Exploring culturally meaningful definitions of justice and resilience through the lens of sovereign Indigenous foodways

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Abstract

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In this thesis I explore frameworks of environmental justice, food justice, and community resilience that center Indigenous communities and their perspectives. First, I conducted an integrative literature review on environmental injustice that uniquely impacts Indigenous communities, specifically as it relates to water resources. I propose five major pathways through which environmental justice occurs: the physical manipulation of waterways, chemical contamination, the introduction of species, the exploitation of culturally significant species, and global climate change. The supplementary material for chapter one is an expanded list of all literature reviewed. In the second chapter, I present a framework for understanding food justice that integrates pre-existing theories of food justice, food sovereignty, and cultural sovereignty. In the third and final chapter, I have defined a theory of cultural-ecological resilience that builds from existing theories of social-ecological resilience to incorporate the non-tangible, cultural relationships between Indigenous Peoples and their traditional lands and waters. Using my framework for food justice from chapter two, I explore the ways justice within Indigenous food systems cultivates cultural-ecological resilience.

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Introduction

Western environmental scientists have long sought solutions to problems created by the physical, chemical, and biological alteration of the earth's ecosystems. Little attention has been paid to the processes at the root of these issues—political and economic processes owing to settler colonialism (Reeder-Myers et al., 2022; Sluyter, 2001). Settler colonialism is the process through which a colonial power establishes itself in a previously occupied territory with the intent of permanent settlement there (Englert, 2020; Veracini, 2019). What differentiates settler colonialism from other forms of colonialism is the simultaneous expansion of colonial power through land acquisition to support capitalist economies through resource extraction, and the intentional elimination, or displacement, of Indigenous Peoples (Englert, 2020). Settler colonialism also entails the imposition of political and economic processes by the colonial power that marginalizes Indigenous Peoples' governmental structures and economies and seeks to exploit the occupied lands for natural resources "in perpetuity" (Coulthard, 2014). Environmental justice and recognitional justice offer frameworks for understanding the role of settler colonialism in producing environmental changes, as well as the inequitable distributions of societal impacts resulting from those changes (Bullard, 1996; K. P. Whyte, 2011). Recent scholarship examining the intersection of environmental science and environmental justice has emphasized that the exploitation of resources and Indigenous labor by colonial powers places environmental injustice at the heart of settler colonialism (Veracini, 2019; Whyte, 2019). The marginalization of Indigenous Peoples and resources in capitalistic, settler colonial societies

disrupt the eco-social relationships that Indigenous People have maintained since time immemorial.

Waterways are among the landscapes that have been dramatically altered through the process of settler colonialism, but water is complex, dynamic, and mobile. The relationships between settler colonial political processes and waterways are not as explicitly articulated as settler colonial land relationships, and so settler colonial influence over waterways and Indigenous Peoples' water-based rights and resources is not as well understood in contrast to land (Pawling, 2017).

Water rights and access to aquatic resources is a complicated issue in settler colonial nations. The resulting patchwork of experiences with settler colonial power dynamics and policies dictating Indigenous water rights are not universally applicable across jurisdictions or individual communities, making discussion of settler colonial relationships to waterways equally complex. The complexity of settler colonial water management is problematic because it elides important eco-social relationships that Indigenous Peoples have sustained since time immemorial and the ways in which settler colonialism actively attempted to disrupt those relationships in its mission to claim dominance over both the landscape and Indigenous Peoples (Wilson & Inkster, 2018). As Berry et al. (2017) notes,

> "Looking through the lens of water, then, can expand what is visible about settler colonialism and Indigenous agency, providing evidence of the particular motivations, decisions, and encounters that drove histories and which, in many instances, continue to underpin contemporary situations. Because of its essential nature, water histories have the potential to reveal details about settler colonialism and insights into Indigenous resistance, reappropriation, and restoration that are not often evident in other histories."

While the academic literature has overlooked the importance of water in the landscapes claimed through settler colonialism, agents of settler colonialism have not. Water was vital to the expansion of colonial empires, from the crossing of oceans by European settlers to the

exploration of Indigenous lands via riverways as evidenced by the Lewis and Clark expedition, which charted the largest land acquisitions made in the creation of the present-day United States through its explorations of the Missouri and Columbia Rivers (Friis, 1954). Water also played a pivotal role in environmental conflicts throughout North America and continues to be used as a tool to marginalize Indigenous communities through inequitable water governance (Boelens et al., 2016; Mitchell, 2019). Indigenous Peoples have been excluded from governance over water resources through the imposition of settler colonial styles of management. Degraded water systems and water quality have direct impacts on Indigenous People who disproportionately experience the effects of industrial pollution and lack infrastructure to ensure access to clean water (Chief et al., 2016).

There is an ongoing trend in many fields, including the environmental sciences, to engage with Indigenous communities and knowledge systems. However, engagement by settler scholars with Indigenous communities is limited by the failure to name settler colonialism as the root cause for many of the environmental issues experienced by ecosystems today. This failure is a move towards innocence by Western scientists and perpetuates the erasure of Indigenous Peoples and detracts from Indigenous assertions of decolonization, or unsettling relationships with settler colonial powers (Sluyter, 2001; Tuck & Yang, 2012). There is a need for research that investigates the connections between settler colonialism and the environment with the understanding that environmental change, both historical and contemporary, is the result of settler colonial political and economic processes and have direct impacts on marginalized populations (Reeder-Myers et al., 2022; Sluyter, 2001).

Environmental Justice and Recognitional Justice

Environmental Justice is a framework for examining how environmental degradation, such as exposure to hazardous materials, disproportionately affects people of color and other marginalized identities. The range and extent of these environmental injustices are far and wide, and much of what we know comes from the groundbreaking work of Black scholars that have been at the forefront of the field since its conception (Bullard, 1996). To understand contemporary Indigenous environmental justice issues, we must acknowledge the history of settler colonialism in producing environmental injustice to contextualize the ongoing effects of environmental racism and marginalization (Cantzler & Huynh, 2016; Gilio-Whitaker, 2019; Liddell et al., 2021; Van Sant et al., 2021).

However, environmental justice alone is inadequate to evaluate issues of power and justice in Indian Country because of the complexity of inter-government relationships of tribal nations with the settler state. The cultural and social dimensions of harm caused by environmental injustice are also often overlooked when environmental injustice is only examined through the lenses of race and class (Whyte, 2011). This oversight is because of the unique status of tribes as sovereign nations with inherent cultural rights, as well as legal rights outlined by treaties with the United States government.

A primary goal of settler colonialism is the intentional disruption of Indigenous People's relationships to their lands. Historically, this was partially accomplished through assimilationist and forced relocation practices that physically severed Indigenous Peoples from their lands (Adams, 1995; Goyes et al., 2021; Perdue, 2012; Perry & Robyn, 2005). However, it must also be recognized that environmental degradation throughout the history of settler colonialism is responsible for much of this cultural loss, as well as the cause for many eco-social conflicts (Bacon, 2019; Grandia, 2017; Lee, 2016; McGregor et al., 2022). Non-Indigenous Peoples'

understanding of harm caused by environmental injustice is limited by the different worldviews and environmental heritages held by settler societies and Indigenous Peoples (Figueroa & Waitt, 2010). For example, the reciprocal relationships and knowledge systems Indigenous Peoples maintain with their ancestral lands underlie the understanding that humans are an important and inseparable part of the environment. Indigenous environmental justice also directly examines justice towards non-human relations, and waters and lands themselves (McGregor, 2022). Greater inclusion of Indigenous perspectives adds depth to the environmental justice literature by offering the understanding that environmental change can be a causative agent of cultural genocide through the rapid environmental changes it imposes on Indigenous Lands that exceed Indigenous Peoples' capacity for adaptation (Dockry & Whyte, 2021).

In her book Decolonizing Methodologies, Linda Tuhiwai Smith lists remembering as one form of Indigenous research. "Obliteration of memory was a deliberate strategy of oppression" (Tuhiwai Smith, 2021); this intentional amnesia is present in Western environmental research that fails to reconcile the historical context of settler colonialism with contemporary environmental crises. The objective of this review is to remember the historical context of environmental change that continues to impact Indigenous Peoples today and provide a framework for understanding those impacts to advance recognition justice in an environmental justice context.

I conducted an integrative literature review of over 300 papers, historical documents, reports, and book chapters relating to settler colonial impacts on waterways and Indigenous Peoples. I used Google Scholar to search for a series of key terms in combination with "settler colonialism". These terms included "water rights", "environmental justice", "food sovereignty", "food security", "community health", "cultural sovereignty", and "tribal sovereignty". From

these results, I conducted a staged review to identify specific case studies for further investigation. I focused on the United States due to my personal limitations in experience and understanding. This review was conducted in 2021 and primarily contains literature published prior to that year with a few exceptions. I identified four major pathways by which settler colonialism produces environmental injustice towards Indigenous Peoples (Figure 1): 1) modification of waterscapes, 2) contamination of waterways, 3) introduction of non-native species, and 4) exploitation of culturally important resources. I end with a discussion on the impacts of climate change disproportionately experienced by Indigenous Peoples, as well as Indigenous resistance to environmental injustice. I present these categories of anthropogenic environmental change individually, but it must also be understood that they do not occur in isolation and can influence each other (Figure 1).

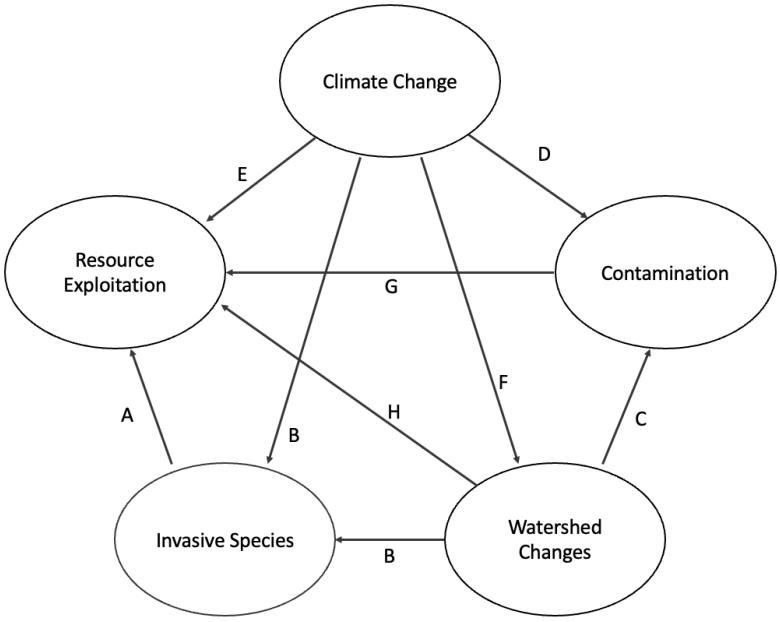

Figure 1. Cascading effects of anthropogenic-induced environmental change can occur: invasive species introductions leading to the extirpation of native species through predation or competition (A); climate change or physical changes to watersheds can facilitate the spread of invasive species (B); anthropogenic activity related to physical watershed manipulations can introduce industrial contaminants to the environment (C); changing

environmental conditions due to climate change can exacerbate the environmental impacts of contaminants (D), lead to local extirpations of species (E) or alter watersheds from their natural state (F); physiological stress from contaminants can impact population viability (G); watershed changes such as dams can affect the distribution of populations leading to local extirpations (H).

Watershed Impacts of Settler Colonialism

Manipulation of waterways

Although settler colonialism is primarily land-centric, physical manipulations of waterways played a pivotal role in facilitating settler colonialism through its treatment of water as a commercial resource. In contrast to capitalistic, utilitarian views of water that have driven settler colonial watershed manipulations, Indigenous Peoples recognize water as multi-dimensional and carrying agency (Nelson, 2020). For example, during the Dakota Access Pipeline resistance movement, Lakota environmental justice advocates told the world, "Mní Wičóni", which translates to "water is life" (Standing Rock Sioux Tribe, 2022). This teaching encapsulates how water is necessary for sustaining life in the physical sense, but also through the roles water plays in ceremony, sense of place, culture, and identity (Chief et al., 2016; Wilson & Inkster, 2018).

This is not to say Indigenous Peoples did not manipulate waterways to serve their purposes; Indigenous Peoples constructed dams, canals, irrigation ditches, and other innovative structures to manage waterways. For example, there is historical evidence and contemporary practice of Indigenous irrigation methods in the arid Southwestern United States (although not universally used) to support agriculture (Salmon, 2012). Indigenous Peoples of the Southwest carried knowledge of water systems that supported survival, innovation, and even resistance against settler colonialism. However, the imposition of settler colonial governance of water systems has infringed on Indigenous sovereignty to self-govern waterways and water resources; water as a commodity in capitalistic markets has been leveraged as a tool to facilitate the

displacement and marginalization of Indigenous Peoples. This process is defined as hydrocolonialism by Strube and Thomas (2021), which provides a framework for analyzing the relationships between colonial powers and Indigenous Peoples as it relates to watershed management. To quote Jeff Corntassel (2012), “When market transactions replace kinship relationships, Indigenous homelands and waterways become very vulnerable to exploitation by shape-shifting colonial powers”.

