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Contested Icescapes: Land, Politics, and Change on an Arctic Agricultural Frontier

By

Mindy Jewell Price

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Environmental Science, Policy, and Management

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Kathryn De Master, Chair
Professor Nancy Peluso
Professor Thomas Biolsi

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Contested Icescapes: Land, Politics, and Change on an Arctic Agricultural Frontier

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By Mindy Jewell Price

Abstract

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Doctor of Philosophy in Environmental Science, Policy, and Management

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Professor Kathryn De Master, Chair

Contested Icescapes is an ethnographic and historical study of climate and agrarian change in the Northwest Territories, Canada. This dissertation examines how and in what ways marginal Arctic land has become an imaginary and material frontier for agriculture and considers the implications of the new frontier for rural and Indigenous lands and livelihoods. Through archival and ethnographic research, I contribute a deeply situated analysis of agricultural development and broader food systems change in this cold-climate region. I trace the entangled histories of settler colonialism, agricultural development, and climate change, and I demonstrate how these forces (re)shape the subjectivities and class relations of rural peoples, as well as their relationships with the state, Indigenous governments, society, and the environment.

Throughout this dissertation, I develop the concept of "contested icescape," which I use to analyze how various material, social, and political-economic forces assemble and reassemble to enable a Northwest Territories' agricultural frontier at various historical moments. The contested icescape also refers to a discordance between frontier imaginary and frontier reality, and it is in this liminal space – shaped by local political contestations, increasingly uncertain ecological futures, and historical transformations in the regional political economy – that Northwest Territories' agriculture continues to be characterized by smallholder family farmers and subsistence agriculture.

Despite deep historical and political tensions between commercial smallholder famers and Indigenous subsistence growers, I demonstrate that both groups have been dispossessed of land and livelihoods as a result of new climate enclosures. I argue that rural and Indigenous peoples are adapting to new conditions of production and social reproduction, yet these adaptive practices are mediated by long standing colonial inequalities and transformations in the regional political economy. This dissertation underscores the importance of Indigenous and local environmental governance in climate justice.

This dissertation is dedicated to my grandparents, Ed and Eunice Jewell, who instilled in me a love of farming and education that inspired this work.



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Acronyms

GNWT	Government of the Northwest Territories
KTFN	Ka'a'gee Tu First Nation (alternative spelling: K'agee Tu First Nation)
NFTI	Northern Farm Training Institute
NWT	Northwest Territories
SKFN	Sambaa K'e First Nation
TFA	Territorial Farmer's Association

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Chapter 1

Introduction: Agriculture in a Climate-Changing Arctic

I first met Jackie in May 2019 at the Northern Farm Training Institute (NFTI), a 260-acre farm and agricultural training center on a lone access road 12 miles from the town of Hay River in the Northwest Territories (NWT), Canada. When I arrived, a NFTI staff member took me on a tour of the 260-acre property. The farm hosted an array of livestock including cattle, goats, pigs, a yak, chickens, and ducks, as well as field crops, several greenhouses, a barn, abattoir, kitchen, composting toilets, large instruction yurt, and a series of smaller yurts that served as lodging for farm staff, volunteers, and trainees. Previously an industrial hog farm, the NFTI campus was also strewn with old machinery, scraps of building materials, and a few half-finished projects in varying stages of decay. Walking around the farm generated feelings of awe in the midst of organized chaos. International volunteers came to NFTI through organizations like Workaway and World Wide Opportunities on Organic Farms (WWOOF) and provided the bulk of the daily labor, while Jackie, NFTI's president who identifies as Métis, prevailed over NFTI's financial and agricultural decisions.

After returning from a solitary meditation in her on-farm trailer, Jackie greeted me in the afternoon of my first day over the stainless-steel kitchen island and told me the story of NFTI's origins. In the early 2010s, Jackie had been the president of the Territorial Farmer's Association (TFA)[1], and NFTI was Jackie's brainchild. With a $2 million grant from the federal government in 2014, the new organization opened as a working farm and an immersive training center for small-scale intensive home and market gardening. During my three-month stay that summer, NFTI hosted trainings for several individuals from Tłı̨chǫ First Nation as well as off-site programs with West Point First Nation and Ka'a'gee Tu First Nation. They ran a summer internship that hosted a high school student from K'athl'odeeche First Nation and participated in community food events in Hay River and on the K'athl'odeeche First Nation Reserve. Ongoing daily chores at NFTI included the maintenance of the farm and animals as well as management of a weekly vegetable subscription box for local subscribers.

Over the next several months as I spoke with current and former NFTI employees, trainees, and NWT residents, I learned more about the organization's mission, its politics, and the charged public opinion surrounding its founder and president. Jackie was a locally divisive figure who, as many people told me, "made a lot of enemies." She had bold ideas about the territorial government, the end of the world, and what she saw as the essential role of agriculture in northern food systems. Some saw her as a leader and a visionary, some as a crook who mismanaged government funds, and others as a passionate but unstable person who had been given too much power. NFTI's active training arm was active and trained over 300 northerners during its eight-year tenure, many of them from First Nations and other Indigenous communities

[1] The Territorial Farmer's Association formed in 1973 with a $500 grant from the Commissioner of the NWT to "sponsor, organize, and promote communication and to further the exchange of ideas among the agricultural community of the Northwest Territories," and to "encourage the development of legislative and other programs to benefit all northern peoples, and especially the northern agricultural community" (TFA, 1973).

in the NWT. For many NWT commercial farmers, however, the organization fell short of its promise to support the agriculture industry through scientific experimentation, crop development, and financial independence. For reasons that were not entirely clear, NFTI absorbed the TFA as an organization, and farmer membership as well as agricultural research and financial records seemed to disappear with Jackie.[2] Over and over again, farmers in the NWT suggested to me that NFTI was a "good idea," but that it was suffering under a faulty financial model (dependent on government grants) and poor leadership. When the COVID-19 pandemic hit in spring 2020, Jackie immersed herself in a political anti-vaccination campaign and often disappeared from the farm campus for hours or days at a time to protest public health guidelines and to create or repost conspiracy theory videos on social media. When I visited NFTI again briefly in 2021, the farm campus was in disarray. The farm had fewer volunteers and staff than in 2019 and produced a fraction of the crop yield.

In late 2022, after Jackie allegedly fled the territory with NFTI assets, the Town of Hay River boarded up the farm and closed the access road. One local commercial farmer described how NFTI's dissolution reflected poorly on the rest of the NWT's agriculture sector:

> [NFTI] cost the territory a lot more than the 5 million (estimated dollars invested) from the feds and everybody else. (Jackie) did more detriment to the territory, to the agriculture sector up here, left the territory's agricultural sector with a bad stigma to everyone else, to anyone who was paying attention. (Author interview, 2023)

In many ways, NFTI represented a common story of agriculture in the NWT: a significant amount of federal and territorial financial investment, an overtly educational mission, a promise of food security through agricultural production, lack of direction and a lot of trial and error, and ultimately a spectacular failure. Contemporary farmers in the NWT were aware of this stigma, and many felt that it impeded the development of land, regulation, and taxation policies they desperately needed to succeed in the industry. Longer-term farmers were often suspicious of new sector entrants who accepted agricultural funding from federal and territorial grants, invested the money in flashy new technologies or farm infrastructure, and folded after only a year or two of experiencing the NWT's challenging farming conditions.

In September 2023, new photos from the NFTI site emerged on social media. A series of wildfires in 2023 burned almost 10 million acres of boreal forest in the NWT, leading to the evacuation of nearly 70% of the territory's 40,000 people at some point during the summer. Several of those fires burned through the Hay River area and leveled most of what remained of the NFTI farm and training center. The barn, yurts, and abattoir were reduced to their cement foundations; trees blackened and fell. In the end, NFTI went up in smoke. Against the backdrop of governmental investment, local micropolitics, social conflict, and climate change, the story of NFTI is a snapshot of forces assembling on the NWT's agricultural landscape.

This dissertation closely examines those forces through a grounded, critical history of agricultural development in the NWT. I analyze agriculture as a tool of governmental power that

[2] A new organization, the Territorial Agrifood Association (TAA) formed in 2020 as a separate entity from NFTI to support commercial growers and other members of the agrifood industry, including agricultural processors, manufacturers, chefs, and restaurants.

works to manage and develop Canada's Arctic region, as well as a cultural, economic, and nutritionally meaningful form of production for local people. I focus on the relationships between different actors – federal and territorial governments, state bureaucrats and citizens, Indigenous and settler residents, subsistence and commercial growers – and examine how these relationships are both mediated by and acting upon larger social, political, economic, and biophysical forces. I show that climate change plays an important role in motivating resource frontier narratives and in transforming local peoples' material, economic, and sociocultural relationships to the land and ultimately to agriculture. This case sheds light on the lived experiences of settler and Indigenous farmers and growers who make up the NWT agricultural sector and shows how their experiences and adaptive practices challenge broader political narratives around agricultural resource development and Arctic security.

In this dissertation, I develop the concept of the "contested icescape"[3] to describe how material, social, and political-economic forces assemble and reassemble to enable an NWT agricultural frontier at particular historical moments (Chapter 2). I examine contestations on the northern frontier through local micropolitics interacting with material changes and transformations in the regional political economy. As climate change alters the land and access to its resource, farmers and harvesters are developing alternative practices of production and social reproduction. However, these practices are largely constrained by historically established social and political-economic structures (Chapter 3). Finally, on the contested icescape, I show how Indigenous peoples are politically engaging, challenging, and resisting large-scale, export-oriented commodity agriculture in the NWT by developing alternative practices and frameworks for sustainable and just agricultural development (Chapter 4).

Throughout this dissertation, I suspend judgment on whether Arctic agriculture is "good" or "bad," though I caution against romanticizing the development of northern agriculture. I entertain a different set of questions posed by Kasia Paprocki at the 2023 Royal Geographical Society conference. As Paprocki discussed agrarian struggles in climate-changed Bangladesh, she asked: Is agrarian production desirable or viable, and for whom? What are smallholders' visions for a just and sustainable future? For some smallholder commercial farmers in the NWT, agriculture is a livelihood strategy and a cultural connection to settler heritage. For some Indigenous communities, it is a necessary adaptation to the state-subsidized colonial food import system and to climate change. In ethnographically observing and analyzing this contested icescape, I bring a new dimension to the literature on agrarian change and the political ecology of climate change: much like the often-studied frontlines of agriculture development in the Global South, smallholder agricultural frontiers in the far North are sites of significant contestation and inequality.

Research Approach

This research undergirding this dissertation includes 15 months of ethnographic fieldwork in the NWT and extensive historical and policy analysis. This project is community-engaged and has

[3] In an earlier article for *Rural Sociology* (Price, 2023, Chapter 2 in this dissertation), I refer to this concept as "contested space." I have since refined the concept as "contested icescape" to draw attention to the materiality of ice and its changing properties, both ruinous and generative, under climate change.

involved robust community participation at all stages of the research process, from developing initial research questions, to defining research agreements, conducting research, and disseminating information (see Appendix for further details). These methods are motivated by my desire to interrupt what Moffitt et al. (2015, para.4) refer to as "a northern research industry," whose legacy is "intimately tied to the 'modernizing' agenda of the federal government and the development agenda of industry and government." As a settler researcher from outside of northern Canada, I regularly examined my positionality, power, and knowledge values throughout the research process; I discuss this is in more detail in the Appendix.

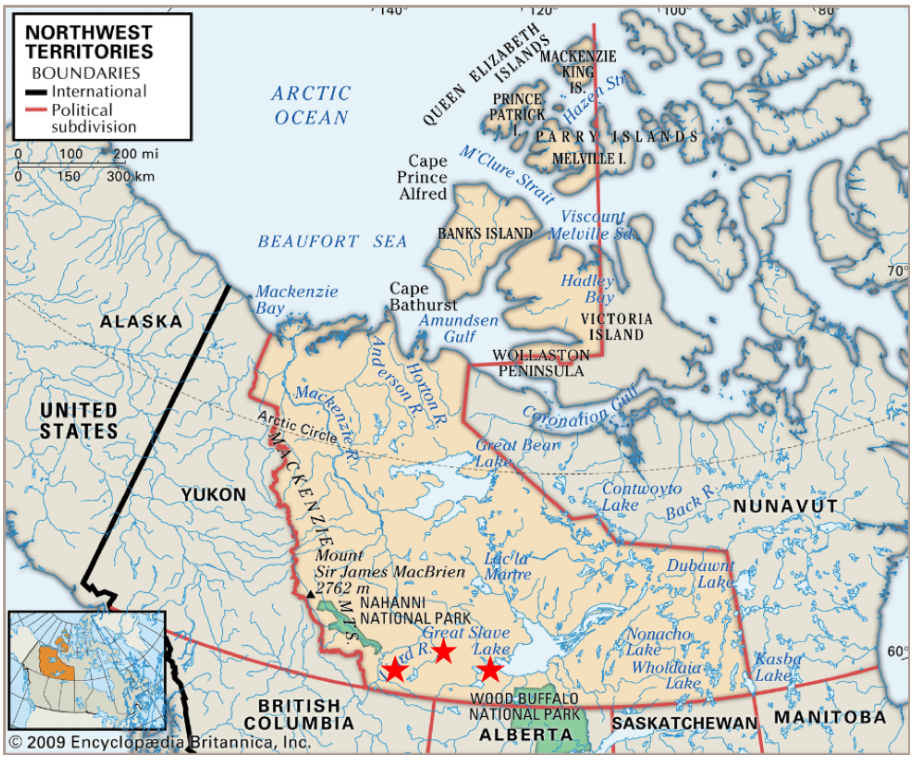


Figure 1. Location of three relational cases: Sambaa K'e, Kakisa, and Paradise Valley. Map: Encyclopedia Britannica, Inc.

This study includes a relational comparison of three communities in Sambaa K'e, Kakisa, and Paradise Valley (Hay River) (Hart, 2018).[4] In partnership with Indigenous Band Councils and local agriculture leaders, I chose these cases in order to analyze various agricultural histories, production practices, market orientation, and food systems across the NWT. The cases are similar in several ways: they all have active agriculture production, are located between 60 degrees and 61 degrees North latitude, and all are small communities of between 40 and 99 people. The small community size meant that all interviewees had familiarity with farming and agriculture projects even if they did not directly participate in them. Additionally, the communities are all included in the Dehcho Land Use Plan area, which designates agriculture as a potentially allowable land use after Dehcho First Nations land claims and self-governance agreements are settled; this has implications for potential future agricultural development. The

[4] Place names are used with permission from participants. Interviewee names throughout the dissertation are pseudonyms, and some details have been minimally changed to protect participants' anonymity. Some names have been used at the request of participants or in the case of publicly identified officials.

communities include commercial and non-commercial farmers and growers, Indigenous and non-Indigenous community members, crop cultivation, animal husbandry, family farmers, community agriculture projects, in-ground and above ground crops, and greenhouse production, so interviewees shared a wide range of agricultural experiences and perspectives that are present across the agriculture sector of the NWT. Through these three cases, I also analyzed how several key differences, including Indigenous and non-Indigenous identities, market access and orientation, quality of soil, length of time practicing agriculture, and type of land tenure affect agrarian trajectories and land-based relationships in the three communities.

Throughout my fieldwork, I conducted participant-observation, spending thousands of hours in peoples' homes, gardens, farms, camps, lakes, rivers, and cultural ceremonies, as well as government offices and conference rooms in Yellowknife. In addition to daily field notes containing observations and informal conversations, I also conducted 52 semi-structured and key informant interviews with Indigenous harvesters, fishers, farmers, agricultural workers, government officials, and nonprofit leaders. These interviews were designed to help me understand individual and collective perspectives on how agricultural development and climate change had been unfolding on the ground, and how local and state actors were navigating changing material, policy, and market conditions. Though I conducted formal interviews, I found that informal conversations with people while engaging in daily activities such as fishing, gardening, hunting, driving, cutting firewood, and preparing meals offered the most illuminating insights and were also the most comfortable for everyone involved in the research process. The long period of uninterrupted time I had in the field and the return visits throughout all seasons allowed me to learn and gather data in this way.[5]

To understand the NWT's historical transformations in agriculture and food systems, I conducted archival research at local, territorial, and national archives in Hay River, Sambaa K'e, Yellowknife, and Ottawa. I also cataloged and analyzed grey literature on agriculture and climate change in the NWT, including funding proposals, soil surveys, climate data, grant reports, nonprofit studies and reports, interest group minutes, and community planning documents. I was particularly interested in contemporary narratives of public officials and private citizens, so I analyzed the dominant, public depictions around agriculture and climate change in the NWT appearing in 98 news articles in three mainstream NWT media outlets and 78 government speeches from 2011-2021. I used MAXQDA software and Microsoft Word to code and sort all transcribed interviews, news articles, government speeches, and archival documents.

Using these combined qualitative methods, I answered two central research questions in this dissertation: How and in what mays has marginal Arctic land become an imaginary and material frontier for agriculture in the NWT? What are the implications of the development of the NWT's agricultural frontier for rural and Indigenous lands and livelihoods? I analyzed the social and material aspects of agricultural production and examined the relationships of people, politics, knowledge, and perceptions around the development of NWT agriculture. Drawing on these various data sources, I engage in broader debates about Arctic geopolitics, resource frontiers, rural development, climate change adaptation and mitigation, and local level experiences of food systems change.

[5] Other ethnographers have made similar observations of their ethnographic data, including Paul Nadasdy (2003) in his research with Kulane First Nation in the Yukon.

Setting the Stage of Cold-climate Agriculture: The Arctic Region and Climate Paradox

The Arctic Region

What *is* the Arctic? The Arctic is a region of extremes: extreme climate, extreme weather, extreme darkness, extreme sunshine, and extreme cold. While some describe "the Arctic" as the area north of the Arctic Circle (about 66.5 degrees North latitude), there are multiple was of defining the Arctic region. Figure 4. depicts the Arctic region as designated by several working groups of the Arctic Council based on different human and ecological dimensions. In North America, the Arctic region is usually drawn at 60 degrees North latitude. This includes all of the three Canadian territories of the Yukon, NWT, and Nunavut and much of Alaska in the United States. In this dissertation, I refer to both the Arctic and the Subarctic regions in the NWT. In Chapter 2 and Chapter 4, I use the more expansive term, "the Arctic," because I discuss the agricultural frontier narrative across the whole NWT. In using this term, I also draw on national imaginaries of the NWT as a region within "Canada's North" or the "Canadian Arctic" (Cavell, 2002; Zaslow, 1988, pp.227–28). Chapter 3 deals more specifically with ethnographic data and climatic observations in Sambaa K'e, Kakisa, and Paradise Valley. These three communities are located in a Subarctic climatic zone and are seeing climate effects specific to that region, so I use the narrower descriptor here.



Figure 2. Different Arctic boundaries according to Arctic Council working groups.

Map by: Arto Vitikka, Arctic Centre, University of Lapland.
Border data: Runfola, D. et al. (2020). GeoBoundaries: A global database of political administrative boundaries. PLoS ONE 15(4): e0231866.
AHDR: Arctic Human Development Report, four million people live inside this border.
AMAP: Arctic Monitoring and Assessment Program Working Group.
CAFF: Conservation of Arctic Flora and Fauna.

The Climate-Agrarian Paradox

"Agriculture" and "the Arctic" rarely appear together in scholarly literature. When they do, they often tell of one of two dominant narratives. The first narrative sees Arctic ice as antithetical to agricultural production: ice is anti-agriculture. Eyak scholar Jen Rose Smith (2021, p.159) theorizes the concept of "temperate-normativity," a colonial assumption that "civilized" peoples settle in temperate locales to engage in agricultural cultivation. European philosophers and natural historians in the 18th century, linking Arctic climate to race and human difference, saw icy Arctic geographies as unable to produce agriculture and thus located Arctic Indigenous peoples as inferior, aberrant, and always in transit. Temperate-normativity fueled racialized assumptions of Arctic peoples as pathologically unsettled and having inferior intelligence. Andrew Stuhl (2016) similarly shows how 19th century Canadian explorers portrayed the climate of Arctic Canada as isolated and inhospitable and Arctic peoples as backward and primitive.


Figure 3. Ice as anti-agriculture. Enterprise, NWT, January 2022. Photo by author.

However, the icy limits and the recognized sovereignties of the Arctic are being reconfigured by climate change. Gerhardt et al. (2010, p.999) describe how "Arctic materiality, stable in neither time nor space, complicates the ideal of permanence that underpins modern concepts of sovereignty, just as it complicates the practice of polar science." Ice that once acted as solid land

is now melting, throwing territorial boundaries into question and generating new opportunities for resource development (Dodds, 2010; Nichol, 2010). These include oil, gas, and possible new shipping routes connecting markets in Asia, North America, and Europe via the Arctic Ocean (Dodds, 2010; Bennett et al., 2020), though the economic viability of accessing Arctic resources such as oil and gas is still in question (Petrick et al., 2017). Nevertheless, these "New North" narratives capture state and public imaginaries of resource frontiers opening under rapid social-ecological change (Stuhl, 2013). Seldom discussed, but with significant implications for Arctic peoples and ecosystems, are the shifting possibilities of Arctic and boreal agriculture.



Figure 4. Greening icescapes. Paradise Valley, August 2021. Photo courtesy of Austin Price.

The second dominant narrative of Arctic agriculture is one of greening icescapes. While this narrative is not new with climate change (Price, 2023), there is now new evidence to support it (KC et al., 2021; King et al., 2018; Unc et al., 2021; Zabel et al., 2014). Crop feasibility studies suggest that several globally important commodity crops such as wheat, maize, and soy will become cultivable in polar regions by 2060-2080, creating potential for what Hannah et al. (2020) call a "climate-driven agricultural frontier." However, the impacts of climate change are uneven in the North and cause new agricultural challenges as well as opening new possibilities (Bradley & Stein, 2022; Ksenofontov & Polzikov, 2020; Unc et al., 2021). Some scholars caution against the potential ecological and social impacts of developing Arctic agriculture, signaling a need to consider tradeoffs between food production and unintended consequences (Hannah et al., 2020; KC et al., 2021; King et al., 2018; Price et al., 2022). Nevertheless, the tone of much of this growing body of work is optimistic. Developing Arctic and boreal agriculture could contribute to local and regional food security (Lemay et al., 2021; Stevenson et al., 2014). It may contribute to the economic potential of this region (GNWT, 2013a). The circumpolar North may even play a role in global food security, as climate change jeopardizes agriculture elsewhere (Hannah et al., 2020; Unc et al., 2021; Zabel et al., 2014). In Alaska and northern

Canada, where hunting and gathering remain culturally and nutritionally important yet vulnerable to climate change, crop cultivation can support climate adaptation by facilitating access to new and traditional foods (Bradley & Stein, 2022; Price et al., 2022).

Both of these dominant narratives of Arctic agriculture (ice as anti-agriculture and ice as potential) were generated by powers at a distance, abstracted by tools of science, and categorically separate Arctic materiality from political economy, social structures, and culture in what Julie Cruikshank (2005), drawing on Latour (1993), identifies as the "Great Divide" of Arctic nature and culture.[6] Like the scientific tools of migration maps, soil surveys, and temperature gauges that colonial administrators and natural historians used to support assumptions around ice as anti-agriculture and anti-civilization, western climate and crop scientists are using mathematical models to predict a circumpolar agricultural frontier that is abstracted from the human and non-human beings who reside there. The effect of these narratives, which have consistently worked to render Arctic landscapes legible to southern audiences, has been to erase Indigenous inhabitants from their co-relationalities with ice and cold (Dodds & Smith, 2023). They also belie the social-ecological history of agriculture in the North, the political and economic conditions for its emergence and development, and the lived experiences of cultivators under climate change. These two dominant narratives stand in contrast to the embodied, relational, and affective experiences of Indigenous and local peoples who call the Arctic region home.

A closer examination of the climate-driven agricultural frontier narrative reveals a profound paradox of possible futures. Global expectations for polar agriculture are increasing as warmer soils and longer summers suggest new cropping possibilities. At the same time, evidence of the climate crisis floods global news stories, and we are inundated with images of disappearing coastlines, melting glaciers, and endangered livelihoods and food systems. Nowhere are these stories of climate crisis more prevalent than in the Arctic region. Scholars have shown how permafrost loss, melting sea ice, and severe and unpredictable weather associated with climate change threaten the traditional harvesting and livelihood practices of Arctic and Subarctic Indigenous peoples (Berkes & Armitage, 2010; Pearce et al., 2010; Riseth et al., 2011). More recently, scholars have shown how climate change is creating more challenging conditions in agricultural and pastoral systems of in Alaska, Scandinavia, and Russia through increased flooding, extreme weather events, reduced pasture, and new varieties and increased numbers of pests (Bradley & Stein, 2022; Crate, 2022; Kiselev et al., 2013; Nakada, 2015; Takakura, 2016). Climate change in the Arctic is a theatre of both ruination and speculation. While both resource potential and landscape ruination remain possible, I show throughout this dissertation that these narratives do not reflect the experiences and responses of Indigenous and non-Indigenous Arctic peoples to climate change and agriculture.

Land and Climate of the NWT

Much of the NWT is in a Subarctic climate zone. Winters are long and cold, but summer temperatures reach a mean of 60 degrees Fahrenheit at most settlements along the Mackenzie

[6] Latour (1993) sees the "Great Divide" as an ontological separation between nature and culture as misleading, an illusion invented by western modernist thought.

River. The frost-free period across the NWT averages 70-95 days (Biostim, 2000, p.10). Winters in the NWT are long and cold, at times reaching -50 degrees Celsius (-60 degrees Fahrenheit) in both Arctic and Subarctic climate zones, and summers are short but warm with long hours of daylight (Biostim, 2000). The summer sun enables a photosynthesis period of 20-23 hours a day in the NWT, offsetting some of the challenges associated with a short growing season. However, unpredictable frosts can damage crops midseason.

The climate of the NWT has warmed over the last 50 years and is predicted to continue warming with climate change, resulting in a greater number of summer days (temperature rises to at least 77 degrees Fahrenheit), a longer frost-free season (approximate length of the growing season), and earlier day of last spring frost (approximate beginning of the growing season for frost-sensitive crops). Tables 1-3 below show the historical and predicted values for each of these variables in Sambaa K'e, Paradise Gardens, and Kakisa between 1950 and 2095.

	1950	**2013**	**2060**[7]	**2095**
Sambaa K'e	18	27	35-43	36-65
Paradise Gardens and Kakisa[8]	13.9	28.4	39-45	40-65

Table 1. Number of summer days in Sambaa K'e, Paradise Gardens, and Kakisa. Data from the Climate Atlas of Canada (Climateatlas.ca).

	1950	**2013**	**2060**	**2095**
Sambaa K'e	81	122	131-136	128-151
Paradise Gardens and Kakisa	118	118.8	125-138	131-152

Table 2. Number of frost-free days in Sambaa K'e, Paradise Gardens, and Kakisa. Data from the Climate Atlas of Canada (Climateatlas.ca).

	1950	**2013**	**2060**	**2095**
Sambaa K'e	May 24	May 21	May 8-9	May 2-9
Paradise Gardens and Kakisa	May 25	May 17	May 9-16	May 6-15

Table 3. Day of last spring frost in Sambaa K'e, Paradise Gardens, and Kakisa. Data from the Climate Atlas of Canada (Climateatlas.ca).

