézhzhíe covers 14,218 square kilometers of crucial wildlife habitat that has helped sustain several Dehcho First Nations communities for generations. The establishment agreement provides for co-management between Dehcho First Nations and the Government of Canada, includes a commitment to respect and promote traditional Dene land use, and provides a central stewardship role for Dehcho Guardians (Dehcho First Nations and Government of Canada 2018). Both KTFN and SKFN have also engaged over several years with federal and territorial governments as they work towards creating their own protected areas. As part of this process, 9600 square km around Kakisa and 10,600 square km around Sambaa K'e are demarcated as candidate areas (Government of Northwest Territories 2021).

In the environmental register, agriculture in the North must consider inherent challenges associated with soil and climate, as well as impacts on the boreal ecosystem. At the heart of agroecological practice is the belief that agricultural ecosystems should mimic regenerative relationships and reflect the levels of biodiversity within natural ecosystems. Examples of agroecological practices include a variety of diversification strategies (e.g. mixed or intercropping, agroforestry, silvopastoralism, crop rotation), soil management strategies (e.g. cover cropping, green manures, mulching, compost application, organic and no-till methods), and soil conservation strategies (e.g. contour farming, terracing). Natural scientists have shown how these practices enhance ecosystem resilience by improving soil and water dynamics and increasing biodiversity (Altieri and Nicholls 2017; Kremen and Merenlender 2018), and these practices should be considered for agriculture in the North. Because the soil quality is poor in much of this region, composting to build soil health will be an essential component of northern agriculture. Fish compost is one example of an innovative way to utilize products from the food system in crop production and is currently being tested with the waste generated by a small commercial fishery in Kakisa. In Sambaa K'e, gardeners are using leaf litter from the forest floor to supplement soil nutrients.

## Economies

Agroecology in the North pushes against conventional agriculture's logic of market expansion. In political economic terms, this means re-embedding the agricultural economy within social and cultural values (Polanyi 1944). In terms of northern Indigenous food systems, this means recognizing that *economies* of food include sharing and trading (Coté 2016; Hoover 2017). This re-embedding need not entail a complete rejection of market relations, but centers traditional

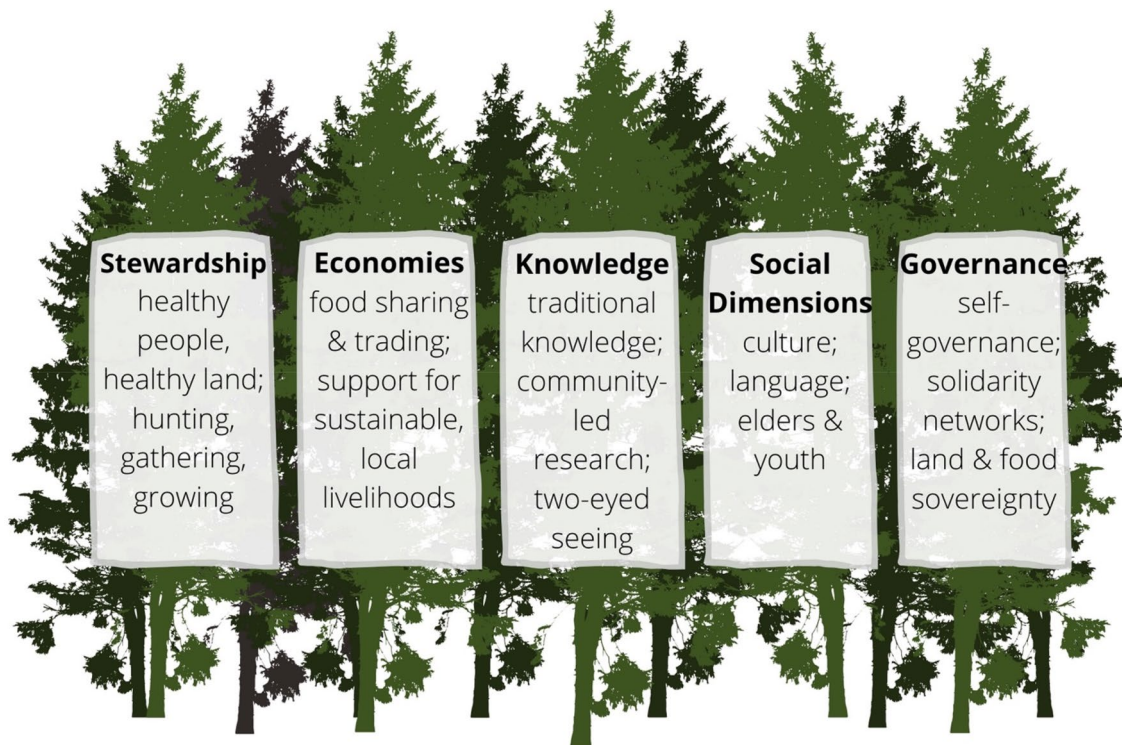




**Fig. 1** Components of agroecology, adapted from IPES-Food (2020)

values alongside those relationships (Manson 2018/9). Among KTFN and SKFN, the annual fall hunt is a time where the community hunts together. Moose and other food harvested from the land is shared among families to ensure everyone has food for the winter. Agroecological practices

by KTFN and SKFN also embody this sharing economy, ensuring that no matter who tends the gardens, the entire community shares in the harvest. Many federal-territorial agriculture programs require that farms be market-oriented and economically productive in order to receive funding.