The imposition of settler colonial water governance over Indigenous governance structures has produced inequities in water allocation and infrastructure that affect Indigenous nations’ access to freshwater (Tanana et al., 2021). One example of how settler colonial powers exert control over Indigenous watershed governance is the Navajo Nation’s ongoing water insecurity crisis. Despite controlling much of the San Juan watershed, settler colonial governance prioritizes settler interests in such a way that it structurally denies the Navajo Nation’s sovereignty in self-governing this resource and many Navajo homes still do not have access to fresh water (Bray, 2021).

The key piece of legislation that determines tribal access to water is the Winter’s Doctrine, but there are many limitations that prevent the full realization of tribal sovereignty (Durette, 2010). These include restrictions on what sources of water are available for tribes' use, which in many cases excludes groundwater, as well as restrictions on what allocated water resources can be used for, which often excludes ceremonial and cultural uses (Flanagan & Laituri, 2004; Royster, 2013). Settler colonial water laws also do not accommodate Indigenous perspectives of water that oppose the privatized, capitalistic views held by colonial powers, thereby limiting tribal sovereignty in self-determining water management (Chief et al., 2016; Tanana et al., 2021). These limitations to tribal water rights pose a direct threat to Indigenous

Peoples' water security and wrested physical control of waterways from Indigenous nations, paving the way for settler colonial interference in waterscape management.

Environmental manipulations at the interface between land and water fulfilled settler colonial desires to "tame" the lands they acquired and cultivate them. These changes include the construction of dams (see "Damming Rivers"), draining of wetlands, deforestation and urbanization of riparian zones, and other land use changes that impacted the integrity of aquatic ecosystems. The affected ecosystem types served as intermediaries between land and water, and thus served important ecosystem functions. However, settler colonial land management deems many of these important ecosystems as being of low value because they could not be cultivated without intense manipulation (Claire & Surprise, 2022). Ecosystems that were uncultivatable were viewed as a problem to be solved via settler colonial infrastructure, which disrupted the hydrology and ecosystem functioning of waterways. Wetlands are extremely productive ecosystems that serve as the intermediary between aquatic and terrestrial ecosystems. They provide food, raw materials, regulating services such as climate regulation, and serve as valuable habitat for many species, but have been systematically drained globally (Clarkson et al., 2013).

Many of these targeted wetland areas were stewarded by Indigenous Peoples for the harvest of culturally important resources since time immemorial (Dick et al., 2022). Therefore, the loss of wetland ecosystems is associated with the loss of Indigenous stewardship and negatively impacts the access to and availability of culturally important resources for Indigenous harvesters. For example, Back Swamp in Robeson County, North Carolina, was drained in 1914 by settlers because it was viewed as untamed wilderness. The ecosystem services the swamp provided were disrupted, as well Lumbee cultural harvest of species that used wetland habitats (Maxwell, 2017). Wetland manipulations were unsustainable and contributed to the erosion of

Indigenous environmental stewardship, thus affecting cultural practices relating to wetland resources, economic self-sufficiency, and food sovereignty (Dick et al., 2022).

Damming rivers

Dams have been used as a tool to accomplish settler colonial watershed management objectives of exploiting and manipulating water for economic gain. The manipulation of riverways from their natural flows, and the creation of reservoirs following dam construction, disproportionately impact Indigenous communities that were excluded from decision making when these dams were constructed and actively resisted their construction (Gilio-Whitaker, 2019; Luby, 2020). Gagnon and Desbiens (2018) describe reservoirs as "hydrocolonialism's most powerful tool of erasure" because sites for dam construction historically have disproportionately marginalized Indigenous lands and communities (Figure 2). Flooding associated with reservoir formation has been a major cause of land loss for Indigenous communities in the twentieth century, which displaces communities from their ancestral lands or lands they had previously been relocated to through settler colonial land acquisition projects. Examples include the Garrison Dam on the Missouri River, which required land acquisition from the Fort Berthold Reservation, displacing thousands of Native Americans, and legally restricting the Three Affiliated Tribes' access to the newly created reservoir, thus affecting access to traditional resources (Estes, 2019). The O'Shaughnessy Dam created the Hetch Hetchy reservoir, which forced Ahwanachee Miwok to relocate; the Kinzua Dam forced the Seneca Nation to relocate; the Crow Creek were displaced twice by the Fort Randall Dam in 1953, and again in 1964 following the opening of the Big Bend Dam. Displacement has many negative consequences on Indigenous Peoples' sense of place and identity as it alters communities'

relationship with ancestral lands and waterways, and access to resources (Fabris, 2022; Luby, 2020).

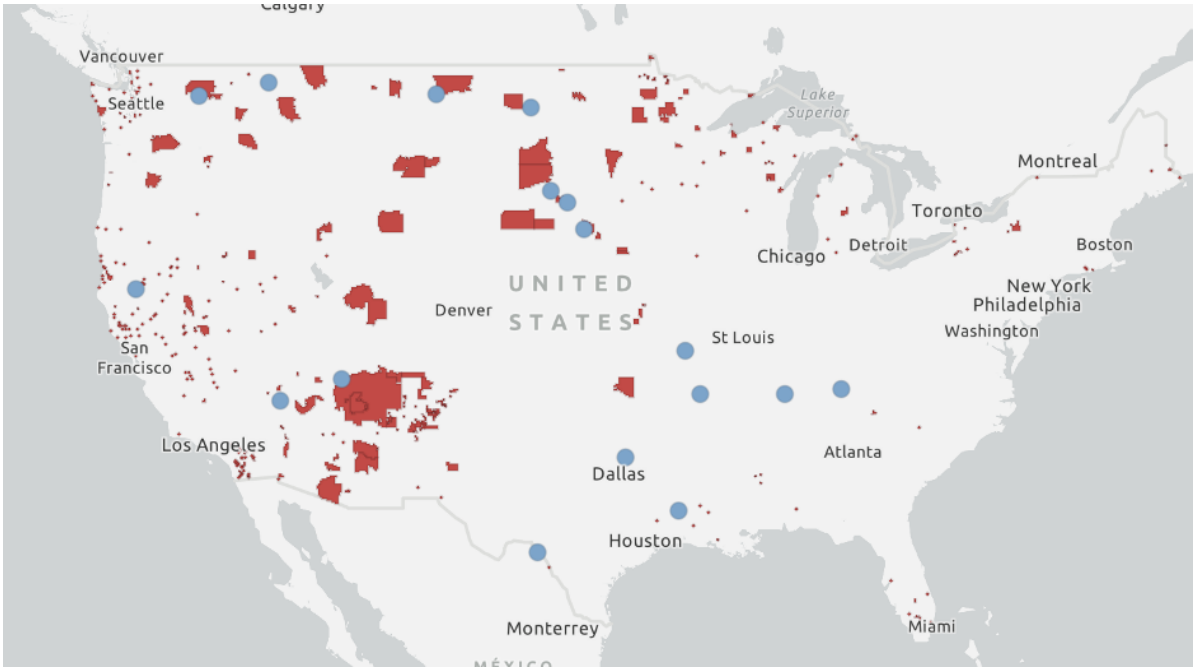

Figure 2. The above map shows the locations of Native American reservations and seventeen of the largest reservoirs, by capacity, that have been created by dams in the United States. Other than the dams located in the Mississippi watershed, a majority of these reservoirs are by design located on or in very close proximity to reservations.

Dams also produce environmental consequences to aquatic ecosystems that further disrupted Indigenous Peoples' access to traditional resources. For example, dams on the Klamath River block salmon from reaching Yurok and Karuk fishers. The Klamath River dams have created food insecurity for these tribes by restricting their access to salmon and many other traditional food sources, thus impacting their subsistence harvest and economic self-sufficiency (Norgaard et al., 2011). In addition to being a physical barrier to species, dams can impact waterways in such a way that it limits persistence of endemic species, making them unavailable to Indigenous harvesters (Galbreath et al., 2014; Gautam et al., 2013; Gilio-Whitaker, 2019; Gustafson et al., 2007). For example, reservoir creation by the James Bay hydroelectric projects caused caribou to drown, vegetation was flooded or rotted, posing a contamination risk, and

rivers became entirely dried up (Grinde & Johansen, 1995). Another unintended ecological consequence of dams is increased predation pressure on migratory species that are stalled by dams (NRC 1996). The ecological consequences of dams on traditional resources of Native American communities are relatively underrepresented in the literature, however.

Dams built in the 1900's are now aging and pose an ecological and human health risk. Tribes that have been impacted by dams have been at the forefront of advocating for their removal to restore their traditional foodways and assert their sovereignty. Many nations have successfully advocated for the removal of dams on the Penobscot, Ottaway, and Elwha Rivers to protect culturally important species, restore ceremonial sites and land losses (Fox et al., 2022). The removal of dams is an important step towards restoring tribal sovereignty for many nations; however, dam removal might not be sufficient for restoring ecosystems to their pre-dammed states. Re-established communities upstream of dams might not resemble the communities that existed prior to damming and facilitate the expansion of invasive species' ranges (Bellmore et al., 2019). Dams are associated with irrevocable loss for many Indigenous communities—loss of traditional foods, medicines, land, culture, and sovereignty (Mauer, 2021). Unfortunately, dams are not the only way settler colonial water governance has irreversibly altered aquatic ecosystems in ways that disproportionately marginalize Indigenous communities.

Contamination of watersheds

Indigenous lands and waters contain disproportionate levels of contaminants due to settler colonial intervention, and oftentimes this is intentional. As has been widely discussed in environmental justice literature, the siting of industrial facilities is not a coincidence, but rather an intentional act of environmental violence perpetrated by settler colonial governments on Black, Indigenous, immigrant, and other marginalized communities (Bullard 1996). The impacts

of chemical contamination on Indigenous communities, particularly on reservations, have been explored through the lens of internal colonialism (Taylor, 2014). “Wastelanding” is another term to describe the settler colonial political processes that marginalize both Indigenous lands and Indigenous Peoples through their production of environmental injustice (Voyles, 2015). Reservations represent 4% of the lands within the United States, and they are situated on only 3% of the United States’ natural gas and oil reserves, and between 37 and 55% of uranium reserves (Taylor, 2014). However, reservation lands are disproportionately targeted as sites for fossil fuels and uranium extraction, as well as dumping grounds for the toxic waste these industries produce. The operation of these industries on Indigenous lands are often nonconsensual, or only consented by a small number of the elite members of tribal communities that hold political and economic power.

Environmental justice frameworks should be further developed to understand the ways settler colonialism influences tribal communities’ complex relationships with extractive industries: “This kind of analysis moves environmental justice studies, particularly studies of environmental justice on Native land, to a more complex understanding of nature and justice in the past, present, and future of settler colonialism” (Voyles, 2015). The interconnectedness of colonial dispossession and industrial contamination is also described by Murphy (2008) as the chemical regime of living that draws the connection from industrial contaminants’ impacts on organisms and landscapes to historical economic processes of capitalistic production and consumption. Understanding the history of colonial governance and industry marginalizing Indigenous lands is vital to understanding contemporary inequities that continue to impact tribal water security, public health, and sovereignty.

Intervention by settler colonial water governance has systematically failed to ensure tribal water security in the United States and disrupted traditional water governance, cultural relationships, and contamination that produces disproportionate health impacts among tribal communities (Chiblow, 2019; Chiefs of Ontario, 2008). Settler water governance and environmental scientists historically viewed water as a sink for pollutants— "the solution to pollution is dilution" (Liboiron, 2021). With the introduction of the Clean Water Act and its amendments throughout the 1970's and 1980's, that mentality began to shift, but still leaves tribes behind in equitable access to clean water. Reservation groundwater and private water contamination from mining, agriculture, industry, and poor infrastructure, is a major challenge to achieving water security in many tribal communities (Chief et al., 2016; McGinnis & Davis, 2001; Schell, 2020). The lack of regulation and monitoring only compounds this issue and systematically suppresses tribal sovereignty in addressing water quality concerns that impact the health of community members (Redvers et al., 2021).

One section of the Clean Water Act provides an avenue for tribes to self-determine water quality standard as a state might ("Treatment as a State"), but there are still limitations to which tribes can pursue this and how they would put it into practice. Transboundary issues are one such challenge to achieving tribal sovereignty in dictating water quality standards, especially when reservation boundaries are unclear due to historical land loss through allotment (Chandler, 1994). Another challenge is that the lived experiences of tribal members affected by contaminated waters and resources are often not aligned with colonial water quality monitoring findings and standards due to their inadequacy in assessing unique exposure routes through ceremonial and cultural uses of water resources (Middleton et al., 2019). Pollution, therefore, undermines

cultural sovereignty by limiting participation in cultural and ceremonial activities due to community concerns over safety (Liddell et al., 2021).