The Subarctic zone is home to boreal forest, muskeg (peat), and permafrost. The NWT boreal forest consists of eleven species of trees including aspen popular, tamarack, paper birch, white spruce, black spruce, and jack pine. It also provides habitat to a variety of edible plants and animals that form the basis of the traditional food system, including caribou, muskox, moose,

[7] Ranges for all predictions in 2060 and 2095 are based on low carbon RCP4.5 vs. High carbon RCP8.5 scenarios (Climateatlas.ca).

[8] Paradise Gardens and Kakisa are reported as averages from the Tathlina Lake region. The two communities are approximately 70 miles apart and located at 60.8 and 60.9 degrees North latitude.

muskrat, seal, bearberry, cloudberry, and cranberry. High acidity and low nutrient soils contribute to mostly inhospitable environments for crops, but rich alluvial soils can be found along the Mackenzie River and its tributaries (Leahey, 1947). An estimated two million acres of land "with a high capability for agriculture" exist in the NWT (EcoDynamics, 2008). The most suitable regions for agriculture based on soil and climate are the Slave River Lowlands, the Upper Mackenzie River Area, the Hay River Valley, and the Liard River Valley (Biostim, 2000; Day, 1966; Day, 1968; Day, 1972; Kozak & Rostad, 1977). Most of these agricultural-suitable soil regions lie within the Dehcho and South Slave administrative regions where there are currently unsettled Indigenous land claims (Figure 5).

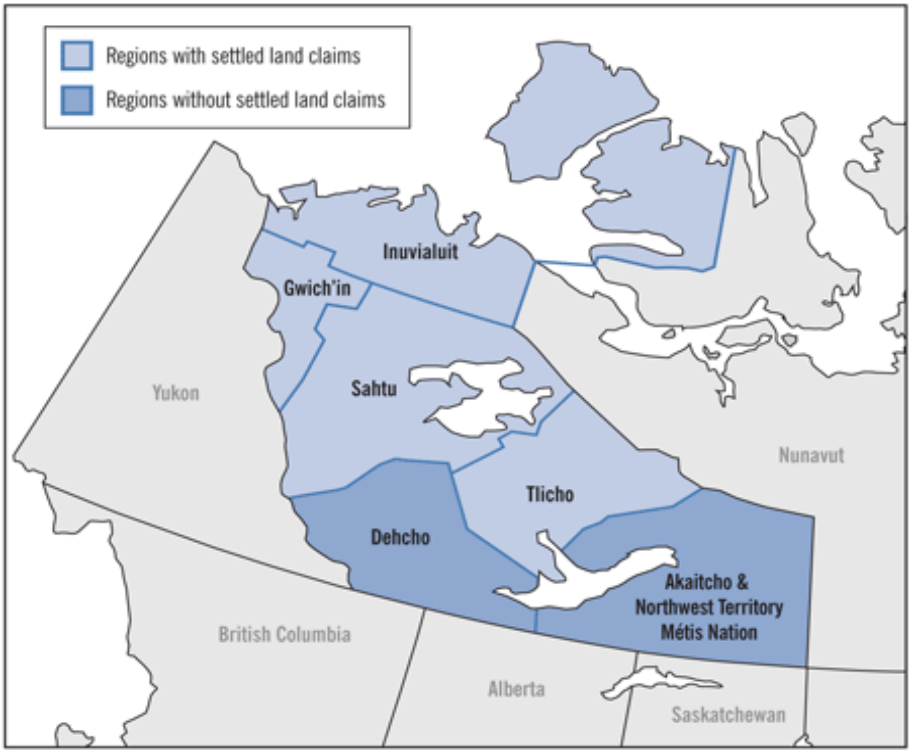


Figure 5. Settled and unsettled land claims in the Northwest Territories, Canada. Office of the Auditor General of Canada in Parlee, 2012.

The NWT, like the Yukon and Nunavut, is distinct from the Canadian provinces in its large percentage of Indigenous peoples (20,040 people, 49.6% of the population in the NWT, Statistics Canada, 2022a) and extent of Indigenous owned and managed lands. Following resistance from Indigenous peoples across Canada in the 1970s and a split decision by the *Calder* court affirming the existence of Indigenous title,[9] the federal government introduced the Comprehensive Land

[9] In 1967, Nisga'a member Frank Calder and other elders sued the provincial government of British Colombia, saying that title to their lands had never been extinguished. The British Columbia Supreme Court and Court of Appeal rejected the Nisga'a claim, and the Supreme Court of Canada agreed to take the case. In a groundbreaking decision in 1973, the Supreme Court affirmed that Nisga'a title existed at the time of the Royal Proclamation of 1763, that is, Indigenous title existed outside of colonial law. However, the Court was split over whether the Nisga'a land claims were still valid, or if they had been extinguished through treaty or statute. Though the Nisga'a did not win their case, the Supreme Court's acknowledgement of Indigenous title paved the way for the Comprehensive Land Claims process for Indigenous peoples to claim title to their territories. See Pasternak (2017, pp.142-145) for a

Claims Policy (CLCP) in 1973 in effort to quickly and permanently settle Canada's unceded lands. It is through the CLCP that most Indigenous land claims in the NWT have been settled, though different groups received formal settlements in different years. Inuvialuit land claims were settled in 1984, forming the Inuvialuit Settlement Region (DIAND, 2007). The Gwich'in Dene settled a comprehensive land claim agreement in 1992 (DIAND, 1992). The Sahtu Dene settled their land claims in 1993 together with the Métis (DIAND, 1993). The Tłı̨chǫ settled their land claims and self-government agreement in 2003 (GNWT & Government of Canada, 2003). Though initiated in 1999, negotiations between Dehcho First Nations and the federal and territorial governments have stalled over the decades, and the Dehcho First Nation land claim and governance agreements have yet to be settled. The Akaitcho and Métis in this region have pursued land grievances around Treaty Land Entitlement processes, rather than comprehensive land claims, but these processes have yet to be settled (Coulthard, 2009, p.78).

The NWT has 33 settlements of cities, villages, hamlets, or designated authorities located in five administrative regions: Inuvik, Sahtu, North Slave, South Slave, and Dehcho. Land in the NWT is either owned, managed, controlled, or administered by private land owners or by land managers appointed by various levels of government. Indigenous nations largely own and manage private lands in regions with settled land claims (Indian and Northern Affairs Canada, n.d.). The unsettled land claims in the Dehcho and South Slave regions (Dehcho, Akaitcho, and NWT Métis Nation claims areas), where I have conducted much of this research, have led to a complex land access and governance matrix. When land claims are eventually settled, more private lands will be created, and First Nations and Métis will become land owners. In the meantime, much of the land in the Dehcho and South Slave regions is public land managed by the federal government (Crown land) or the territorial government (Commissioner's land). Besides Indigenous nations, other landowners include public and private businesses that hold title within or outside of community boundaries (Indian and Northern Affairs Canada, n.d.). Acquiring title for Crown or Commissioner's land is usually not possible, and acquiring a lease often requires a multi-year process involving consultation with both federal and territorial governments and with First Nations. The Dehcho and the South Slave regions contain the highest quality agricultural land in the territory (EcoDynamics, 2008; Qatalyst Research Group, 2023a, 2023b), and are considered to have high to very high hydrocarbon potential (GNWT, 2019), complicating the land claims negotiations and increasing the stakes for resource control in these regions.

People and Economies of the NWT

This section provides a brief history of Indigenous groups in the NWT and discusses the emergence and development of the wage economy.[10] Indigenous peoples of the NWT comprise three main groups: Inuvialuit (Western Canadian Inuit), First Nations, and Métis. *Inuvialuit* origin stories tell of belonging in the Canadian Western Arctic since time immemorial (Lyons, 2010). Archaeological evidence suggests Inuvialuit descended from the Thule and migrated

critique of Canada's Comprehensive Land Claims processes, in particular the "extinguishment" language that requires the cession of Indigenous lands in exchange for rights associated with those lands.

[10] For a detailed history of Indigenous peoples in the NWT, see: Asch, 1977; Brody, 1987; Coates, 1985; Helm, 2000; Zaslow, 1988.

eastward from Alaska to Canada between 6-700 years ago (Alunik et al., 2003; Friesen & Arnold, 2008). South of Inuvialuit territory is Denendeh, the "land of the people," the traditional homeland of the Dene, which spans from the mouth of the Mackenzie River, south to the northern parts of the provinces, and east to the Hudson Bay (Coulthard, 2009, p.77). According to oral histories, the Dene, which comprise a number of *First Nations*, have occupied lands within and immediately outside the NWT since time immemorial (Coulthard, 2009, p.76). Archeological and linguistic evidence, though inexact and contested, estimates that Dene first migrated to the NWT between 2-3,000 years ago. However, unspecified human populations are thought to have lived there between 10,000-28,000 years ago (Abel, 1993). Though spread out over a vast area, the Dene nations occupying Denendeh speak related subdialects of Northern Athapaskan and have historically shared similar spiritual beliefs, cultural values, governance structures, and economic systems (Coulthard, 2009, p.79). The *NWT Métis Nation* formed as a distinct cultural and rights-bearing group through marriages of Dene women and European explorers and traders in the late 18th century (NWT Métis Nation, n.d.). Many NWT Métis participated in the trapping economy and practiced Dene cultural values, yet they also adopted European cultural and social norms and occupied positions such as fur trading guides, clerks, and post managers (Sandlos, 2007, p.15).

First Nations peoples make up the largest Indigenous identity in the NWT (30.5% of the NWT population, 12,315 people, Statistics Canada, 2022a). I worked closely with two Dene nations in this dissertation research (Ka'a'gee Tu First Nation and Sambaa K'e First Nation), so the focus of this section is Dene social history and economic relations. For thousands of years and into the early 20th century, most Dene lived on the land in small bands, moving seasonally for hunting, trapping, and fishing throughout the year (Helm & Damas, 1963, p.11; Sandlos, 2007, p.15). Caribou, moose, wood bison, rabbits, and a variety of fish species provided important sources of food and raw material for Indigenous communities (Gillespie, 1981, pp.15-18). Hunting, trapping, and gathering also played important social and cultural roles (Helm, 2000, pp. 21-90). In particular, the collective hunting of big mammals such as caribou and moose, and the sharing of meat, were integral to maintaining reciprocity systems among and within kinship and social groups (Helm, 2000, pp.63-71; Sandlos, 2007, p.16). Families with fewer resources were supported by those with more so that "the principle of mutual sharing of resources was extended beyond the local group to include all groups in the region" (Asch, 1977, p.48). Families moved seasonally on foot or in canoes in the summer and on snowshoes and dog sleds in the winter (Helm, 2000, p.52). Family groups mainly traveled together, regularly returning to specific camps, but larger groups also met to share news, visit, and conduct ceremonies. Survival depended on intimate knowledge and connection to the land, seasonally changing resources, and respectful relationship with them. Relational ontologies form the basis of Dene values and law, where reciprocity governs relationships between and among all life forms (Scott et al., 1978; Walsh, 2016).

The subsistence relationships between land, peoples, and animals in the NWT began to change with the whaling industry and fur trading enterprises in the late 18th century (Coates, 1985, pp. 41-65; Coulthard, 2009, p.79; Lyons, 2010; Piper & Sandlos, 2007). With the fur trade also came previously unknown diseases and a transformation of social and economic relations (Coates,

1985: 41; Piper & Sandlos, 2007). By the late 1780s, the North West Company[11] had penetrated the NWT (then called Rupert's Land) and quickly established trading posts at Fort Providence, Yellowknife, Fort Simpson, Fort Norman, and Fort Liard. After much competition and violence with the competing Hudson's Bay Company, the two companies merged in 1821 (Coates, 1985, pp.41-45). European fur traders depended upon Indigenous peoples as trappers, guides, intermediaries, and provisioners of game and fish (Piper & Sandlos, 2007, p.765). In the Mackenzie District, most Indigenous trappers traveled to trading posts once or twice a year, where they would participate in a greeting ceremony with traders, gift exchange, and traded furs for guns, ammunition, and other goods (Coates, 1985, p.49).

As fur trading enterprises transformed Dene hunters into a petty commodity-producing class of hunter-trappers throughout the mid-19th and early-20th century, federal wildlife legislation began restricting subsistence hunting (Clancy, 1986). Beginning with the first wildlife legislation in 1894, the Government of Canada managed wildlife conservation through game laws, the enclosure of traditional hunting grounds, the creation of national parks and game sanctuaries, and policing by game wardens charged with protecting large game such as caribou, muskox, and wood bison. Federal officials were influenced by ideologies of the North American wildlife conservation movement that excluded Indigenous peoples from conservation ideals, and they exerted "unconditional authority" over wildlife policy until devolving certain powers to the territorial government in 1970 (Sandlos, 2007, p.8). Wildlife conservation laws were underwritten with a racist assumption of the primitive, itinerant Indigenous hunter who, after contact with traders, adopted guns and whiskey, became unable to control his impulses and needed Canadian legislation to protect both wildlife and ensure his own survival (Sandlos, 2007, pp.7-14). By the end of the 1920s, wildlife conservation laws became a main administrative tool through which the state reshaped human-environment relations in the Canadian North (Sandlos, 2007, p.13). Enclosures of hunting grounds constituted a form of dispossession and eroded Indigenous sovereignty over the land and land-based resources.

In wider Canada, settler economy and legitimacy hinged on transforming land into agricultural production. Agriculture in the provinces facilitated Indigenous dispossession as homesteaders cultivated and improved land, which they then acquired as fee simple property (Rotz, 2017). Unlike the agriculture-driven settlement that colonized the provinces to the south, there was little settlement in Canada's northern territories into the early 20th century. Historian Morris Zaslow argues that "tentative colonization" in Canada's North instead occurred through the advancement of bureaucratic institutions, law enforcement, and mineral and hydrocarbon development beginning in the 1930s (in Piper & Sandlos, 2007, p.760). Over the early 20th century, however, as new oil and mineral resources were discovered, the state pursued an increasingly explicit economic strategy around wildlife, mineral resources, and small industries designed to transform Indigenous hunter-trappers into wage laborers (Clancy, 1986; Price, 2023). The fur trade crashed in the 1930s with the Great Depression, and prices continued to fall throughout the 1940s and 50s. Coulthard (2009, p.79) argues that Indigenous hunters across the NWT have been integrated into the wage economy since at least the 1950s. However, the state was only partially successful in assimilating Indigenous economic systems, and hunting, trapping, and traditional livelihood

[11] The North West Company was founded in Montreal in 1779 largely by Scottish-Canadian traders and became a major force in the Canadian fur trade from 1780 until 1821 when it merged with the British-formed Hudson's Bay Company.

strategies continue to play an important subsistence role in many NWT Indigenous communities, including in Sambaa K'e and Kakisa where I have conducted much of this research (Wilson et al., 2020).

The economy of the NWT today is largely based on non-renewable resources such as diamonds, oil, and gas. Before the Northwest Territories Devolution Act in 2014, the Government of Canada controlled nearly all of the money that investors paid to develop resources on public land in the NWT. Since devolution, the GNWT has been allowed to keep 50 percent of the resource revenues on public land up to a fixed share of its budget needs, and the rest is funneled into federal coffers (ITI, n.d.). Indigenous governments that have settled lands claims and self-governance agreements also receive some resource revenues. Because the GDP of the NWT is so dependent on its natural resources, it is highly impacted by the volatility of global demand and commodity prices (GNWT, 2022). Mining, quarrying, oil, and gas extraction continue to be (and are projected to be) a major contributor to the NWT's GDP, but the territorial mining industry has declined since its peak in 2007 (GNWT, 2020). As the NWT's overall GDP has contracted with the loss of mining revenue, the GNWT has worked to diversify the economy by investing in other sectors, including tourism, arts, manufacturing, and agriculture (GNWT 2013a).

In 2013, the territorial government identified agriculture as an emerging priority industry (GNWT, 2013a) and published its long-awaited commercial agriculture policy in 2017, "The Business of Food: A Food Production Plan," outlining strategies to develop an NWT agrifood industry (GNWT, 2017). Since 2003, the state has committed over $24.5 million dollars to NWT agriculture through shared federal-territorial agricultural partnership funding agreements alone.[12] Nevertheless, the number of commercial farmers in the NWT have decreased since 2006 (Statistics Canada, 2007, 2017, 2022), and unlike in the rest of Canada, this has not been accompanied by an overall increasing trend in farm size. Historic analyses show that the state has pushed centuries of exploration, calculation, and investment in the northern agriculture industry to support efforts in territorialization, security, and economic development (Price, 2023). However, the commercial agriculture industry has struggled in response. In 2015, agriculture and the agrifood industry contributed only $3M to the economy, or 0.1 percent to the overall NWT GDP (Statistics Canada, 2015).

Among the NWT farmers who seek to expand or grow their industry, many struggle to do so. Rather than becoming increasingly integrated into regional or global commodity markets, the agriculture industry in the NWT is a fledging group of mostly smallholder family farmers, home gardeners, and Indigenous community gardens. According to the Government of the Northwest Territories (GNWT), the NWT agriculture sector includes 32 community gardens, 25 community greenhouses, and at least one commercial agricultural operation in every region in the NWT (GNWT, n.d.a).[13] The Census of Agriculture recorded just eight census farms in the NWT in

[12] The Agriculture Policy Framework, a shared federal-territorial agriculture funding agreement, began in 2003 and has been renewed every five years since then. The most recent program is the Sustainable Canadian Agriculture Partnership, scheduled to run from 2023-2028. These agreements are not the only federal or territorial investments in NWT agriculture, but they have been a major and consistent source of funding for NWT farmers and agriculture programs over the last two decades.

[13] The GNWT has an expansive view of what constitutes the NWT agriculture sector, including activities such as commercial egg production, community gardens and greenhouses, commercial potato production, personal

2021, all of which were less than 70 acres (Statistics Canada, 2022b).[14] It is unknown how many people in the NWT are producing agricultural products for family or community subsistence, or who are trading and selling in informal markets, but both the census and GNWT counts undoubtedly underrepresent the full extent of production in the territory.[15] Nevertheless, it is clear that a large-scale agriculture industry has yet to emerge in the NWT despite dozens of development programs and millions of dollars of investment.

Contributions to Literature

This dissertation brings together four bodies of literature: agrarian studies, political ecology, settler colonialism, and Indigenous studies. In the field of *agrarian studies*, I am interested in new articulations of the agrarian question under climate change in the cold-climate, historically hunter-gatherer region of the NWT. I also analyze how climate change is materially changing the conditions of production and social reproduction, and I show how these changes articulate with historical and regional transformations in political economy to shape local practices of subsistence and small-scale commercial farming in the NWT. In the field of *political ecology,* I engage in timely debates around resource frontiers in the Arctic. I argue that the NWT agricultural frontier has assembled, disassembled, and reassembled at various historical moments, and that these moments of state-driven frontier advancement impact individual livelihoods and social relationships and reproduce inequalities, despite the perpetual stalling of large-scale and widespread NWT agriculture. The third and fourth fields this work engages are *settler colonial studies* and the adjacent field of *Indigenous studies.* While settler colonial studies scholars examine the ongoing structure of settler colonialism, Indigenous studies scholars emphasize Indigenous resistance to the structure of settler colonialism through collective practices of Indigenous resurgence and assertions of sovereignty. I draw on both fields to argue that contemporary Dene practices of subsistence agriculture are a form of resistance against the structures of settler colonialism and climate change. In the following subsections, I review key concepts in the fields of agrarian studies, political ecology, settler colonial studies, and Indigenous studies, and I discuss how my work contributes to new debates in agrarian questions, resource frontiers, and Indigenous resistance in the age of climate change.

Agrarian Questions

Agrarian questions, following Kautsky's foundational text (1988 [1899]), consider how capitalism induces agrarian transitions. In Kautsky's words, the classic agrarian question is "whether, and how, capital is seizing hold of agriculture, revolutionizing it, making old forms of

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gardening, farmers and community markets, and harvesting of wild edibles such as mushrooms and teas (GNWT, n.d.a).

[14] As of 2021, the census farm refers to a unit that produces agricultural products and reports expenses or revenues on those products to the Canada Revenue Agency (Statistics Canada, 2023). Prior to 2021, a census farm was defined as an agricultural operation with at least one product *intended* for commercial sale.

[15] Statistics Canada only collects data on census farms (commercial producers). However, much of the agricultural production in the NWT is and has always been for personal or community subsistence. Some producers grow crops or raise animals to trade or sell in informal markets. The sale of meat products is not regulated in the NWT, for example, so beef producers could not register as commercial cattle farmers and report income from those sales, which are illegal.

production and property untenable and creating necessity for new ones" (Kautsky, 1988 [1899], p.12). Kautsky grapples with the loss of the peasantry in the 19th century German countryside and the functional role of peasant agriculture in capitalist accumulation. There continues to be much global debate on the agrarian question under 21st century transformations in political economy, both in the loss and the persistence of family farmers (Akram-Lodhi & Kay, 2009; Bernstein, 2006; McMichael, 2006; Paprocki, 2021). My work engages new agrarian actors and new agrarian environments. This dissertation extends the agrarian change literature in considering the relatively young emergence of NWT agriculture[16] in this cold-climate region and its increasing importance under climate change. I ask: How does capitalism articulate with traditional hunting and trading economies to produce new trajectories of agricultural production? What becomes of marginal cold-climate land that has resisted agricultural development for thousands of years but is becoming more suitable to crop and animal production due to climate change? My research suggests that the polar world is facing a new agrarian question due to the specific ways in which climate change is altering peoples' access to land and the conditions of possibility for its use.

Paprocki (2021, 2020) asserts that climate change and responses to climate change may be the most significant drivers of agrarian change in the 21st century. Borras et al. (2021) discuss how studies of capitalism's entanglements with climate change have ranged from Marx's identification of the 'metabolic rift' (Foster, 1999), to debates about the Anthropocene and the Capitalocene (Reisman & Fairbairn, 2021; Moore, 2017a), to analyzing how capitalism exacerbates climate injustices and generates 'climate apartheid' (Rice et al., 2021; Sultana, 2021). They also note that relatively little attention has been given to the relationship between capitalism and climate change in rural areas the world, and to how rural peoples are responding to these changes (Borras et al., 2021). They suggest that new work in agrarian studies should "retain the focus on local material histories and power relations, while embedding both in long-term analysis of global environmental change and understandings of the way in which this new historical moment and the phenomenon of climate change are shaped by both material limits and the legacies of colonial and imperial inequality" (Borras et al., 2021, p.5). I take up this imperative in my dissertation in analyzing the emergence and trajectory of agriculture within this cold-climate region and amongst traditionally hunter-gatherer societies (Chapter 2), the ways in which climate change alters the relations of production and social reproduction (Chapter 3), and the responses of local peoples to new threats of capitalist agriculture on the climate-driven northern agriculture frontier (Chapter 4).

Studies of peasants (sedentary farmers) and pastoralists (itinerate livestock keepers) have developed fairly parallel literatures, despite encountering similar problematics in production, accumulation, and politics (Scoones, 2021). Even further removed from the agrarian change literature are studies of hunters and gatherers which have tended to compile in anthropological journals of very different questions about culture and identity. Nevertheless, as Ian Scoones (2021) has argued, many of the same questions posed in agrarian studies around production, accumulation, social differentiation, class formation, and politics are relevant to pastoralists, as

[16] Agriculture arrived in the NWT in the late 18th century and developed tentatively and slowly through missions and trading posts (Piper & Sandlos, 2007; Zaslow, 1988). The Dehcho Dene communities of Sambaa K'e and Kakisa, where I conducted much of this research, did not practice agriculture until around 1960.

well as to the Dene hunters and gatherers at the heart of this analysis, who are now embedded within a capitalist system of production.

Bernstein (2010, p.104) argues that all farmers have been integrated into petty commodity production through the commodification of subsistence and "are subject to the dynamics and compulsions of commodification, which are internalized in their relations and practices. If they farm only for their own subsistence, this is because they are integrated into commodity relations in other ways, usually through the sale of their labour power." NWT agricultural producers have long been integrated into commodity relations, first through their relationships with the fur trade and then through wage labor, which now provides the basis for production and reproduction. Furthermore, the peasantry that Bernstein says has been eliminated arguably never existed in the NWT. Agriculture began in the NWT as traders, missionaries, and miners from southern Canada, the US, and Europe settled in the region. Settlers farmed to support their nutritional needs and cultural values, though their primary means of social reproduction were fulfilled through other avenues. It is also important to remember that not all who produce agriculture in the NWT are farming as either a livelihood strategy or a primary subsistence strategy. Some are, first and foremost, hunters and trappers who have adopted agriculture to supplement traditional food systems threatened by the colonial food import system and by climate change (see Chapter 3). Relational ontologies that form the basis of Dene law and values continue to animate Indigenous economic and cultural systems even as they are embedded in capitalism (see Chapters 3 and 4).[17]

As Gillian Hart (1998) has argued, multiple forms of capitalist engagement are possible within a capitalist society. Specific trajectories emerge from "ongoing processes of struggle and contestation in multiple, intersecting social arenas, both local and translocal" (Hart, 1998, p.341). The ethnographic material I present throughout this dissertation demonstrates how capitalism intersects with local conditions, historically specific land relations, social struggles, political conflicts, and cultural laws, resulting in very different agrarian trajectories between two Dehcho Dene communities and a third predominately settler, commercial agriculture community. In the uncertain and liminal spaces of these contested icescapes, NWT agriculture continues to be characterized by smallholder family farms and subsistence agriculture combined with hunting, gathering, and wage labor among Indigenous peoples and settlers.

Resource Frontiers

> A frontier is an edge of space and time: a zone of not yet – not yet mapped, 'not yet' regulated. It is a zone of unmapping: even in its planning, a frontier is imagined as unplanned. Frontiers are not just discovered at the edge; they are projects in making geographical and temporal experiences. Their 'wildness is' made of visions and vines of violence; it is both material and imaginative. Frontiers reach backward as well as forward in time energising old fantasies, even as they embody their impossibilities. On the resource frontier, the small and the great collaborate and collide in a climate of chaos and

[17] Johnnie Manson (2018/19) describes how both Indigenous and liberal governmental logics infuse Indigenous people's economic exchange processes and shows that Indigenous ontologies continue to structure Indigenous food-based practices, even as people engage in wage labor. He argues that "market logic has not subsumed Indigenous governmental logics, meaning that the ways in which Indigenous peoples trade and share food within spaces defined by market relations is deeply informed by their Indigenous values" (p.216).

> violence. They wrest landscape elements from previous livelihoods and ecologies to turn them into wild resources, available for the industries of the world (Tsing, 2003, p.5100).