**Fig. 2** Framework for agroecology in the North

While these programs can help to support small-scale market-oriented agriculture in the NWT, they may not reflect the full range of priorities of communities that want to grow food. An agroecological funding program would consider that household food provisioning in northern Indigenous communities includes a variety of market and non-market strategies and would make provisions for agriculture that follow alternative economies models.

### Knowledge

The *knowledge* dimension of agroecology in the North incorporates both Traditional Knowledge and Western science and values them equally in what has been called “two-eyed seeing” (Barlett et al. 2012). Both forms of knowledge are considered important for understanding changes in the land and for making decisions on harvesting and travel, particularly in the face of climate change. In Kakisa, programs such as bio-monitoring and archaeological studies corroborate what community members see when they are on the land and the stories told by Elders. Traditional Knowledge of the land and its foods, changes in climate, and relationships between humans and other-than-humans can inform new agricultural production in the North. Agroecological practices in the South reinforce the sharing of traditional and local knowledge and science-based conservation agriculture

techniques through farmer-to-farmer field schools, participation in local agriculture investigation committees, seed exchanges, informal exchanges, rural extension field visits, workshops, and by engagement in participatory research, among other activities. Similarities between these forms of exchange and Indigenous on-the-land camps, common in the North, include providing spaces for intergenerational learning, supporting local culture and language, gaining knowledge by doing, and creating opportunities for training by local knowledge holders.

Many land stewardship and conservation programs in the North also rely on monitoring the environment using combined Western science and Traditional Knowledge. One example is the Dehcho K’ehodi program, a regional initiative for environmental stewardship and monitoring. Dehcho Guardians, who are key members of this program, collect water quality data as part of the Government of NWT’s Community-Based Water Monitoring program, conduct fish and other aquatic ecosystem monitoring funded by the Government of Canada’s Aboriginal Aquatic Resource and Ocean Management program, and contribute to ongoing Traditional Knowledge observations that feed back into community deliberations about harvesting plans, land-user safety, and adaptations to environmental change. Similar two-eyed seeing programs could be implemented when experimenting with different crops or agriculture practices to monitor

the impacts on soil, water quality, and broader ecosystem changes.

Research, policy, and implementation of agriculture and land systems should be participatory and community-led. Agroecology in the North must practice non-hierarchical relationships built around solidarity and mutual trust (Laforge et al. 2021). Agroecology promotes research and policy agendas that place land users at the center, enabling local communities to prioritize the types of research and practices to be pursued. In the global south, this looks like partnerships between multiple actors, typically academic institutions, local non-profits and farmers themselves (Humphries et al. 2015). In the North, this can manifest through community-led research carried out by communities in partnership with universities, local non-profits, and Indigenous governments. Of course, ensuring that communities drive their own research and food system agendas may not always lead to the pursuit of agriculture as a path toward local food sovereignty.

## Social dimensions

Agroecology in the North also encompasses *social dimensions* by supporting language revitalization and strengthening Elder and youth engagement. Elders pass on knowledge to youth about how to live on and with the land, such as how to hunt and gather sustainably and how to be in respectful relationship with the land. These principles can also inform agricultural practice. For example, by monitoring the lakes' shorelines and observing where the rabbits come to eat grass each season, Elders in Sambaa K'e provide insight as to where the soil is best for growing and where to avoid planting when there is risk of erosion. Elders also share knowledge about what kinds of plants can be used as medicines and consider whether they could be cultivated and made more widely available in the community. Another role of the social is in addressing inter-generational trauma and healing to address the impacts of settler colonialism. In a K'éhodhi Strategy meeting, one KTFN Elder shared a story told by her dad: "a long time ago, people were so healthy that they could walk side-by-side with an animal, and they didn't even know you're there," but she said this relationship has been damaged and needs to be restored. The residential school system was a central factor in undermining Dene peoples' identities, as Dene children were severed from their relationships with the land, culture, language, and other generations. Indigenous communities need emotional, spiritual and physical healing from the residential school system and other traumas, including diabetes and substance abuse. Growing healthy, fresh foods is one way that KTFN and SKFN are healing from diet-related diseases, increasing

food self-sufficiency, finding mental healing, and restoring relationships with the land through stewardship practices.

## Governance

Across northern Canada, Indigenous peoples have secured higher rates of land tenure and self-governance than in the southern provinces, but some land claim and self-government negotiations are ongoing, as in the Dehcho region. This generates insecurity in the face of resource development pressures and limits to Indigenous peoples' decision-making power over land and resources in their territories. Even among settled land claims, the negotiation process can perpetuate settler colonialism through shrinking land bases, incurred debt, and bureaucratization of traditional governance structures (Pasternak 2017). As a result of the treaties, non-Indigenous settlement, and the need for a unified voice in land and self-government negotiations, many Indigenous communities in the NWT have adopted new structures that reflect Western forms of governance. Referring to the pressure to assimilate with Canadian society, one KTFN leader shared during a K'éhodhi Strategy meeting, "It's not us. It's not who we are." Dehcho Dene are "people [who] harvest geese, moose, caribou...berries." This assertion underlines a strong connection between traditional *governance*, being on and with the land, and environmental stewardship. Before settlement, Dene families moved seasonally between camps for hunting and harvesting. As they did, they monitored the health of the land and animals, coming together periodically to share observations about species numbers and animal health, and making harvesting decisions according to the wisdom of the Elders. Traditional monitoring continues when community members go fishing, trapping, and berry picking, and it serves as a model for environmental stewardship work that members of KTFN and SKFN do today.