Fossil Fuels

The intrusion of fossil fuel industries on Indigenous lands is ironically, and insidiously, made possible by historical incidents of settler colonial nations breaking treaties with Indigenous Nations, facilitating further land acquisitions by those colonial nations (Whyte, 2019). The issue of fossil fuels on Indigenous lands gained international attention through the Dakota Access Pipeline (DAPL) resistance movement of 2016. The Dakota Access Pipeline was initially routed across the Missouri River but was rerouted due to its proximity to municipal water supplies for the primarily white town of Bismark, North Dakota. The new proposed route crossed the Standing Rock Indian Reservation instead, threatening the integrity of their water supplies in the event of the pipeline leaking. The Standing Rock community led a grassroots resistance movement against the pipeline's construction, as it also threatened sacred grounds of the Lakota (Whyte, 2019). Resistance camps attracted Indigenous and non-Indigenous allies, youths, and environmental justice advocates from the international community, and pushed this issue to the forefront of mainstream media. The grassroot and legal battles fought against the pipeline construction came to a roadblock in early 2017 when the Trump administration and U.S. District Judge Boasberg permitted the DAPL construction to continue with the reasoning that the risk of oil spills was low (White & Millett, 2019). However, the DAPL and Keystone XL Pipelines have already experienced multiple leaks, including a major spill in December of 2022 (National Public Radio, 2022).

Transboundary oil spills also impact Indigenous communities through the far-reaching environmental impacts oil spills have on aquatic ecosystems. Another notable incident is the

2010 Deepwater Horizon Spill in the Gulf of Mexico that impacted marine fisheries and coastal communities, such as the Pointe-au-Chien Indian Tribe and the United Houma Nation, that depend upon those fisheries for their livelihoods and subsistence (Barbier, 2011; Beyer et al., 2016). Similar oil spills have caused mass mortality events of culturally important species to Indigenous Peoples, and fishery closures that impact cultural shellfish harvest (Andrade-Rivas et al., 2022; Todd, 2018). Fossil fuels pose a threat to environmental and human health. These industries also contribute to climate change through carbon emission production; settler colonial intrusion onto Indigenous lands for fossil fuel extraction is a threat to sovereignty, community health, and cultural wellbeing.

Uranium

Radioactive materials such as uranium have become another valuable resource for settler colonial economic and militaristic advancement. Following the discovery of militaristic uses for uranium in creating nuclear weapons, thousands of mines were established on Native American lands in the United States, primarily in the Black Hills and southwestern states (Moore-Nall, 2015). Historically large spills of radioactive materials, such as the 2015 Gold King Mine Spill, have contaminated several rivers and freshwater sources in Navajo Nation, making it unsuitable for human and livestock consumption (Voyles, 2015). Uranium contamination has also been associated with increased rates of miscarriages and birth defects, cancers, and kidney damage, which can compound health complications caused by diabetes, another major public health concern among Indigenous communities (Credo et al., 2019; Moore-Nall, 2015).

The Pacific Islands served as a testing ground for nuclear weapons. In total, 67 bombs were detonated in the Marshall Islands within a twelve-year span following World War II, which exposed the lands, waters, and resources to radioactive contamination (Taitingfong, 2019). The

Castle BRAVO hydrogen bomb contributed the highest levels of radioactive exposure and resulted in the displacement of entire communities (Takahashi et al., 2003). There have been increased rates of thyroid disease and cancer on the Marshall Islands, as well as miscarriages and birth defects. The use of the Marshall Island's waters for military operations was not consensual and aligned with settler colonial processes of military conquest and marginalization of Indigenous Peoples.

Although Indigenous communities have been disproportionately harmed by the impacts of settler colonial industries, they have also been disproportionately responsible in seeing environmental rehabilitation and recovery efforts. Agencies in the Navajo Nation have conducted site cleanups and much needed internal studies on the impacts of radioactive contamination, such as the Navajo Birth Cohort Study (Moore-Nall, 2015). Many other tribes have taken the initiative to protect cultural resources, raise awareness on the risk of contaminant exposure, and amend practices to protect their citizens (Simonds et al., 2019). Building upon the capacity of tribes to conduct this work and environmental health literacy is the first of many steps to undoing colonial environmental injustice and achieve equitable recovery from industrial contamination.

Exploitation of culturally important animals

Settler colonial economies are built upon exploitation of raw materials from acquired lands and waters. The targeting of biodiversity through settler colonial extractive economies produces irreversible impacts on Indigenous Peoples' foodways and relationships with their environments that had previously been sustainably maintained for millennia (Reeder-Myers et al., 2022). Settler colonial harvest reduced populations of species, often with the intent of causing ecological violence against Native Americans by creating food insecurity. A terrestrial example of this is the decimation of the buffalo in the western United States. Settlers harvested

buffalo in an unsustainable and militaristic way, creating food insecurity among Native American communities on the Great Plains (Hubbard, 2014). Hubbard (2014) further argues that the intentional decimation of the buffalo was an act of genocide and injustice against Indigenous Peoples, who hold subsistence, cultural, spiritual, and ceremonial relationships with the buffalo. This lens can be applied to aquatic ecosystems as well as they have been impacted by the fur trade, and industrial whaling, and fishing.

The imposition of settler colonial economies disrupted Indigenous stewardship through assimilation, coerced participation in settler economies, and outright banning of traditional management practices. Missionary and managerial colonies were established in the early phases of settler colonialism, particularly in the western United States. These types of colonies exploited Indigenous and Black labor for participation in exploiting natural resources to promote economic success of the colony (Lightfoot et al., 2013). The assimilative nature of these missions disrupted traditional Indigenous stewardship of their lands and waters. Traditional fisheries, such as the Chumash red abalone fishery, that had been sustainably managed for millennia, were gravely impacted by the establishment of missionaries, and the diseases brought by European settlers (Braje et al., 2009). Residential schools led to the loss of traditional knowledge and language through assimilationist education and removed children from their homes and lands that served as sites of knowledge transmission (Adams, 1995; Deur et al., 2015).

The command-and-control management regimes that were superimposed onto Indigenous management were not sustainable ecologically, or socially (Reid et al., 2021); they led to the disruption of sustainable Indigenous management systems that were based on respect and reciprocity (Carothers et al., 2021). Settler colonialism's marginalization of traditional Indigenous lifeways placed economic and political incentive on Indigenous participation in

extractive economies, which also led to the erosion of traditional stewardship practices and facilitated the exploitation of Indigenous labor.

The loss of Indigenous stewardship through cultural genocide disrupted reciprocal eco-social relationships that have been upheld by Indigenous Peoples since time immemorial. The impacts were bi-directional in that Indigenous Peoples' cultures, identities, and community cohesion were impacted by the loss of cultural resource stewardship, and the lands and waters that had previously been stewarded by Indigenous Peoples were no longer under their protection and care (Dick et al., 2022). This further facilitated the imposition of settler colonial management regimes that were less sustainable and led to environmental degradation.

Settler fishing industries depleted populations of many species through unsustainable harvest practices informed by colonial views on the environment and humans' place within it. These perspectives generally are informed by Christianity, in which there is a stark divide between humans and nature, over which man has dominion: "Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish of the sea and over the birds of the air and over every living thing that moves on the ground" (Genesis 1:38, The Holy Bible, 1987). Thus, settlers viewed the oceans and lakes of the "New World", as unlimited caches of resources ripe for the taking (Blackford, 2009). The intricate and biologically diverse ecosystems that had been sustainably stewarded by Indigenous Peoples prior to contact, quickly became depleted and dramatically altered through colonial extractive industries that targeted ecologically keystone species and apex predators (Jackson et al., 2001).

One of the major industries that facilitated colonial dominion over North America's megafauna was the fur trade. The exploitation of North American animals such as beavers supplied the European fashion industry with valuable furs for several decades until local

populations became depleted. Beavers are one of the aforementioned ecological keystone species, and so their depletions had cascading ecological impacts such as decreasing habitat heterogeneity that benefits salmon with the loss of beaver dams. Following the fall of the fur trade, beavers were reintroduced throughout their native range with minimal success because the environment had been so drastically changed by settler colonialism; fire suppression, extirpation of predators that would have kept the beaver populations in check, and introduced salmonids, have tipped the balance and complicated the management of beavers in the Midwest, as they were now considered a nuisance species (Johnson-Bice et al., 2018).

Sea otters are another semiaquatic mammal that was exploited through the fur trade. This led to the extirpation of many populations along the west coast of the United States and Canada. As ecological keystone species, sea otters played important roles within the coastal food webs as predators of sea urchins, and so the loss of sea otters had cascading deleterious effects on the kelp forests that were historically abundant on the west coast (Estes & Palmisano, 1974). Rapid population declines are associated with decreased genetic diversity at the population level; a study by Larson et al. (2002) found exploited otter populations exhibited evidence of a bottleneck effect on genetic diversity. Decreased genetic diversity and population sizes can lead to deleterious consequences such as decreased fitness, inbreeding depression, and limitations on evolutionary potential, all of which makes species more vulnerable to future extirpation.

The advent of new technology in the early twentieth century made exploitation of marine fisheries more efficient, opening new opportunities for the expansion of settler colonial harvest economies. Western fisheries management is guided by the principle of maximum sustainable yield, estimated by stock assessments. Simply defined, setting a harvest goal based on maximum sustainable yield prioritizes capitalist values of accumulation and profit over ecological

sustainability. It is also not aligned with many Indigenous Peoples' values in maintaining honorable harvest practices and reciprocal relationships with traditional resources (Pitcher, 2001). Fisheries have been globally depleted by industrial and commercial harvest, but the sheer unsustainability of settler colonial fisheries management is most clearly evidenced by the collapse of Atlantic cod in the late twentieth century (Blackford, 2009; Pitcher, 2001). Cod has historically been an important cultural resource for many communities spanning the Atlantic Ocean, Indigenous and European alike. Throughout the twentieth century however, the industrial cod fishery was booming, especially in coastal areas such as Newfoundland where cod served as the basis of local economies. Chronic fishing pressure has been identified as the leading agent in causing the cod fishery to collapse by the 1990's, leading to a moratorium on fishing (Pitcher, 2001). This outcome, under capitalistic resource management, is inevitable and known as the tragedy of the commons (Carothers, 2010).

The economic and social impacts of fishery collapses are devastating, especially to local communities that relied upon those resources for their livelihoods, but there are also far-reaching ecological ramifications as well. Reduced populations, as mentioned previously, typically undergo a genetic bottleneck which can impact fitness, future abundance and evolutionary potential, and alter communities (Pinsky & Palumbi, 2014). Exploited populations of large, long-lived species such as cod opens niches within the marine food web for different species such as short-lived forage fish to become dominant (Pitcher, 2001). Short-lived species also tend to have more volatile and unpredictable population dynamics as well, and so marine ecosystems overall become much less stable through exploitation of high trophic level species such as the Atlantic cod.

The commercial whaling industry serves as another case study of the tragedy of the commons and infringement on Indigenous food sovereignty. Throughout the nineteenth and twentieth centuries, there was a high demand for whales for the raw materials they provided such as baleen for corsets and umbrella, and their oil that fueled the Industrial Revolution as machinery lubricant and lamp fuel. As technology advanced and allowed for more efficient, safer harvesting of whales, the number of whales that met their fate in the industrial whaling industry increased. This increase in whale takes was also driven by capitalistic greed and competition between the industrial powerhouses scrambling to secure their share of a declining resource (Mchugh, 1977). Settler colonial nations that participated in the commercial whaling industry infringed on Indigenous Peoples' sovereign relationships with whales, which are culturally important food sources for Indigenous Peoples in the Arctic. Their cultural harvests were restricted, as well as other economic activities such as selling whale parts. These harvest and resource sharing activities build community cohesion, affirm Indigenous cultural identity, and contribute to the economic self-sufficiency of Indigenous communities. By restricting Indigenous Peoples' participation in subsistence whaling, the commercial whaling industry directly impacted Indigenous food and cultural sovereignty (Kishigami, 2021). Looking to the twenty first century, there have been efforts to increase Indigenous participation in whale management and monitoring to assist with recovery efforts. However, whale recoveries are globally limited by whales' naturally long lives and low reproductive rates, and other anthropogenic factors that endanger whale populations such as conflict with the oil and gas industries, boat strikes, and climate change (Berkes et al., 2007). Indigenous Peoples' restoration of sovereignty regarding cultural whaling is limited by conflicting management goals with colonial nations; for example, cultural harvest of endangered whale populations restricts Indigenous harvest, and anti-whaling

activism often targets Indigenous whaling practices, such as the Makah's cultural grey whale harvest, with the goal of seeing those hunts suspended (Kishigami, 2021).