The political ecology literature on resource frontiers is extensive, though undertheorized with regards to Arctic agricultural frontiers. Resource frontiers are "projects in making" that continually change in response to global market demands and where new resource extraction and commodification are possible (Tsing, 2003, p. 5100). Capital expands in frontiers by identifying and enclosing new resources. Ongoing accumulation occurs often on land but also through bodies, resource privatization, intellectual property, and social commons (De Angelis, 2004, p.15). Frontiers provide "cheap natures" of energy, food, labor, and raw materials to subsidize capitalist accumulation, which are frequently seized violently from local environments and with little payment to local peoples (Moore, 2017a; Peluso & Lund, 2011). In the name of climate adaptation, investors are constructing new resource frontiers by exploiting cheap wind energy on the Mexican isthmus of Techuantepec (Boyer, 2019), developing new large-scale energy projects on commons land in India (Yenneti et al., 2016), expropriating Indigenous territory for water desalinization projects in Australia (Barnett & O'Neill, 2010), and transforming local rice paddies for shrimp exportation in Bangladesh (Paprocki, 2021). Resource frontiers can be newly discovered places with abundant natural resources, or they can be reinvented and given new value due to changing access through technology, institutions, state support, or environmental changes as in the case of the warming Arctic (le Polain de Waroux et al., 2018).

Polar geographers have readily taken up the concept of resource frontiers to understand global speculation of mineral and shipping resources in the Arctic. Mark Nuttall (2010) engages the imaginary of the "arctic energy frontier" to conceptualize Canada's investment in northern oil, gas, and mineral extraction. He argues that the Canadian state has for decades encouraged corporate energy development in order to generate national economic wealth while also exerting territorial control over its sparsely populated, majority Indigenous population in the NWT and Nunavut (Nuttall, 2010, p.51-2). Natural resource development reached a critical national moment in the NWT with the Mackenzie Valley Pipeline and Berger Inquiry in the mid-1970s, but resource control by state territorialization started much earlier. The Dominion Lands Act of 1872 involved surveying and demarking administrative boundaries in Canada, effectively emptying space and granting lands in Western Canada to the Hudson's Bay Company, railways, municipalities, missions, and individual settlers. As the Canadian prairies filled up, territorialization processes moved north and west in search of land that could produce wheat (Nuttall, 2010, p.37). Now, as climate change alters the frozen landscape of the Arctic, the region is being portrayed as a "last frontier." Arctic states and other countries such as China, Japan, Singapore, and India are rushing to claim and extract mineral resources that had previously been hidden under the ice (Dodds, 2010; Nuttall, 2010).

Beyond political ecology's critical engagement with resource frontiers, northern nations and industry also often marshal the concept of the frontier, constructing untapped resources as economic potential rather than acknowledging the different ways those spaces have been used and managed, often by Indigenous people (Moffitt, 2019, p.155). In a 2013 speech at Prospect North, former NWT Minister of Industry Tourism and Investment David Ramsay declared, "I am here today to say - and I hope you will all help me spread the message - that the Northwest Territories is open for business. We are the place for investment dollars. We are the next frontier

for development and economic growth. It is time for us to have our day" (GNWT, 2013b)." The discursive framing of the frontier, Moffitt argues, has "significant social, political and material implications for northern [I]ndigenous peoples, specifically their relationships with their home territories and their right to self-determination" (Moffitt, 2019, p154). Moffitt counters the hydrocarbon industry's frontier narrative with Sahtu Dene and Métis stories that are rooted in northern Indigenous lifeworlds and that tell of the landscape's plurality. Local perspectives of hydrocarbon development are informed by intertwined narratives of family, Indigenous cosmology, and development, resisting the frontier versus homeland dichotomy that often underlines Arctic resource debates.

The massive potential for cultivating agricultural commodities such as potatoes, wheat, maize, and soy in the warming Arctic is seldom discussed in the resource frontiers literature. The range of land suitable for agriculture is projected to expand northward into the boreal and Arctic regions by the end of the century, opening up 4.2 million km^2 of land in Canada and 4.3 million km^2 of land in Russia alone through longer and warmer growing seasons (Hannah et al., 2020). This frontier narrative of climate-driven high latitude farming has been widely substantiated by climate and crop scientists using climate projection data and crop suitability models to suggest future growing potential (Hannah et al., 2020; King et al., 2018; KC et al., 2021; Zabel et al., 2014). The science is being disseminated through hundreds of articles in high-readership publications such as the *New York Times Magazine* and *New Yorker* with titles like "The Surreal Abundance of Alaska's Permafrost Farms" (Tayag, 2022) and "How Russia Wins the Climate Crisis" (Lustgarten, 2020). The dream of an agrarian livelihood draws some farmers and investors to uncultivated northern regions of imagined potential, while state administrators are lured by the prospect of an agriculture sector that could support economic and food security goals (Altdorff et al., 2021; Price, 2023; Unc et al., 2021).

If we are to take the speculation about an Arctic agricultural frontier seriously, we should take heed from other agricultural resource frontiers globally (Meyfroidt, 2021). Agricultural resource frontiers globally have contributed to widespread deforestation, land degradation, loss of smallholder livelihoods, violence, migration, and an unequal distribution of social-ecological impacts for local and Indigenous peoples (le Polain de Waroux et al., 2018; Kröger & Nygren, 2020; Peluso, 2017; Wolford, 2021). Further, Arctic States are embedded in increasing geopolitical tension as a result of climate change, new capitalist interests in Arctic resources, and political conflicts including Russia's ongoing war in Ukraine. Significant increases in food production in northern regions at the same time as contractions of food production in low-latitude regions could redistribute power in global agricultural markets (Meyfroidt, 2021).

Despite widespread state and public narratives of the Arctic agricultural frontier, few farmers I interviewed in the NWT shared either vision or concern for NWT land being developed for large-scale, export-oriented commodity agriculture. Many thought the taxation structure of the NWT was unsupportive, the land leasing issues too onerous to navigate, the markets too small, and the climate simply too unpredictable. Among the few individuals who imagined eventual land dispossession and enclosures in the NWT were those who described an inevitable frontier for commodity agriculture emerging because of climate crises elsewhere. One retired farmer described, "It's getting warmer, and there's not enough water… I think it's almost going to be like, where's the last place we can still grow? … And I think it's going to come to a point where

it's going to be forced. And nobody's going to have any control. It's just going to be a forced thing." Her spouse agreed:

> This might be the new frontier… I mean, there's places all over the world that people can't, you know, can't live or farm anymore. So where do they go? They gotta go north, there's land up here… And then you're not going to have any control. [Indigenous] land claims, too bad. It won't matter at that point. (Author interview, 2021)

So, while crop and climate scientists are modeling future polar agricultural frontiers emerging from climate possibilities (warming temperatures and melting ice), some NWT farmers are pointing to climate crises elsewhere in the world as a driver for Arctic land grabs for agriculture. Others deny altogether that developing the Arctic region for large-scale, commodity agriculture is possible. States and investors, however, have marshalled the narrative of climate *inevitability* – both with respect to the crises it creates and the resource opportunities it offers for economic gain – to cast this region as a place of agricultural value and resource potential.

Even though widespread commodity agriculture has not yet materialized in the NWT, the frontier as both a material and an imagined project has real effects (Barney, 2009; Cons & Eilenberg, 2018; Tsing, 2003). I employ the frontiers concept in this dissertation to understand how various social, political, and economic forces assemble, disassemble, and reassemble to create frontiers imaginaries and to understand impacts of those imaginaries on local peoples. In Chapter 2, I show how a mid-20th century agricultural frontier imaginary threatened Indigenous food systems and land governance through agriculture programs in residential schools. I argue that the current agricultural frontier imaginary (and state efforts to develop it) impact Indigenous-settler social and economic relations and exacerbate inequalities on the land. Finally, I argue that frontiers are not structural inevitabilities. Farmers and growers in the NWT are resisting both the narrative of the agricultural frontier and the imposition of large-scale agricultural development through everyday livelihood practices in production and social reproduction and through organized policy advocacy (see Chapters 3 and 4).

Settler Colonialism

Settler colonialism is distinct from other colonialisms, including classical colonialism, neo-colonialism, or post-colonialism in that it describes colonizers who never return home. They migrate, they stay, and they make themselves rulers in a new place. Patrick Wolfe (2006) describes two fundamental components of setter colonialism: its logic of elimination and its ongoing structure. Settler colonialism is fundamentally a territorial project in that settlers use the logic of Indigenous elimination in order to claim territory and proclaim "settler sovereignty over all things" (Tuck & Yang, 2012, p.5; Wolfe, 2006, p.388). Elimination has included direct killing, but it also operates as a biopolitical force "to produce life, as in methods to amalgamate Indigenous peoples, cultures and lands into the body of the settler nation," through assimilatory tactics such as education, marriage, and blood quantum (Morgensen, 2011, p.56). For example, the 1876 Indian Act in Canada worked to amalgamate Indigenous peoples into the settler state by denying status to Indigenous women who married non-Indigenous men. It was not until Bill C-31 passed in 1985 that status was restored to Indigenous women who had it terminated through marriage. The logic of elimination also operates through settler appropriation of Indigenous

culture to produce settlers' own "native" identity, which serves to differentiate them from the metropole and legitimate new rule (Glenn, 2015).

Settler colonialism is not a historical event but an ongoing structure. It is "as much a thing of the past as a thing of the present" (Veracini, 2011, p.9). In *Plundering the North,* Burnett and Hay (2023, p.3) describe how the government of Canada undermined Indigenous food sovereignty by "manufactur[ing] food insecurity and retail monopolies" in remote Indigenous communities following World War II and by assimilating Indigenous food systems to "settler strategies of grocery shopping and market-based food consumption" (Burnett & Hay, 2023, p.4). When the state pursued agriculture projects to support community nutrition in northern Canada, they often contributed to ecosystem degradation, loss of traditional harvesting practices, and an increased reliance on an import-based food system (Piper & Sandlos, 2007; Spiegelaar & Tsuji, 2013). Yet while settler colonialism is ongoing, it does not remain as an unchanged or undifferentiated structure. The tactics and techniques of settler colonialism evolve within particular geographies and under social and political transformations. The settler colonialism that motivated agriculture programs in NWT residential schools, for example, is not the same settler colonialism that funds Indigenous agriculture programs in the NWT today. Yet as I describe in Chapter 2, settler assumptions about the precarity of Indigenous food systems and the imperative of agriculture to support food security remain key to government-supported Indigenous agriculture programs today.

Settler colonial theory is not without critique. In centering the state and emphasizing the continuity of colonialism, the actual and attempted elimination of Indigenous peoples, and the dispossession of Indigenous lands, studies of settler colonialism can reify at best – and at worst, replicate – settler colonial domination (Snelgrove et al., 2014). Many Indigenous studies scholars have instead committed to centering Indigenous resurgence alongside critiques of the settler state (e.g. Essa et al., 2022; Coulthard, 2014; Simpson, 2016, 2017; Stark et al., 2023; Snelgrove et al., 2014). Indigenous resurgence refers to ways to restore and regenerate Indigenous nationhood (Corntassel, 2012), which Simpson (2016, p.22-23) describes as necessarily occurring through "profoundly different ways of thinking, organizing, and being because the Indigenous processes that have given birth to our collective resurgence are fundamentally nonhierarchical, nonexploitative, nonextractivist, and nonauthoritarian."

Though I draw on settler colonialism as a theoretical tool, this dissertation extends beyond simple critiques of settler colonialism to identify and highlight areas of Indigenous resistance and resurgence. I argue in this dissertation that contemporary Dene agricultural practices are not simply evidence of the dominance of settler colonialism, as settler colonial theory might suggest, nor as merely a form of climate adaptation, as anthropologists of climate change might suggest. Instead, I argue that Indigenous subsistence agriculture is a form of resistance to the ongoing structure of colonialism and to new threats of climate change. Chapter 3 provides an ethnographic account of how Sambaa K'e First Nations and Ka'a'gee Tu First Nations are claiming agriculture in their communities as a tool of food sovereignty in the midst of climate crisis – in a way using the master's tool (agricultural production) to tear down the master's work (climate change, colonialism). Chapter 4 decenters productivist, capitalist-colonial agriculture as the future of agriculture in the North and offers instead an Indigenous-driven agroecology framework for sustainable and just agriculture development in polar regions.

Chapter Outline

In the first paper (Chapter 2), published in *Rural Sociology,* I draw on extensive archival and discursive analysis to analyze mid-20th century and recent 21st century popular narratives of the agricultural frontier in the NWT. I show that the early agricultural frontier imaginary (1939-1975) is relatively intact in its present articulation. I argue that it is not simply climactic forces that are driving an emergent northern agricultural frontier, but rather the more diffuse and structural forces of capitalism, governmental power, settler colonialism, and resistance to those forces. I also show how social, political, and material limits impede the development of agrarian capitalism in the Northwest Territories and discuss how smallholder farmers and Indigenous communities differently situate production practices within their local food systems. This chapter contributes to critical debates in the frontiers literature by foregrounding the contested space between the state-driven and dominant public narratives underpinning frontier imaginaries and the social, cultural, and material realities that constrain them in the Arctic.

My second paper (Chapter 3) examines how local peoples respond to the crises of climate change in the NWT and how they respond in a particular way: through innovative and adaptive food production practices. This chapter draws on ethnographic and interview data in the communities of Paradise Valley, Sambaa K'e, and Kakisa in the wake of floods and fires in 2022 and 2023. I develop and employ the concept of "climate enclosure" to examine new forms of land dispossession in process in northern Canada, not at the hands of the state or investors, but through material forces that are transforming the conditions of production and fundamentally altering peoples' relationships to the land. I argue that the material processes of climate enclosures work in concert with sociocultural, political, and economic conditions that influence local peoples' responses. Unlike in classically defined enclosures in which there is a clear class differentiation (bourgeois and proletariat), the changing class relationships within climate enclosures are unclear. I argue that climate change creates uncertainty with no inevitable future, offering a new lens through which to analyze contemporary enclosures and adaptive production practices.

My third and final paper (Chapter 4), published in *Agriculture and Human Values,* is a collaborative, community-engaged contribution that I led with members of Sambaa K'e First Nation, Ka'a'gee Tu First Nation, and collaborators at Wilfrid Laurier University. In this paper, we situate northern food systems in Canada within the corporate food regime and settler colonialism. We argue that expanding the conventional, industrial agriculture paradigm into the Canadian North would have significant socio-cultural and ecological consequences for Indigenous lands and livelihoods. We then propose agroecology as an alternative framework uniquely accordant with northern contexts. In particular, we suggest that elements of agroecology are already being practiced in northern Indigenous communities as part of hunter-gatherer food systems. We present a new 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, NWT. Finally, we discuss several challenges and cautions in creating policy around agroecology in polar regions, and we encourage community-based research in developing and testing this framework moving forward.

Finally, in a brief conclusion (Chapter 5), I outline the broader implications of this study in the Arctic under changing social, economic, and climatic conditions, including speculative new developments in shipping, mining, and agriculture. Reflecting on the potential of a climate-driven northern agricultural frontier, I join other scholars in calling for Indigenous and local Arctic peoples to be centered in decisions about their land and food. Appendix 1 is a detailed account of my methods and positionality.

Chapter 2

Seeing Green: Lifecycles of an Arctic Agricultural Frontier

Price, M. J. (2023). Seeing green: Lifecycles of an Arctic agricultural frontier. *Rural Sociology, 88*(4): 941-971. doi: 10.1111/ruso.12506

Introduction

In the summer of 1922, Harry A. Warner of Edmonton, Alberta, traveled to Canada's Arctic coast and observed oversized cabbage growing at the Northern Trading Company's trading post in Aklavik, Northwest Territories (NWT). Warner extolled the promise of northern agriculture: "Just as surely as the prairies were subdued and brought to serve men's needs, so will the far north," he told the *Stony Plain Sun*, "and it is by no means impossible but that the North-West Territories will later be regarded as a heritage of which Canadians will be justly proud" (Stony Plain Sun, 1923). Root crops and wheat failed to mature in 1922, but Warner predicted that warming years were coming, and with them, a boom in agricultural production. "The frost of a previous geological age is passing slowly, the present age is a warmer one, and if the top moss and other overburden is stripped from the ground the perpetual frost will recede," he envisaged, "and the non-cultivatable area will gradually diminish" (Stony Plain Sun, 1923).

Harry A. Warner was not a farmer, nor a climate scientist; he was an engineer. Over the last decade, however, agronomists and climate scientists have produced data that support Warner's claims: a warming North will yield more cropping opportunities for Arctic and sub-Arctic agriculture (Hannah et al., 2020; King et al., 2018; Zabel et al., 2014). Popular media has caught on to this narrative. Scores of newspaper articles over the last decade have profiled farmers across the North with giant heads of cabbage and greenhouses bursting with tomatoes. A 2013 *Modern Farmer* headline simply states, "Farming in the Arctic: It can be done" (Nobel, 2013). A 2020 article in *New York Times Magazine* describes "How Russia wins the Climate Crisis" through massive agricultural transformation on a scale that will "remake the world order" (Lustgarten, 2020). These glossy, multi-page magazine features, paired with supportive climate data, have reinvigorated fervor among industry, governments, and communities to develop agriculture in the North, inviting capital and demanding land.

There has been significant scholarly investigation of the Arctic as a frontier for minerals, energy, and transportation (Dodds, 2010; Hanacek et al., 2022; Moffitt, 2019; Nuttall, 2010; Thompson, 2009), and rising stakes and multiple interests in the Arctic Ocean have drawn new attention to the role of discourse in the spacemaking of Arctic geopolitics (Bennett, 2016; Dittmer et al., 2011). However, far less critical attention has been given to the North as a frontier for agriculture. Indeed, Jen Rose Smith (2021) recently argued that 18th century settlers in Alaska viewed icy Arctic spaces as unable to produce civilizing agriculture, therefore locating Arctic Indigenous peoples as inferior, aberrant, and always in transit. While this idea has influenced the social and legal racialization of northern Indigenous peoples in lasting ways, a competing, though perhaps less pervasive assumption was also at work: hard-working white settlers would

successfully bring agriculture to the North, and Indigenous peoples could be taught to farm. These dueling assumptions have worked together to enable a unique Arctic and boreal agricultural frontier at various historical moments. In the 20th century in northern Canada, church and state aimed to assimilate Indigenous Arctic and sub-Arctic hunter-gatherers as farmers through policies of settlement, residential school education, and community agriculture programs (Evenden, 1998; Piper & Sandlos, 2007; Spiegelaar & Tsuji, 2013). In zones of sporadic or isolated permafrost, where potatoes, cabbage, and oats could be grown, officials imagined the greening of white landscapes. Further north, where the deep ice rarely receded, the federal government imagined a pastoral frontier through which itinerant Arctic Indigenous peoples would partake in civilizing agriculture (Finnie, 1931). Settlers, too, were enthralled with the dual narratives of ice and agriculture. Some migrated to northern Canada from southern Canada, the US, and Europe, terraforming the land by clearing trees, exposing permafrost to the sun, and planting crops in the newly thawed soil (Copland, 1967; Piper & Sandlos, 2007; Robbinson, 2010; Wood, 2006).

In the 21st century, these two assumptions are now being upended and brought to a gradual convergence under climate change. Temperature and precipitation changes are projected to improve crop suitability, supporting a "climate-driven agricultural frontier" across the circumpolar north (Hannah et al., 2020). Despite a growing body of evidence that climate change will enable new cropping possibilities, much remains unknown about the social and political factors influencing Arctic and boreal agriculture today. In this article, I aim to understand the drivers of northern agriculture by performing a discourse analysis on the state-driven and dominant public narratives around the NWT agricultural frontier in the mid-20th century (1939–1976) and the most recent decade (2011–2021). In analyzing these narratives across time, I find that the agricultural frontier imaginary undergirding mid-20th century development is relatively intact in the 21st century imaginary, appearing as a new lifecycle of an earlier frontier. In both periods, state-driven narratives forward the promises of economic opportunity, state securitization, and food security through local food production. These three narratives—the image of what the agriculture frontier *can be*—drive funding, policy development, and food systems change in the NWT. However, archival and ethnographic evidence also reveals a contested space between frontier imaginaries and materialities that has and continues to bound the NWT agricultural frontier as a space of limited smallholder production.

Theoretical Framework

Much of the recent literature on northern agriculture is written by climate scientists, agronomists, and soil scientists, and scholars often employ the concept of the northern agricultural frontier without critical examination of its cultural, racial, economic, and material legacies, with a few recent exceptions (cf. Bradley and Stein, 2022; Meyfroidt, 2021; Price et al., 2022). Critical social scientists, however, have utilized the concept of frontiers to invoke literal and figurative borderlands, distant places, liminal spaces, and zones of possibility. Cons and Eilenberg (2018) identify three classical framings in the critical frontiers literature that undergird frontier imaginaries: as integral to economic activity, as sites of danger and lawlessness, and as unpeopled wilderness. In the first framing, analyses focus on the appropriation of land and commodification of natural resources. Frontiers are economic sites where capitalism expands by

enclosing resources through ongoing primitive accumulation (De Angelis, 2004), or accumulation by dispossession (Harvey, 2004), and where capitalists uncover new "cheap natures" of energy, food, labor, and raw materials (Moore, 2017a). In a second framing, frontiers are sites of danger and lawlessness, where states struggle to exert administrative control and authority (Hall, 2013; Peluso & Watts, 2001; Watts, 2017). When states lack control of their frontiers, one key strategy has been to draw in transnational corporations, wielding investment, infrastructure, and migration to legitimate state presence and control. This tactic is seen across the Arctic as states have simultaneously encouraged oil and gas development and a militarized police presence (Hall, 2013; Nuttall, 2010; Thompson, 2009). In a third classical framing, the frontier is imagined as an untouched, unpeopled wilderness open for exploration and exploitation (Katerberg, 2003; Turner, 1893). This frontier narrative requires Indigenous dispossession through erasure, and it has animated settler colonialism in North America, Australia, Oceania, South Africa, and elsewhere, with agricultural expansion as a key driver (Adas, 2001; Veracini, 2011). In Canada, land expansion was made possible through Indigenous dispossession and white European farmer land acquisition, and the family farm system that emerged was central to the success of Canada's agricultural production and its legitimacy as a settler state throughout the 20th century (Rotz, 2017).

In the wider critical frontiers literature, agricultural frontiers are usually conceptualized as resource frontiers whose primary activities are land appropriation and resource commodification through the transformation of "nature" into "natural resources" (Moore, 2017a; Tsing, 2005). When resources are extracted and commodified for global markets, they may become commodity frontiers characterized by large-scale production and the capture of abnormal rents (Kröger & Nygren, 2020; Wolford, 2021). Agricultural commodity frontiers in lower latitudes have contributed to widespread deforestation, loss of smallholder livelihoods, violence, and migration as a result of state intervention and capital investment (Carr, 2004; le Polain de Waroux et al., 2018; Peluso, 2017; Wolford, 2021). While important to take lessons from commodity agriculture frontiers in other regions (Meyfroidt, 2021), it is misguided to assume that all Arctic and boreal frontiers will follow the precedent of large-scale, highly industrialized agriculture in tropical regions. The context of the agricultural and economic regimes in these regions are very different from those in the North. Whereas most recent analyses of agriculture frontiers are of export-oriented commodity production, in the NWT, Canada, few agricultural products are sold outside territorial borders.

While current trends of agricultural frontier scholarship center around large-scale commodity frontiers, small-scale frontier advancement have historical significance. Agricultural frontiers initially advanced as smallholder farmers relocated to new regions. This was driven by a combination of population pressures, land scarcity, conflicts, natural resource depletion, and incentives from states (le Polain de Waroux et al., 2018). In the US, for example, Turner (1893) argued that early pioneers gave way to a wave of settlers, and settlers paved the way for capitalist development and distinctly American enterprise. Canadian historiography has also been influenced by Turner's frontier thesis, but historians have tended to modify it, emphasizing Canada's cultural and economic ties to Europe, the brevity of the frontier experience, the interaction between new-world hinterlands and old-world metropolitan centers, and the importance of tradition (Katerberg, 2003; Zaslow, 1988). Smallholder frontier advancement in the US and Canada both required and motivated Indigenous dispossession, resulting in a

transformed social, cultural, environmental, and economic landscape through settler-colonial rule. Settler and state administrators' expansionist dreams of a northern agricultural frontier akin to that of the prairie provinces were largely disillusioned (Cavell, 2002; Piper & Sandlos, 2007; Wood, 2006). Nevertheless, state-led agricultural development and colonial nutritional science in sub-Arctic Canada have similarly contributed to the loss of Indigenous food sovereignty through ecosystem degradation, loss of traditional harvesting practices, and increased reliance on an import-based food system (Piper, 2017; Piper & Sandlos, 2007; Spiegelaar & Tsuji, 2013).

Smallholder agricultural frontier expansion has had profound consequences for hunter-gatherer societies globally. Most of the remaining hunter-gatherer communities today live in rural regions on the margins of the "developed" world, where farming has not been profitable, such as the Arctic, sub-Arctic, and the Kalahari Desert (Brody, 1999). However, some of the natural limits obfuscating agriculture development in circumpolar regions may soon be removed (Hannah et al., 2020; King et al., 2018; Zabel et al., 2014). Agriculture is predicted to increasingly expand into rural northern regions as climate change improves crop suitability and as Arctic states initiate new policies and programs to intensify and expand agricultural production (Unc et al., 2021). Despite what climate models suggest, however, infrastructural barriers, isolated markets, insecure land tenure regimes, and natural limits continue to occlude Arctic commodity frontiers in North America (Bradley & Stein, 2022; Price et al., 2022; Stevenson et al., 2014). In their analysis of agriculture in Alaska, Bradley and Stein (2022, p.3) conclude that "an Arctic frontier of large-scale capitalist agribusiness is unlikely to materialize as presently imagined," though they acknowledge that with state support, technological break-throughs, and private investment, this future remains possible.

This article evaluates the discourses that shape agricultural frontier imaginaries in the NWT. I draw from scholars who understand frontiers as both imagined and experienced (Barney, 2009; Smith, 2021; Tsing, 2005). Cons and Eilenberg (2018, p.9), for example, define frontiers as imaginative "zones in which the material realities of place are inextricably bound to various visions of and cultural vocabularies for what the frontier is and might be." Cons and Eilenberg (2018) theorize frontiers as occurring over lifecycles, emerging and reemerging as assemblages of human and nonhuman actors. Similarly, Tsing (2005, p.32) describes the frontier as an "imaginative project capable of molding both places and processes." For Tsing, frontiers make use and reuse fantasies of possibility, even as they are marked by impossibilities. My study of the narrative follows these and other critical frontiers scholars who analyze the making of frontier imaginaries and the effects they have on peoples and landscapes (Barney, 2009; Goodhand, 2021; Moffit, 2019; Peluso, 2017; Tsing, 2005).

Relatedly, in his "transnational environmental history of science," Andrew Stuhl (2016, p.4) shows that climate-urgent tales of the "New North" have continuity with historical scientific encounters in the Arctic, and settler-colonial relations which formed the basis of early exploration endure in contemporary climate science. In analyzing the agricultural imaginary across these two lifecycles, I have come to understand the NWT agricultural frontier as a *contested space* where competing narratives—icy realities and green futures, ecological possibilities and economic disappointment, transient hunters and settled agriculturalists, and scores of geopolitical tensions—assemble and reassemble to enable development possibilities at different times. Contested space also refers to the discordance between frontier imaginary and

frontier reality. It is in this contested space that the NWT agricultural frontier has been made and remade over several lifecycles, and that it continues to be characterized by smallholder production.