Some Indigenous leaders are calling for their communities to return to traditional modes of self-governance, to a time of emotional and physical health and strong connections between Elders and youth. At the same time, there is an understanding of the need to bridge traditional ways with present institutions. Elder-harvester committees that help inform decision-making on the land, and Guardian programs that formalize observation and data collection, are examples of how Dene law and traditional values are being incorporated into new forms of governance.

## Conclusion

Labeling the North as an agricultural frontier is problematic. We contend that agricultural development in the North cannot proceed without recognizing Indigenous sovereignty. Through the framework of agroecology, the



North can be a model of regenerative and restorative food systems that include agriculture and traditional foods, while protecting Indigenous territorial rights. Indeed, we believe that forms of agroecology are already present and thriving in Indigenous communities across the region. At the same time, we see agroecology in the North as a framework that can guide both Indigenous and non-Indigenous farmers, producers, and gardeners. For Indigenous communities that choose to take on agricultural activities, agroecology provides a framework that can more fully align with their values and worldviews. Even among non-Indigenous agriculturalists, there is widespread recognition that large-scale, industrial agriculture in the North is not feasible, and small-scale, diversified production is preferred (Lemay et al. 2021). The framework of agroecology in the North supports sustainable agricultural production across the North; its key contribution is to ensure that Indigenous land and food sovereignty are brought to the center of the discussion.

Though we present agroecology as a way forward for agriculture in the North, we caution that agroecological models and practices developed in the South will not fit directly onto northern food systems. The framework presented here offers a set of northern agroecology components that move beyond crop production to incorporate traditional food provisioning practices and environmental stewardship such as hunting, fishing, gathering, and Indigenous guardianship. Our framework is based on previous and ongoing participatory research in the NWT but is limited to work with a few communities. Wider dialogue is needed to understand how communities across the North think about agriculture in relation to broader and multi-dimensional questions around Indigenous sovereignty over land, livelihoods and food systems, where diverse nations and communities face different challenges and have distinct aspirations for the future. More research is also needed to understand what agroecology as a science, movement, and practice looks like in the North. What stewardship practices are important, and how can Traditional Knowledge and agricultural knowledge be shared and brought together? What does a broader social or political movement look like in defense of Indigenous territory and food sovereignty in the region, and how does agroecology support it? We hope that the framework presented in this article will stimulate much-needed discussion and community-based research about how to move forward with agriculture in the North.

**Acknowledgements** The authors would like to thank the members of Ka'a'gee Tu First Nation and Sambaa K'e First Nation for their ongoing support, involvement and guidance in this research including the Northern Agriculture Futures project and workshops on their Dehcho K'éhodi Strategy. We would also like to thank Amanda Di Battista for creating the figures.

**Funding** Fulbright Canada, Berkeley Center for Canadian Studies, Government of Canada Crown-Indigenous Relations, Northern Affairs Climate Change Preparedness in the North (CCPN) Program, Social Sciences and Humanities Research Council.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Ahmed, R., and C. Wenman. 2020. Ka'a'gee Tu First Nation and Sambaa K'e First Nation Climate Change Workshop Report: February 11–13, 2020- Kakisa, NT. Yellowknife, NT: PlanIt North.
- Alfred, T. 2015. Cultural strength: Restoring the place of indigenous knowledge in practice and policy. *Australian Aboriginal Studies* 1: 3–11.
- Allen, P., and J. Guthman. 2006. From “old school” to “farm-to-school”: Neoliberalization from the ground up. *Agriculture and Human Values*. <https://doi.org/10.1007/s10460-006-9019-z>.
- Altdorff, D., N. Borchard, E.H. Young, L. Galagedara, J. Sorvali, S. Quideau, and A. Unc. 2021. Agriculture in boreal and Arctic regions requires an integrated global approach for research and policy. *Agronomy for Sustainable Development*. <https://doi.org/10.1007/s13593-021-00676-1>.
- Altieri, M., and C. Nicholls. 2017. The adaptation and mitigation potential of traditional agriculture in a changing climate. *Climatic Change*. <https://doi.org/10.1007/s10584-013-0909-y>.
- Artelle, K.A., M. Zurba, J. Bhattacharyya, D.E. Chan, K. Brown, J. Housty, and F. Moola. 2019. Supporting resurgent indigenous-led governance: A nascent mechanism for just and effective conservation. *Biological Conservation*. <https://doi.org/10.1016/j.biocon.2019.108284>.
- Barlett, C., M. Marshall, and A. Marshall. 2012. Two-eyed seeing and other lessons within our co-learning journey of bringing together indigenous and mainstream knowledges and ways of knowing. *Journal of Environmental Studies and Sciences* 2: 331–340.
- Beck, H.E., N.E. Zimmerman, T.R. McVicar, N. Vergopolan, A. Berg, and E.F. Wood. 2018. Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Scientific Data* 5: 180–214.
- Berkes, F. 2012. *Sacred ecology*, 3rd ed. London: Routledge.
- Blaser, M., R. de Costa, D. McGregor, and W.D. Coleman. 2010. Reconfiguring the web of life: Indigenous Peoples, relationality and globalization. In *Indigenous peoples and autonomy: Insights for a global age*, ed. M. Blaser, R. de Costa, D. McGregor, and W.D. Coleman, 3–26. Vancouver: UBC Press.
- Boillat, S., E. Serrano, S. Rist, and F. Berkes. 2013. The importance of place names in the search for ecosystem-like concepts in indigenous societies: An example from the bolivian andes. *Environmental Management*. <https://doi.org/10.1007/s00267-012-9969-4>.
- Borrows, J. 2018. Earth-bound: Indigenous resurgence and environmental reconciliation. In *Resurgence and reconciliation*:



- Indigenous-settler relations and earth teachings*, ed. M. Asch, J. Borrows, and J. Tully, 49–81. Toronto: University of Toronto Press.
- Brody, H. 2000. *The other side of Eden: Hunters, farmers, and the shaping of the world*. New York: North Point Press.
- Cameron, E.S. 2012. Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global Environmental Change*. <https://doi.org/10.1016/j.gloenvcha.2011.11.004>.
- Castleden, H., V.S. Morgan, and C. Lamb. 2012. “I spent the first year drinking tea”: Exploring Canadian University researchers’ perspectives on community-based participatory research involving Indigenous peoples. *Canadian Geographer*. <https://doi.org/10.1111/j.1541-0064.2012.00432.x>.
- Chevalier, J.M., and D.J. Buckles. 2019. *Participatory action research: Theory and methods for engaged research*. New York: Routledge. <https://doi.org/10.4324/9781351033268>.
- Cons, J., and M. Eilenbeg. 2018. Introduction and Framing essay. In *Frontier Assemblages: The emergent politics of resource frontiers in Asia*, ed. J. Cons and M. Eilenberg, 1–24. Hoboken: Wiley.
- Copeland, N. 2019. Linking the defence of territory to food sovereignty: Peasant environmentalisms and extractive neoliberalism in Guatemala. *Journal of Agrarian Change*. <https://doi.org/10.1111/joac.12274>.
- Coté, C. 2016. “Indigenizing” food sovereignty. Revitalizing Indigenous food practices and ecological knowledges in Canada and the United States. *Humanities*. <https://doi.org/10.3390/h5030057>.
- Dehcho First Nations and Government of Canada. 2018. Edézhzhie protected area. <https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations/edehzhie.html>. Accessed November 18, 2020.
- Eilenberg, M. 2014. Frontier constellations: Agrarian expansion and sovereignty on the Indonesian-Malaysian border. *Journal of Peasant Studies*. <https://doi.org/10.1080/03066150.2014.885433>.
- Ens, E., M.L. Scott, Y.M. Rangers, C. Moritz, and R. Pirzl. 2016. Putting indigenous conservation policy into practice delivers biodiversity and cultural benefits. *Biodiversity and Conservation*. <https://doi.org/10.1007/s10531-016-1207-6>.
- Fairbairn, M. 2010. Framing resistance: International food regimes and the roots of food sovereignty. In *Food sovereignty: Reconnecting food, nature and community*, ed. H. Wittman, A.A. Desmarais, and N. Wiebe, 15–32. Halifax: Fernwood Publishing.
- Francis, C., G. Lieblein, S. Gliessman, T. Breland, N. Creamer, R. Harwood, L. Salomonsson, J. Helenius, D. Rickerl, R. Salvador, M. Wiedenhoef, S. Simmons, P. Allen, M. Altieri, C. Flora, and R. Poincelot. 2003. Agroecology: The ecology of food systems. *Journal of Sustainable Agriculture*. [https://doi.org/10.1300/J064v22n03\\_10](https://doi.org/10.1300/J064v22n03_10).
- Friedmann, H. 2005. From colonialism to green capitalism: Social movements and emergence of food regimes. *New Directions in the Sociology of Global Development*. [https://doi.org/10.1016/S1057-1922\(05\)11009-9](https://doi.org/10.1016/S1057-1922(05)11009-9).
- Friedmann, H., and P. McMichael. 1989. Agriculture and the state system: The rise and decline of national agriculture. *Sociologia Ruralis*. <https://doi.org/10.1111/j.1467-9523.1989.tb00360.x>.
- Gaarde, I. 2017. *Peasants negotiating a global policy space: La Via Campesina in the Committee on World Food Security*. New York: Routledge. <https://doi.org/10.4324/9781315444963>.
- Gaudry, A.J.P. 2011. Insurgent research. *Wicazo Sa Review*. <https://doi.org/10.5749/wicazosareview.26.1.0113>.
- Government of Newfoundland and Labrador. 2017. The way forward on climate change in Newfoundland and Labrador. [https://www.gov.nl.ca/ffa/files/Agriculture-Sector-Workplan\\_Final.pdf](https://www.gov.nl.ca/ffa/files/Agriculture-Sector-Workplan_Final.pdf) Accessed 6 December 2021.