Introduction of species

Following on the heels of European settlers, or sometimes even preceding them, were hundreds of species from the eastern hemisphere, ranging from crop plants and domestic animals to pathogens, and unintentional stowaways that run the gamut of biological diversity. Described by Crosby as "portmanteau biota", these species were introduced by settlers either intentionally to facilitate colonial and economic expansion, or unintentionally. Many of these introduced species out-competed native species such as native grasses and caused ecological changes (Crosby, 1986). Undoubtedly, many of these species impacted Indigenous Peoples' eco-social relationships with native species, but the cultural impacts of invasive species are largely unknown (Pfeiffer & Voeks, 2008). Because of this, the introduction of novel species through settler colonial processes could be considered environmental injustice. The answer to the question of how Indigenous Peoples interact with introduced species is not straightforward since Indigenous communities vary greatly in the ways they relate to introduced species. Introduced species can outcompete native species that serve medicinal, cultural, or ceremonial roles in Indigenous cultures, and invasive species management in itself can cause conflict between Indigenous and settler communities, but they can also become integrated into Indigenous cultures.

Much of the literature that examines the relationship between introduced species and Indigenous cultural sovereignty come from terrestrial systems, for example the Black Ash Borer's impacts on traditional basket weaving (Costanza et al., 2017; Pfeiffer & Voeks, 2008). When looking at aquatic introduced species, the literature is much sparser. However, it is known

the spread of aquatic invasive species is facilitated by many of the processes described previously; reservoir creation by dams, land use change, industrial economies that transport resources and biological hitchhikers across the globe, and intentional introductions to fulfill settler economic interests and recreational interests in sportfishing (Gilio-Whitaker, 2019; Padilla & Williams, 2004; Trebitz & Taylor, 2007). Species can naturally expand their ranges, especially in a rapidly changing climate, or be unintentionally introduced, but oftentimes aquatic species introductions are not a passive process. Intentional or not, invasive species have the potential to impact Indigenous food security, food sovereignty, and community health, and the exclusion of Indigenous communities from invasive species management by settler colonial environmental management intentionally marginalizes Indigenous communities by limiting their capacity to respond to introduced species in culturally appropriate ways as sovereign nations (Reo et al., 2017).

Settler invasive species management often relies on militaristic eradication strategies (Adams et al., 2021). This includes attempts to eradicate populations of introduced species, or introducing another novel species to "combat" the previously established one. An example of this was the introduction of Pacific salmon in the Great Lakes to prey upon invasive alewives (Dettmers et al., 2012). Eradication measures can also involve deployment of chemical contaminants such as lampricide or herbicides, that could potentially impact human and environmental health (Kittle & McDermid, 2016; Mattes & Kitson, 2021). This militarized approach to invasive species management can be contradictory to Indigenous values and approaches to building eco-social relations with novel introduced species (Mattes & Kitson, 2021). Indigenous participation in management can ensure actions taken to mitigate invasive species' impacts do not unintentionally harm native species, aligns with the values of the local

community, and is ecologically sound (Moody et al., 2021). However, invasive species themselves can be a limiting factor in assertions of Indigenous sovereignty in managing self-defined and culturally appropriate food systems. One example of this is the use of Pacific Islands as laboratories for non-native species introductions that Indigenous Peoples did not consent to. Hawai'i has been greatly impacted by the introduction of mangroves, which have altered the coastal ecologies of the affected islands. They have also taken over traditional fishpond sites that had been originally disrupted in their use by other colonial processes, but now the mangroves are limiting the potential for Native Hawaiian resurgence of traditional aquaculture practices (Allen, 1998).

There can also be conflicts between settler economic interests in managing introduced species, and Indigenous Peoples' traditional resources. One example of this is the risk to wild rice posed by the introduction of genetically modified strains or unintentional crossbreeding of traditionally harvested strains with proprietary, domesticated strains that have been commercialized by settler enterprises. The latter poses a legal challenge to Indigenous wild rice harvesters, but both also have cultural and ceremonial implications as well, since wild rice is a cultural keystone species to Anishinaabe communities and other Indigenous Peoples. Wild rice plays a central role in Anishinaabe cultural identity, traditional foodways, and ceremonies, and so infringements on traditional wild rice by genetically modified or domesticated strains, poses a threat to Indigenous sovereignty in self-determining food systems (Raster & Hill, 2017).

Similarly, aquaculture industries can pose a threat to Indigenous food systems by increasing reliance on non-traditionally harvested fish, or even non-traditional fish that have been introduced to areas outside of their natural range. For example, Atlantic salmon have previously been reared in net pens on the Pacific Coast and the potential implications of

escapement were a major concern to Indigenous fishers. The aquaculture industry can also pose a challenge to ecological integrity due to unsustainable practices that introduce chemical contaminants from feed, antibiotics, and waste to the environment (Page, 2007). Aquaculture development can infringe on Indigenous Peoples' waters and traditional fishing grounds, thus negatively impact access to wild fish (Joyce & Satterfield, 2010). Increased reliance on fish produced through aquaculture can also threaten community cohesion and the transmission of traditional knowledge because the skills relating to fishing would no longer be practiced, as well as traditional harvest and sharing activities that build community cohesion (Gerwing & McDaniels, 2006). However, aquaculture can also be an opportunity for tribal nations to assert their sovereignty in self-defining their food system or participating in an industry that can bolster economic success and self-sufficiency. The relationships between tribal nations and aquaculture industries are diverse and often nuanced.

The exchange of species following contact with European colonizers has always been primarily one-sided in that Indigenous Peoples have disproportionately experienced the impacts of novel species introductions. This is not commonly discussed from environmental justice and Indigenous sovereignty frameworks despite the known negative impacts of invasive species on environments they are introduced to. Invasive species present a complex challenge to Indigenous Peoples' cultural sovereignty, eco-social relationships, and traditional foodways. The contemporary power imbalances in watershed governance and resource economies poses added challenges to Indigenous participation in invasive species management. However, invasive species management and cultural adaptive capacity of Indigenous Peoples offers a multitude of opportunities for asserting tribal sovereignty in self-determining food systems and stewarding resources, both traditional and non-traditional. The diversity of Indigenous Peoples' experiences

with settler-introduced species and opportunities to promote sustainable, culturally appropriate management through Indigenous inclusion is currently a gap within the literature, but it is worth investigating to understand the cultural impacts of introduced species, especially in the context of environmental change resulting from climate change that will continue to impact aquatic communities globally.

Climate Change

Anthropogenic climate change is a continuation of environmental change brought about by settler colonial political and economic processes; carbon emissions that have polluted the Earth's atmosphere are a product of settler colonial extractive industries and capitalism-driven demand for carbon-based economic expansion (Whyte, 2017). Climate change is poised to exacerbate existing environmental injustice issues that disproportionately affect Black and Indigenous communities, as well as produce racial and socioeconomic disparities as a result of changing environmental conditions. Climate change will have material and political implications on global food security, disproportionately so for Indigenous Peoples that are not responsible for the climate crisis (Satterfield et al., 2017; Tsosie, 2007, 2013).

Indigenous communities have historically been resilient in the face of environmental change, but the climate is changing at such an accelerated rate that it exceeds Indigenous Peoples' adaptive capacities to cope with change in culturally appropriate ways (Colombi, 2012; Whyte, 2017). There is much work being done at the intersection of climate change and Indigenous environmental justice within, and more importantly outside of, academia. The impacts of climate change on Indigenous communities are well represented in the literature and so this section will not be an exhaustive review but rather a brief overview of a few ways climate change will impact Indigenous lands, waters, and communities. Climate change also cannot be

disentangled from the environmental issues such as those previously discussed in this paper; it will exacerbate the spread of novel species as distributions shift, the rate of species extinctions, and the severity of natural disasters as a result of settler colonial infringement on environmental management.

Climate change will and is already changing aquatic ecosystems, including altered temperature regimes, changes in precipitation and flow, and impacts on biodiversity due to the physiological pressures a rapidly changing climate places on species, and increased potency of contaminants (Alava et al., 2017; Prakash, 2021; Rahel et al., 2008). In response to these changing environmental conditions, species physiology, abundance, distributions, and interspecific interactions with other species will be impacted (Wang et al., 2021). This can cause shifts in their distributions to occupy more suitable habitat, making them unavailable to communities that historically depended on them. Changing environmental conditions can place added physiological strain on species, especially when experienced in combination with other anthropogenic stressors. For example, Satterfield et al. (2017) estimated that culturally important species such as Sockeye, Pink, and Chum salmon, clams, and herring, could be negatively affected by climate change or shift their distributions to become inaccessible to the Nigmas First Nation. Another outcome of climate change is sea level rise, which will alter coastal ecologies. Sessile intertidal species such as shellfish can be submerged by rising sea levels and therefore much more difficult for Indigenous harvesters to access (Donatuto et al., 2014).

Indigenous communities have historically been displaced via settler colonial expansionist policies, thus disrupting their relationships with ancestral territories and making traditional resources inaccessible to geographically displaced communities. Climate change will lead to another wave of Indigenous communities being displaced by changing environmental conditions

that make territories uninhabitable. A review by Maldonado et al. (2013) highlighted three different case studies of Indigenous communities facing displacement, but there are many legal and economic barriers for climate-induced migrations, for which there is currently no legal protections. Coastal cities, such as the small communities of Kivalina on the Chukchi Sea and Isle de Jean Charles in Louisiana, face displacement due to sea level rise, erosion, and increased extreme weather events such as hurricanes. Melting permafrost in the arctic is also threatening the infrastructure of communities such as the village of Newtok in Alaska. Indigenous Peoples in the United States have lost millions of acres of land through settler colonial land acquisitions, extractive industries, dams, and now climate change is threatening Indigenous communities' territories that lack the capacity and immense resources required to relocate. The Biden administrations Bipartisan Infrastructure Law and Inflation Reduction Act will assist a small number of Indigenous communities adapt to the impacts of climate change. This includes $25 million grants to the assist the Alaskan villages of Newtok and Napakiak, and Quinault Indian Nation in Washington with relocation (U.S. Department of the Interior, 2022).

Our shared lands and waters are changing at an unprecedented rate. The burden of these changes falls disproportionately into the hands of Indigenous communities that have sustainably stewarded their lands since time immemorial and have not significantly contributed to the input of carbon emissions into our atmosphere. The loss of non-human species, fundamental changes to the ecologies of our lands and waters, and the displacement of Indigenous communities that have been historically marginalized by settler colonial states are just three examples of injustices produced by global climate change. There are many more that are being brought to light by Indigenous scholars, researchers, communities, and environmental activists.

Conclusion

Environmental justice has become an increasingly important and widely relevant topic within the environmental sciences. Since its beginnings in analyzing the inequitable distribution of contaminant exposure in urban Black, Indigenous, Latinx, and immigrant communities, environmental justice has been greatly expanded upon to be more inclusive of other marginalized communities and pressing environmental issues. Indigenous Environmental Justice is one area in which environmental justice has been ever-evolving to critically analyze the ways settler colonialism has re-shaped cultural relationships Indigenous Peoples maintain with their Lands and Waters, non-human or more-than-human relations, and infringed upon Indigenous environmental stewardship. The relationship between settler nations, sovereign Indigenous nations, and our shared environments is complex and diverse across Indigenous communities that have been impacted by settler colonialism for centuries. This makes understanding the long-term historical context of environmental injustice towards Indigenous Peoples vitally important to understand as we work towards creating more just and equitable environmental futures.

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Chapter Two: "Understanding food justice through integrating frameworks of food security, food sovereignty, and cultural sovereignty"

Abstract

Food injustice is an increasingly prevalent problem with the simultaneous growth in global population, global climate change, political conflict, and persisting socioeconomic injustice. International food justice movements have developed two frameworks, food security and food sovereignty, for achieving justice in our global food systems. Academic scholarship has placed these two frameworks in opposition with each other or treated them as isolated models for food justice. However, both frameworks have much to offer, and their treatment in isolation can lead to harmful oversight of important issues. Here I treat food security and food sovereignty as complementary frameworks for achieving food justice on local scales. I also consider cultural sovereignty more broadly to include the cultural and community-level features of food systems that lend themselves to promoting justice. Finally, I use Indigenous foodways of the Columbia River Basin as a case study for integrating food security, food sovereignty, and cultural sovereignty in movements for food justice. The conceptual framework for food justice presented in this paper integrates diverse perspectives, experiences, and strategies for creating food justice; this inclusivity will be necessary in addressing a problem as multi-dimensional and complex as global food justice.

Introduction

Within the food justice literature, food security and food sovereignty have been put forth as two frameworks for understanding food systems. Both frameworks arose independently as movements to address hunger and food justice on a global scale, but are different in their approaches to addressing food insecurity. As defined by the Food and Agriculture Organization

of the United Nations, food security entails adequate availability, access, utilization, and stability of food to meet nutritional needs and preferences to maintain a healthy and active lifestyle (FAO, 2008). Food sovereignty, popularized through peasant movements such as La Via Campesina and other Indigenous movements for food justice, advocates for self-determination by communities in their food systems (Coté, 2016). The Declaration of Nyéléni, which was created during the World Forum for Food Sovereignty in Nyéléni, Mali by 500 delegates representing more than 80 nations, defines food sovereignty as "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems (Nyéléni Village, 2007).