Materials and Methods

This article is guided by two research questions: What state-driven logics and narratives undergird NWT agriculture? and How are these narratives produced and reproduced, with what impact on agricultural development? To answer these questions, I employ discourse analysis of NWT agricultural frontier narratives over two periods: the mid-20th century (1939–1976) and the most recent decade (2011–2021). Both periods are marked by significant state investment in funding, policy, and projects to develop the agricultural frontier. The earlier era is marked by colonialist–expansionist logic and geopolitical tension. During WWII and into the postwar period, the Canadian Arctic was subject to increased surveillance and natural and social science research designed to develop Canada's northern resources (Evenden, 1998; North Pacific Planning Project, 1947; Perreault, 2011). These included a series of high-latitude agricultural studies (Eley & Findlay, 1977; Leahey, 1947, 1954; Resources Management Consultants, 1974) as well as a high-profile Experimental Farm at Fort Simpson. The expansion of settler agriculture in the mid-20th century was enabled by immigration and growing local markets as the NWT natural resource sector expanded around gold and oil.

A turning point in the development of the NWT agricultural frontier occurred in 1975 when the federal government instituted a land lease moratorium for agriculture in the Yukon and NWT, purportedly to limit agriculture because of environmental impact concerns (Gorrie, 1975), but more urgently because of new Indigenous land claims following the introduction of Comprehensive Land Claims (CLCs) (DIAND, 1975). CLCs were introduced during a period of national and territorial reckoning around Indigenous sovereignty following the *Calder* and *Paulette* cases, which affirmed the possibility that Indigenous title existed on unceded lands. CLCs were designed to quickly and permanently deal with Indigenous titles and are critiqued in particular for their "extinguishment" language that requires the cession of land in exchange for a bundle of rights associated with that land (Pasternak 2017, p.142–45). Also occurring during this time was the Berger Inquiry, carried out between 1974 and 1975, which was significant in collecting and considering for the first time in-depth, nationally publicized testimony over how a proposed natural gas pipeline would impact the lands and economies of northern Indigenous peoples. The Berger Report recommended a 10-year moratorium on pipeline construction while Indigenous land claims were negotiated, though it ultimately acknowledged the importance of oil and gas development, affirming that "in the North lies the future of Canada" (Gamble, 1978; Gray & Gray, 1977; Nuttall, 2010, p.63).

In the NWT, the 1975 agricultural land lease moratorium effectively limited all large-scale agriculture in northern Canada by removing the possibility of leasing Crown land for agricultural use. Though NWT agriculture fell swiftly in 1975, the first study period for this discourse analysis extends from 1939 to 1976 to capture the initial fallout from the land lease moratorium. Over the last decade, however, the NWT has seen an increase in local, territorial, and federal political and financial investment in NWT agriculture and renewed local interest in agricultural

production, pushed by food price increases, supply chain interruptions, and climate disturbances (City of Yellowknife, 2019; GNWT, 2013a, 2017, 2018; Serecon, 2014).

To examine mid-20th century agricultural frontier narratives, I reviewed over 1,640 archival records at the Prince of Wales Northern Heritage Centre and the Library and Archives Canada. The collection at the Prince of Wales Northern Heritage Centre was the most relevant for the state-driven narratives, including government logs and reports, correspondence between agricultural settlers and government bureaucrats, state-funded agricultural surveys, funding reports, and government memos between federal and territorial agencies. Missionary journals showed how the state and church worked closely together on early agriculture projects, particularly through the residential school program and experimental sub-stations at missions. The collection at the Library and Archives Canada provided information on state involvement in NWT agriculture through the Experimental Farm Service and on geopolitical competition between Canada and Russia. Both collections included newspaper clippings that showed dominant public discourse on agriculture.

From these collections, I removed duplicates and non-NWT-agriculture-related documents, and I selected a subset of 124 key documents for in-depth discourse analysis. I did a close reading of these documents and took detailed notes, observing the authors, audience, tone, syntax, theses, and key quotes. I then coded my notes for the narratives they contained. First, I coded deductively using a codebook generated from my literature review of NWT agricultural history and the frontiers literature, and then I coded a second time inductively based on emerging themes. Throughout this process, I performed a circular textual, contextual, and sociological analysis of the discourses (Ruiz, 2009).

To examine 21st century narratives, I employed discourse analysis on 78 ministerial speeches and press releases related to agriculture between 2011 and 2021 and on 96 mainstream newspaper articles published in three NWT media outlets and one national media outlet reporting on the NWT. News articles were included from *Up Here* magazine, Cabin Radio, NNSL Media, and CBC News. Articles were selected from searchable online archives at each publication using the keywords “Northwest Territories” and “agriculture,” “farming,” “gardening,” or “livestock.” Available online archives varied between news sources, so the first article about agriculture I analyzed within the study period varied between outlets. Year of the first article analyzed: *Up Here* (2018), Cabin Radio (2018), NNSL Media (2017), and CBC News (2012). For newspaper articles, bureaucratic speeches, and press releases, I employed deductive and inductive coding to analyze the texts using the same codebook from the archival data. Two research assistants and I independently coded each speech and newspaper article using a shared codebook. We discussed and resolved any differences in coding, and I analyzed the data using the methods described above.

In addition, I conducted a literature review of agriculture in the NWT, including both academic and gray literature, such as territorial agricultural policy reports and agricultural nonprofit reports. Finally, this discourse analysis is part of a larger project involving 13 months of ethnographic research in three communities in the NWT between 2019 and 2023. I also conducted 38 semi-structured interviews with government officials, nonprofit leaders, academics, Indigenous leaders, and farmers participating in the NWT agricultural sector. For the

purposes of this article, I reviewed my ethnographic field notes and interviews for all mentions of motivations and impacts of agriculture, paying attention to the individual and community-level narratives I encountered. Because this article primarily identifies and analyzes the state-driven discourses around agricultural development—produced by those who hold political power and influence over the public narrative—I do not provide a complete analysis of the ethnographic and interview data here. Instead, I use these data to triangulate the discourse analysis by exploring the narratives of those not typically reflected in the dominant state and public discourses. In this case, this includes Indigenous communities and non-Indigenous growers who produce food for family or community subsistence, as well as individual farmers whose material experiences farming do not always align with the narratives told about them.

Results: The Mid-20th Century NWT Agricultural Frontier

The narratives among territorial leaders and farmers centered around agrarian dreams. Settlers sought agrarian livelihoods, while the territorial government initiated agricultural projects in order to support food security for isolated rural populations and to provide jobs that would stimulate industry. Federal motivations for agricultural development took on broader geopolitical goals of territorializing what they viewed as a harsh, uncivilized landscape. The contested space between imagined possibilities and the materialities of growing food in the North shaped the development of the frontier and ultimately contributed to its constraint in the latter half of the 20th century.

Agrarian Promise: Agricultural Livelihoods and a Food-secure Future

Farmers and territorial bureaucrats viewed the NWT as untouched land of economic and productive potential, "one of the largest areas of virgin land now left in the world," that could and should be exploited for agriculture (Russell, ca.1973). In spite of its cold climate and uncleared lands, magazine articles and government publications commonly referred to the NWT as a wilderness that could be tamed and made productive with a bit of grit and hard work. Influenced by these public narratives, hundreds of prospective farmers from southern Canada, the US, and Europe wrote to territorial and federal officials, inquiring about land for homesteading or farming. At least 49 agricultural land lease applications were submitted between 1970 and 1975 alone.

The distinctive geography of the sub-Arctic and Arctic both motivates and delays agrarian dreams. It is a region of near-24-hr summer sunlight and few pests, with pockets of rich, alluvial soils, and abundant water resources. At the same time, the North is a landscape of mostly poor soils, sudden frosts, and dark, frigid winters. NWT farmers lamented that the work was hard and clearing land was expensive, but they continued to invest in the yeoman farmer ideal in the hope of eventual agrarian livelihoods. Some found promise in technological advancements, such as greenhouses, hydroponics, and waste heat converters (Maginnes & Green, 1975), whereas others thought success could only be reached with government support (DeMoss, 1940). For example, one potato farmer in Fort Providence who harvested 80 tons of potatoes in the fall 1972 was faced with having to dispose of 90 percent of his crop due to the lack of markets. He wrote to the

NWT Commissioner in early 1973, frustrated with the government's failure to provide marketing support but restating his hope of an agrarian future:

> On many previous occasions, I've stated my belief that there's a future for limited, intensified agriculture in the N.W.T. I still think there's a potential for northern residents to create a viable industry if a lot of the present minor problems, which are mostly tied to government policies or lack of policies in this particular area, are effectively dealt in the very near future. (Henson, 1973)

Though the government was slow to develop taxation, market, or agricultural land-use policies in the NWT, they supported a series of agricultural projects intended to bolster crop and animal production in the territory. In the high Arctic, greenhouse projects were initiated in the Inuit communities of Frobisher Bay and Sanikiluaq (located in what is now Nunavut), where the production of vegetables was described by one university-affiliated staffer as "both badly needed… and practically possible" (Cooper, ca.1974). The greenhouses were abandoned within a few years due to poor planning and high operating costs. Similarly, the territorial government initiated and funded a Muskox project in the 1960s–1970s intending to engender a regional qiviut industry. After an initial period of consideration and support, the project was abandoned in 1974 before it fully got off the ground.

Territorialization

Although narratives from territorial leaders and farmers centered around the economic and food-securing possibilities of agriculture, federal bureaucrats had larger goals of territorializing the North. As geopolitical tensions rose during WWII and into the Cold War, the North American Arctic became an imaginative and material frontier for military exercise and science in the East versus West scramble for political power (Farish, 2006). The US and Canada invested heavily in Arctic research in natural and social sciences throughout the mid-20th century, including new scientific laboratories, military training centers, and military exercises (Zaslow, 1988, p.203–33). Following the 1941 Japanese attack on Pearl Harbor, the US and Canada co-sponsored the North Pacific Planning Project to carry out an inventory of northern resources including minerals, forest, wildlife, water power, and agriculture possibilities. The US withdrew from the project in 1944 following improvements in the war situation, but Canada continued the project and published its findings as *Canada's New Northwest* (North Pacific Planning Project, 1947). The project collated previous agricultural studies and initiated new surveys of soil, climate, and water to establish crop feasibility at high latitudes (Department of Agriculture, 1939; Leahey, 1947, 1954).

During this time, the Canadian Arctic was also subject to a new study by academic researchers and private philanthropy (Evenden, 1998). Between 1943 and 1944, Canadian professor Harold Innis led the Arctic Survey, an integrated social and natural science survey in the Canadian Arctic funded by the Rockefeller Foundation. Canadian scholars were primarily interested in the survey as a nationalist project of social science study, whereas American scholars and funders saw the study as a means to aid the Allied war effort and influence American foreign policy. The effect of the Arctic Survey was the crystallization of northern studies among southern institutions (Evenden, 1998). Meanwhile, state-led scientific inquiries and military and infrastructural

developments in the North brought clarity to Canadians who came to understand the "Arctic" as a real and imaginative space referring to the Yukon and Northwest Territories (Cavell, 2002; Zaslow, 1988, p.227–28).

In physically marking the landscape, federally run experimental farms supported northern territorialization through agriculture projects. The Dominion Experimental Farms Service was inaugurated in 1886 in order to put agriculture "upon a permanent, profitable footing" for the benefit of Canadian people and pride (Department of Agriculture, 1939:27). By the mid-20th century, the Canadian government began to view the northern territories as an insecure space on the global stage. Agricultural development, in addition to mining, was a way to claim and govern that space:

> Canada has three fixed boundaries. She only has one direction in which to grow. Europe and Asia are developing to the Arctic Circle and beyond. Canada is unfolding mineral and cropping possibilities in like latitudes, the cropping possibilities especially to the far northwest. To hold her vacant territory she must *occupy* and *use* it. (Department of Agriculture, 1939, p.27, emphasis added)

In the early 20th century, the Dominion Experimental Farms Service inaugurated the first NWT experimental farms at Oblate missions of the Roman Catholic Church, including at Fort Smith (60.0 degrees North latitude), Fort Resolution (61.2 degrees), and Fort Good Hope (66.3 degrees). A full-fledged Experimental Farm was established at Fort Simpson (61.8 degrees) in 1946 and operated until 1969 (Interdepartmental Commission on Northern Agriculture, 1944). The experimental farms tested and successfully produced cold suitable crops including crab apples, a wide variety of market vegetables, cereal grains, and cattle (Department of Agriculture, 1939). Dr. E. S. Archibald, Director of the Experimental Farms Service between 1919 and 1950, described the role of the experimental farms in opening up the North: "few people may realize the pioneer work done, first by settlers, second by Dominion and Provincial governments, and later development more rapidly by Experimental Stations… extend[ing] the boundaries of food production farther and farther north, in fact all the way to the Arctic" (Winnipeg Mirror, ca.1944/1945). Administrators recognized that northern farms were unlikely to support large-scale export agriculture as they did in southern Canada. Rather, the experimental farms aimed to support the new settlement of miners, fishers, and trappers in the NWT by enabling food production in the isolated northern communities.

Canadian settler economy and legitimacy hinged on terraforming land for agriculture. In the provinces, agriculture facilitated Indigenous dispossession as homesteaders cultivated and improved land, often acquiring title to the land as fee simple (Rotz, 2017). In the northern territories, settler agriculture did not result in immense Indigenous land dispossession, but the state used wildlife regulations, the introduction of the food import system, nutritional policies and nutritional science, and to a lesser extent, agriculture projects in residential schools, as a means of exerting control over social and environmental changes in what Piper (2017, p.182) calls "food colonialism." Martha McCarthy (1995, p.163) argues that Catholic missionaries did not try to induce Dene to adapt from hunting and trapping to a settled agricultural lifestyle. However, many NWT residential schools ran agriculture programs, which alienated children from land and home communities and trained them in gardening and husbandry rather than for

skills in the bush (Piper, 2017; Piper & Sandlos, 2007; TRC, 2015). State administrators, who took over the residential schools by the 1960s, envisioned that students would take agriculture back to their home communities, not necessarily as a full-time endeavor but as part of a transformation from fur-based economies and into settled communities (NWT Legislative Assembly, 1959).

The federal government also implemented a large-scale reindeer project among Inuit, which served an explicitly assimilatory goal of transforming the trapping-based economy and traditional food system of Inuit into one that centered around animal husbandry (Stuhl, 2016, p.61–87). Modeled after the U.S. government's reindeer herding program, the government of Canada purchased 3,000 Alaskan reindeer in 1929 and herded them 1,600 miles across the North American Arctic to the Mackenzie River delta (Department of Mines and Resources, 1956). Government officials privately recognized that trapping was both culturally relevant to Inuit and more profitable than herding at that time (Department of Mines and Resources, 1948, 1949) but insisted publicly that the program served the economic benefit and food security of Indigenous peoples (Birt, 1973; Department of Mines and Resources, 1940). Taken together, the experimental farms and Indigenous agriculture projects worked to transform what was considered untamed and undeveloped boreal forest and tundra into productive spaces of civilization, and in doing so governing the landscape and peoples within its northern frontier.

Contested Space

A central feature of the 20th century agricultural frontier is the tension between agricultural potential and reality. This led to inconsistent public–private depictions of the frontier. Popular articles depicted the NWT as a land of promise, almost supernatural in its ability to produce verdant crops under a midnight sun. Government-issued publications were also usually optimistic, even when they conceded climactic or financial challenges. For example, one Department of Agriculture (1972, p.25) pamphlet on market gardening in the NWT encouraged farmers: “A farming enterprise that is not economical now, might by next year or the year after, or vice versa.” Internal government memos and experimental farm logs, however, were less sanguine. Time and time again, farm experiments demonstrated that crops could be grown in the NWT, but these ventures were seldom profitable. One officer's report on the Sanikiluaq Greenhouse project describes, “To date, this project has shown that we can grow cucumbers and tomatoes in Sanikiluaq at an exceptionally high cost and that this produce can be given away to local residents… I do not know why we should continue to fund this project” (Wilson, 1976). Similarly, Dr. Archibald and Dr. Albert, agricultural specialists for the Experimental Farms Service, agreed that “the agricultural possibilities of the north should not be over-publicized at present so as to start an ill-advised rush of settlement,” and “only the most experienced, provident, resourceful and determined settlers will ever succeed in northern parts” (Copland, 1967, p.148). On one hand, the state saw agriculture's potential to increase settlement in the northern frontier, occupy and govern the land, and make it legible to national and international audiences. On the other hand, doing so was found to be economically costly and environmentally concerning.

Officials were variably forthcoming with this information to agricultural settlers. The federal government more readily acknowledged the limited success of farming in the NWT, going so far

to suggest in 1968 that settlement based on full-time farming in the northern territories "should be discouraged, if not prevented" (Hunt, 1968). Indeed, the federal government effectively shut down large-scale agriculture in the northern territories with the 1975 agricultural land lease moratorium, at least in part because of environmental concerns related to mounting failed private agricultural ventures (Department of Indian and Northern, Affairs 1975; Gorrie, 1975). The Fort Simpson Experimental Farm closed in 1969 and was turned over to the territorial government so the land could be used for housing (Gordon, 1968; Hodgson, 1968; Kennedy, 1968). Officials in the NWT government, however, wavered. Letters to prospective agricultural settlers were often lackluster: "It should be pointed out that the prospects for successful farming in the NWT are not as promising as in southern Canada. The enclosed information should not be taken therefore as encouragement for the formation of farming units that would be clearly submarginal," wrote an NWT Industrial Liaison Officer to a prospective farmer in Syracuse, New York (Birt, 1973). However, correspondence with farmers already residing in the NWT tended to be optimistic. In one high-profile case, territorial officials repeatedly encouraged a cattle farmer to settle and develop land in the Horn River area, despite the farmer having no approved agricultural lease. When his lease was officially denied in 1975, the territorial government was forced to pay the farmer $10,000 in assistance for relocation (Buchanan, 1975; GNWT, 1975; Hodgson, 1975).

The mid-20th century agricultural frontier imaginary is thus one of shifting and fading optimism. There was public hope amidst private pessimism, agrarian promise, and government calculation. Scores of prospective settlers were attracted to the NWT for hope of fulfilling an agrarian dream, but relatively few actually came. Those who did were met with a confluence of material and bureaucratic challenges. In the mid- to late-20th century, the federal government began to discourage, then prohibit settler agriculture while they continued to invest in Indigenous gardening projects. In 1975, the federally mandated land lease moratorium prohibited large-scale agriculture and stalled the development of a broad-scale NWT agricultural policy for over 40 years. For decades, the agricultural industry was held in abeyance.
Despite this, the government continued funding research to clarify and classify the suitability of agriculture in the North, including compiling and digitizing 40 years of soil research (EcoDynamics, 2008; Eley & Findlay, 1977). The Territorial Farmer's Association (TFA) also commissioned a series of reports that tell of the storied history and promising future of agriculture in the NWT, in addition to making local and territorial-level policy recommendations (Avery et al., 1997; Biostim, 2000; Cardinham Text and Creations, 1995; Crosscurrent Associates Ltd., 2004; Serecon, 2006). Small-scale agriculture continued in bursts and fits over the next four decades. However, few farms were active for more than one generation as farmers continued to meet significant barriers to accessing land and supportive agricultural policies.

Results: The New 21st Century Frontier

Renewed political will and financial investment in NWT agriculture were building again by the 2010s. In 2013, the territorial government identified agriculture as an emerging priority industry and in 2017 developed its long-awaited territorial agriculture strategy, "The Business of Food: A Food Production Plan," outlining its strategies and commitment to developing an NWT agriculture and agrifood industry (GNWT, 2013a, 2017). During the second study period of 2011–2021, food security and economic promise emerge as two key narratives from state

discourses and popular media. As motivations for agricultural development, however, these narratives play out differently at the local, regional, and global scales. In the contested space that underpins this agricultural frontier lifecycle, participant-observation and interviews revealed that the government's stated goals and promises of agriculture do not necessarily match individuals' motivations and lived experiences of farming and gardening in the NWT.

Food Security

Overwhelmingly, 21st century territorial agricultural reports, speeches, and press releases portray agricultural production as fundamental to NWT food security. This narrative is often discussed in relation to the NWT's high food insecurity rates, nearly double the national average (GNWT, 2015a; Tarasuk and Mitchell, 2020), high food import costs (GNWT, 2015a, 2017), dependence on southern food production (GNWT, 2015b), and vulnerability to market and supply chain disturbances (GNWT, 2013a). Only 18 of the NWT's 33 communities have uninterrupted road access through an all-weather highway, and those with seasonal or no road access are at increased risk of being food insecure (GNWT, 2015c; Tarasuk & Mitchell, 2020). By the mid-2010s, the territorial government had established community gardens or greenhouses in every NWT community, from Fort Smith at the Alberta border to Sachs Harbor on Banks Island in the High Arctic (GNWT, 2015b). In some instances, community gardens were built collaboratively by First Nations leaders, community members, and children working along government employees (Author interview, 2021). In others, gardens were clandestinely planted by a state official. A community could go to sleep without a garden, and in the morning, they would wake up to a plot that had been rototilled and planted with vegetables (Author interview, 2021).

News media often centers on affordable food, nutritional benefits, and access, rather than economic gain through agricultural production. The local food for local food security narrative took on fervency in the COVID-19 era, exemplified by one farmer in Yellowknife who urgently pleaded with her local government to increase support for agricultural programs to protect against unexpected supply chain disturbances. “This is absolutely the right time to be doing this,” France Benoit said in 2020. “A few weeks from now it will already be too late – we need to do it pretty quickly” (Desmarais, 2020).

The local food production for food security narrative is also articulated in Indigenous agriculture projects (Chen & Natcher, 2019; Hugall, 2018; Zelniker, 2015). Federal and territorial funding for agriculture in Indigenous communities has continued and expanded since 20th century investments through programs such as the Canadian Agriculture Partnership and Canadian Northern Economic Development Agency. Nonprofit organizations and academic institutions are also driving funding and support for NWT agriculture projects. For Ka'a'gee First Nation and Sambaa K'e First Nation, partnering with university researchers through participatory action research has enabled funding, human resource capacity, and technical assistance for community agriculture projects while avoiding the funding stipulations and reporting burden that comes with government programs. Whereas mid-20th century administrators tended to portray agriculture as fundamental to food security in Indigenous communities (Cooper, ca.1974; Department of Mines and Resources, 1948; Wilson, 1976) - reflecting deeply held colonial beliefs around the reliability of foodstuffs and what was considered a safe and secure diet (Piper, 2017:211) - in

more recent policy documents and scientific literature, agriculture is described as supportive of Indigenous food security while maintaining that the traditional food system plays key cultural, nutritional, and social roles in Indigenous communities (GNWT, 2015a, 2021; Price et al., 2022; Spring et al., 2019; Wilson et al., 2020).

State-driven and popular media narratives, however, offer little insight into syncretic ways that some Indigenous communities in the NWT are integrating traditional hunting and gathering with agriculture in community food provisioning. For example, members of Sambaa K'e First Nation have cultivated potatoes, carrots, and turnips since before settlement in Sambaa K'e (previously Trout Lake) in the 1960s. Community members tell of their Elders who learned farming techniques from traders and missionaries and cultivated root vegetables to supplement what they harvested from wild varieties of carrots, parsnip, and other vegetables. Today, Sambaa K'e First Nation maintains a large community garden and community greenhouse. They grow a wide variety of crops including potatoes, root vegetables, lettuces, berries, squashes, brassicas, and melons. Rather than commodifying the produce for sale within the community, vegetables are distributed to members, integrated into community meals, and available at no cost in the local store. When I asked a member of Sambaa K'e First Nation about the relationship between the garden and the traditional food system, she suggested, “agriculture is [consistent with] Dene way of life” and pointed out the similarities in the two food provisioning systems: growing seasonally is as hunting seasonally, both require Dene values like patience, both connect you to the land and keep you mentally and physically healthy (Field Notes, 2021; Author interview, 2021). While hunting retains spiritual and cultural values that agriculture does not share, leaders in the community often viewed agriculture as consistent with Dene law and supportive of broader goals for community food sovereignty and food independence.

Economic Promise: From Local to Global

The economic potential of agriculture features prominently in territorial-level discourses, particularly in governmental speeches between 2012 and 2017. Pressure to grow the agricultural industry mounted in the 2010s as the territory's mining industry began to decline. Mining, oil, and gas extraction contributed 25.3 percent to the NWT's GDP in 2020 (NWT Bureau of Statistics, 2020). However, revenue from the mining industry was down 60 percent in 2020 from its peak in 2007, and the overall economy shrank from $4.5 billion to $3.9 billion during this time (NWT Bureau of Statistics, 2020). As the NWT's GDP contracted with the loss of mining revenue, bureaucrats increasingly emphasized the need to diversify the economy by investing in agriculture as well as tourism, arts, manufacturing, and other industries (GNWT 2013a, 2013b).

Economic uncertainty in the NWT is occurring in the midst of an international race for political and economic power across the Arctic (Dittmer et al., 2011). Linking local to global, prime ministers, premiers, and ministers have urged the economic development of the NWT frontier over the last decade. In a 2013 address, David Ramsay, former NWT Minister of Industry, Tourism and Investment said, “I am here today to say - and I hope you will all help me spread the message - that the Northwest Territories is open for business. We are the place for investment dollars. We are the next frontier for development and economic growth. It is time for us to have our day” (GNWT, 2013b). What is needed to realize this goal, according to Ramsay, is “billions of dollars of investment capital,” and, in a rural region with a small population, more federal

transfer payments, more tax dollars, more labor, and more money circulating in the local economy - in a word, immigration (GNWT, 2013b). The mining industry remains paramount, but agriculture has been reimagined as integral to the NWT's economic diversification and development strategy (GNWT, 2013a).

At the federal level, interest in the NWT agricultural industry sparked during the Stephen Harper administration (2006–2015) as the Canadian Arctic underwent a re-securitization process following a relatively short period of Arctic cooperation (Perreault, 2011). As prime minister, Harper prioritized the occupation and development of the Canadian North, famously adopting a "use it or lose it" approach to the Arctic that aligned with Canada's broader foreign and defense policy. The administration saw development as the avenue to securing its northern border and geopolitical position among Arctic states. Arctic securitization under the Harper administration was most visibly marked by mineral extraction and a growing police presence, but the administration also supported the development of an NWT agricultural industry. Between 2014 and 2015, Harper committed $4 million to support NWT agriculture projects, including $2 million to build a campus for the Northern Farm Training Institute (NFTI), a 260-acre farm and agricultural training school, and $2 million for the Northern Greenhouse Initiative to support commercial greenhouse production across Canada's North (CBC News, 2014; Government of Canada, 2015). Over 300 northerners from 30 communities were trained at NFTI, and until the training farm closed in 2022, NFTI occupied one of the largest tracts of farmland in the territory (NFTI, 2018).

Contested Space

The state's agricultural frontier imaginary is influenced by its geopolitical positioning and economic obligations. However, individuals and communities who farm and garden in the territory do not necessarily share the same visions. Individual motivations for agriculture center around producing healthy, fresh food, reducing reliance on food imports, and, for a minority of people I interviewed, supporting household livelihood strategies.