- Government of Northwest Territories. 2017. The business of food: A food production plan 2017–2022. [https://www.iti.gov.nt.ca/sites/iti/files/agriculture\\_strategy.pdf](https://www.iti.gov.nt.ca/sites/iti/files/agriculture_strategy.pdf) Accessed 6 July 2021.
- Government of Northwest Territories. n.d. Candidate areas. <https://www.enr.gov.nt.ca/en/services/conservation-network-planning/candidate-areas>. Accessed 13 September 2021.
- Government of Yukon. 2016. Local food strategy for Yukon. Encouraging the production and consumption of Yukon-grown food 2016–2021. <https://yukon.ca/sites/yukon.ca/files/emr/emr-local-food-strategy-for-yukon.pdf> Accessed 6 December 2021.
- Grey, S., and L. Newman. 2018. Beyond culinary colonialism: Indigenous food sovereignty, liberal multiculturalism, and the control of gastronomic capital. *Agriculture and Human Values*. <https://doi.org/10.1007/s10460-018-9868-2>.
- Grey, S., and R. Patel. 2015. Food sovereignty as decolonization: some contributions from Indigenous movements to food system and development politics. *Agriculture and Human Values*. <https://doi.org/10.1007/s10460-014-9548-9>.
- Guzmán, E., and J. Martinez-Alier. 2006. New Rural Social Movements and Agroecology. In *The handbook of rural studies*, ed. P. Cloke, T. Marsden, and P. Mooney, 472–483. London: Sage. <https://doi.org/10.4135/9781848608016.n34>.
- Hannah, L., P.R. Roehrdanz, E.D.G. Fraser, C.I. Donatti, L. Saenz, T.M. Wright, R.J. Hijmans, M. Mulligan, A. Berg, and A. van Soesbergen. 2020. The environmental consequences of climate-driven agricultural frontiers. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0228305>.
- Harvey, D. 2004. The “new” imperialism: Accumulation by dispossession. *Socialist Register* 40: 63–85.
- Hemming, S., and D. Rigney. 2008. Unsettling sustainability: Ngarrindjeri political literacies, strategies of engagement and transformation. *Continuum*. <https://doi.org/10.1080/10304310802452438>.
- Holt-Giménez, E., A. Shattuck, M. Altieri, H. Herren, and S. Gliessman. 2012. We already grow enough food for 10 billion people... and still can't end hunger. *Journal of Sustainable Agriculture*. <https://doi.org/10.1080/10440046.2012.695331>.
- Hoover, E. 2017. “You can't say you're sovereign if you can't feed yourself.” Defining and enacting food sovereignty in American Indian community gardening. *American Indian Culture and Research Journal*. <https://doi.org/10.17953/aicrj.41.3.hoover>.
- Howitt, R., and S. Suchet-Pearson. 2006. Rethinking the building blocks: Ontological pluralism and the idea of ‘management.’ *Geografiska Annaler: Series B, Human Geography*. <https://doi.org/10.1111/j.1468-0459.2006.00225.x>.
- Huambachano, M. 2018. Enacting food sovereignty in Aotearoa New Zealand and Peru: Revitalizing Indigenous knowledge, food practices and ecological philosophies. *Agroecology and Sustainable Food Systems*. <https://doi.org/10.1080/21683565.2018.1468380>.
- Humphries, S., J.C. Rosas, M. Gomez, J. Jimenez, F. Sierra, O. Gallardo, C. Avila, and M. Barahona. 2015. Synergies at the interface of farmer-scientist partnerships: agricultural innovation through participatory research and plant breeding in Honduras. *Agriculture & Food Security* 4: 27. <https://doi.org/10.1186/s40066-015-0046-0>.
- Indigenous Circle of Experts. 2018. We rise together: Achieving pathway to Canada target 1 through the creation of Indigenous protected and conserved areas in the spirit and practice of reconciliation: The Indigenous Circle of Experts’ report and recommendations. Parks Canada. <https://www.deslibris.ca/ID/1009675>. Accessed 27 July 2021.
- IPES-Food. 2020. The added value(s) of agroecology: Unlocking the potential for transition in West Africa. [http://www.ipes-food.org/\\_img/upload/files/IPES-Food\\_FullReport\\_WA\\_EN.pdf](http://www.ipes-food.org/_img/upload/files/IPES-Food_FullReport_WA_EN.pdf). Accessed 27 July 2021.
- Isaac, M.E., S.R. Isakson, B. Dale, C.Z. Levoke, S.K. Hargreaves, V.E. Mendez, H. Wittman, C. Hammelman, J.C. Langill, A.R. Martin,