These two fields have been considered mutually exclusive within food justice literature. However, Clapp (2014) argues against the positioning of food security and food sovereignty in opposition with each other because it can lead to harmful omissions of important issues emphasized by either framework. Clapp (2014) further argues that this apparent opposition arises from the assumption that food security must be achieved through neo-liberal, globalized and market food systems, when this is not necessarily the case. This assumption is based on the idea that neoliberal food markets are the most efficient way to achieve food security, when there are alternative foodways operating outside of globalized food markets that are sufficient in meeting the nutritional needs of communities, as has been demonstrated through the food sovereignty movement.

Settler colonialism is the process through which a colonial power establishes itself in a previously occupied territory with the intent of permanent settlement there (Englert, 2020; Veracini, 2019). The acquisition of Indigenous lands in creating a settler state also entails the imposition of settler political, social, and economic processes on Indigenous Peoples (Coulthard,

2014). Settler colonialism has drastically altered traditional Indigenous foodways through assimilative practices and imposition of neoliberal globalized food production (Cidro et al., 2015; Coté, 2016). Yet Indigenous communities have autonomously sustained both food security as well as food sovereignty through self-defined means that can articulate with neo-liberal food systems but are also reliant on traditional foodways that exist outside of globalized trade and market economies.

In the context of Indigenous food systems, food security, food sovereignty, and cultural sovereignty more broadly are vital components of cultural foodways that should not be disentangled. Scholars have proposed conceptual or theoretical models to integrate these concepts, but these have not been consistent in their approach. As described by Via Campesina (1996), food sovereignty is a precursor to food security (Carney, 2012). This counters the equation of food security with globalized neo-liberal food systems that is present within food justice discourse, as this implies food security can be achieved without engaging in food sovereignty (2014). The goal of this paper is not to critique either framework, but rather present a conceptual framework that integrates food security and food sovereignty within an Indigenous cultural sovereignty context.

Integrating food security, food sovereignty, and cultural sovereignty

Settler colonialism eroded Indigenous food sovereignty by suppressing Indigenous self-determination in their foodways. This was accomplished through assimilationist education systems, such as residential or boarding schools, and the imposition of western foodways through the distribution of commodity and non-traditional foods. The displacement of Indigenous communities also inhibited their ability to fish, hunt, gather, and harvest traditional foods (Turner and Turner, 2008; Coté, 2016). Simultaneously, the settler state created conditions

of food insecurity within Indigenous communities through the processes of economic marginalization that interfere with communities' ability to equitably participate in the neo-liberal globalized food systems that have been imposed on them (Sowerwine et al., 2019; Cidro et al., 2015).

The disruption of Indigenous foodways by settler colonialism cannot be addressed through food security or food sovereignty in isolation. The injustices of settler colonial interventions in Indigenous food systems are multi-dimensional, and not generalizable by looking through singular lenses of either food security or food sovereignty. Certain elements of food justice are related to environmental justice, which is understood through the complementary frameworks of distributive justice, procedural justice, and recognitional justice; one without the others is not sufficient in addressing issues of injustice (Taylor, 2014). The joint economic and environmental marginalization of Indigenous communities on reservation systems, and assimilationist policy of settler colonial states, cumulatively impacted the food security and food sovereignty of tribes. Food sovereignty is also situated within broader movements for Indigenous cultural sovereignty that have been intentionally eroded by settler colonialism. As Delormier and Marquis (2018) write:

> Food is profoundly meaningful and significant, and symbolizes the reciprocal caring relationship that Indigenous Peoples hold with the natural world, and that the earth is our mother who provides all that is needed; food is an important part of that relationship. Food is a connection to the specific places and spaces wherein Indigenous Peoples draw their identity. These social, relational, and cultural features of Indigenous societies and food systems remain key to reclaiming food security and food sovereignty today.

Food sovereignty cannot and should not be removed from cultural sovereignty because food is embedded within Indigenous Peoples' cultural identities and relationships. Thus, I

include cultural sovereignty in this conceptual model for understanding food justice within an Indigenous context.

Today approximately 25% of Native Americans experience food insecurity compared to 15% of the general United States population (Feeding America, 2021; Jernigan et al., 2017). Food security offers a framework for understanding the economic marginalization of Indigenous communities and the imposition of neo-liberal food systems. Food insecurity is a major issue in many Native American communities due to the external pressures of settler colonialism. Therefore, it is important to not disregard food security as an important lens through which to understand Indigenous food justice.

Food sovereignty is an integral aspect to cultural sovereignty as they are deeply interrelated. Compared to food security, food sovereignty more explicitly considers the cultural aspects of traditional food systems that have been marginalized through settler colonialism such as community cohesion, knowledge and language transmission, and ceremonial use of traditional resources (Cidro et al., 2015; J. L. Donatuto et al., 2011; Sowerwine et al., 2019). Importantly, food sovereignty and cultural sovereignty move beyond rights-based frameworks of food security to consider cultural relationships supported through traditional food systems. This field of literature also emphasizes the resistance and resurgence efforts of Indigenous communities to push-back against these impacts to restore traditional foodways (Gurney et al., 2015; Turner & Turner, 2007; Whyte, 2017).

The historical context underpinning contemporary Indigenous food systems make disentangling food security and food sovereignty difficult when addressing issues of Indigenous food justice. The above quote by Delormier and Maquis also makes clear that food justice is inherently tied to cultural sovereignty. Here I present a conceptual model that considers all three

frameworks for food justice as complementary, and occurring in synchrony (Figure 1). Metrics and objectives defined through food security, food sovereignty, and community-level cultural sovereignty created through foodways, are all represented. This holistic understanding of food justice can lead to the development of creative and holistic solutions to food insecurity by communities seeking to restore sovereign foodways. As an example, I explore food justice in the Columbia River watershed through this conceptual framework that integrates food security, food sovereignty, and cultural sovereignty to provide a holistic understanding of Indigenous food justice.

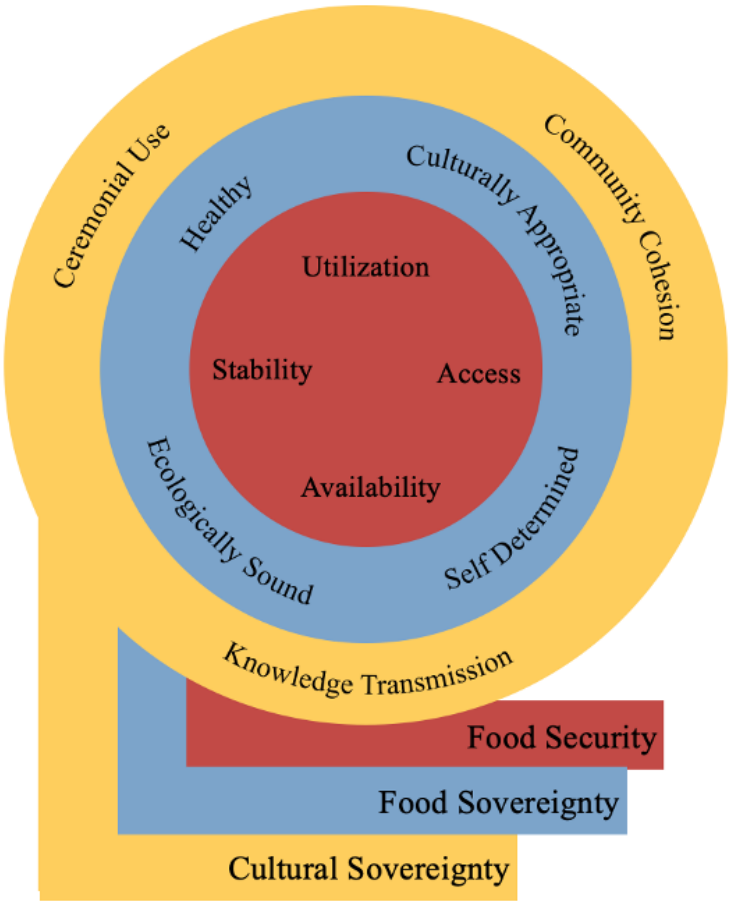

Figure 1: A conceptual framework for how food security, food sovereignty, and cultural sovereignty are interrelated. Food sovereignty and food security are complementary models for food justice. Food justice is inherently nested within the broader framework of cultural sovereignty that recognizes inherent rights of Indigenous communities that extend beyond the externally defined political sovereignty of federally recognized tribes (Coffey & Tsosie, 2001).

Columbia River Basin

Salmon are integral to the cultural identities, ceremonies, economies, and foodways of many Indigenous communities on the west coast of Canada and the United States. It is difficult to convey in words the importance of salmon to Indigenous peoples in this region, who have sustainably managed long-standing, reciprocal relationships with the diverse salmon stocks in Pacific waters since time immemorial (Carothers, 2010; Turner & Turner, 2007). Indigenous Peoples deployed a variety of advanced technologies and innovative tools to selectively harvest salmon to ensure healthy population returns every year, such as fish wheels and weirs. The management of salmon was tightly interrelated to social and political structures, and inter-community economies of the Pacific Northwest (Atlas et al., 2021).

However, these practices and social structures were gravely impacted by settler colonial governance that banned the use of Indigenous harvest practices and managed salmon based on the previously described metrics of maximum sustainable yield (Turner & Turner, 2008). Commercial harvest of salmon also differed from Indigenous harvest practices in that settlers fished salmon in the sea, while Indigenous peoples typically fished inland rivers; this marginalized Indigenous fisheries by disadvantaging their harvests since settlers had access to salmon prior to their migrations to Indigenous fishing grounds (Atlas et al., 2021; Galbreath et al., 2014).

The Columbia River Basin, which stretches across several tribes' lands, multiple states, and British Columbia, is one river system that has been greatly impacted by settler colonial environmental changes. More than 60 dams have been constructed in the Columbia River Watershed, further disrupting the natural structure and flow of the river system. These dams impede up-river migration of adult salmon on the way to their spawning grounds and negatively affect juvenile salmon during their seaward migration (Mattocks et al., 2017). The four Snake

River Dams, for example, impede salmon migrations and make them less accessible to tribal nations situated upriver of the dams (Meyer Resources Inc., 2021). These include the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, the Shoshone-Bannock Tribes, and the Nez Perce Tribe. A 2021 report created for the Columbia River Inter-Tribal Commission estimated that salmon are being harvested at 1% of the pre-contact levels due to the four Snake River dams (Meyer Resources Inc., 2021).

Chief Joseph Dam and Grand Coulee Dam on the Columbia River prohibit salmon passage into the Colville Reservation and Spokane Reservation. Bonneville Dam is the lowermost dam on the Columbia River and while it does allow fish passage through the use of fish ladders, those fish ladders have become a site of conflict between sea lions and migrating salmon; salmon accumulate at the fish ladders and are preyed upon by sea lions, which, due to settler colonial interference in Indigenous sea lion management, are at an all-time high (Schneider, 2013). Predation by sea lions at dams disproportionately impact Indigenous fishers that fish upstream of the dams in comparison to commercial fishers that fish in the ocean (Schneider, 2013).

Food security is a useful framework for understanding the impacts of dams on Indigenous communities that have lost access to traditional resources. The loss of traditional resources impacts Indigenous food security by restricting the accessibility, availability, stability, and utilization of culturally relevant resources, which are the four pillars of food security defined by the FAO (Food and Agriculture Organization, 2008). Salmon was a staple food to several Indigenous communities impacted by the dams, and with the loss of salmon, those communities lost a major source of nutrition and sustenance from their diets (Meyer Resources Inc., 2021). Food security impacts of dams lead to negative health outcomes by increasing Native American

communities' reliance on government assistance and processed foods. As Estes (2019) writes, "The loss of wildlife and plant life and the gardens also had a deleterious health impact. Prior to the dams there was no diabetes. After the dams, diabetes rates soared". The negative health outcomes such as diabetes, high blood pressure, heart disease, etc associated with dams does not meet the criteria for food security outlined by the Food and Agriculture Organization for meeting nutritional needs and preferences to lead a healthy and active lifestyle (Estes, 2019).