Some farmers have found economic success in NWT agriculture, including a multigenerational family in Hay River with a 118,000-bird egg barn. Egg production is regulated by supply management through the Canadian Egg Marketing Agency Quota Regulations and guarantees a market for the eggs. This is a unique system enabling large-scale production of eggs in the NWT, with the majority of eggs being shipped south as surplus for the national market. Some farmers, like this successful egg producer, see the government's role as supportive of the agrarian dream through grant funding and forthcoming regulatory and policy standards (*Up Here*, 2019). Other farmers - particularly among conventional crop and livestock farmers who require access to larger acreages of land, loans for equipment, and tax subsidies to offset the costs of large-scale farming operations - think more support is needed for conventional agriculture. Reflecting on differences in farming between the mid-1970s and now, one farmer explained:

> I think it has changed a little bit. And I think it's because government has bought into small scale farming… so okay, so we have this industry that wants to grow. But we (the government) don't want to give away land. And we don't really want animals or feed. So maybe let's make it look like we're really supporting small scale. And I, you know, so

> kudos to greenhouse growers and the egg producers. But it really left a whole sector (without support). (Author interview, 2021)

Another farmer applied for an agricultural lease on a quarter section (160 acres) of town land to expand his grazing area and forage crops in 2020. The town supported the farmer's agriculture lease, but the GNWT ultimately denied it because of overlapping First Nations claims on the requested acreage. After a second failed application and a flood that destroyed his farm in 2022, the farmer left the NWT and purchased a quarter section to farm in Alberta. For this farmer and others, policy declarations such as the NWT Agriculture Strategy (GNWT, 2017) fall short of meeting their needs.

Conflicts also arise over funding. Since most of the available programs through the shared federal-territorial agricultural funding program (at the time of study, Canadian Agricultural Partnership) are aimed at commercial farmers, this leaves out many in the NWT who are producing food, yet do not sell their products, or who, for cultural, economic, or land tenure reasons, do not identify as commercial farmers. Some Indigenous communities have been able to access large sums of funding and support through federal or territorial programs and university research projects. On the other hand, some individuals who want to farm commercially but do not have the land permitting to allow it - like one individual who produces rabbit meat and who occupies a recreational land lease that cannot be converted to an agricultural lease - may not able access the primary programs designed to support the agriculture industry.

Discussion: Lifestyles of an Agricultural Frontier

Academic literature often portrays the 21st century northern agricultural frontier as a recent climate-driven phenomenon (Altdorff et al., 2021; Hannah et al., 2020; Unc et al., 2021), yet in the case of the NWT, archival evidence reveals that the 21st century agricultural frontier imaginary is not new. Rather, the current NWT agricultural frontier appears as a new lifecycle of an older imaginary, undergirded by three recurring narratives: agriculture as a tool of economic opportunity, territorialization, and food security. In a study of scientific engagement in the Arctic, Stuhl (2016) found that colonial logics have and continue to undergird the positioning of tools that will “help” or “save” the North and northern Indigenous people from a series of vulnerabilities including starvation, economic depravity, disease, and (now) climate change. These same logics undergird imaginaries around agriculture as a tool of economic opportunity and social good, both historically and in the present.

In the NWT, discourses around economic opportunity in agriculture have often taken the form of promise. Few individuals have found farming in the NWT to enable fully agrarian livelihoods, but the promise of the agrarian dream continues to lure new farmers. Just as Calo (2020) identified the reappearance of the yeoman farmer myth in the “beginning farmer” programs in the US, the yeoman farmer myth also reappears in 21st century narratives of NWT agriculture. While popular narratives often depict individuals' agrarian dreams of independence and self-sufficiency, government speeches and policies reveal that state-driven motivations for farming are connected to larger geopolitical goals of development, food security imperatives, and an urgency to diversify the NWT economy to achieve a more secure future.

Agriculture as a territorializing force also features in both lifecycles of the NWT agricultural frontier imaginary. Agriculture, through its terraforming of raw land, its transformation of food systems, and its control over natural resources, has proven an effective way to claim and occupy territory (Hall, 2013; Sack, 1986; Vandergeest & Peluso, 1995). Scholars have shown how these processes have differently played out in southern Canada and northern Canada, particularly in the scale of agricultural settlers dispossessing Indigenous peoples from their land in order to claim it for the settler state (Rotz, 2017). However, my research demonstrates a continuation of these logics in the North. In the mid-20th century, this territorializing discourse of agriculture was forwarded by federal agencies concerned with Canada's geopolitical position in WWII and into the postwar period and was operationalized through experimental farms and other state projects. In the 21st century, the Harper administration (2006–2015) reinvoked discourses around Arctic securitization and used agriculture, in addition to boosting police presence and developing mineral resources, as a way to claim territory. To a much greater degree, Russia has also employed agricultural development and mineral exploitation as tools of territorialization (Meyfroidt, 2021; Thompson, 2009). Though the Trudeau administration (2015-current) has backed away from Harper's militarized rhetoric of the region, federal and territorial funding for agriculture programs in the NWT has continued to expand as geopolitical tensions around Arctic boundaries heighten (Bennett, 2016; Dittmer et al., 2011; Dodds, 2010; Solli et al., 2013).

The territorializing project of NWT agriculture runs in tandem with the discourses of agriculture as a food-securing force, particularly for remote NWT communities. In "modernizing" hunter-gatherer food systems, settled agriculture also makes claim on the landscape, visually transforming dynamic, fluid ecosystems to simplified, occupied fields and pastures (Brody, 1999; Scott, 1998). Daschuk (2013, p.95-98) shows how Dominion officials advocated that plains First Nations convert from fur-based economic systems to agriculture in order to secure a more permanent position in society. The Reindeer Experiment among Inuit in the NWT had a similar goal (Stuhl, 2016). In the NWT, mid-20th century agriculture narratives follow a more explicit allegiance to assimilation and land dispossession by reducing Indigenous land base through settlement, converting traditional diets to Euro-Canadian staples, and introducing a food import system. In the 21st century, ongoing government programs now work to develop Indigenous agriculture while also supporting the traditional food system. At the same time, unsettled land claims effectively diminish Indigenous sovereignty over land and governance structures needed to ensure the continuation and protection of traditional food systems across the NWT.

As dominant narratives, these imaginaries work to reinforce settler-colonial structures and productivist agriculture policies. However, in both lifecycles of the NWT agricultural frontier, there is contested space between imaginary and development reality. Over the last decade, government officials have imagined the growth of an NWT agriculture and agrifood industry. Territorial agricultural policies and funding programs align with these goals, but limited markets, land, and regulatory policies continue to limit the expansion of commercial agriculture in the NWT. Among farmers I spoke with who wanted to access new land to expand commercial production, most were unable to do so. Complex and ongoing land-use planning following devolution and existing land claims negotiations have made public lands extremely difficult to access, and purchasing land within the municipalities of Hay River and Yellowknife can be

prohibitively expensive for small-scale farmers and growers. There is also limited arable land available in the NWT, much of it along rivers and inaccessible by road, so there are geographic barriers to land access as well as political ones.

Interlocuters described other barriers existing in current infrastructure, shipping, processing, regulatory, and taxation policies that do not readily support an agriculture industry in the NWT, making it challenging for even small-scale farmers to make it work economically. Many NWT communities do not have year-round road access (GNWT, 2015c), and flying in agricultural inputs, or flying out agricultural products, is expensive. Greenhouse production is often discussed as a promising future of northern agriculture, but energy costs in the NWT are more than double the national average (Canada Energy Regulator, 2017). Furthermore, despite an overall warming trend, the inherent climactic and production risks of NWT agriculture continue to discourage large-scale corporate investment. Family farmers, however, have been willing to take on these risks, a trend Mann and Dickinson (1978) first identified in lower latitudes. Finally, the NWT has historically lacked large internal markets for agricultural products, since traditional food systems often integrate both wild and imported foods (Huntington et al., 2005), and the region is sparsely populated. Because of these barriers, most agricultural production in the NWT today is small-scale, intensive, diversified agriculture in or near the population centers of Yellowknife and Hay River. Despite state goals for broad-scale economic growth, agriculture and the agrifood industry contributed only 0.1 percent to the overall NWT GDP in 2015 (Statistics Canada, 2015).

Finally, the dominant narratives underpinning the NWT agricultural frontier do not capture the possibilities of Indigenous agriculture as a form of resistance, rather than acquiescence, to capitalist-colonial structures. Some northern Indigenous communities view local food production as a way to supplement traditional harvesting and hunting practices and are including crop cultivation as part of their climate change adaptation plans (Ahmed & Wenman, 2020; Johnston and Ka'a'gee Tu First Nation, 2022; Johnston & Sambaa K'e First Nation, 2022). For others, local food production helps address food insecurity resulting from a state-facilitated trend toward dependence on imported food (Spiegelaar & Tsuji, 2013). In the NWT, many Indigenous communities have resisted pressure to commercialize local food production, instead maintaining community agriculture that functions through shared community labor, or through paid and volunteer labor of non-Indigenous outsiders. Shared harvest is often given away. In this way, Indigenous agriculture may actually subvert the capitalist-colonial agricultural frontier imaginary by integrating cropping systems with traditional food systems and alternative economies.

Conclusion

In this article, I use discourse analysis of state-driven and dominant public agricultural narratives to show that the climate-driven agriculture frontier imaginary has historical precedent. Drawing on Cons and Eilenberg (2018)'s theorization of imaginative frontiers as existing in lifecycles, emerging and reemerging as assemblages of material reality and visions of possibility, I argue that the present northern agricultural frontier is not simply a new imaginary enabled by changing climate materialities. Rather, the current NWT agricultural imaginary appears as a new lifecycle of earlier agricultural frontier imaginaries, fueled by capitalist-colonial logics and colored by the

narratives of agriculture as an economic strategy, a tool of territorialization, and a food-securing force.

As Tsing (2005) reminds us, the frontier imaginary molds both process and place. But the NWT agriculture frontier imaginary does not have the material effects we might expect. This research also found divergences between the imaginary and the lived experiences of farmers and gardeners, and these constitute the contested space of the NWT agricultural frontier and bound it as a quasi-commercial space of smallholder production. For over a century, the state has not accomplished the growing agricultural industry it imagined in the NWT. Still, new development projects, policies, and funding programs are launched, and these have material effects on farmers and growers producing food in the NWT.

More research is needed to understand the implications of new agricultural policies and programs for NWT farmers and growers and the Arctic and boreal landscapes where they are planned or in process. While significant political, economic, and infrastructural barriers prevent a wide expansion of commodity agriculture in the NWT, this may not be true for other northern regions. Russia, for example, already has large-scale, intensive agriculture production and may be impacted by global environmental change and sociopolitical dynamics in different ways (Lustgarten, 2020; Saritas & Kuzminov, 2017). Northern regional governments have also differently encouraged agricultural growth, for example, through new conversion of boreal forests to cropland or by focusing on sustainable intensification where agriculture is already occurring or anticipated (Unc et al., 2021). Future comparative research should explore the development and impacts of the agricultural frontier in other historical, cultural, and political contexts.

Chapter 3

Navigating New Enclosures in a Warming Climate

Introduction



Figure 1. Golden Gardens farm, October 2021. Photo courtesy of owner/operator of Golden Gardens.

Golden Gardens[18] is an 11-acre market garden in the South Slave region of the Northwest Territories (NWT), Canada. The family-owned and operated farm produces a variety of crops including root vegetables, tomatoes, greens, peas, berries, and bedding plants. Products are sold at the farm gate and in the nearby town's farmer's market. The farmers also raise sled dogs and horses, they have chickens and sell eggs, and they keep an elderly pair of sheep to graze and fertilize the fields at the end of each harvest. Golden Gardens is located in Paradise Valley, a small community of approximately 55 people in an oxbow of the Hay River. Canadian, American, and Swiss settlers first cleared the wooded valley in the early 1960s, and famers have continuously used the land for agriculture since that time. Paradise Valley has a Subarctic climate. It contains rich, alluvial soils, has limited or no permafrost deposits, and enjoys approximately 120 frost-free days per year and an outdoor growing season from May to September (Climateatlas.ca).

[18] Farm and interviewee names are pseudonyms. Community names are used with permission.



Figure 2. Paradise Valley in an oxbow of the Hay River. Source: Google Earth.

In early May 2022, one week after Golden Gardens opened for the bedding plant season, extreme weather hit. High snow levels, record water levels in the river basin, and the annual ice breakup of the Hay River coincided with an unprecedented heavy precipitation event. As breakup occurred, an ice jam formed in the oxbow of the river. On May 8th, the river rose above the 25-foot bank and spilled across the road and into the valley. On May 12th, the river crested, and the entire valley flooded. Giant ice chunks spilled out from the river and tore into homes and fields. Greenhouses were lifted off their foundations and moved 100 yards or more. Sheep, cows, and chickens were killed. The topsoil eroded under the current of the river, and the gravel from the road washed into farmers' fields. According to the Government of the Northwest Territories (GNWT), 40% of the territory's commercial agricultural production was destroyed in this single climate event (Author interview, 2023).



Figure 3. Flooding in Paradise Valley, May 2022. Photo courtesy of Aaron Tambour.

When I returned to the valley in June 2023, a year after the flood, there was still debris everywhere. River silt covered the insides of many basements and greenhouses. Some homes had been torn down, while others had been cleaned and mitigated. Others remained standing but were condemned. The flood undercut the bank, so the town moved the road further inland and onto farmers' fields. A new orange road sign was staked on the eroded edge of the bank, "CAUTION. Sudden drop off. Proceed with care." At Golden Gardens, the new gravel road now occupied the three front fields, which once held kale, peas, carrots, beets, and other vegetables. Five greenhouses were swept away. Much of the farm infrastructure – tractors, quads, snowmobile, machine shed – were destroyed by the floodwaters. In the undeveloped bush behind the farm, I saw the skull of a sheep they lost, dragged across the property and crushed under the roof of its shelter.

Paradise Valley, which was previously understood as among the most fertile land in the territory and a beacon example of NWT agriculture, is now a living memory of flood. As I walked in the valley a year after the disaster, I wondered about the future of agriculture in the community. Moreover, I wondered how people whose lives and livelihoods depended on the land would respond to the rising risks associated with climate change. These valley wonderings prompted the central research questions I address in this article: How is climate change transforming the conditions of production and social reproduction, and how are local people responding to those changes?

In this article, I propose and develop the concept of "climate enclosure" to examine new forms of land dispossession that are occurring in the NWT, not at the hands of the state or investors, but through material forces that are transforming landscapes and fundamentally altering peoples' relationships to them. I argue that the material force of climate change works in concert with sociocultural, political, and economic conditions to shape peoples' production practices. Unlike in classically defined enclosures where there is a clear and permanent transformation of class relations between those who can access the means of production and those who cannot, class

differentiation is not so clear in climate enclosures. Climate enclosures create new uncertainties on the land which present both challenges and opportunities for individuals and communities undergoing enclosure.

Local responses to climate enclosures demonstrate agency and choice but are nonetheless largely constrained and produced by historically established social structures (Svarstad et al., 2018, p.354). For example, Watts (1983) examined the relationship between drought, political economy, and social relations in northern Nigeria, and he showed that while drought is a climatic event, famine is socially produced. The peasants and pastoralists in Watts' study had created safety nets against recurrent drought years – including long-term food storage techniques used by households and communities – but colonial authorities undermined local capacity to combat food scarcity by introducing mechanisms such as tax collection systems and pressure to produce crops for export. Commodification meant instant sales of staple foods rather than saving some for bad years. As farmers shifted from saving consumption crops to selling export crops, they became increasingly dependent on the unstable commodity market and experienced increased economic marginalization and hunger.

Like Watts (1983), Davis (2001) considers how climate events and social structures combine to produce certain outcomes – in his study, a series of El Niño-induced droughts throughout the late 19th century and famine in India, northern China, and northeastern Brazil. Davis (2001) ultimately argues that drought (a climate event) became famine (socially produced) under destructive imperial and capitalist policies, and this created lasting underdevelopment in what became known as the Third World. The "fate of tropical humanity," Davis (2001, p.9) writes, was determined "at the precise moment (1870-1914) when its labor and products were being dynamically conscripted into a London-centered world economy." Millions of people died in the "process of being forcibly incorporated into its economic and political structures" (Davis, 2001, p.9). Drought induced the failure of crops, but it was the free-market economy and the technologies of railway and steamship that allowed grain to be exported to Europe and monopolies that made people in famine-stricken areas unable to purchase grain at high prices.

In analyzing new enclosures in the NWT under climate change, I build on and differentiate my analysis from studies that examine how individual weather or climate events articulate with social relations and the wider political economy (e.g. Watts, 1983; Davis, 2001). I understand climate change as a long-term shift in the Earth's weather patterns which is causing a multiplicity of climate events including rising sea levels, loss of permafrost and melting sea ice, and increased frequency and severity of extreme weather such as wildfires and floods, all of which are expressed in the Arctic. This study demonstrates the ways in which climate change alters the conditions of possibility of production and affects the ways that power is emplaced and resources are controlled. It is the effects of multiple climate events occurring at the same time, and recurring over time, that lend to extreme, different, and new conditions.

This article unfolds as follows: First, I review the political ecology of climate change literature and discuss how political ecologists have approached the study of climate change and its impacts on local communities. In the subsequent sections, I develop the concept of "climate enclosure" and apply it in the NWT. My analysis aims to understand how climate change alters the conditions of production and social reproduction and, in concert with political economy and

sociocultural forces, leads to different adaptation possibilities and responses among local people. I demonstrate that climate enclosures are leading to migration and new forms of wage labor for some smallholder commercial farmers in Paradise Valley, while Indigenous hunters and harvesters in Sambaa K'e and Kakisa are responding to the crises of climate change by increasing subsistence agricultural production. In each case, the practices reflect communities' adaptive practices under the ongoing structural forces of colonialism and capitalism, and in the face of increasingly uncertain climatic conditions. In the conclusion, I further reflect on the uncertainty created in climate enclosures, not only as it relates to land-based agricultural opportunities and dispossessions in this region, but also to wider discussions in the development of Arctic resources such as shipping, mineral, oil, and gas under climate change.

My analysis of climate enclosures is informed by 15 months of ethnographic research in the NWT communities of Sambaa K'e, Kakisa, and Paradise Valley between 2019 and 2023. Sambaa K'e and Kakisa are Dene communities (Sambaa K'e First Nation and Ka'a'gee Tu First Nation respectively) in the Dehcho region of the NWT. Paradise Valley is a small, predominately settler agricultural community that is formally incorporated into the town of Hay River in the South Slave Region of the NWT. All three communities are located between 60 and 61 degrees North latitude, were first settled in the 1960s,[19] and are small communities of between 40 and 99 people. I engaged in participant-observation in farming and gardening, hunting, fishing, and harvesting, participating in cultural ceremonies, and preparing and preserving food alongside community members. I also conducted 52 in-depth semi-structured and key informant interviews with farmers, gardeners, community members, Indigenous leaders, government officials, and nonprofit leaders. I transcribed recorded interviews and thematically coded interview notes and transcripts in MAXQDA using deductive and inductive coding. Additionally, I triangulated ethnographic data by collecting and analyzing extensive archival material at local, federal, and territorial archives in Hay River, Sambaa K'e, Yellowknife, and Ottawa, as well as grey literature on agriculture, climate change, and land use policies in the NWT. Through an analysis of ethnographic and archival data, I offer detailed findings of local peoples' encounters with climate change and their adaptive agricultural responses in the face of ongoing climate enclosures.

The Political Ecology of Climate Change

Climate change is transforming social and ecological systems in dramatic and irreversible ways. Early qualitative approaches to understanding the scale and impacts of these changes often took the form of vulnerability studies. Vulnerability studies beginning in the 1990s examined who was vulnerable and to what climate impacts, how and in what ways, and to what extent local people were able to adapt to the stresses (Stepien et al., 2014). The vulnerability approach has

[19] Paradise Valley is located approximately 20 miles south of the Town of Hay River, population 3,500, on the shore of Great Slave Lake. Traders and missionaries first settled in the Town of Hay River in 1868. Formerly a fishing town, Hay River is now a transportation hub for the territory and is connected by railway and highway to Canada's southern provinces. Following a devasting flood in the Town of Hay River the late 1950s, several families left the town, moved further south from the mouth of the river, and cleared land in Paradise Valley to farm. Paradise Valley was incorporated into Hay River at the turn of the 21st century, and though valley residents pay taxes, are schooled, shop, bank, and work in the larger town, in many ways Paradise Valley remains its own distinct cultural community centered around agriculture and rural life.

been particularly prevalent in studies of climate change impacts in the Arctic, and especially among Arctic Indigenous peoples, whose traditional harvesting and livelihood practices in hunting, whaling, fishing, and gathering are threatened by permafrost loss, melting sea ice, and severe and unpredictable weather (Belfer et al., 2017; Bennett, 2021; Pearce et al., 2010; Stepien et al., 2014). Critical social scientists have critiqued vulnerability approaches for promoting a static understanding of human-environment interactions, portraying those impacted as passive victims without agency, having limited influence on policy and governance, and failing to account for structural issues like capitalism and colonialism (Cameron, 2012; Ford et al., 2018; Sovacool, 2021).

Political ecology, a subfield of geography that draws on ecology and political economy to examine intertwined social and environmental systems (Blaikie & Brookfield, 1987; Robbins, 2004), is well-positioned to examine how spatial and historical drivers of inequality articulate with climate impacts in local communities (Tschakert, 2012; Taylor, 2014). In *The Political Ecology of Climate Change Adaptation,* Marcus Taylor writes that political ecology is central to the task of understanding lived environments under climate change because the field approaches climate change,

> not as a rupture between society and a climate thrown out of balance by human actions, but as a series of tensions in the way that meteorological forces are actively worked into the production of our lived environments. On this basis, climate change represents a shift in the socio-ecological relationships through which our lived environments, with all their engrained inequities and forms of power, are actively produced. (Taylor, 2014, p.5)

What other approaches have failed to struggle with, Taylor (2014, p.5) argues, is that human beings are not separate from their environments but are "active protagonists in their ongoing production." Climate change alters the conditions in which we produce and socially reproduce, and efforts to understand the stakes and implications of climate change must see the social and meteorological as fundamentally intertwined, as co-productive, and as constantly changing. Thus, instead of focusing on the imperative to adapt to these changing conditions, we must instead consider how to *produce* ourselves differently (Taylor, 2014, p.5).

Benjamin Sovacool (2018) proposed one potential framework to analyze climate change impacts through a political ecology lens. Sovacool's framework considers how climate adaptation projects perpetuate four partially overlapping processes: enclosures (economic dimension, especially the process of transferring public assets into private hands), exclusion (political dimension, limiting access to recognition and decision-making processes), encroachment (ecological dimension, damaging the environment by interfering with biodiversity and ecosystem services), and entrenchment (social dimension, worsening inequality of the vulnerable and disempowered). In using the framework to analyze the impacts of climate adaptation and mitigation projects over 215 cases, Sovacool (2018, 2021) demonstrates that climate change and its projects are imbued in and unescapable from power and politics.

Much political ecology of climate change literature has sought to examine the first process in Sovacool's (2018) framework – new land enclosures amid climate change. Scholars have shown how states and investors exploit new extractive opportunities under the crises of climate change

in a phenomenon that Kimberly Thomas calls "accumulation by adaptation" (Thomas, 2024; Franco & Borras Jr., 2019; Paprocki, 2021; Sovacool, 2018). For example, Yenneti et al. (2016) describe how new land acquisitions for large-scale energy projects required the enclosure of common land in India, which eliminated smallholders' and workers' land-based livelihoods. In this climate-driven "regime of accumulation," the low-carbon investors "maximize[d] their gains by dispossessing vulnerable social groups of their life-sustaining interests" in the name of climate mitigation (Yenneti et al., 2016, p.90). To address drought and storage capacity issues in Melbourne, Australia, planners built a desalinization plant capable of storing 150 billion liters of water per year. The project required the enclosure and expropriation of thirteen pieces of land that were highly significant to the Bunruong Aboriginal community (Barnett & O'Neill, 2010). In Bangladesh, Paprocki (2018) shows how shrimp aquaculture – touted by NGOs and the government as an economically productive project amidst the "anticipatory ruination" of a salinized, sinking coastline – has resulted in the loss of traditional rice cultivation and other local livelihood activities.

With power and politics as focus of analyses of enclosures under climate change, the *ecological* transformations driven by climate change have become somewhat of a background consideration. Critics could describe such studies as emblematic of when the environment in political ecology becomes "simply a stage or area in which struggles over resource access and control take place" (Zimmerer & Basset, 2003, p.3). This has been a contentious debate in political ecology since the poststructuralist turn within the field in the 1990s, leading Peter Walker (2005, p.73) and others to question, "Where is the ecology in political ecology?" In the remainder of this article, I address the ecology question in political ecology's engagement with ongoing enclosures under climate change while maintaining political ecology's commitment to seeing "nature and society as dialectically constituted" (Watts, 2015, p. 32). I take Sovacool's framework a step further, in developing the concept of "climate enclosure" to examine new forms of land dispossession unfolding in northern Canada. These enclosures are not driven by political or economic interests, but by material forces that are interacting with power and political economy on the ground, transforming landscapes and fundamentally altering local peoples' relationships to them and to each other.

Climate Enclosures as Process

Climate enclosures are ongoing material processes that affect the ways that power and resource use are controlled. Ecological changes articulate with social, political, and economic forces, and climate change itself is shaped by the structures of capitalism and colonialism (Fraser, 2021; Moore, 2017b; Whyte 2018b). Local responses to climate enclosures are entangled in local micropolitics and shaped by historical changes in the wider political economy. I argue that climate enclosures have incomplete, uncertain futures and that class relations are not fully differentiated as in the original enclosures Marx describes. In each of the cases I examine in this article, however, rural peoples are experiencing at least a partial separation from their means of production and social reproduction under the crises of climate change.

It is helpful to revisit Marx's classic interpretation of enclosure to understand what is distinct in climate enclosures. Marx theorized enclosures as part of the process of what he called

"primitive" accumulation which also created a surplus labor force. The enclosure process Marx explained occurred as peasants were separated from their means of production on the land (Marx, 1887 [1867], Chp 27). As early as the 16th century, the gentry and aristocrats began enclosing lands to which they held rights through practices such as replacing crops with animal husbandry and building fences and hedgerows. By the late 18th century, however, the law became a key instrument through which common land was enclosed by direct acts of Parliament. Both practice and law therefore created a labor force of people that had lost their access to common land could no longer socially reproduce themselves; they had only their labor power to sell.

Political ecologists have argued that enclosures are not merely historical; they recur also as conditions on the ground change (De Angelis, 2004; Harvey, 2004; Moore, 2017b). Among other things, contemporary enclosures involve the expansion of capital into new or previously remote areas (Sovacool, 2018, p.187). The process of reconstituting common land into private property is a hallmark form of enclosure, but enclosures can also occur through other mechanisms. For example, enclosures can occur directly through water privatization or by indirectly enclosing land and water resources via pollution. Urban space enclosures can happen through gentrification and laws persecuting homelessness (De Angelis, 2004). What I argue in this paper, however, is that enclosures also occur as a consequence of climate change.