- E. Nelson, M. Ekers, K.A. Borden, S. Gagliardi, S. Buchanan, S. Archibald, and A.G. Ciani. 2018. Agroecology in Canada: Towards an integration of agroecological practice, movement, and science. *Sustainability* 10: 3299. <https://doi.org/10.3390/su10093299>.
- Johnston, C., and A. Spring. 2021. Grassroots and global governance: Can global-local linkages foster food system resilience for small northern Canadian communities? *Sustainability* 13: 2415. <https://doi.org/10.3390/su13042415>.
- Kepkiewicz, L., and B. Dale. 2019. Keeping 'our' land: Property, agriculture and tensions between Indigenous and settler visions of food sovereignty in Canada. *Journal of Peasant Studies*. <https://doi.org/10.1080/03066150.2018.1439929>.
- Keske, C. 2021. Boreal agriculture cannot be sustainable without food sovereignty. *Frontiers in Sustainable Food System*. <https://doi.org/10.3389/fsufs.2021.673675>.
- King, M., D. Altdorff, P. Li, L. Galgedara, J. Holden, and A. Unc. 2018. Northward shift of the agricultural climate zone under 21st-century global climate change. *Scientific Reports*. <https://doi.org/10.1038/s41598-018-26321-8>.
- Kirby, A., J. Kotaska, and Coastal Stewardship Network. 2018. *Guardian watchmen: Upholding Indigenous laws to protect land and sea*. West Coast Environmental Law. <https://www.wcel.org/publication/guardian-watchmen-upholding-indigenous-laws-protect-land-and-sea>. Accessed 27 July 2021.
- Kremen, C., and A.M. Merenlender. 2018. Landscapes that work for biodiversity and people. *Science*. <https://doi.org/10.1126/science.aau6020>.
- Laforge, J.M.L., D. Dale, C.Z. Levkoe, and F. Ahmed. 2021. The future of agroecology in Canada: Embracing the politics of food sovereignty. *Journal of Rural Studies*. <https://doi.org/10.1016/j.jrurstud.2020.10.025>.
- Laforge, J.M.L., and S.M. McLachlan. 2018. Environmentality on the Canadian prairies: Settler-farmer subjectivities and agri-environmental objects. *Antipode*. <https://doi.org/10.1111/anti.12362>.
- Leblanc-Laurendeau, O. 2020. *Food insecurity in northern Canada: An overview*. Ottawa: Library of Parliament. <https://lop.parl.ca/statifiles/PublicWebsite/Home/ResearchPublications/BackgroundPapers/PDF/2020-47-E.pdf>. Accessed 6 July 2021.
- Lee, L., M. Reid, R. Jones, J. Windbourne, M. Rutherford, and A.K. Salomon. 2019. Drawing on Indigenous governance and stewardship to build resilient coastal fisheries: People and abalone along Canada's northwest coast. *Marine Policy*. <https://doi.org/10.1016/j.marpol.2019.103701>.
- Legat, A. 2012. *Walking the land, feeding the fire: Knowledge and Stewardship Among the Tlicho Dene*. Tucson AZ: University of Arizona Press.
- Lemay, M.A., J. Radcliffe, D. Bysouth, and A. Spring. 2021. Northern food systems in transition: The role of the emerging agri-food industry in the northwest territories (Canada) food system. *Frontiers in Sustainable Food Systems*. <https://doi.org/10.3389/fsufs.2021.661538>.
- Manson, J. 2018/9. Workmanship and relationships: Indigenous food trading and sharing practices on Vancouver Island. *BC Studies*. <https://doi.org/10.14288/bcs.v0i200.191475>.
- Manuel, A., and R.M. Derrickson. 2015. *Unsettling Canada: A national wake-up call*. Toronto: Between The Lines.
- Margulis, M.E. 2015. Canada at the G8 and UN Committee on World Food Security: Forum-shifting in global food security governance. *Canadian Foreign Policy Journal*. <https://doi.org/10.1080/11926422.2015.1037850>.
- Mascarenhas, M. 2007. Where the waters divide: First Nations, tainted water and environmental justice in Canada. *Local Environment*. <https://doi.org/10.1080/13549830701657265>.
- McGregor, D. 2014. Traditional Knowledge and water governance: The ethic of responsibility. *AlterNative: An International Journal of Indigenous Peoples*. <https://doi.org/10.1177/2F117718011401000505>.
- McMichael, P. 2009. A food regime genealogy. *Journal of Peasant Studies*. <https://doi.org/10.1080/03066150902820354>.
- McMichael, P. 2012. The land grab and corporate food regime restructuring. *Journal of Peasant Studies*. <https://doi.org/10.1080/03066150.2012.661369>.
- Moore, J.W. 2017. The Capitalocene, Part 1: On the nature and origins of our ecological crisis. *Journal of Peasant Studies* 44: 3. <https://doi.org/10.1080/03066150.2016.1235036>.
- Mosby, I. 2013. Administering colonial science: Nutrition research and human biomedical experimentation in aboriginal communities and residential schools, 1942–1952. *Histoire Sociale/Social History*. <https://doi.org/10.1353/his.2013.0015>.
- Muller, S., S. Hemming, and D. Rigney. 2019. Indigenous sovereignties: Relational ontologies and environmental management. *Geographical Research* 57 (4): 399–410.
- Nadasdy, P. 2003. *Hunters and bureaucrats: Power, knowledge, and Aboriginal-state relations in the southwest Yukon*. Vancouver: UBC Press.
- Norder, L.A., C. Lamine, S. Bellon, and A. Brandenburg. 2016. Agroecology: Polysemy. *Pluralism and Controversies*. *Ambiente and Sociedade*. <https://doi.org/10.1590/1809-4422ASOC129711V1932016>.
- Paprocki, K. 2018. All that is solid melts into the bay: Anticipatory ruination and climate change adaptation. *Antipode* 51: 1. <https://doi.org/10.1111/anti.12421>.
- Pasternak, S. 2017. *Grounded authority: The Algonquins of Barriere Lake against the state*. Minneapolis, MN: University of Minnesota Press.
- Patel, R. 2012. *Stuffed and starved: The hidden battle for the world food system*. New York: Penguin Random House.
- Pearce, T., J. Ford, A.C. Wilcox, and B. Smit. 2015. Inuit Traditional Ecological Knowledge (TEK), subsistence hunting and adaptation to climate change in the Canadian Arctic. *Arctic Institute of North America*. <https://doi.org/10.14430/arctic4475>.
- Peluso, N., and C. Lund. 2011. New frontiers of land control: Introduction. *Journal of Peasant Studies*. <https://doi.org/10.1080/03066150.2011.607692>.
- Pimbert, M. 2018. *Food sovereignty, agroecology and biocultural diversity: Constructing and contesting knowledge*. New York: Routledge.
- Piper, L. and J. Sandlos. 2007. A broken frontier: Ecological imperialism in the Canadian North. *Environmental History* 12. <https://www.jstor.org/stable/25473161>.
- Polanyi, K. 1944. *The great transformation*. New York: Farrar and Reinhart.
- Prosper, K., J. McMillan, A.A. Davis, and M. Moffitt. 2011. Returning to Netukulimk: Mi'kmaq cultural and spiritual connections with resource stewardship and self-governance. *International Indigenous Policy Journal*. <https://doi.org/10.18584/iipj.2011.2.4.7>.
- Reed, G., N.D. Brunet, S. Longboat, and D.C. Natcher. 2020. Indigenous guardians as an emerging approach to Indigenous environmental governance. *Conservation Biology*. <https://doi.org/10.1111/cobi.13532>.
- Reid, A.J., J. Lane, S. Woodworth, A. Spring, R. Garner, and K. Tanche. 2019. Leading on-the-land science camps with Indigenous youth: Towards reciprocity in research. *The Solutions Journal* 11 (1): 39–47.
- Rosset, P.M., L.P. Barbosa, V. Val, and N. McCune. 2021. Pensamiento Latinoamericano Agroecológico: The emergence of a critical Latin American agroecology? *Agroecology and Sustainable Food Systems*. <https://doi.org/10.1080/21683565.2020.1789908>.
- Rudolph, K.R., and S.M. McLachlan. 2013. Seeking Indigenous food sovereignty: Origins of and responses to the food crisis in