Indigenous Peoples' subsistence and ceremonial connections to salmon have been threatened by declines in salmon populations (Norgaard et al., 2011). The interruption of traditional eco-social relationships has led to a loss of traditional knowledge relating to salmon fishing, and disrupted cultural activities such as feasting that build community cohesion (Atlas et al., 2021; Dale & Natcher, 2015). This is exemplified by the flooding of Celilio Falls by the creation of the Dalles Dam. Celilio Falls was an important fishing location where Indigenous Peoples from Washington and Oregon gathered to fish in community, which also made it a vital economic and cultural center in the region as a place to trade, socialize, and harvest fish to support their communities. The reservoir that was created by the Dalles Dam inundated Celilo Falls, flooded tribal fishing platforms, and restricted fishing access for multiple tribes that historically depended on Celilo Falls for its productive fishery, as well as economic and social functions as a gathering site (Grinde & Johansen, 1995; Hibbard, 2006). The loss of culturally significant sites due to dams' altering watersheds can have significant impacts on the transmission of knowledge, such as the cultural skills and activities around fishing. Environmental change can also disrupt the intergenerational transmission of traditional knowledge that becomes less relevant in a changed riverscape, and storytelling (Daigle, 2019; Gagnon & Desbiens, 2018; Pawling, 2017). This loss of knowledge and sites of cultural

significance can impact perceptions of place, identity, and cultural well-being, which contribute to community cohesion (Sowerwine et al., 2019).

Dams impact the food sovereignty of tribes by foreclosing the possibility of self-defined, traditional foodways supported by healthy salmon returns and reciprocal relationships that communities have maintained with their fisheries since time immemorial. As an integral component of cultural identity, the consequences of dams on salmon have directly impacted tribes' cultural identities in ways that extend beyond viewing salmon through the lenses of food security or food sovereignty.

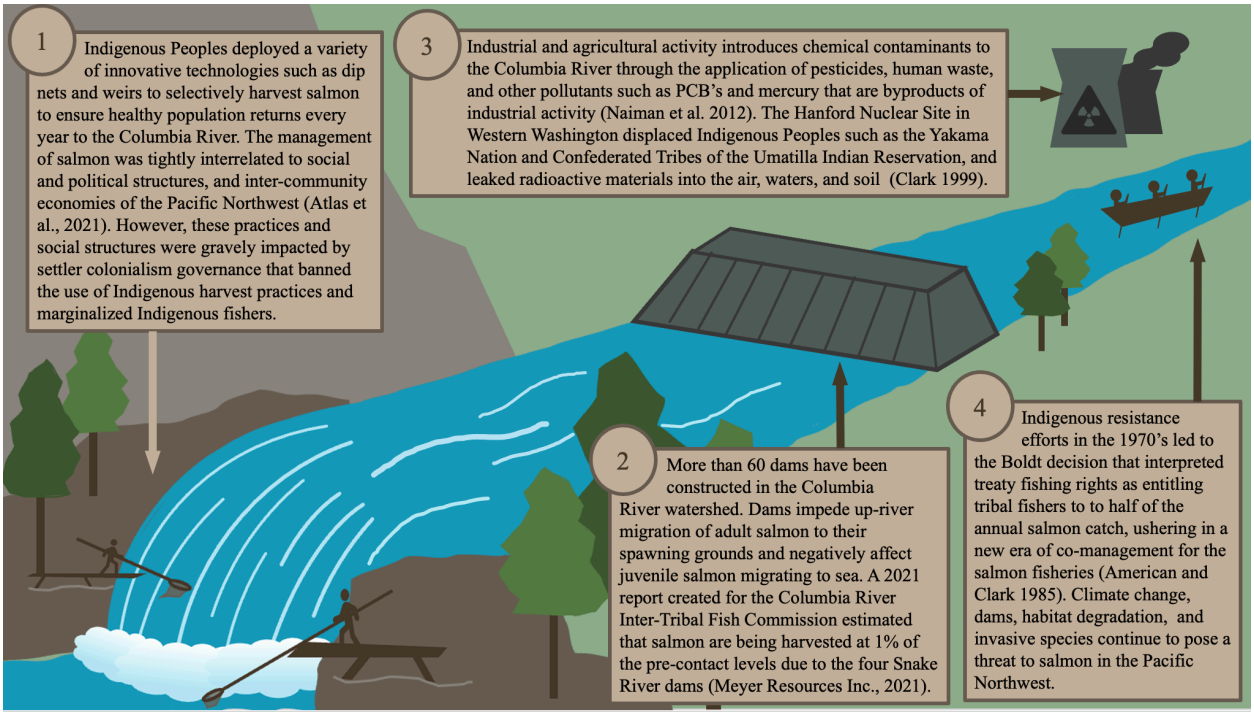

Figure 2: A graphical timeline of settler colonial intervention on the Columbia River showing the transition from traditional Indigenous management regimes to the development of hydroelectric projects, industrial agriculture and nuclear production sites, and settler colonial marginalization of Indigenous fishers, to the present-day era of co-management between commercial and tribal fisheries.

There is a direct linkage between biodiversity and cultural diversity. The extirpation of culturally important species such as salmon limits Indigenous cultural sovereignty by eliminating

the possibility of restoring the cultural relationships communities have with those species (Garibaldi & Turner, 2004). Indigenous languages carry traditional ecological knowledge that is place-based and specific to cultural relationships upheld by its respective community. Indigenous languages' persistence is already threatened by assimilationist colonial processes, and so they are doubly threatened by ecological loss that leads to a loss of traditional knowledge (Wilder et al., 2016). In summary, the loss of language, culture, and biodiversity are interrelated and cannot be disentangled; the impacts of losing culturally important species can be felt in all aspects of Indigenous culture, foodways, identity, and community because it leads to the erosion of food sovereignty and cultural sovereignty, as will be explored in the following case studies.

In addition to the physical changes industrial activity brings to the watershed, it introduces chemical contaminants through the application of pesticides, human waste, and other pollutants such as PCB's and mercury that are byproducts of industrial activity (Naiman et al. 2012). The areas that have been most impacted by contamination in the Columbia River Basin include the Colville, Spokane, Yakama, Kalispel, Umatilla, Shoshone-Bannock, Nez Perce, and other reservations. Another source for contamination in the Columbia River basin is the Hanford Site in western Washington. This site was constructed to assist with the creation of nuclear weapons for the Manhattan Project during World War II. It displaced Indigenous Peoples such as the Yakama Nation and Confederated Tribes of the Umatilla Indian Reservation, which conceded reservation land for the establishment of the Hanford Site, and leaked radioactive materials into the air, waters, and soil of the Columbia River Basin that persist today, further impacting tribes that retained fishing rights on the Columbia River (Clarke, 1999).

The risk contamination poses to the health of Indigenous communities is a direct assault on food security, as it impacts the utilization of food and water resources. Tribal communities not

having access to clean water for drinking, cooking, and cleaning is an issue of water insecurity; likewise, the inability to safely consume fish from polluted rivers creates food insecurity for individuals reliant on subsistence harvest.

The trans-boundary impacts of the Hanford site and other industrial facilities that affect downstream tribal lands is an infringement on tribal food sovereignty. PCB's can accumulate in the tissues of fish and other organisms that when consumed by humans, can harm human health, especially among vulnerable populations such as pregnant women, infants, and elders (Roe, 2003). Decreased health in elders and knowledge carriers due to contaminant exposure is associated with decreased motor function and memory, which can have negative impacts on the intergenerational transmission of knowledge, language, stories, and culture to younger generations (Carroll et al. 2017).

To reduce the risk of negative public health impacts, fisheries experiencing concerning levels of contamination typically undergo closures or advisory warnings to prevent excess consumption of contaminated fish (Varanasi et al., 2021). However, as stated previously, salmon and other fishes play an important cultural and ceremonial role for Indigenous communities in the Columbia River basin beyond simple subsistence, and so fishery closures directly impact Indigenous cultural sovereignty (Donatuto et al., 2011). Oftentimes, these advisories are not culturally sensitive in their definitions of contamination, which to Indigenous Peoples could consider non-physical or spiritual perceptions of contamination, or determining what level of contamination is considered "acceptable", which could contradict communities' perceptions of what is acceptable. To some Indigenous Peoples, the risks of not consuming culturally important food sources outweigh the perceived risks of consuming contaminated resources (Donatuto et al., 2011; Fitzgerald et al., 1996). Inequitable contamination of waterways affects not only

subsistence economies of Indigenous fishers, but also cultural identity and social relationships, which are often not incorporated into health risk assessments.

Facing an ecological and cultural crisis with the simultaneous decline in salmon populations and erosion of Indigenous stewardship, Indigenous communities in the Pacific Northwest resisted settler colonial infringements on treaty-based fishing rights. In the 1970's, fish-ins, modeled after the Civil Rights movement's sit-ins, were used by Indigenous fishers to assert their rights to fish as outlined in the Steven's Treaties. This led to racial tension between Native American and settler fishers and law enforcement, which even resulted in violence (Johnson, 1999; Parham, 2013). The outcome of Indigenous resistance efforts was a series of court cases, and the particularly monumental 1974 "Boldt Decision", that liberally interpreted the Steven's Treaties as entitling half of the annual salmon catch to Indigenous nations in the state of Washington (American & Clark, 1985; Colombi, 2012). The Boldt decision has also been extended to include environmental protection to ensure healthy salmon runs are accessible to tribal nations in accordance with their treaty rights. The series of Boldt decisions ushered in a new era of co-management in the state of Washington, which has become formalized through annual meetings with Indigenous stakeholders to discuss annual allocations of salmon (Brown, 1994). Intertribal agencies such as the Columbia River Inter-Tribal Fish Commission have been established to facilitate tribal inclusion in fisheries management (Galbreath et al., 2014). The assertion of tribal sovereignty through co-management in Washington, as well as other food sovereignty initiatives in other western states and Canadian provinces, to restore Indigenous stewardship over salmon supports community health, ceremony, cultural identity, and economic self-sufficiency (Blanchet et al., 2021).

With the establishment of co-management of salmon in Washington State rose yet another challenge to the persistence of culturally important salmon species—climate change. There is a large degree of uncertainty in how climate change will impact salmon populations due to the complex interplay between climate change's ecological impacts and salmonids' responses to changing conditions (Beechie 2013). Climate change will elevate water temperatures throughout Columbia River Basin, which can thermally stress salmonids that are better adapted for cold-water. A decrease in snowmelt that runs into the Columbia River's tributaries can further elevate summer temperatures, and lead to more intense periods of low-flow in the summers and flooding in the winters (Manuta 2010). There is also the potential for climate change to further exacerbate causes for salmon mortality by altering the Columbia River Basin's aquatic food web dynamics (Wenger et al. 2011). Many of the introduced piscivores in this region are better suited to warm water than salmonids, and so predation pressure introduced species exert on salmonid populations could increase in response to climate change (Sanderson et al, 2009).

The impacts of climate change will further exacerbate issues of food security and tribal food sovereignty that have been discussed previously. Climate change will impact cultural sovereignty by inhibiting the transmission of traditional knowledge; Indigenous knowledge systems are place-based and developed over long periods of time through relating with the environment. While traditional knowledge systems are adaptable to change, the environment is changing too rapidly because of climate change, thus making traditional knowledge systems less applicable under altered environmental conditions (Turner & Clifton, 2009). For example, the time for knowledge and story transmission for Confederated Salish Kootenai Tribes is dictated by seasonal cues, in this case the timing of snowfall. With decreased snowfall due to climate change, the community has had to adapt their protocols to avoid the risk of shortened time

periods in which it would be culturally appropriate to share stories (Chisholm Hatfield et al., 2018). Indigenous Peoples' cultural activities such as ceremony, harvest, and knowledge transmission are not only under threat due to changing seasonality and environmental cues, but also the loss of opportunity to participate in these activities.

Settler colonialism has impacted the food security, food sovereignty, and cultural sovereignty of Columbia River Basin tribes. However, tribes are and have always been at the forefront of advocating for their tribal sovereignty and treaty rights to fish salmon in the Columbia River Basin as they had since time immemorial. Several efforts to restore sovereign foodways and reciprocal relationships with their traditional animals and foods are underway, including advocating for the removal of the Snake River dams. The salmon fisheries and cultural sovereignty of the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, the Shoshone-Bannock Tribes, and the Nez Perce Tribe have been gravely impacted by the four Snake River dams; their removal could restore tribal sovereignty and food sovereignty by increasing salmon returns to their traditional spawning areas upriver of the dams.

Similar movements for restoring cultural sovereignty and food justice have been successful in the state of Washington, including the removal of Elwha River Dams. Constructed over one hundred years ago, the Elwha Dams blocked up-river salmon migration to the Lower Elwha Klallam Tribe's usual and accustomed fishing grounds. The reservoir that formed behind the Elwha Dam also drowned the Lower Elwha Klallam Tribe's creation site, which is an important ceremonial and cultural site that is the physical representation of the tribe's relationship to the Elwha River (Fox et al., 2022). The Lower Elwha Klallam Tribe successfully advocated for the removal of two Elwha River Dams that were removed in the 2010's; the long-term restoration efforts for the Elwha River ecosystem have directly engaged with the tribe in an

effort to restore tribal food sovereignty and cultural sovereignty through re-building traditional relationships with the river that had been not lost, but temporarily disrupted by the dams (Mauer, 2021). The fall of 2023 saw the return of a small subsistence and ceremonial fishery for the Lower Elwha Klallam Tribe, which allowed tribal members to harvest 400 coho salmon.