Climate change alters the material conditions under which enclosures occur. In the Arctic region, climate change is causing warming at a rate three to four times the global average and is leading to an increase in the frequency and severity of floods, forest fires, drought, permafrost thaw, sea ice loss, and coastal erosion (Cameron, 2012; Bennett, 2021; IPCC, 2021; Osakada, 2021; Rantanen et al., 2022; Stepien et al., 2014). Infrastructure such as buildings, airports, and pipelines are literally losing the ground beneath them as the land becomes progressively more unstable (West, 2009). Increasing forest fire activity further accelerates permafrost thaw, which in turn reduces the probability of permafrost recovery (Price et al., 2013). Climate change is distinct from individual weather events in scale, intensity, and temporality. Climate-driven disasters such as the May 2022 flood in Paradise Valley are not isolated occurrences but complex crisis moments, connected spatially and temporally through the increasingly erratic, severe, and unpredictable weather patterns of climate change. The unprecedented and unpredictable nature of climate change also challenges Traditional Ecological Knowledge and observations which have formed over thousands of years (Krupnik & Jolly, 2002; Loring & Gerlach, 2009). As described by Michi Saagiig Nishnaabeg scholar Leanne Simpson, "Indigenous peoples have always been able to adapt, and we've had a resilience. But the speed of this – our stories and our culture and our oral tradition doesn't keep up, can't keep up" (Klein, 2013).

I draw attention to the materiality of climate change, following political ecologists who emphasize the always intertwined role of the social and the material (or meteorological) in climate change (Borras et al., 2021; Fraser, 2021; Moore, 2017b; Taylor, 2014). Climate change is not a passive force but has the capacity to disrupt social-ecological relations through the mechanism of climate enclosure. I demonstrate that climate enclosures are undermining rural livelihoods and displacing individuals in the Arctic.

As Taylor aptly writes,

> (climate change is not) simply an alteration of patterns of select meteorological variables in an external environment shaped by biophysical forces operating at a global level. It can also express a reordering of the socio-ecological relations through which humans seek to reproduce themselves and, in doing so, co-produce material climates. (Taylor, 2014, pp.15-6)

From this perspective, we can see capitalism as intimately tied to the nature and origin of the ecological crisis (Moore, 2017b). Capitalist development depends on the ongoing exploitation and accumulation of unpaid work, both from human labor and nature. Thus, the effects of ecological exploitation are inseparable from the rise and development of capitalism (Moore, 2017b). Nancy Fraser (2021, p.120) argues that capitalism inclines towards environmental crisis "non-accidentally," and that climate change is deeply entwined in the systemic crises of capitalism. Similarly, Borras et al. (2021) describe capitalism and climate change as produced and experienced as entwined social and ecological processes.

Many scholars have also pointed out that colonialism contributes to the origin and development of climate change (Davis & Todd, 2017; Reibold, 2023; Todd, 2022; Whyte, 2018a). Climate change also reinforces settler colonial structures, for example if Indigenous peoples are as portrayed climate "victims" in need of settler governments, policies, or programs. State responses to climate crises often take the form of the dominant settler colonial society by framing "vulnerability as a matter of enhancing local capacities*,* rather than attending to the structural and systemic processes by which those capacities are continually undermined" (Cameron, 2012, p.110). For example, by instituting Indigenous nutrition and gardening programs to combat diet-related diseases and food insecurity in the NWT, the state ignores its own role in limiting access to the traditional food system through forced settlement, game laws, the food import system, and broader environmental degradation due to extraction, emissions, and unrestrained production. In failing to understand the intertwined role of capitalism and colonialism in current climate disparities, we implicitly assert that ecological devastation is the result and responsibility of all humans equally (Moore, 2017b).

In the following two sections, I examine three communities' responses to climate enclosures in the NWT. In one case, smallholder commercial farmers are being alienated from the land by climate enclosures, and this is leading to migration, increased reliance on wage labor, and uncertain agrarian livelihoods. In two other cases, Indigenous communities are participating in subsistence agricultural production in response to new enclosures of the traditional food system. In each of these cases, I show how the logics and practices of adaptive agricultural production are entangled in local micropolitics and state power, and they are shaped by the regional political economy.

Adapting Agricultural Practices

When I first began to research Canada's North as a site of agrarian change, I was intrigued by the scientific and public narratives around climate-enabled commodity agriculture there (e.g.,

Hannah et al., 2020; Lustgarten, 2020). I wanted to know whether agricultural frontierization was really occurring in northern Canada, or whether the frontier dream existed only as an imaginary. What I found in the NWT is that a commodity-based agricultural frontier has not yet materialized, but the imaginary has long motivated state and settler interests in northern agricultural production (Price, 2023). As I spent time with commercial farmers, home gardeners, and Indigenous harvesters throughout 2019-2023, I learned that local producers did not often share in the narrative of an impending commodity frontier for agriculture. Many farmers described political, economic, and material limitations that they viewed as unsupportive of large-scale agriculture in the NWT: insecure land tenure and difficulty accessing agriculture land leases, a lack of supportive tax breaks or subsidies, small and isolated markets, high operating and input costs, and an unpredictable climate. Unlike the popular resource frontier narratives that portray climate change as an opportunity for agriculture, farmers and harvesters in the NWT discussed climate change in negative terms, as disrupting the traditional food system, destabilizing the food import system, and creating a riskier future for agrarian livelihoods due to floods, wildfires, and unpredictable weather.[20]

Climate change has led to some benefits for farmers such as longer and warmer growing seasons, but those benefits are far outweighed by the costs. For example, an unseasonably warm spring enabled Golden Gardens in Paradise Valley to direct seed peas in April 2023. This was a new record for early planting and would have extended the growing season a couple of weeks, enabling a higher overall yield of peas to take to the market. But that year was warm and very dry, and in 2023 the NWT experienced its worst wildfire season in recorded history. The 2023 fires burned more than 4 million hectares (9.9 million acres) of land in the NWT. Nearly 70% of NWT residents were under evacuation orders at some point during the summer, with some communities evacuated for a month or more. In August 2023, a wildfire started near Paradise Valley and burned through it, torching farms and destroying several houses that had survived the flood only a year prior. The physical devastation caused by the fires and the loss of revenue due to the evacuation orders were far more consequential than the few extra weeks of production might have been.

[20] Other scholars have discussed the negative impacts of climate change on agricultural systems across the circumpolar north. In northern Eurasia, where Indigenous pastoralists have practiced reindeer herding for approximately 3,000 years and cattle-horse husbandry for 600-800 years, increased flooding, permafrost degradation, and reduced pasture poses new challenges for pastoralists (Crate, 2022; Nakada, 2015; Takakura, 2016). In cropping systems in northern Norway, Canada, the US, and Russia, observed climate change impacts include unstable and variable winters, extreme weather events, increased fall precipitation, and new and more pests and diseases (Alcamo et al., 2007; Bradley & Stein, 2022; Kiselev et al., 2013; Uleberg et al., 2013).



Figure 4. Empty lot on Golden Gardens farm and smoke in the air, June 2023. Photo by author.

To examine climate enclosures in Paradise Valley, I return to the aftermath of the May 2022 flood. For months following the disaster, families were displaced as a new road, electricity, plumbing, internet, and phone service were slow to return. During that time, families sorted through damaged homes, greenhouses, and barns that had been filled with mud and livestock carcasses and floating chunks of river ice. They salvaged farm equipment and personal items. Some families living in the valley rebuilt and mitigated their homes against future floods, hoping they would not live to see another climate disaster of the same magnitude. However, the majority of commercial farmers whose livelihoods depended on the land resources have not rebuilt their farms in Paradise Valley. Most farmers felt torn between their personal ties to the land and the increasing riskiness of investing in agriculture under climate change. As Paul, a young hydroponic farmer in his 30s told me after the flood,

> We know it can flood, right? It's not a matter of if, it's when. It might not be for 100 years, might not be for 200 years, but it might be two, three years down the road. You know, you want to go and expand, put on more greenhouses. But with that kind of risk, why would you? Now, the profits, if you're sitting there and going, yeah, great, you know, we're making excellent, excellent money here, and we can basically self-insure ourselves for it. Yeah, maybe we take that risk. But we can't…
>
> We don't want to relocate. I mean, you sit here now: the river is as low as it is. We love the property. We love this region. We love this area. But you got to try and think logically through this, right? And it's like, okay, we're farming. We've got substantial investments. There's very little that can be done to mitigate… how do we go and spend hundreds of thousands of dollars, and then to have that risk of it being wiped out? You know, we look at starting (the greenhouses) in February. When we fire up, we've got high

> overhead for the spring, right? So you need to come out strong. And to get hit again (by a flood at ice breakup), it would just be devastating.

It has been two years since the flood, and Paul has not fired up his greenhouses again. To make up for lost farm income, Paul found work in construction while his wife continued in her government job. Paul and his family are planning to relocate out of Paradise Valley but remain in the territory where they have deep familial ties. In the NWT, where permafrost underlies much of the landscape, where soil quality is highly variable, and where unsettled Indigenous land claims tremendously complicate the matrix of land access, leasable agricultural land is extremely difficult to find (Lemay et al., 2021). However, because Paul and his wife run their farm operation predominately through hydroponic greenhouses, they are "not so tied to the soil" and have more flexibility in accessing land. In spring 2024, Paul and his wife purchased 40 acres of land a few miles north of Paradise Valley. The previously heavily wooded land was leveled by the 2023 wildfires that also consumed the family's residential home in Paradise Valley. "Look at it this way," Paul told me, "my land clearing costs are way down." Paul's first priority is rebuilding a home, and after that, he hopes to restart to the hydroponic farm. "There's gonna be some major changes" to the business, he said, and being smart about climate change meant further diversifying the family's livelihood to protect against future climate risk. Paul started looking into equipment that could be used across a variety of income streams (e.g. agriculture, horticulture, and construction) and was thinking differently about how to secure his family's future over the next generation. Paul had also uniquely benefited from dual insurance payments of flood insurance on the farm business after the 2022 disaster and home insurance on his burned home after the 2023 wildfires. Combining these payments, in addition to greater flexibility of farm location, meant that Paul could adapt to the changing conditions of production; he even saw opportunity in them.

For other commercial farmers in the valley, however, the flood marked the beginning of a climate enclosure alienating them from farming as a livelihood strategy. Some producers lost properties and livestock they had invested hundreds of thousands of dollars in and suffered huge financial losses under the government's limited insurance program. The GNWT capped flood relief at $240,000 per property. Beyond that, the territorial government offered 50% more money up to $600,000 lost in damages. For farmers like Andrea and Ben of Golden Gardens whose farms and homes were destroyed in the flood, coming up with the remaining money was not a viable option. "How are you supposed to come up with half? You just lost everything," Andrea questioned in frustration. She and Ben have not rebuilt Golden Gardens, saying they "no longer feel comfortable investing in expensive infrastructure as we now know the risk of flood is very real." They farm now in several fields that were least eroded and damaged by rock and gravel and in the single greenhouse that survived the flood. Compared to previous years, they sell little in the market. Andrea says they can no longer rely on farming as a steady and reliable source of income because of the increasing risks of floods, wildfires, and the slow cost of evacuations.[21]

[21] Residents of Paradise Valley were evacuated for several weeks in 2022 following the flood and over a month in 2023 due to wildfire activity. Long farm evacuations can be devastating for both field and greenhouse crops, as well as livestock that require regular attention. Following the 2023 evacuation, for example, Andrea of Golden Gardens found that her greens (kale, swiss chard, herbs), broccoli, cauliflower, peas, cucumbers, and berries were no longer edible, though some root crops including carrots, beets, and potatoes survived and were able to be harvested and sold.

The family hopes to relocate to higher ground, perhaps in British Columbia or Alberta, but they have yet to find land where they can afford to rebuild Golden Gardens given the limited insurance payment. There is an emotional cost too that has likely delayed their migration. "Spending over 20 years in the valley building our family farm – it's very tough to move on. Our hearts are still attached to the way it was."

Josh had two 6-acre parcels of land in Paradise Valley and farmed potatoes commercially. Though Josh has farmed in the NWT for several decades, first in Yellowknife and later in the Hay River area, he was never able to fully live off his farming income and supplemented it with work as an engineer. Josh also grew hay for animal feed and cultivated native grasses which he intended to sell for seed. With partners in Paradise Valley, he raised a few pigs and planted a vegetable garden for home consumption. Josh lived in a temporary trailer on the farm and intended to one day build a cabin there. The 2022 flood wiped out around 6,000 pounds of potatoes leftover from the 2021 crop which he had stored in a root cellar on the farm to sell later that summer. The flood damaged Josh's trailers, tractors, and other farm equipment. Josh described two things that happened simultaneously as a result of the flood: the land value fell, and his property taxes increased. When I asked him about the changing valuation of the land, Josh explained that even though his property was zoned for market gardening, the land was valued according to its residential potential, rather than its agricultural production value. So while he believed that the spring flood did not necessarily alter the land's capacity to produce summer potatoes in future years, it dramatically decreased its value as a place of residence. When it comes to market value, Josh said,

> I don't know if there's any value (left). Because number one, you can't really build here. I mean, I guess you could put a house ten feet in the air if you didn't want to farm it, and you just wanted a big land area (to live on). But I mean, if you want to farm, you need something more than just a house, you need a place for your equipment and all the rest of that… you probably want to have a shop or a machine shed or something you can do repairs in and yada yada. So you can't really build those things here very easily. So I think that the value of this property is really zero now. And in fact, it's probably negative, because it's costing me to have that building there.

The building Josh referenced was a machine shed and root cellar he had starting building in 2020 and finished in 2021. The land had been assessed prior to the building and again after the flood with the new structure on the property. Despite that the building was now unusable for storing potatoes or farm equipment, the permanent structure was considered to have "improved" the property and thus increased its market value. Josh's land taxes went up four-fold in accordance with the new assessment. Because there are no tax subsidies for agricultural land in the NWT, famers still pay the residential rate for property taxes, including in Paradise Valley where the land value has fallen with rising flood risk. Unable now to store farm equipment and potatoes on his current land, the farmer applied in 2022 to lease a new 15-acre parcel of nearby Crown land on higher ground. As of March 2024, the lease had not been approved.

Several farmers and residents in Paradise Valley have already migrated in search of new land and work. A cattle farmer who lost his livestock and home in the flood moved to Alberta and hopes to start a new farm there, though for now he and his wife work in construction and sales.

An older couple who ran a summer camp at the end of the valley never returned. Two retired farmers moved from Paradise Valley to Enterprise, NWT, only to face wildfires that destroyed much of the hamlet a year later. Other valley residents want to migrate, but without a reasonable government buyout, and with little hope of selling to private owners now that they occupy a known flood zone, they are unable to do so. The majority of commercial farmers I interviewed felt stuck. They could not rebuild farm infrastructure in Paradise Valley knowing the climate risks. At the same time, they had already invested their savings in the land – "all our eggs in one basket," one farmer described – and they believed their farms to be worth double or more what the government was willing to repay them. If they took the buyout, they would not have the capital to restart elsewhere.

These stories demonstrate how new climate enclosures are unfolding in Paradise Valley. Farmers are navigating uncertain futures as climate change alters the material conditions upon which they produce and socially reproduce. State responses in the forms of road encroachment, increased property taxes, and limited disaster relief are exacerbating vulnerabilities and constraining farmer adaptations. While not yet fully dispossessed from their land and livelihoods, family farmers of Paradise Valley are, in Borras et al. (2021)'s terms, among the "staggering rise in the number of people who originated from rural areas but are now partly or fully separated from their means of production and social reproduction...who remain in rural settings but are unable to construct a livelihood sufficient for their survival. These are the rural 'surplus populations,' 'working people,' 'precariat', 'footloose labor', 'semi-proletariat' and 'fractured classes of labour'" (Li, 2010; Shivji, 2017; Standing, 2014; Breman, 1996; Moyo, 2005; Bernstein, 2006 in Borras et al., 2021, p.16). Facing ongoing climate enclosures, their agrarian futures have become uncertain.

Agriculture as an Adaptive Practice

Climate enclosures occur not only as a result of large disaster events like the Paradise Valley flood but also through the ongoing and increasing precarity of an erratic and unpredictable climate – "climate weirding," as Bradley and Stein (2022) describe of climate change's impacts in Alaska. In 2014, a wildfire burned to the edge of the Dehcho Dene community of Kakisa and for miles around. It destroyed Ka'a'gee Tu hunters' trails, altered the habitat of important animal species, and damaged the graves of ancestors. Farther east, a wildfire in June 2023 came within 8km of Sambaa K'e and burned over a million acres of land in total in the NWT and British Columbia. Several Sambaa K'e cabins and hunting camps burned, but more critically, so did the trees, lichen, and other plants in Sambaa K'e territory that are essential animal habitat. When reindeer lichen burns, for example, it takes approximately 100 years to regrow and mature as a key food source for caribou and moose (Roturier et al., 2017). Without the usual nearby food sources, Ka'a'gee Tu hunters observed that animals migrated further from the community of Kakisa after the 2014 fires and could be expected to do the same following the 2023 fires in Sambaa K'e territory.

Members of Sambaa K'e and Ka'a'gee Tu First Nations told me of other changes in the land because of climate change. As permafrost is melting and draining, a Sambaa K'e Elder observed that trees in the boreal forest are dying without the moist environments they have adapted to for millennia. This alters animal habitat, she explained, and it changes the migration patterns and

nesting grounds of caribou and moose. The effects of climate change on the migratory patterns of animals like caribou are also well documented in the scientific literature (Sharma et al., 2009; Tyler, 2010; Guararie et al., 2019; Dedeban et al., 2023). Several informants discussed the disappearance of rabbits around Sambaa K'e. Others described how the lakes are warming, and the trout are diminishing. A culturally and nutritionally important source of food (Sambaa K'e is translated to "place of trout"), community members now must limit their consumption of this fish. Other fish species are suffering from physical deformities and increases in mercury content. The migration patterns of duck and geese are no longer predictable. Harvesters are responding by going further out to hunt, altering the timing of when they hunt, consuming fewer or different species of fish and animals, and using a variety of tools such as GPS, GIS, real-time data apps, and new safety protocols to navigate the changing conditions.





Figure 5. Hunting wild chickens in Sambaa K'e territory, September 2021. Photo by author.
Figure 6. Crossing Trout Lake, August 2021. Photo by author.

Indigenous peoples have always been adapting to climatic and social-ecological changes (Cameron, 2012; Whyte, 2018a). Yet while harvesters continue to rely on personal observations, stories, knowledge passed down from Elders, and new tools, recent unprecedented and unpredictable changes render these knowledges and observations less effective (Krupnik & Jolly, 2002; Loring & Gerlach, 2009). After an unpredictably warm winter in April 2020, a respected Ka'a'gee Tu Elder and fisherman passed away after falling through the ice on Tathlina Lake. When the Elder's surviving sister told me of her brother's death, she described that his extensive knowledge of the land and ice failed because of climate change's unpredictable impacts on the land. She wrote in a letter to Ka'a'gee Tu First Nation Band Council, "Even though (my brother) was an experienced land user and knew the risks, his knowledge was not enough to escape the new dangers that climate change presents." She implored the council to adopt new precautions for land-user safety.

There is shared concern within Sambaa K'e First Nation that climate change will eventually transform the land in such a way that the traditional food system is no longer accessible. As one Sambaa K'e member discussed with me, "Somewhere along the line with global warming and climate change, our animals, I don't know if it's going to be safe. They might slowly die off and get extinct just like the rabbits." She continued, "so we need to start doing livestock to teach our younger generation how to feed them and how to maintain them." This Sambaa K'e member suggested increasing egg production and adding cattle and pigs to community food production.

These were the most popular suggestions among those who saw a need to start raising livestock in the community. Steak and pork chops were well-loved animal products, purchased often at the community store, and featured in many community meals and gatherings, so they seemed an obvious choice to produce locally. Other members suggested raising goats, which had previously been trialed in the 1990s by the then-Chief in Sambaa K'e. When the goats were slaughtered in the 1990s, however, nobody wanted to eat them because they had become like pets in the community. In 2022, an Elder suggested to me that the younger generation was more likely to "go with it," and that they could come to treat domesticated animals "more like livestock, less like pets."

While members of Sambaa K'e First Nation and Ka'a'gee Tu First Nation have cultivated crops since the communities were settled in the 1960s,[22] both communities have increased community food production in recent years. Both First Nations describe agriculture as a necessary adaptation to the community food system within their climate change adaptation plans (Ahmed & Wenman, 2020; Johnston & Ka'a'gee Tu First Nation, 2022; Johnston & Sambaa K'e First Nation, 2022). Ka'a'gee Tu First Nation has a small-scale greenhouse operation that has been expanding since 2018 with significant co-investment of money and labor by a research team in Ontario and through government grants. They are beginning to develop a food forest in the firebreak on the outskirts of the community. Sambaa K'e First Nation maintains a large community garden and several greenhouses which are also supported by government programs and research grants. They grow a wide variety of crops including root vegetables, lettuces, berries, squashes, brassicas, and melons, as well as chicken eggs. Sambaa K'e recently added a cold storage and food preparation building to be used for both traditional foods and foods from the garden. Gardeners employed by the First Nations harvest and distribute vegetables to members, integrate them into cooking demonstrations and community meals, and make them available at no cost in the local store. In aligning this new form of production with the values of the traditional food system, both communities see the gardens as a shared resource to support community food sovereignty (Price et al., 2022). As members of Sambaa K'e First Nation and Ka'a'gee Tu First Nations assess the impacts of climate change on the land, they are adopting subsistence crop and animal agriculture to support social reproduction.

[22] In interviews, Elders in Sambaa K'e and Kakisa described growing potatoes and carrots in small family plots in the newly settled communities as early as 1965, which they learned through visiting missionaries, traders, and time spent in the residential schools. Hunting families used the vegetables to supplement what was harvested from the land and often cooked and served vegetables in soups.


Figure 7. Potato patch and chicken coop in Sambaa K'e, NWT, August 2021. Photo by author.

In a similar analysis of the role of agricultural production in northern Indigenous food systems, Spiegelaar and Tsuji (2013, p.2) describe Fort Albany First Nation's local agriculture production in northeastern Ontario as "an adaptive response" to the colonial food import system. Prior to missionary agricultural initiatives in this Subarctic community, Fort Albany First Nation families hunted and harvested animals, fish, berries, and other vegetables for sustenance. The state deemed traditional food practices inadequate during the residential school era, and families were forcibly settled, becoming less reliant on traditional foods. Poor farming practices, soil degradation, and invasive species accompanied the Church and state agricultural initiatives, and Fort Albany First Nation became more reliant on the food import system rather than on local agriculture. This parallels the history of colonialism and ecological imperialism in the NWT, though agricultural initiatives were less widespread in the northern territories than in the southern provinces (Piper & Sandlos, 2007). Similar to the way Spiegelaar and Tsuji (2013) describe Fort Albany First Nation's contemporary farming practices, Ka'a'gee Tu First Nation and Sambaa K'e First Nation's agricultural production can be seen as an adaptation to changes in the traditional food system under climate change and as resistance to the structures of colonialism and capitalism which contribute to and exacerbate the effects of climatic change. In both communities, agriculture is produced for subsistence rather than for commercial sale. Vegetable crops and animal products are shared in community meals and donated to individual households, much like the way moose, fish, and other traditional foods have been distributed for thousands of years.

However, the two communities are not opposed to one day producing agricultural products commercially. Nearly everyone I interviewed in Sambaa K'e and Kakisa discussed how participating in the traditional activities that culturally define Dene way of life requires money – money for gas, money for guns, money for food, money for cars, boats, and skidoos. If the communities decide to sell what they produce agriculturally, it would not be a departure from

how the traditional food system has operated within the regional political economy for decades. According to the Chief of Ka'a'gee Tu First Nation,

> (The garden) hasn't progressed to the point where we're looking at it commercially. But we've always, you know, we've always participated (in multiple intersecting economies). For instance, the community has always helped out the businesses like the Northern Store in Providence, like with (selling) potatoes, dry meat, dry fish, just to get them going through the winter and that kind of stuff. And that's how I think we've always looked at it. Not a money-making thing, but sort of a place where we could encourage that sort of helping one another. Bettering that relationship, and also just the survival of other people that come into that area and stuff. So that's how it was always looked at. That's how they've done things before.

Exchanging furs for cash and goods throughout the 20th century allowed Dehcho Dene to participate in the regional economic system while maintaining traditional practices in hunting and trapping. Today, a Ka'a'gee Tu fisherman runs a small commercial fishery out of Kakisa. Most Ka'a'gee Tu members view this as consistent with Dene values and laws. As Mason (2018/9) argued of several First Nations on Vancouver Island, Indigenous ontologies continue to infuse Indigenous food-based practices like sharing and trading, even as people engage in wage labor. If Ka'a'gee Tu First Nation decides to one day commercialize their agriculture, it would not be in order to become a capitalist enterprise but to ensure the community's social reproduction as climate change encloses access to their traditional territory and to survive within the broader regional economy, as they have done for centuries.

Conclusion: Uncertain Futures

This paper has examined climate change as a material force that is actively changing the conditions of production and social reproduction in the NWT. In the cases I have shown, neither smallholder commercial farmers nor subsistence harvesters have yet been fully dispossessed from the land as a result of climate enclosures. But most family farmers can no longer rely on farming as a livelihood strategy in Paradise Valley, NWT. Sambaa K'e and Ka'a'gee Tu harvesters are increasingly alienated from the land resources that are integral to the traditional food system and to important cultural and economic activities. The Subarctic peoples at the heart of this analysis are among an increasing number of rural peoples worldwide who are now partly or fully separated from their means of production and social reproduction as a result of climate change, yet their futures remain uncertain (Borras et al., 2021). As Kasia Paprocki writes,

> What is at issue is not whether climate change will impact lives and livelihoods. It will. Rather, at issue is how those impacts will be distributed with and between communities. These systems of distribution are not natural or inevitable. Rather, they are forged in the present and shaped by existing ideologies and power structures. (Paprocki, 2021, p.5)

Because their land was destroyed and devalued by flooding, migration was the only viable adaptation for most commercial farmers in Paradise Valley. The communities of Sambaa K'e and Kakisa are responding to climate enclosures by developing subsistence agriculture, in

addition to changing how they access and participate in the traditional food system. Though it is common for young people to out-migrate from Sambaa K'e and Kakisa for education, work, and family opportunities, participants did not discuss climate change as a cause of migration in these First Nation communities. Similarly, Huntington et al. (2017, p.1) considered the phenomenon of climate migration in 43 predominately Indigenous Alaska communities and observed, contrary to trends in other climate-affected locales, "a relative lack of demographic or migratory response to rapid environmental and other changes." They identified three possible mechanisms motivating rootedness among Alaskan Indigenous communities: attachment (the desire to remain in place or the inability to relocate successfully), alternatives (ways to achieve similar outcomes through other means), and buffering (the reliance on subsidies or use of reserves to delay impacts). Both attachment to territory and alternative strategies seem to be at play in Sambaa K'e and Kakisa. Community members described an enduring commitment to remaining on the land yet are developing alternative strategies of production and social reproduction through subsistence agriculture.