- northern Manitoba. *Canada. Local Environment*. <https://doi.org/10.1080/13549839.2012.754741>.
- Saxinger, G., First Nation of Na-cho Nyäk Dun. 2018. Community based participatory research as a long-term process: Reflections on becoming partners in understanding social dimensions of mining in Yukon. *The Northern Review*. <https://doi.org/10.22584/nr47.2018.009>.
- Saylor, C., K.A. Alsharif, and H. Torres. 2017. The importance of traditional ecological knowledge in agroecological systems in Peru. *International Journal of Biodiversity Science, Ecosystem Services and Management*. <https://doi.org/10.1080/21513732.2017.1285814>.
- Sevilla-Guzmán, E., and G. Woodgate. 2013. Agroecology: Foundations in agrarian social thought and sociological theory. *Agroecology and Sustainable Food Systems*. <https://doi.org/10.1080/10440046.2012.695763>.
- Simba, M., and A. Spring. 2017. Growing a garden in Kakisa. *Northern Public Affairs* 5 (1): 24–26.
- Spring, A., K. Skinner, M. Simba, E. Nelson, J. Baltzer, H. Swanson, and M. Turetsky. 2019. Taking care of the land: An interdisciplinary approach to community-based food systems assessment in Kakisa, Northwest Territories, Canada. In *Sustainable food system assessment: Lessons from global practice*, ed. A. Blay-Palmer, D. Conaré, K. Meter, A. Di Battista, and C. Johnston, 42–65. London and New York: Routledge.
- Steinhäuser, C. 2020. Mountain farmers' intangible values foster agroecological landscapes: Case studies from Sierra Santa Victoria in northwest Argentina and the Ladin Dolomites, northern Italy. *Agroecology and Sustainable Food Systems*. <https://doi.org/10.1080/21683565.2019.1624285>.
- Tarasuk, V. and A. Mitchell. 2020. Household food insecurity in Canada, 2017–18. Toronto: Research to identify policy options to reduce food insecurity (PROOF). <https://proof.utoronto.ca/>. Accessed 9 September 2021.
- Tchebakova, N., E.I. Parfenova, and A. Soja. 2011. Agroclimatic potential across central Siberia in an altered twenty-first century. *Environmental Research Letters*. <https://doi.org/10.1088/1748-9326/6/4/045207>.
- Trant, A., J.D. Jacobs, and T. Sable. 2012. Teaching and learning about climate change with Innu environmental guardians. *Polar Geography*. <https://doi.org/10.1080/1088937X.2012.682229>.
- Turner, N.J. 2020. From “taking” to “tending”: Learning about Indigenous land and resource management on the Pacific Northwest Coast of North America. *ICES Journal of Marine Science*. <https://doi.org/10.1093/icesjms/fsaa095>.
- Unc, A., D. Altdorff, E. Abakumov, S. Adl, S. Baldursson, M. Bechtold, D. Cattani, L. Firbank, S. Grand, et al. 2021. Expansion of agriculture in northern cold-climate regions: A cross-sectoral perspective on opportunities and challenges. *Frontiers in Sustainable Food Systems*. <https://doi.org/10.3389/fsufs.2021.663448>.
- Wezel, A., S. Bellon, T. Doré, C. Francis, D. Vallo, and C. David. 2009. Agroecology as a science, a movement and a practice. A review. *Agronomy for Sustainable Development*. <https://doi.org/10.1051/agro/2009004>.
- Wilson, N.J., and J. Inkster. 2018. Respecting water: Indigenous water governance, ontologies, and the politics of kinship on the ground. *Environment and Planning E: Nature and Space*. <https://doi.org/10.1177/2F2514848618789378>.
- Wolfe, P. 2006. Settler colonialism and the elimination of the native. *Journal of Genocide Research*. <https://doi.org/10.1080/14623520601056240>.
- Young, L., P. Nash, M. Hamilton, L. McDermott, A. Marshall, and C. Marshall. 2020. Tan Telolti'k: How we are doing. Unama'ki Institute of Natural Resources. <https://www.uinr.ca/indigenous-protected-conserved-areas-ipc-as-report/>. Accessed 27 July 2021.
- Zhou, J. 2016. Chinese agrarian capitalism in the Russian Far East. *Third World Thematics: A TWQ Journal*. <https://doi.org/10.1080/23802014.2016.1327795>.
- Zurba, M., K.F. Beazley, E. English, and J. Buchmann-Duck. 2019. Indigenous protected and conserved areas (IPCAs), Aichi target 11 and Canada's pathway to target 1: Focusing conservation on reconciliation. *Land*. <https://doi.org/10.3390/land8010010>.
- Zurba, M., H. Ross, A. Izurieta, P. Rist, E. Bock, and F. Berkes. 2012. Building co-management as a process: Problem solving through partnerships in Aboriginal Country. *Australia. Environmental Management*. <https://doi.org/10.1007/s00267-012-9845-2>.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Mindy Jewell Price** is a PhD Candidate in the Department of Environmental Science, Policy, and Management at the University of California, Berkeley. Drawing on political ecology, agricultural sociology, and Indigenous studies, her research examines food systems and agrarian change in the Northwest Territories, Canada.