This example of food justice from the Lower Elwha Klallam Tribe is a promising example of what opportunities are made available by viewing Indigenous food justice through culturally appropriate frameworks that holistically integrate food security, food sovereignty, and cultural sovereignty. The Columbia River Basin tribes have ancestral ties to their lands and waters that will be revived through food justice movements and the expression of Indigenous sovereignty. Columbia River salmon are inherently important to the cultural sovereignty of Columbia River Basin tribes; the movement to see salmon return home is at its heart a movement for food justice, but it cannot be removed from the tribes' movements for cultural sovereignty because of the deep cultural connections that exist between Indigenous communities and their ancestral Lands, Waters, plant, and animal relations.

Conclusion

Food security and food sovereignty have commonly been discussed as two distinct approaches to achieving food justice; however, the treatment of food security and sovereignty as being in opposition with each other is not productive because it can lead to oversights of the important justice and equity issues highlighted by one or the other. Pursuing food justice through food security or food sovereignty in isolation closes the door to potential opportunities for Indigenous food systems that have been impacted by settler colonial processes in a multitude of ways. The diversity of Indigenous communities, including the diversity of tribal nations each with their own current and envisioned foodways, and the diversity across reservation, rural, and

urban Indigenous communities, means that one framework acting in isolation will not meet the requirements of each community seeking food justice. I have proposed a layered understanding of food justice as requiring both food security, food sovereignty, and broader conceptions of cultural sovereignty to create conditions for food justice at individual and community levels. This framing of food justice could lead to creative solutions that integrate existing frameworks for food security, food sovereignty, and cultural sovereignty, thus building community resilience through equitable and culturally appropriate food systems.

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Chapter Three: "Building a framework for cultural-ecological resilience through food justice"

Abstract

Resilience within social and ecological contexts has consistently been defined as a product of the external forces acting on a system. This definition is insufficient to describe the forces of systemic racism, injustice, and inequitable power dynamics that are often at play within systems. This paper seeks to expand upon previous frameworks of resilience that have come out of social-ecological systems thinking. It has three major goals: 1) to provide a definition for resilience based on community agency rather than passive acceptance of external disturbances, 2) to address questions of power and injustice within a settler colonial system, and 3) of cultural systems is built upon the maintenance of relationships, defined broadly to include social and environmental relationships that have been upheld by Indigenous Peoples since time immemorial. By broadening our understanding of resilience, this paper seeks to better link social-ecological systems thinking with thought and practice being produced by Indigenous scholars and Indigenous Peoples. As a case study, this paper develops a framework for cultural-ecological resilience to apply these concepts to sovereign food systems.

Introduction

Western science has only recently begun to theorize what Indigenous Peoples have known since time immemorial—natural and social systems are tightly interwoven through complex interactions and feedback loops (Chisholm Hatfield et al. 2018, Liu et al. 2007, Schoon & Van Der Leeuw 2015). Social-ecological systems thinking has emerged as an interdisciplinary approach to understand the ways in which social systems and their environments interact, and the resulting levels of sustainability and resilience of these linked systems. This framework has

proven useful as the basis of social-ecological systems thinking in a Western context, but it does not adequately explain cultural-ecological systems such as environmental relationships stewarded by Indigenous communities globally.

Where many social-ecological systems frameworks fall short is in their consideration of governance, which does not include discussion of sovereignty and the plurality of governance systems that interact within settler states, or address questions around power, justice, and equity (Fabyini et al. 2014). Second, many of these frameworks draw a clear line of distinction between social and ecological systems with less attention paid to bi-directional interactions between the two (Binder et al. 2013). For example, Ostrom's (2009) widely cited framework divides social-ecological system characteristics into resource users (humans), resource units (individual resources), and the resource system (the environment in which these other components are situated). This framework radically transformed thinking about environmental governance by stressing the importance of social systems and their links to ecology. Nevertheless, it still represents an anthropocentric view based on the separation of humans and nature that social-ecological systems thinking seeks to eliminate (Cote & Nightingale 2012, Fabinyi et al. 2014). The dualistic thinking in which Ostrom's framework and other social-ecological system frameworks are situated also does not provide a comprehensive way to include cultural and spiritual dimensions of peoples' relationships with their environment and non-human entities that hold non-utilitarian relationships with people beyond being resources. Specifically, this social-ecological system framework only emphasizes one side of human-nature interactions, in which humans benefit from services nature provides, and does not account for the responsibilities and reciprocal relationships Indigenous Peoples maintain with their Lands (Hessami et al. 2021, Martinez et al. 2023).

Resilience is another characteristic of social-ecological systems that has been paid much attention in the literature. First understood in ecological theory as the ability of systems to absorb disturbance and maintain stable equilibria (Holling 1973), resilience theories have evolved to fit within social-ecological systems thinking. This integration of social and ecological theories of resilience is difficult, however, from a western perspective that is deeply rooted in nature-culture dualistic thinking that is not compatible with differing worldviews. Many studies that rely on Ostrom's or other SES frameworks to examine a system's resilience incorporate quantitative measurements of ecological resilience with only minimal inclusion of social resilience, which is often reduced to socioeconomic variables (Carpenter et al. 2001, Cretney 2014, Masselink and Lazarus 2019, Arnaiz-Schmitz et al. 2023). In these frameworks, there is little place for cultural relationships with the ecosystem, spiritual relationships, or other non-tangible features of social systems that are important to building resilience. Cinner & Barnes (2019) identify six factors in social resilience: agency in decision making, assets people can draw on, flexibility, the ability to organize and act collectively, learning to recognize and respond to change, and socio-cognitive constructs that inform perceptions, biases, and behavior. However, there is still a lack of integration of social and ecological resilience because variables that have been used to link social and ecological systems, such as harvest levels, socioeconomic variables, and production metrics, are only measurements of how humans interact with natural resources in a utilitarian way.

Social scientists have also critiqued this definition of resilience and have poignantly noted that the question of "resilience of what and for whom?" is rarely given serious consideration (Cote & Nightingale 2012). One framework that has been proposed to address the shortcomings of the resilience concept is the Vulnerability Framework, which seeks to analyze vulnerabilities to environmental change. A shortcoming of this framework is that it emphasizes

communities' deficits by defining resilience through vulnerabilities, and its approach to vulnerability analysis does not easily allow for the inclusion of non-measurable attributes of communities that may be disturbed by change, such as culture and spirituality (Bryant et al. 2021). Another short-coming of the Vulnerability Framework and others like it is that it is rarely grounded in historical context, meaning the long-term effects of settler colonialism and oppression are not considered in the analysis of a communities' vulnerability or resilience. Therefore, they are most often used in short-term disaster response or preparedness (Cretney 2014). As a result, the time scale for social-ecological resilience as it is currently defined in social-ecological systems literature is not suitable for Indigenous communities that have experienced chronic disturbance because of settler colonialism and occupy unique political positions within the settler state that places constraints on the sovereignty of tribal nations. Developing one-size-fits-all frameworks does not promote inclusivity in academic research on social-ecological systems that are inherently diverse. Generalized frameworks that do not interrogate questions of power and equity also do not contextualize resilience within systems that contend with power imbalances or injustices that disproportionately impact certain groups more than others.

Here, I present cultural-ecological resilience as a more appropriate lens through which interrelationships between cultural groups and their environments can be better represented. "Cultural-ecological resilience" has been used elsewhere in the context of Indigenous traditional ecological knowledge (Lyver et al. 2009, Persaud 2022), but has not gained momentum within social-ecological systems thinking. It is not well-defined as a framework thus far, but cultural-ecological resilience offers the opportunity to broaden our understanding of societal interactions with nature in non-utilitarian relationships that cannot be captured through political or economic

measures. The key features of cultural-ecological resilience that I will explore in this paper are conceptions of cultural sovereignty that expand beyond externally defined political sovereignty to include cultural rights and responsibilities, holistic views on health and wellness that integrates individuals, communities, and nature, and intergenerational sustainability. These characteristics address many of the aforementioned critiques of existing resilience frameworks and situates cultural resilience within the historical context of settler colonial and environmental injustice. The focus of this paper will be Indigenous communities within the United States, but could be relevant to Indigenous Peoples globally, as well as other communities that maintain cultural connections with the environment, including Black communities and other cultural groups that experience systemic racism within settler states.

Defining Sovereign Food Systems

Food systems are an ideal social-ecological system to conceptualize cultural-ecological resilience. Food is deeply embedded in environmental relationships, and yet industrialized food systems and environmental injustice has disrupted these environmental relationships, thus creating disturbance within cultural food systems. When thinking about resilient food systems, it is important to contextualize the history of those systems as the past, present, and desired future of those systems will vary greatly. Resilient to what and for whom? This discussion will focus on food systems of sovereign Indigenous nations that have been fundamentally transformed through the external influences of settler colonialism and environmental change. In this section I will define the concepts and histories of food security, food sovereignty and cultural sovereignty, which play key roles in the concept of cultural-ecological resilience.

Indigenous communities experience the highest rates of food insecurity and water insecurity in the United States and Canada (Cidro et al. 2015, Coté 2016). Characteristics of food

security are identified by the Food and Agriculture Organization of the United Nations as availability, access, utilization, and stability (Food and Agriculture Organization 2008). These terms mean food sources must be stable and available, accessible to consumers, and safe to meet nutritional needs through its use. However, the disruption of Indigenous foodways cannot be fully understood through these pillars of food security because of its utilitarian, one-dimensional view of food systems (Cidro et al., 2015 Sowerwine et al. 2019). Settler colonialism has imposed political and economic structures on Indigenous communities, disrupting food systems that had traditionally been based on interactions of reciprocity and traditional modes of environmental stewardship (Chisholm Hatfield et al. 2018). Simultaneously, assimilationist polices of the settler state, such as boarding schools, imposed Western ways of being and suppressed Indigenous languages, spirituality, knowledge systems, and cultures (Adams 1995). This led to a loss of traditional ecological knowledge and embodied practice of harvesting and preparing traditional foods, greatly impacting Indigenous communities' resilience and capacity to self-determine their own cultural foodways (Atlas et al. 2021, Turner & Turner 2007). Although food security is a critical component of settler colonialism's impact on Indigenous communities, it does not fully consider tribal sovereignty and the right to self-determine food systems.

Food sovereignty and cultural sovereignty move beyond externally defined rights-based frameworks of food security to consider cultural relationships supported through traditional food systems (Coffey & Tsosie 2001). The Declaration of Nyéléni, which was composed by a group of 500 delegates representing more than 80 nations at the World Forum for Food Sovereignty in Nyéléni, Mali, defines food sovereignty as "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Nyéléni Village 2007). Food sovereignty

frameworks provide a path towards Indigenous self-determination through their recognition of injustices produced through settler colonial suppression of traditional food systems (Whyte 2015). Food sovereignty also addresses the multi-dimensional components of food systems and wellbeing that are not included through food security frameworks, such as community building, social cohesion, knowledge transmission, storytelling, songs, and spirituality that are supported through sovereign Indigenous food systems and lend themselves to social-ecological resilience (Blanchet et al., 2021, Miltenburg et al. 2022, Phillipps et al. 2021, Todd 2014).

Cultural sovereignty in the ways it relates to Indigenous food systems provides a greater, holistic understanding of individual, community, and cultural health to address the health disparities that have resulted from neoliberal food systems (Blanchet et al. 2021, Wittman 2011). While cultural sovereignty is a colossal topic that will vary between communities and contexts, I have represented cultural sovereignty here through features of community wellness as defined by Donatuto et al. (2011). This framework of community wellness is linked to the cultural aspects of traditional food systems that have been marginalized through settler colonialism such as community cohesion, knowledge and language transmission, and ceremonial use of traditional resources (Cidro et al. 2015, Donatuto et al. 2011, Sowerwine et al. 2019). These aspects of community wellness are important for building intergenerational community resilience and promoting Indigenous resurgence.