Family farmers and gardeners in Paradise Valley also expressed deep attachment to the North. Many have extended relatives and large communities in the NWT, and some are Indigenous to the area. Among those for whom agriculture was a livelihood strategy, however, remaining in Paradise Valley to farm was not an option. Houses can be mitigated against flood waters, but cropland and livestock cannot be fully protected against the inevitable next flood or wildfire. For family farmers whose livelihoods were tied to land productivity, migration was often seen as necessary, though undesirable. Some residents have stayed in Paradise Valley, both because of attachment to place, and because the flood and fire have left them financially vulnerable, unable to sell their homes and properties now that they have been devalued due to increasing flood risk. Most of the residents who will stay in Paradise Valley are wage laborers and not dependent on the land for social reproduction. They are working in government, mining, healthcare, trucking, or are retired, though many also maintain large home gardens that support family consumption needs. In choosing to stay, however, they must continuously adapt to climate change and assume new risks to land, livelihood, and personal safety that threaten their social reproduction.

Climate enclosures are embedded in historical transformations in the regional political economy and in local social and cultural forces. These conditions affect individuals' and communities' production responses under climate change. State decisions in insurance payments, tax law, and land leasing regulations were key barriers for family farmers who wanted to continue farming in or near Paradise Valley, and many felt abandoned by territorial officials who have claimed to support farmers but failed to change the structures that contribute to their land and livelihood struggles. Similarly, the historical and ongoing effects of settler colonial land policies and governance arrangements threaten Indigenous peoples' access to and authority over their traditional territories. Transformations in these broader political and economic structures would have real impacts for local peoples' ability to adapt to the changing conditions of production and social reproduction under climate change.

The eventual outcomes of climate enclosures remain unknown. In the Arctic region, new opportunities for capitalist accumulation arise from the anticipatory ruination (Paprocki, 2018, 2021) of melting permafrost and disappearing shorelines. At the same time, speculation in oil, minerals, marine and agricultural resources is a result of anticipatory *possibility* of accessible

new resources (Bennett et al., 2020; Hanacek et al., 2022; Hannah et al., 2020; Moffitt, 2019). Land grabs for commodity agriculture in the Arctic have not yet widely occurred, though local and national governments are currently developing new agriculture through land sales and grants across the circumpolar north (Unc et al., 2021; Alaska Department of Natural Resources, n.d.; Bertelsen & Gallucci, 2016).[23] In the NWT alone, an estimated 2 million acres of land are suitable for agriculture but have not yet been developed (EcoDynamics, 2008). Ongoing accumulation is possible through processes enabled by climate enclosures, but these projects have not yet occurred at a large scale.

Climate enclosures may make the Arctic region more susceptible to exploitation and capitalist expansion of agriculture and other resources. If family farmers migrate out of the NWT, leaving a gap in local and regional food production, new investment possibilities could arise in large-scale commodity agriculture such as Confined Animal Feeding Operations or industrial greenhouse operations. As climate change makes it more difficult for Indigenous harvesters to hunt and fish on the land, other land resources such as oil and minerals may be easier for investors to exploit. In 2023, The GNWT amended the Business Stream pathway to make it easier for foreign investors to start businesses in the territory and to secure permanent residence in Canada by decreasing the eligible investment amount required (GNWT, 2023). As many scholars have warned, capitalism has an unceasing need for raw materials and cheap labor and a propensity for discovering or reinventing new resources (Moore, 2017b; le Polain de Waroux et al., 2018), and climate change is making the Arctic appear ripe with resource frontier possibilities (Bennett et al., 2020; Moffitt, 2019).

Finally, climate enclosures offer a new way to examine climate adaptation and mitigation practices at the local level. Climate risk in the Arctic region is universal, though not equally distributed. While 20th century residential schools and forced settlement alienated NWT Indigenous peoples from their territories, floods and wildfires do not discriminate between individuals. Climate change creates conditions of precarity under which all communities are forced to contend. Yet as farmers and harvesters across the NWT face climate enclosures, their responses in agriculture production are different, even contradictory at times. Thinking with climate enclosures offers a valuable lens to consider new forms of adaptation, resistance, and resurgence under climate change, particularly among marginalized groups. Because this study deals with very small communities (40-99 people) and the NWT has a unique and patchwork system of land governance, these experiences of climate enclosures may not necessarily be generalizable to other regions. More research is needed to examine climate change as an enclosing process, including the impacts on class and other forms of social differentiation and production practices.

[23] For example, the state of Alaska completed Phase 1A land sales of the Nenana-Totchaket Agricultural Project in 2022, part of a plan for 148,502 acres in the Kantishna Region designated for agricultural development in the Alaskan interior (Alaska Department of Natural Resources, n.d.). Russia is working to develop large tracts of arable land in the Russian Far East and Eastern Siberia through offering free land to new settlers. The Chinese government has significant interest for agriculture in this region as a result of population, food safety, and climate pressures in China, though development has slowed somewhat because of Russia's mistrust of Chinese investment (Bertelsen & Gallucci, 2016).

Chapter 4

Agroecology in the North: Centering Indigenous Food Sovereignty and Land Stewardship in Agriculture "Frontiers"

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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 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., 2010). 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 & Spring, 2021; Simba & 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-20th 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 & 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 & 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 & McLachlan, 2013; Johnston & 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, 1999). 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 coloniality 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 80s. 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 Sambaa K'e First Nation (SKFN), located in Kakisa, NWT, and Sambaa 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 & 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 Sambaa 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 & 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 (see Saxinger & First Nation of Na-cho Nyäk Dun, 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 & Patel, 2015). Settler colonization is an ongoing process, evident in the active consolidation and legitimation 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 metropoles 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 & 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 & 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 & 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 & 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 & 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 & 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 & 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 & 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 and colleagues (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, 2017a). Frontiers are also zones of social experimentation and innovation, where new governance structures and hybrid politics arise (Cons & Eilenberg, 2018). Agriculture frontier rhetoric has been used in Canada and globally to justify Indigenous land dispossession and territorialization (Eilenberg, 2014; Peluso & Lund, 2011; Piper & 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 (GNWT, 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 (GNWT, 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 & 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 & 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 Martinez-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 Tłı̨ ch 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 (see Nadasdy, 2003; Wilson & Inkster, 2018; Howitt & 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 & 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 & 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 & 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 & 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.



Figure 1. Components of agroecology. Adapted from IPES-Food (2020).



Figure 2. Framework for agroecology in the North.

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 Figure 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 & 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 Edéhzhíe Protected Area in 2018, a product of close collaboration with the federal government, which will also provide protection for Edéhzhíe as a National Wildlife Area. Edéhzhíe 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 & Government of Canada, 2018). Both KTFN and SKFN have also engaged over several years with federal and territorial

governments as they work towards creating t their own protected areas. As part of this process, 9,600 square km around Kakisa and 10,600 square km around Sambaa K'e are demarcated as candidate areas (Government of Northwest Territories n.d.).

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 & Nicholls, 2017; Kremen & 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 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. 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'éhodi 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 intergenerational 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.

Chapter 5

Conclusion: Justice on the Arctic Frontier

In August 2023, I visited the Natural History Museum in London to view an exhibit by Australian artist and photographer Gregor Sailer. The collection of 67 images depicted manmade structures from four Arctic countries. Sailer said the photographs were meant to show how "Global warming and its impacts in the Arctic is a topical issue that affects us all, even if it is geographically far way" (Natural History Museum, 2023). The exhibit's title, "The Polar Silk Road," connotes new frontier possibilities and their tensions in the Arctic. The Polar Silk Road refers to a Chinese initiative to develop new maritime trade routes through the Arctic Ocean to enhance trade between China, Eurasia, and Africa (Bennett et al., 2020). The Polar Silk Road, and China's investment in the Arctic in general, is contentious. Sailer's photo exhibition is meant to highlight this tension, including increasing demands in power, energy, and mineral development in the race secure and develop the Arctic. Sailer's photographs are nearly all monochromatic shades of white and grey as ice and steel blend into each other against a stark background. They depict military structures, research facilitates, and power stations in Greenland, Canada, Norway, and Iceland.[24] A few splotches of color show up as faded red paint on a geothermal power station in Krafla, Iceland, and on the barracks for the WWII United States air base-turned-National Science Foundation's research base in Kangerlussuaq, West Greenland.

One photograph stands apart from the others. It is the only image that depicts any sign of life. While the other photos capture impressive architectural designs made to withstand the Arctic's extreme weather, the structures in this image are more organic. Wooden trellises teeter over raised garden beds on a dirt floor. Dried vines and bushes are overwintering (or possibly waiting out the NWT's strict quarantine rules of 2020), anticipating the next season of planting. Were it a typical summer afternoon, the greenhouse would be bursting with vibrant green life. The image is the community greenhouse in Inuvik, NWT, and it is striking to me that Sailer includes this homely photograph in the midst of all the others – an unassuming gesture to the way in which climate change affects not just energy and trade in the Arctic but the fundamental basis of human life: food.

[24] See Sailer's website for a selection of photographs from The Polar Silk Road exhibition: https://www.gregorsailer.com/The-Polar-Silk-Road



Figure 1. The Polar Silk Road exhibit at the National History Museum, London. Gregor Sailer's photographs are displayed in black frames on stark white walls in several rooms clustered by country. The caption reads: "The northernmost commercial greenhouse in North America contains over 170 growing beds occupying over 5,500 square meters (approx. 60,000 square feet). These are rented to locals for a small fee. Over the summer, the midnight suns allows fruit, vegetables and flowers to grow quickly. Farming on frozen soil is expensive, as is transporting fresh produce to isolated locations, so the greenhouse gives the community more independence. It also raises awareness about the importance of fresh, local food and individual growing. In the future, hydroponics, a process where plants are grown without soil, might allow some plants to be cultivated throughout the year."

In the caption, Sailer hints at the Arctic's resource frontier paradox. On one hand, climate change creates crises in Arctic ecosystems and livelihoods, and it intersects with other global pressures including China's investments in Arctic resources, Russia's war in Ukraine, global pandemics, and unexpected supply chain disruptions. Agricultural production may support Arctic communities' independence in the face of growing uncertainty. On the other hand, climate change creates new possibilities for ongoing accumulation through resource exploitation. In agriculture, this may be possible through new cropping possibilities of a warming climate, or potentially through technological innovations such as hydroponics, as Sailer suggests.

I have not discussed hydroponics and other technological fixes in depth in this dissertation, in part because these types of projects have tended to fail to meet developers' promises in the NWT. Many such initiatives have been financially fraught (e.g. hydroponics may enable year-round growing, but the lighting and heating costs associated with Arctic winters are

astronomical) or because they have failed to produce food of major significance to Arctic and Subarctic communities (greens, tomatoes, cucumbers and other market vegetables tend to grow well in greenhouses, yet they offer fewer caloric contributions compared to heartier root and grain crops as well as meat and fish products).[25] I am reminded of the Sanikiluaq Greenhouse Project, which was part of a collaborative federal and territorial effort to establish greenhouses throughout Arctic Indigenous communities in the 1970s.[26] The Sanikiluaq greenhouse successfully produced 600 pounds of cucumbers on the remote island, but it suffered from high heating and electricity costs and lack of available local labor. One project officer concluded in 1976, "To date, this project has shown that we can grow cucumbers and tomatoes in Sanikiluaq at an exceptionally high cost and that this produce can be given away to local residents. The cost of operating the greenhouse would not appear warranted given the small local market. I do not know why we should continue to fund this project" (Wilson, 1976). Challenges in energy and heating costs, available markets, labor, and weather continue to impact NWT agriculture in ways that technology has been unable to fix. Nevertheless, the agriculture technology sector (AgTech) is backed by billions of dollars of venture capital, and some entrepreneurs have already set their sights on the Arctic region. Highly capitalized technologies are also crucial to other forms of resource development and security in the North (e.g. accessing deep sea oil deposits, solar imaging) and will be an increasingly important area of research for Arctic frontiers.

As a whole, Sailer's photographs indicate a changing sociopolitical and environmental Arctic landscape. These changes impact national and local territorial claims, identities, and practices of production and social reproduction. For many polar geographers, the role of agriculture in the Arctic has been an afterthought, a seemingly small piece of the "potential" that the region offers in terms of its natural resources, geopolitical position, research potential, and sociocultural imaginary. Nevertheless, Sailer manages to include agriculture in his collection, and it is the object of study I have taken up in this research. There are enormous potential local and global implications in developing the Arctic agricultural frontier (Meyfroidt, 2021). Taking a political ecology approach, this dissertation has contributed crucial analysis of the changing role of agriculture in Arctic Canada throughout historical and contemporary conjunctures of the NWT agriculture frontier. Though my relational comparison is centered in the Subarctic climate zone of the NWT, similar agricultural development is occurring throughout the NWT and in other Arctic regions such as Norway, Russia, and Alaska.

Main Findings and Contributions to Literature

In this dissertation, I presented an ethnographic and historical study of how agriculture is imagined, pursued, experienced, and practiced in the NWT, Canada. Employing a political

[25] I am not suggesting here that technologies have not improved agriculture in the NWT or that hydroponics has never been successfully implemented among NWT farmers. Farmers have been using greenhouses in the NWT since the early 20th century to extend the growing season and to increase crop yield. One of the successful commercial growers in Paradise Valley is based in hydroponics, but even he is skeptical of the widespread implementation of agri-tech solutions like container-based agriculture in NWT communities, citing high operating costs, mismanagement, and challenges importing necessary inputs. See Kozachenko, 2020 for an in-depth discussion of controlled environment agriculture in northern Canada.

[26] Sanikiluaq is an Inuit community on the Belcher Islands in the Hudson Bay. It was part of the NWT at the time of the greenhouse project but in 1999 became part of Nunavut when the new territory was established.

ecology lens, I analyzed the political, economic, sociocultural, and material characteristics of agriculture as dialectically linked and co-constitutive. My study was based on 15 months of combined ethnographic field work conducted between May 2019 and June 2023 in three primary communities for relational comparison. I used a variety of qualitative methods including participant-observation, in-depth interviews, archival review, and discourse analysis.

The extreme and changing biophysical landscape of the Arctic – an region of extremes and rapidly accelerating changes – articulates with land and resource governance and with capitalist speculation over new frontiers that hold combined economic, territorial, and geopolitical potential. I analyzed agriculture as a tool of governmental power to control national and geopolitical narratives around territory and (food) security, and as a symbol of economic possibility made available by developing Canada's northern lands. Yet in many ways, agriculture has not fulfilled the economic ideals of state planners. Drawing on new agrarian questions under climate change, I showed that capital's influence in northern Canada has not led to massively industrialized commodity agriculture that is integrated into regional or global markets, as some agrarian studies scholars would expect and predict. Instead, agricultural production has remained small-scale, locally focused, and largely based around household or community subsistence. I developed the concept of the contested icescape to explain how political-economic forces articulate with material, social, and cultural forces to enable and constrain agriculture development at particular historical moments. My work on climate enclosures demonstrates that climate change alters the material conditions and the imagined possibilities of northern agriculture. Local communities are responding to these social-ecological transformations in divergent, intersecting, and unexpected ways.

Chapter 2 addressed two key questions with respect to the NWT's agriculture frontier. First, what state-driven logics and narratives undergird NWT agriculture? Second, how are these narratives produced and reproduced, and with what impact on agricultural development? In tracing the NWT agricultural frontier imaginary over two lifecycles (periods of intense agricultural investment and state pressure) between 1939 and 2021, my archival and textual analysis revealed the recurring motivating narratives of agricultural production for food security, economic development, and territorialization. This finding is contrary to contemporary scientific and popular discourses that show climate change as a driving force in this new agricultural frontier moment. I demonstrated the ways in which capitalism, governmental power, and settler colonialism that underpin new agricultural development and discourse.

Chapter 3 took climate change as the central object of analysis. I developed the concept of "climate enclosures" to examine the increasingly erratic, uncertain, and extreme material forces that are transforming northern landscapes and fundamentally altering local peoples' relationships to them. Through ethnographic data in three communities, I analyzed several climate enclosures in process in Paradise Valley, Sambaa K'e, and Kakisa. I showed how communities' relationships with agriculture are changing as a result of these new enclosures. I argued that ecological changes articulate with social, political, and economic forces, and climate change itself is shaped by the structures of capitalism and colonialism. Because of this, communities' adaptive responses to climate closures were entangled in local micropolitics and shaped by historical changes in the wider political economy. My data also revealed a surprising finding: unlike the initial enclosures that lead to individuals' permanent separation from their means of

production, at this moment, the separation is partial. Climate enclosures have incomplete, uncertain futures with outcomes that are yet unknown.

Chapter 4 considered the future potential of an intensive commodity frontier in the circumpolar north and its potential impacts for northern communities and ecosystems. The article stands out methodologically from the others – rather than gathering, analyzing, and presenting evidence as an individual researcher, I led the development of this paper as a collaborative effort between members of Ka'a'gee Tu First Nation, Sambaa K'e First Nation, and several long-term ethnographic and participatory action researchers working with both communities. Drawing on food regime theory and lessons from commodity frontiers globally, we argued that expanding the conventional, industrial agriculture paradigm into the Arctic region would have significant socio-cultural and ecological consequences for Indigenous lands and livelihoods. We then developed a northern-specific framework for sustainable and just Arctic agriculture rooted in the global agroecology movement. Through our "Agroecology in the North" framework, we considered what it means to translate this global movement in a northern context. We broadened the model of agroecology to accommodate for hunter-gatherer societies and non-agricultural stewardship relationships through an expanded view of agroecology's practices, livelihood orientation, and governance model. We suggested that a sovereignty-centered northern agroecology framework could guide new agriculture in polar regions to move beyond conventional agriculture's drive towards reductionism, anthropocentrism, and unequal capitalist relations.

Overall, the findings in this dissertation contribute to key debates in polar geography on the history and contemporary role of agriculture in Arctic territorialization. The findings also contribute to new analyses of climate-driven frontiers and the growing literature around the environmental and sociopolitical impacts of developing Arctic resources. This dissertation contributes to the agrarian change literature by analyzing agrarian trajectories in the geographically understudied polar region, particularly in the NWT where agriculture has a recent 18th century introduction but is now experiencing rapid social, economic, and environmental change. Much like the often-studied frontlines of agriculture development in the Global South, my findings demonstrate that smallholder agriculture frontiers in the Arctic region are sites of significant contestation and inequality.

Climate Justice in the Arctic

Throughout this dissertation, I have shown how people in the NWT are responding to the current conjuncture of climate and agrarian change through adaptive agricultural practices (e.g. through subsistence production) and political and collective responses (e.g. developing new visions and frameworks for agriculture based around sustainability and justice rather than yield and profit). I consider now how scholars – especially those who identify as public scholars or community-engaged scholars, as I do – might take an environmental justice perspective on the issues of climate change and agricultural resource governance on the Arctic frontier.

Environmental justice has many definitions. According to the Environmental Protection Agency (2013), environmental justice is "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development,

implementation and enforcement of environmental laws, regulations and policies." Scholars like Gordon Walker (2012) and Robert Figueroa (2006) frame environmental justice around broader social justice principles, including compensatory justice (compensation or repair for past harms; related to restorative and retributive justice), distributional justice (the fair distribution of benefits, risks, and burdens to communities), and procedural justice (the fairness of decision-making processes, who is involved and has influence; related to recognition justice). It is generally understood that climate justice emerged as a distinct but interrelated concept to environmental justice around Hurricane Katrina in 2005, though the term "climate justice" first appeared in academic literature in 1989 in a book on intergenerational justice (Schlosberg & Collins, 2014). Climate justice, like environmental justice, has a variety of definitions, but is fundamentally about "paying attention to how climate change impacts people differently, unevenly and disproportionately, as well as redressing the resultant injustices in fair and equitable ways" (Sultana, 2021, p.118).

I return often to a piece by Kyle Whyte (2018a) that I see as a necessary starting point for the discussion of climate justice. Whyte (2018a) argues that our contemporary climate-changing dystopia – with its ecological devastation, species extinction, and social upheaval – is actually a form of settler ancestor fantasy. Through colonialism, settlers have built systems of domination over Indigenous peoples' land, resources, and political agency from which settler descendants today continue to benefit. Climate crisis can thus be seen as an unintended consequence of the intentional – and in many ways successful – project of settler colonialism. Whyte writes that denying this historical and contemporary reality can threaten coalitions between Indigenous peoples and allies to address contemporary climate crises. Moreover, failing to recognize the ways in which settler colonialism has succeeded in its aims of settler domination and exploitation and so contributed to the current climate-crisis moment hinders our ability to address climate injustice.

Alana Shaw (2017) argues that justice in the climate-changed Arctic is contingent upon the disruption of "procedural marginalization" that has long elevated Western ways of understanding nature above Indigenous ways of knowing and relating to the world. She writes that new decision-making structures responding to Arctic climate change must "possess the capacity to recognize and engage with both the traditional values and contemporary perspectives of Arctic peoples" that go beyond scientific knowledge to include alternative forms of knowing and representations of nature (Shaw, 2017, pp.504-8). Climate justice thus requires a multi-species lens which decenters humans and recognizes "the everyday interactions that bind Indigenous and societies to networks of close and distant others, including other people and more-than-human beings" (Tschakert et al. 2021, p.1).[27] Finally, I embrace Doris Friedrich's argument (2023) that climate justice requires an intersectional approach to understanding how Arctic climate change affects different peoples differently, and how it exacerbates existing inequalities and injustices. This dissertation has shown, for example, how climate enclosures articulate with insecure land policies in the NWT (Chapter 3), and these negatively impact both family farmers and Indigenous hunters. In future work, I will examine the ways in which land insecurity under climate change is contributing to new forms of racialization and identity formation. An intersectional approach to climate justice thus allows us to examine how climate change is

[27] See also Bolender, K. & Kirksey, E. (Eds.). (2022). *The Promise of Multispecies Justice.* Durham, NC: Duke University Press.

affecting all peoples living in the Arctic, and how it intersects with local power relations to exacerbate existing inequalities and subjectivities.

Finally, a note of hope: In the case of the NWT and in the Arctic more broadly, the intensive, productivist development of a commodity agricultural frontier has not yet occurred. There is opportunity in the present to help guide just and sustainable northern agricultural development as part of a larger movement to secure Indigenous land and food sovereignty and to mitigate northern food systems against climate change. Pursuing climate justice here is thus an avenue to pursuing agrarian justice globally.

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Appendix

Methods

See the 'Research Approach' section in the Introduction for additional description of methods.

In this dissertation, I use a variety of qualitative approaches to examine agricultural production and climate change in the NWT, Canada. My primary method was ethnographic participant-observation (Geertz, 1973a, 1973b) and was supported by semi-structured interviews and archival analyses. I aimed to do equity-driven and outcomes-oriented, community-engaged research.[28] From the initial stages of research development through data collection, analysis, and research dissemination, I sought robust community participation throughout the entire research process.

I began initial conversations with farmers and gardeners in the NWT in 2017 when I reached out to staff at the Northern Farm Training Institute (NFTI)[29] about collaborating on agricultural research together. During the next two years, NFTI staff and I corresponded via email as I applied to graduate school and began my PhD work at UC Berkeley. In 2019, NFTI staff invited me to come for three months in the summer of 2019 to volunteer on the farm, conduct preliminary interviews, and build relationships with farmers, harvesters, and members of the community. During my initial visit, we discussed the state of agriculture in the NWT and potential research questions for a longer project. I connected with individuals from each of the three communities that would eventually become the basis of my relational comparison. I also became acquainted with graduate students from Wilfrid Laurier University and with their advisors, Dr. Andrew Spring and Dr. Alex Latta. We found that we were each working on issues related to agriculture and food systems with Ka'a'gee Tu First Nation and Sambaa K'e First Nation, and we coordinated some of our research efforts to reduce the participation burden in the communities.

Drawing on Gillian Hart's relational comparison method (Hart, 2006, 2018), I conducted long-term ethnographic research in Paradise Valley, Sambaa K'e, and Kakisa to compare how the processes of capitalism, colonialism, and global environmental change are constituted and contested within each community. Relational comparison differs from other methods of comparison, including comparisons that approach seemingly "bounded" cases or those that approach comparative cases as variants of an overarching general process in that it focuses on "*how* key processes are constituted in relation to one another through power-laden practices in the multiple, interconnected arenas of everyday life" (Hart, 2018, p.375) and "clarifying these connections and mutual processes of constitution – as well as slippages, openings, and contradictions – helps to generate new understandings of the possibilities of social change" (Hart, 2006, p.996). In my dissertation research, I conceptualized this dialectical relationship

[28] See Castleden and Sylvestre (2022) for a genealogy of community-engaged research in geographical scholarship.
[29] Though NFTI staff were instrumental partners in the early stages of research development, when I returned to the NWT for research in 2021, we did not continue working together due to disagreements in the organization's politics and leadership approach. NFTI closed as a farm and training organization in 2022.

between process, practice, and power as various articulations of the "contested icescape," through which I came to understand differing agrarian trajectories within the NWT.

The three communities were selected because they were representative of various agriculture development schemes and production approaches across the NWT, yet they also held several critical differences in political-economic history, culture, and social structure. More importantly, I chose the communities because individual farmers in Paradise Valley and members of Sambaa K'e First Nation and Ka'a'gee Tu First Nation Band Councils invited me into their homes and communities, and they trusted me to partner with them on this research project. This was not a linear or quick process. It takes time to disrupt knowledge and power structures, exemplified by the reflection of one researcher who described of her own work with Indigenous communities in the NWT, "I spent the (whole) first year drinking tea" and developing relationships with Elders before she began data collection in earnest (Castleden et al., 2012, p.168). Much of my field work in 2019 and 2021 was aimed at building trust and establishing rapport as someone who did not participate in the modernizing development agenda of typical northern researchers (Moffitt et al., 2015) and who was genuine about a long-term commitment to the people of the NWT. I established verbal and/or written research and traditional knowledge agreements with all three communities by the end of 2021.

This research was approved by the UC Berkeley Institutional Review Board #2019-04-12099 and #2020-07-13477, licensed in the NWT by the Aurora Research Institute #16916 and #17263, and reviewed and approved by The Town of Hay River, Sambaa K'e First Nation, and Ka'a'gee Tu First Nation. Research conducted in 2021 was also approved by the Government of the Northwest Territories Department of Health and Human Services, as the field season began when the territory was still closed to the public to protect against the spread of COVID-19.

Data Collection

The research is based on 15 months of combined ethnographic field work between 2019 and 2023. From May-July 2019, I lived on site at the Northern Farm Training Institute (NFTI) in the corridor area of Hay River. I did not visit the NWT in 2020 due to COVID-19 restrictions, though I continued to connect with research partners regularly through Facebook, email, and Zoom. Between May 2021 and February 2022, I rented a house in the Paradise Valley where I lived for most of the year. I also took many day trips and several overnight trips to the community of Kakisa (approximately 70 miles west of Paradise Valley). In August-September 2021, I rented accommodations in the community of Sambaa K'e. I made two more month-long field visits to Yellowknife, Paradise Valley, and Kakisa in December 2022 and in June 2023. A planned follow-up visit to Sambaa K'e in July 2023 was canceled due to wildfire evacuations in the community. I also made several shorter field visits between 2021 and 2023 for agriculture conferences, follow-up interviews, and archival research.