**Alex Latta** is Associate Professor at Wilfrid Laurier University. His interdisciplinary research on environmental governance considers Indigenous rights, land stewardship, and climate change adaptation, in relation to political and economic systems within settler states. After a decade of research in Latin America, his current work is with Dene governments and communities in the Northwest Territories, Canada.

**Andrew Spring** is an Assistant Professor in Geography and Environmental Studies and Associate Director of the Laurier Centre for Sustainable Food Systems at Wilfrid Laurier University in Waterloo, On. His research focuses on issues of food security and the impact of climate change on communities in the Northwest Territories. He works closely with governmental agencies, non-governmental organizations and local communities to support the creation of sustainable food systems.

**Jennifer Temmer** is a PhD student in the Department of Geography and Environmental Studies and the Laurier Centre for Sustainable Food Systems at Wilfrid Laurier University in Waterloo, Canada. Using participatory research methods, Jennifer works with Indigenous communities in the areas of alternative economies, and sustainable food production in the Northwest Territories, Canada.

**Carla Johnston** is a PhD candidate at the Balsillie School of International Affairs at Wilfrid Laurier University. She researches the governance of sustainable food systems with Indigenous communities in the Northwest Territories, Canada and at UN Committee on World Food Security. Carla uses Participatory Action Research (PAR) methodologies to work directly with communities to create meaningful actions that help them reach their goals.

**Lloyd Chicot** is Chief of the Ka'a'gee Tu First Nation in Kakisa, NT. Chief Chicot has been involved in community-based research around climate change adaptation, environmental monitoring and youth engagement with various partners and stakeholders. He is also engaged in regional discussions on protected areas, land claim, and development issues that impact his community and traditional lands.

**Jessica Jumbo** is a Sambaa K'e First Nation member and Environment Coordinator. She is also a Sambaa K'e Development Corporation board member, project manager for the Trout Lake Lodge, and a Sambaa K'e First Nation youth counselor. Jessica has been involved in environmental monitoring and management since she was a child, having grown up

on the lands and waters of Sambaa K'e First Nation, and continues to use her passion and actions to protect her land and culture.

**Margaret Leishman** is a Dene Elder, a residential school survivor, and a member of K'agee Tu First Nation. She has worked in the fields of community social service, interpreting, and wellness and healing. Her

leadership in the Dehcho region has included service on the Board of the Fort Providence Residential School Society, the Executive of Dehcho First Nations, the Dehcho Wellness Committee, and the Northwest Territories Supportive Living Advisory Group. Margaret is a committed steward of the land and water, and also of Dehcho Dene Zhatié and Dene culture.