When I arrived with my husband in Paradise Valley in May 2021, we moved into a trailer that we rented from Ben and Andrea, owners and operators of Golden Gardens farm. Ben and Andrea lived in a wood house on the combined 11-acre property, where they raised their son and daughter who occasionally visited from Alberta where she worked. Our trailer had two

bedrooms, a landline, and a Wi-Fi connection (but no cell reception); it was heated by wood. There was a gas furnace in addition to the wood stove, but because of the high price of gas and the furnace's tendency to sputter and smoke, we only used it a couple of times during -40-degree days to keep the trailer from freezing when the fire went out at night. Water was delivered and sewage was pumped weekly. As part of our agreement to sublet the trailer from previous renters, we took over the rearing of a few dozen chickens (for eggs) and rabbits (for meat, which we butchered in the fall). We also maintained a garden and grew potatoes, carrots, beets, brassicas, alliums, rhubarb, and a variety of salad greens for own consumption. In addition to substantially supporting our finances by offsetting the high cost of imported produce, the garden also allowed us to enter into the informal economy of farm goods and labor in Paradise Valley. We weeded our neighbors' garden beds in exchange for pumped river water for our crops, traded eggs for rabbit food (green clippings) from the hydroponic farmer, purchased bedding for the chickens from the rancher, delivered rhubarb cookies to neighbors and received homemade bread in return, and shared labor and chainsaws as we collected firewood together to heat our homes. In Kakisa and Sambaa K'e, I tried to make myself useful as I listened, observed, and conversed with others. I worked in the garden, cut down overgrown bush in hunting camps, helped with paperwork in the Band Office, and took care of the chickens. I participated in social activities in each of the three communities, such as visiting and sharing tea, preparing community meals, game nights, hunting, fishing, gardening, and market days. Through these activities, I learned about social relations, economic activities, and cultural beliefs in the communities.

I supported the participant-observation component of this research with 52 in-depth, semi-structured interviews with farmers, gardeners, harvesters, Elders, and key informants, including nonprofit workers, bureaucrats, and agriculture industry experts. Interviews covered a range of topics including family histories, personal and community food systems, livelihood and subsistence activities, agricultural production, and observed changes on the land (see semi-structured interview guide at the end of this Appendix). With participants' consent, most of the interviews were audio recorded. All recorded interviews were transcribed using Otter.ai software, corrected by an undergraduate research assistant, and checked by me for accuracy. Interview transcripts and notes from unrecorded interviews were systematically analyzed as described in the following section. I approached interviews through two avenues. First, I invited the people with whom I conversed daily to participate in more formal interviews, usually after several months of building a relationship. Though I used an interview guide, many of these interviews served to fill in gaps in stories I had previously heard, probe more about a particular period in a person's life history, or ask pointed questions about their experiences navigating financial issues or complex land tenure rules. Second, among community members with whom I had yet to establish rapport, or among key informants who lived and worked in other communities (e.g. nonprofit workers and government officials in Yellowknife), I reached out through a common network contact who legitimated my research locally. In general, informal conversations through participant-observations and interviews conducted in conjunction with previous participant-observation provided more robust data than interviews conducted over the course of a single meeting.

In order to understand the role of state and dominant public narratives in motivating and facilitating the NWT agriculture frontier, I turned to discussions among territorial and federal bureaucrats and published news articles. In particular, the NWT Prince of Wales Archives and

the Library and Archives Canada provided rich sources of this historical information. I also cataloged and analyzed approximately 100 news articles covering agriculture in the NWT from 2011-2021, including Cabin Radio, CBC News, NNSL Media, and *Up Here* magazine, and 78 speeches by territorial ministers between 2011 and 2021. Finally, I catalogued and reviewed grey literature on agriculture policies, funding, and legislation in the NWT. This included soil surveys, nonprofit reports, funding applications and records of agriculture grant distributions, industry interest group publications, community agriculture plans, bylaws, economic development plans, territorial agriculture policies and plans, and state reports of community policy feedback.

Data Analysis

The three chapters in this dissertation draw on a variety of data requiring different though overlapping analyses. Chapter 2 relied primarily on archival review and discourse analysis of state and public narratives. I drew on ethnographic data to understand how the dominant narratives are contested on the ground. Chapter 3 drew extensively from ethnographic and interview data. I used bureaucratic speeches and grey literature mainly to triangulate the findings and provide background information, e.g. on land zoning and insurance policies. Chapter 4 was developed exclusively through ethnographic and participatory field work, including in observations and informal conversations in Kakisa and Sambaa K'e and through an iterative process of policy development and community feedback over several years, both in person and remotely.

I used several techniques and software to organize and analyze interviews, field notes, and textual data. The archival review included over 1,700 records from the Hay River Heritage Centre, the Prince of Wales Heritage Center, the Library and Archives Canada, and Sambaa K'e First Nation's archives. From these collections, I selected a subset of 124 key documents based on relevancy and importance for in-depth analysis. [30] I was primarily interested in what these data could reveal about the dominant narratives and ideologies around agriculture, so I performed a discourse analysis. I read the texts and took notes on audience, tone, syntax, theses, and key quotes. I then deductively and inductively coded my notes using the comment function in Word (Charmaz, 2006). Throughout this process, I performed a circular textual, contextual, and sociological analysis of the discourses (Ruiz, 2009). I also used Word to perform a discourse analysis of public media articles and government speeches. Two research assistants and I independently coded each speech and newspaper article using the codebook I developed during the archival review. We discussed and resolved any differences in coding and added to the codebook as needed. In addition to performing a discourse analysis, I took content notes and added them to a master list of my secondary review of grey literature.

[30] For example, it was typical for a series of 20-30 documents to include back and forth communication between federal and territorial officials, including some duplicative letters; of these documents, I may have included the first letter (often depicting some problem or critical debate) and the letter or letters that responded most directly to that problem. I would take notes on additional important details but not necessarily include them for discourse analysis. I included most state-issued publications on agriculture research or development projects in the discourse analysis. In the case of personal journals or travel notes, I often selected only a portion of the journal that was relevant to my study region (South Slave and Dehcho) rather than including the full record.

With the support of four research assistants, I transcribed all interviews using Otter.ai software and double-checked the transcripts for accuracy. I then input all of the transcripts and interview notes (unrecorded interviews) into MAXDQA software and coded them in two rounds using a mix of latent and semantic codes. In the first round, I developed codes deductively based on a review of the literature and themes acknowledged while reading through the archives and grey literature. The second round of coding was inductive and iterative based on emergent themes in the data (Charmaz, 2006). Throughout the coding process, I created a codebook consisting of parent and child codes, which I added to throughout each round of coding. After preliminary analysis, I reported key findings back to informants in Sambaa K'e, Kakisa, and Paradise Valley (both remotely and through in-person workshops) and incorporated interlocuters' suggestions, questions, and analyses into the final versions of the three articles. Traditional knowledge holders from Sambaa K'e First Nation and Ka'a'gee Tu First Nation also reviewed and approved the publication of Traditional Ecological Knowledge and interview data before publication of the articles and dissertation.

Chapter 4 takes a different approach. I developed Chapter 4 in collaboration with community members in Ka'a'gee Tu First Nation, Sambaa K'e First Nation, and with several scholars at Wilfrid Laurier University working on participatory action research projects related to agriculture and climate change adaptation in the communities. As researchers we relied on ethnographic and interview data from our various projects to develop an initial agroecology framework, which we then discussed with community co-authors and iteratively adapted based on our conversations over several years. Throughout the framework development and since the publication of the article, I continued to conduct participant-observation and interviews and participated in community workshops to better understand how Dene values are infused in community agriculture and climate adaptation practices. These observations also informed my understanding of "climate enclosures" (see Chapter 3). Co-author Carla Johnston and I also worked with Sambaa K'e First Nation to develop a more granular, community-specific agroecology plan based on community needs and practices. Though I was involved in initial discussions and planning around community engagement, I did not participate in the in-person discussions or the writing of the plan, which took place in both Sambaa K'e and Kakisa during the summer of 2022 while I was at home with my newborn (Johnston & Ka'a'gee Tu First Nation, 2022; Johnston & Sambaa K'e First Nation, 2022).

Navigating my Identity as a Settler

Feminist political ecologist Farhana Sultana (2007, p.382) scholar writes, "It is critical to pay attention to positionality, reflexivity, the production of knowledge and the power relations that are inherent in research processes in order to undertake ethical research." In particular, I found that entering into settler colonial debates at my research site demanded my reflexivity as a settler scholar. Macoun and Strakosch (2013, p.427) argue that settler colonial theory reveals intimate connections between settlers' emotions, practices, knowledges, and contemporary institutions that "places ethical demands on us as settlers." It requires that we confront the present as an image of our ancestors' utopia, while at the same time acknowledging current crises as Indigenous peoples' ancestors' dystopia (Whyte, 2018a). Following Day (2015) and Morten-Robinson's (2015) critiques of whiteness and settler colonialism, it also has scholarly

implications to reflexively engage in the "mobilities of whiteness" and the "unruliness" of race in research contexts (Faria & Mollett, 2014, p.89).

Often times, I did find my whiteness unruly. I found that it meant different things to different people. My whiteness, and especially my settler farming background, seemed to lend credibility among some commercial farmers who felt cheated in past interactions with researchers who they perceived not to fully understand farmers' experiences. During a time of heightened tensions around COVID-19 and federal elections in both the US and Canada, my American citizenship made me approachable to some settler farmers who felt a resonance with Trumpism in rural America and who assumed a particular politics about me as an American. In Sambaa K'e and Kakisa, my national and racial identity differently affected peoples' perceptions of me. Among some individuals, I was a curiosity – a Californian, this far north! – who warranted hospitality but reserve. Others unwittingly viewed me as a farming expert and seemed eager to both learn from me[31] and tell me what they perceived I wanted to hear as a researcher. Between the three communities, I often felt that a was performing a kind of code-switching (Myers, 2020) in an attempt to navigate peoples' assumptions while also maintaining my research integrity and personal convictions.

Gradually as I began to get to know people and became more and more a member of the communities, my anxiety about presenting differently to different people eased, and I believe people began to share more honestly with me. Nevertheless, I often struggled to make sense of conflicting and competing local interpretations of political decisions, legislation, and historical memories in the three communities. Returning to Gillian Hart's (2018) relational comparison method helped me to focus on how power-laden practices and processes are constituted in relation to each other in everyday life, rather than attempt a top-down structural approach that reconciled local experiences as variants of an overarching process or making ethical judgments about the impacts of the NWT agriculture frontier.

Indigenous and settler scholars have written about the uncomfortable nature of clashing worldviews and experiences in settler-Indigenous research and relationships (Aveling, 2013; Brophey & Raptis, 2016; Graeme & Madawe, 2017). Throughout the research process, I regularly confronted how my settler fragility manifested as a tension between the decolonial research I wanted to do, and the research I at times inadvertently contributed to as a result of my worldview and position as a settler academic. Dina Gilio-Whitaker (2018), drawing from DiAngelo's (2018) influential concept of white fragility, defines settler fragility as the invisiblizing of settler privilege the benefits from Indigenous genocide and land theft, which "cuts to the core of American identity in all its iterations, subtly calling into question the legitimacy of the US and the sense of belonging on the land." Though I was conscious of the ongoing structure of settler colonialism and personally motivated to contribute to decolonial research, my own legitimacy as a knowledge-producer hinged on the privileges I gained as a settler.

[31] I regularly explained to community gardeners and members of Sambaa K'e First Nation and Ka'a'gee Tu First Nation that I was a social scientist, not an agricultural scientist, and that unfortunately I was not an expert grower. Wherever possible, I connected gardeners who had agriculture questions directly to experienced farmers in Paradise Valley or to agriculture experts in Yellowknife. I also sought and relayed answers to their farming and gardening questions from within my own academic network.

Watson and Jeppesen (2020) build on settler fragility by mapping four paradoxes that settler researchers must negotiate in decolonizing research. These include (1) the paradox of learning Indigenous worldviews in a profound way, but without appropriation; (2) the paradox of unsettling research by undoing colonial epistemologies in which settlers problematically aim to feel settled; (3) the paradox of reconciling research to improve relationships with Indigenous communities, which can lead to reconciling settlers within their place in colonialism, rather than with Indigenous research partners; and (4) the paradox of decolonizing research in which settler research in colonial universities is recognized as incommensurate with decolonization and yet much be undertaken to decolonize the university. I resonate deeply with the four paradoxes Watson and Jeppesen describe, and I encountered them in many ways throughout the processes of data collection, analysis, and dissemination.

One of the ways I consciously sought to decolonize my own work is to move away from "damage-centered" research that "looks to historical exploitation, domination, and colonization to explain contemporary brokenness, such as poverty, poor health, and low literacy" (Tuck, 2009, p.413) and instead center Indigenous resurgence and sovereignty. If I were to say: Indigenous food systems in the NWT have been damaged by settler colonialism; Indigenous food insecurity, diabetes, and alcohol addiction are the result of assimilatory colonial food programs and policies – and leave my analysis there – I would be centering a settler colonial metanarrative and contributing to damage-centered research. In unsettling these narratives, I refused to see agriculture production on Indigenous lands as "development" or as a sign of settler domination, but instead I asked how some Indigenous peoples were expressing their authority and sovereignty on the land by using agriculture (by their own authority, within their own economic and cultural systems) as tools of resurgence in the midst of global environmental change and the enduring structure of settler colonialism. I drew on these analyses in Chapter 3 and Chapter 4. Centering Indigenous resurgence is a move against replicating settler colonial domination in research (Essa et al., 2022; Coulthard, 2014; Simpson, 2016; Stark et al., 2023), yet I have often wondered what difference this move really makes in the wider structure of academia.

With Indigenous and settler co-thinkers at the University of California, Berkeley, and Wilfrid Laurier University in Canada, I am grateful to engage in challenging and ongoing dialogue about ethical and decolonial research in and with Indigenous communities. I have spoken and written about these challenges at length over the last few years, including in a conference presentation at the Native American and Indian Studies Association (NAISA) conference (Planche & Price, 2023) and corresponding in-progress article on the politics of recognition in academia, as well as an article I co-authored with UC Berkeley's Indigenous Environmental Studies (IES) Working Group on conducting ethical environmental research with Indigenous communities, currently in review. As I continue in this work, I am guided by Watson & Jeppesen's (2020, p.102) charge that "settlers [must] move past settler fragility to remain unsettled, engage in uncomfortable conversations; avoid defensiveness; listen, reflect, and revisit with questions." And so even now, in filing this dissertation, I find I have as many questions as I do answers. I commit to keep asking them.

Navigating my Identity as a Mother

Sultana (2007, p. 382) wrote of her own research experience that "positionality and subjectivity are tempered both spatially and temporally, and are unstable and not fixed. Dynamics change with context, and the insider-outsider boundary gets blurred." I found this to be true of my own positionality and subjectivity, both as a result of structural and environmental changes beyond my control (e.g. federal elections, climate disasters) and also because of personal changes in my own identity as I became a mother. In this final section, I draw from an article I co-authored with Anaya Hall on the role of reproduction in changing research positionalities and field experiences (Price & Hall, In press). We build on Donna Haraway's (1988) concept of situated knowledges by considering how the experience of motherhood impacts our knowledge standpoint. Becoming a mother is a boundary-altering experience. One maternal body becomes two bodies together, and then two bodies separately, and mothers assume new risks for their own bodies and the bodies of their children (Drozdewski & Robinson, 2015; Farrelly et al., 2014). Being a mother affects every phase of the research process (Brown & De Cassanova, 2009, p.54), including, as we emphasize in our concept of *situating reproduction,* how we are perceived in the field and how we observe, question, and interpret data. Below, I examine own embodied experience as a mother-fieldworker and reflect on how these changes affected my research experience and knowledge standpoint. The next three subsections draw on my field journals between 2019 and 2023 and are excerpted from the article in press.

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Untidy Reproduction

In spring 2021, my spouse and I had just come through a pandemic-induced disruption that delayed fieldwork and changed our perspectives on work and family life. As I began fieldwork in the Northwest Territories (NWT), Canada, we put our belongings in storage in California and drove north as a family. Before long, I learned I was pregnant. We were surprised but thrilled. Accompanied fieldwork immediately took on new meaning as I began integrating field activities with healthcare logistics.

I did not stay pregnant. The morning I miscarried, I was scheduled to meet a Dene Chief who eventually became a research partner and his community a case in my study. We had planned to go boating on the lake together. A tearful call to my midwife suggested I had no medical reason not to attend the meeting. Wanting to mourn alone but not wanting to cancel on the Chief, I kept the appointment and the boat ride, moving through the afternoon in a fog. I wrote in my field notes that evening: "I'm not pregnant anymore. I met [Chief] and [his wife] for the first time today. I wonder, could they tell I was sad? Nobody really tells you how to *do* fieldwork. Certainly no one tells you how to handle having a miscarriage in the field. I'm not sure how to process this. I feel numb."

We told almost no one we had been pregnant. Relationships seemed too new in this community we had just entered as guests, and I was afraid to tell colleagues for fear they would assume I was careless or distracted. Over the next several months, fieldwork continued and grew in

intensity and discovery. I kept separate journals for my field notes and my personal experience of loss and longing for motherhood. My spouse was integral to supporting research relationships and to thinking through research ethics, field logistics, and mental health.

Becoming a Mother

A few months later, my husband and I again broached the subject of children. I was already well into my reproductive years. I was also a junior scholar, working towards a tenure-track job, and aware that my best chance of maternity leave in the US was to give birth during the summer. By then, we were planning to be back in California, and I could be home for delivery. Soon, we were pregnant again. Winter arrived quickly in the NWT with its harsh temperatures and persistent darkness. It was easy to hide morning sickness and a growing belly with ginger tea and heavy sweaters. I continued fieldwork, and my once-split self of researcher and mother merged. In some respects, it became easier, and I stopped keeping two separate journals. In other respects, it became harder. I had new anxieties I did not have before: caring for an unborn baby.

We were in a healthcare system that was new and unfamiliar to us, in a rural region with the nearest obstetrician a 6-hr drive away. One of the cases in my study was in an isolated area, accessible only by plane from spring to fall. For a few weeks in the winter, an ice road is carved, and there is land access to the community. I visited in the fall (via air) and planned to return in December for another stay (via ice road) but decided not to take the trip when I became pregnant. Community members drove this ice road every year, and the journey was carefully dotted with emergency cabins and supplies in event of bad weather or car trouble. Women in this community lived, were pregnant, and had babies, often boarding flights to attend midwifery visits or to give birth in regional centers. In choosing not to go, I weighed my own privilege and safety against the idealized image of the intrepid fieldworker I had unknowingly assumed I was supposed to become. Even though I consciously rejected this notion of the disembodied, objective researcher, I felt tension in my decision to stay back.

Around New Year's and well into my second trimester, we shared the news with friends in the field. They were thrilled! I did not find that my interviews changed significantly, or that new opportunities were immediately opened to me, as other mother-fieldworkers have described (Johnston 2015; Korpela et al. 2016), but there was a subtle difference in my relationship with interlocuters, especially women. As a mother, I became an insider-outsider in the community I had long been an outsider (Brown and De Casanova 2009). In addition to everyday conversations about food and politics, we also began talking about pregnancy and sleep deprivation and the way becoming a parent *changes* you. A neighbor and I took frequent walks across the frozen river, sharing our dreams for our children. The single person I had told of the miscarriage, a Ka'a'gee Tu Elder who knew how much we had wanted children, was overjoyed for us. She ushered me into motherhood with a hug and a pair of tiny knit socks.

Managing with and without a Tiny Dependent

In June 2022 in Berkeley, California, I gave birth to a heathy baby, Finn Winter. Around the same time, I was awarded a grant to extend my dissertation research, and the funding was to be released for an August start date. I could have asked for an extension, but like Billo and Hiemstra

(2013), I did not disclose my child, unsure of how the funder would respond. There is no guaranteed paid maternity or parental leave in the US. In contrast, Canada guarantees paid maternity leave (specifically for birthing persons) and parental leave (for parents of new babies) for eligible workers. Paid leave varies by province and territory, but eligible birthing parents in the NWT can take up to 17 weeks of paid maternity leave, and new parents can take up to 63 weeks of paid extended parental leave shared between two people (GNWT, n.d.). In the first year of Finn's life, I took four research trips ranging from four days to three weeks, both with and without him. These included:

An archival trip at four months: My husband could not get away from work, so I asked my mom to watch Finn while I conducted archival research in Ottawa. The grant paid for my plane ticket, and I paid for hers. I planned to step away from the collection every few hours to nurse. The night before we were to leave, my maternal grandmother passed away. I had little flexibility due to my teaching schedule, so I attended the funeral with my mom and then continued on the research trip while my son stayed home with my spouse. We learned it cost $200 to FedEx three days' worth of breastmilk in refrigerated boxes, and Finn started on formula because we could not afford the shipping. I bought a heavy-duty cooler and pumped – in the bathroom at the archives, in the middle of the night in my hotel room, in empty corners of airports – and brought home what I could. Without an infant, I spent more time in the archives during the day and worked more in the evenings, but I felt loss as my body continued producing milk for my son 3,000 miles away. I also held a profound guilt in spending two weeks away from my baby and carried the emotional labor of mothering at a distance (Farrelly et al. 2014).

A field visit at six months: In December 2022, I returned to the field accompanied by my husband and son. Though Inuvialuit, First Nations, and Métis have thrived in the Arctic and Subarctic for generations, I was inexperienced in both motherhood and the cold, and I worried about how to care for my infant at extreme sub-zero temperatures. However, despite new logistical challenges, bringing Finn to meet the people we had known before his birth was rewarding. This time, our relationships did change. We were no longer merely the 'researcher couple' or friendly neighbors. Finding commonalities in our experiences as parents, it seemed that we found a deeper level of relationship and understanding. Interlocuters offered their beds, held and fed Finn, and extended hugs and parental wisdom. In one community, people I had not yet met dropped by to say hello, inquire about Finn, and participate in an interview. While it seemed to me I had accomplished half of my usual work between Finn's feedings and early bedtime, critical observations emerged from this time. I was more attentive to the role of social reproduction in the political economy of food, particularly the ways in which women's bodies are entangled in cultivating, harvesting, preparing, and preserving food, and also in *producing* food. The labor involved in social reproduction was something I was not only seeing in the field, but also experiencing, and I became attuned to it in ways I may have otherwise missed.

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Feminist political ecologists and geographers have long advocated for researchers to attend to positionality as a move towards ethical fieldwork and research integrity (Caretta et al., 2018; Rose, 1997; Sultana, 2007). I also acknowledge that my positionality as a settler, an American, a white person, a woman, and a mother blurs the boundaries of carework and field work,

decolonizer and settler, and learner and knowledge-creator. In critically reflecting on my positionality, I aim to become answerable for what I see and have come to know (Haraway, 1988).

Example Semi-structured Interview Guide
Note that I have variations of this guide for key informants such as government officials, agricultural experts, and non-profit employees.

Guide: The changing role of agriculture in subarctic food systems

INTRODUCTION

1. **How long have you been living in XX place? Tell me a bit about your experience growing up here.**
   a. If not from here, talk about when/how moved here.
   b. Where else have you lived? What were you doing there?

First topic is FOOD.

1. **What are the main ways you source of food right now**? (Grocery store, friends/family, hunting, fishing, other).

Potential probes:

a. What percentage of household food comes from traditional foods? From foods you buy in the store? From foods that are grown locally in the community?
b. Probe differences between seasons
c. Do you gather food from the land? Do you hunt or fish?

2. **How has the way you source food changed in your family over time, if at all?**

Potential probes:

a. Did your parents eat the same way you do? What is same/different?
b. Did your grandparents eat the same way you do? What is same/different?
c. Do your children eat the same way than you do? What is same/different?
d. Are you worried about food changes in your community, or do you feel things are headed in the right direction?
e. How have the foods you regularly eat changed in your family over time, if at all?
f. Are there some foods that you like to eat but do not have as much access to? (If so, what are they, and what is the challenge?)

3. **Which kinds of foods do you most like to eat?**
   a. *Probe traditional foods*
   b. *Probe local vs imported*: If you could choose between a potato or eggs grown locally, versus one that you would be from the store, imported from the south, what would you choose? Why? How do you know one is better than the other? *(cost, freshness, "healthy")*
   c. *Probe changes over time.* Do your kids have different ideas about what is healthy? Do your parents or grandparents that different ideas about what is healthy?

4. **In your family, what food-related activities do you usually do?** For example, if we think about some of the ways we interact with food – getting food, preparing food in your home, sharing food with others, preserving food, or selling food, which roles do you usually do? What roles do others in your household usually do?
    a. *Probe changes over time:* Are these the same roles your mother/father or grandmother/grandfather or elders did when they were your age? What roles do your kids play? How will this change as they get older?

5. **How do you make a living? What is the range of different kinds of work that you do to provide food for your family?**
    a. *Probe work in different seasons of the year. Include paid/unpaid work.*

Now we're going to transition a bit to talking about growing food.
AGRICULTURE

1. **When is the first time you can remember any type of food was grown in your community?**
    a. What did they grow at that time? Where did they grow? Who was involved in growing food? Did it play a big role or small role in community food provisioning? Why do you think they started growing food?
    b. Probe community gardens installed by government in early 2000s (every community had one).
    c. Probe gardens at seasonal summer camps.

2. **One of the things that I study is the history of agriculture in the NWT. Some of the earliest agriculture here was done by the missions, and in the residential school system, children were forced to take part in agriculture at schools. How does this legacy play a role in the way you or people in your community think about ongoing garden projects, if at all?**

Probe: What's to keep this from happening again, the state or other groups taking away your sovereignty over your food system?

3. How have *you* been involved in local food production / the community garden, if at all?

4. Who also works in the garden in your community?
    a. *Probes: transient workers, government employees, college students, youth, etc.*

5. What do you think is the role of the garden in your community food security, if any?

7. Do you have any hesitations or concerns about the garden in your community?

8. What do you think agriculture will look like in your community in 10 years in the future?

Our last topic is LAND AND CLIMATE.

1. **What times of year do you usually go out on the land, and what do you do? What food-related activities do you do on the land?**
    a. *Probe changes over time (parents, grandparents, kids), amount of time on the land, seasonality of on time spent the land.*
2. **Do you think of your land as a homeplace, an economic asset, a relative, or something else?**
3. **Do you own your land? How does your legal relationship to land affect your ability to do hunting/harvesting/agriculture?**
    a. *How do taxes enter in to what you do with your land? (Farmers on the Prairie often think of land as needed to be producing an income in order to pay off loans and taxes. Do you feel the same way, or worry that you might feel the same way?)*
    b. *How do government regulations affect your ability to produce food? For example, if you wanted to build a bigger garden, or clear land for a greenhouse, would you be able to do that? Would this require permission from the government?*
4. **What changes have you observed on the land over time*?***
    a. *Probes: temperature, rainfall, storms, floods, droughts, winter weather, soil health, fish populations; caribou, bear, moose populations*
    b. *When did these changes start to occur? What months are different than before?*
5. **How would you describe how these changes have impacted your food system?**
    a. *Have you made any changes to your diet because of climate change? What changes have you noticed in the quality, quantity, or cost of accessing traditional foods as a result of climate change?*
6. **It was ways are people adapting to changes in the land in your community?**
    a. *Probe: What role, if any, does local food production play in adapting to changes?*

CONCLUSION

1. Is there anything else you would like to share before we finish this interview?

Express appreciation for her/his participation. Ask if it would be ok to contact them for a follow-up interview.