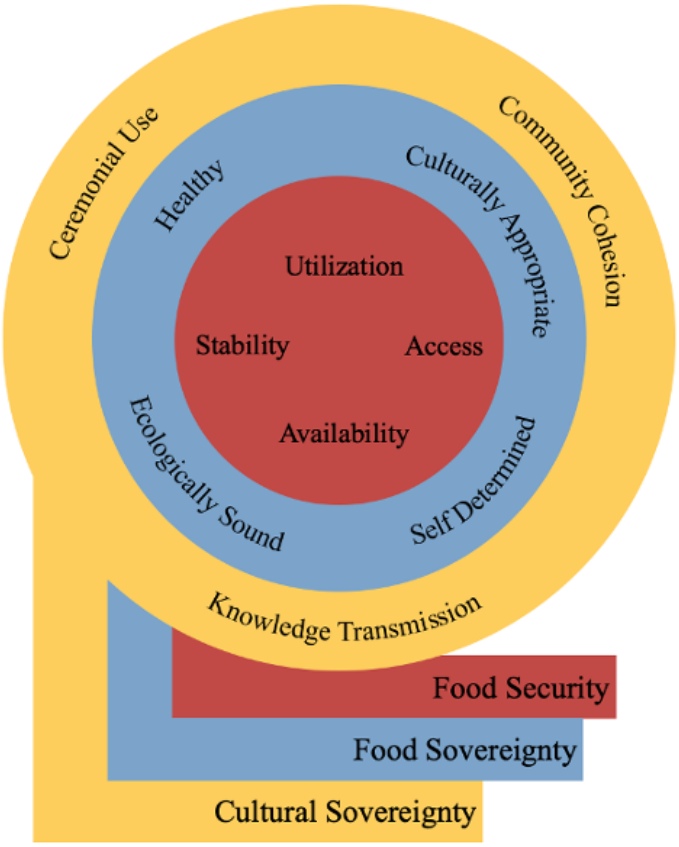

Figure 1. *Building cultural and sovereign food systems. The tenets of food security, food sovereignty, and cultural sovereignty are depicted above in the concentric circles. The realization of outer layers of the circle depends on the food system features within the inner circles. Taken together, these terms are essential components of cultural-ecological resilience.*

Linking cultural-ecological resilience to sovereign food systems

Resilient and sovereign Indigenous food systems are about more than simply access to food or returning to a pre-colonial state. Resilience involves the revitalization of culturally appropriate foodways, languages, and ceremonies within contemporary contexts. Tradition is not a "stable state"—cultures and traditions are dynamic and in a constant state of change. Rather, resilience demands the resurgence, or revival, of self-defined environmental relationships and responsibilities. As depicted in figure 2, there are layers of food system features that build upon each other to form sovereign food systems that honor the multi-dimensionality of cultural

foodways; as Indigenous sovereignty over food systems and environmental relationships expand outwards, each new layer lends itself to the expansion of social-ecological resilience (Figure 2).

Sovereign food systems and the social-ecological systems they are entwined in are also grounded in the specific historical context of the tribal nation, or social group, that holds cultural relationships with their environments. Therefore, the vulnerabilities and resiliencies of diverse communities within the United States and globally, will vary depending on the historical context in which they are situated, and the unique environmental relationships maintained by individual communities (Bargh 2020). For example, external recognition of tribal sovereignty by the United States' governments will vary between federally recognized tribes, state recognized tribes, and unrecognized tribes; therefore, the resources made available to Indigenous communities and the rights that are upheld by these external governance systems will also vary. This impacts communities' adaptive capacities to use the resources available to them to respond to environmental change while still maintaining their livelihoods, food systems, and cultures. Indigenous Peoples' historical experiences with displacement from their traditional lands, and current land tenure regimes pose another constraint to the cultural-ecological resilience of Indigenous food systems, but not necessarily a limitation.

Additionally, certain communities, such as those in the Arctic and low-lying coastal lands, are disproportionately exposed to the impacts of climate change, which places greater pressure on the cultural-ecological resilience of those cultural systems (Bethel et al. 2022, Panikkar & Lemmond 2020). Melting permafrost and sea-level rise threaten the infrastructure of coastal Alaska Native villages such as Newtok and Nepakiak, and could force communities to relocate. Changing sea ice patterns pose another threat to Alaska Native food systems, as it alters navigation routes, reduces hunting opportunities, and can make travel more dangerous. This can

lead to a loss of traditional knowledge, disrupt cultural practices related to hunting and harvesting traditional foods, and food insecurity (Romero et al. 2018). The resilience of these cultural-ecological systems is dependent upon the capacity of the communities to adapt to change, and their autonomy to engage political and economic sovereignty, and traditional ecological knowledge in responding to these joint ecological and cultural changes.

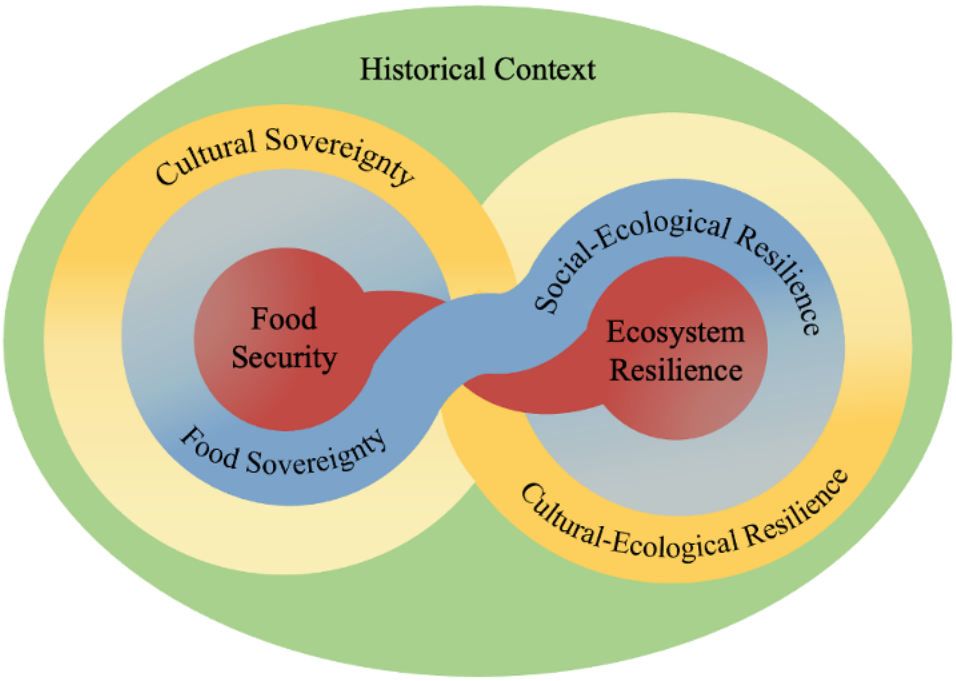

Figure 2. A conceptual framework for considering social-ecological resilience in sovereign food systems. The goal of thinking about resilience in developing sovereign food systems using this framework is to reframe resilience not as something that is an acute product of external disruptors, but as an inherent trait of communities that lends itself to healing and reviving social-ecological relationships that have been disrupted by long-term historical processes.

In linking the layered definitions of social-ecological resilience and cultural sovereignty in the context of foodways, I have developed the following three components of cultural-ecological resilience corresponding to the layers depicted in figure 2: 1) food system stability, 2) adaptive capacity, and 3) community resilience. The features of each component of cultural-ecological resilience are listed in Figure 3 and will be explored in greater detail in the following sections.

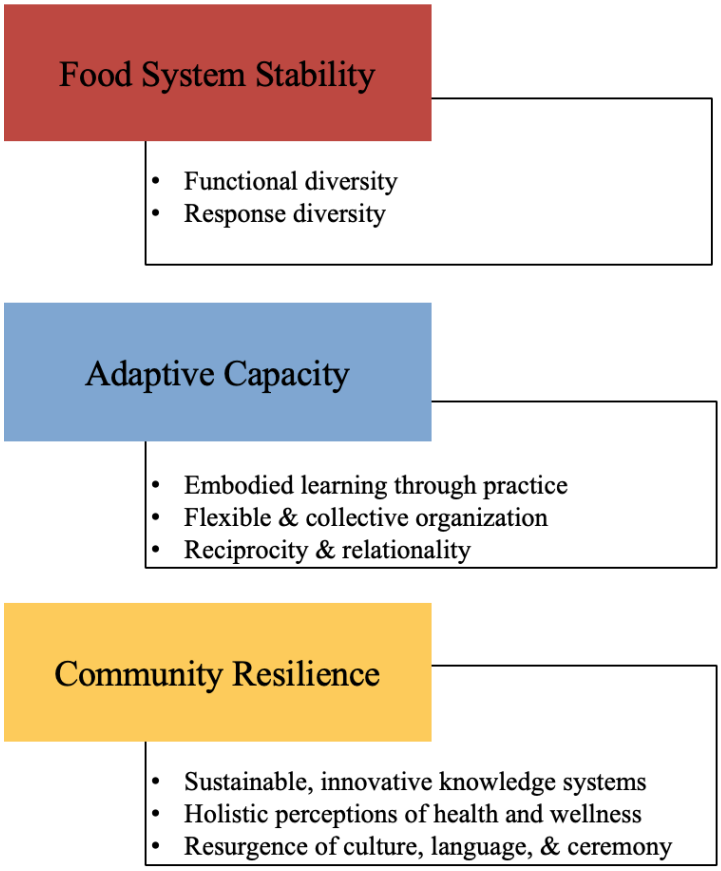

Figure 3. *Applying Cultural-Ecological Resilience to sovereign food systems.*

Food System Stability

The pillars of food security as defined by the FAO are stability, access, availability, and utilization. The resilience of food systems under this framing is dependent on ecosystem stability in the face of perturbation; food sources must be available for consumption, accessible to consumers, meet nutritional needs through "utilizing" food, and stable at all times. In a neo-liberal globalized food system, features such as supply chain length and fragility are key determinants of food system resilience (Toth et al. 2016). System features that lend themselves to ecosystem and food system stability are functional diversity and response diversity (Figure 3; Hodbod & Eakin 2015). Heterogeneity and species diversity can support ecosystem stability by

creating multiple equilibria a system can maintain within its stable state (Hodbod and Eakin 2015). The same is true for food systems. Functional diversity entails food systems that are dependent on diverse food sources, and therefore are able to restructure themselves in response to acute disturbances to maintain food security. The possible pathways for systems to restructure themselves is response diversity. Simply put, stable food systems require complexity and flexibility to restructure themselves in the wake of disturbance.

Indigenous communities' food security is often made vulnerable by the historical context of settler colonialism disrupting environmental and social relationships. Economic disparities on rural reservations can lead to communities lacking access to nutritious and affordable foods, and environmental contamination from extractive industries can make water unsafe to drink (McGinnis & Davis 2001, Tanana et al. 2021). One such example is the Navajo Nation, where excessive water diversions, poor groundwater quality, and contamination from abandoned uranium, copper, and gold mines, have led to many communities not having access to a safe and reliable source of drinking water (Chief et al. 2016). Enhancing the functional diversity and response diversity of food systems by addressing the pillars of food security defined by the FAO within Indigenous communities can build resilience to future disturbances such as climate change or natural disasters.

Adaptive Capacity

One limitation to this framing of resilience, however, is that it does not include desirability or agency in self-defining food systems within the power dynamics of a settler state like the United States or Canada. For example, industrial agricultural fields could be maintained as a stable environment that meets a community's nutritional needs, but that may not be a traditional or desired food source or mode of food production. Traditional agricultural practices may provide more culturally grounded and ecologically sustainable food production methods that enhance community resilience. For example, the Three Sisters method of growing corn, beans, and squash together has ecological benefits for the soil, nutritional benefits in their complementary nutrient profiles, and is a culturally appropriate method for growing crops within many Indigenous communities (Kapayou et al. 2023, Kimmerer 2013).

Food sovereignty and social resilience can be reframed to account for the cultural rights of tribes to self-determine their own food systems and self-define what sustainability means within the context of their community. The previously identified characteristics of social resilience were learning, self-organization, and flexibility (Cinner & Barnes, 2019). These can be reframed to account for the unique political and cultural relationships Indigenous Peoples have with their traditional lands and food sources that carry multi-dimensional meanings beyond basic nutrition. Indigenous communities' adaptive capacity to maintain resilient and sovereign food systems is dependent on the following: 1) embodied learning through practice, 2) flexible and collective social organization, and 3) reciprocity.

Embodied Learning through Practice

Neoliberal food systems have disconnected communities from the foods that they eat. Food sovereignty is a rejection of that disconnection and strengthens physical connection to

foods through traditional harvesting, gathering, and planting practices. This embodied learning through practice and relating to the physical environment is an asset that enhances the resilience of a community and its foodways. Non-industrial food systems that are sustained through culturally relevant harvest practices are important for building cultural identity, and sustainable in that many traditional harvest practices are selective and adaptive to environmental conditions, which enhances ecosystem resilience (Atlas et al. 2021, Kishigami 2021, Mathews & Turner 2017).

Flexible and Collective Self-Organization

Collective self-organization also builds community resilience by providing the tools needed to coordinate food systems across spatial and temporal scales within a community and develop a food system that meets the needs and desires of community members (Gautam et al., 2013). Indigenous communities' adaptive capacities are often limited by economic, legal, and environmental constraints; flexibility and creativity to identify solutions to overcome those institutional barriers builds the resilience of food sovereignty movements (Colombi 2012, Gautam et al. 2013).

Reciprocity and Relationality

Finally, I have added reciprocity to this list. Indigenous Peoples have maintained sustainable and reciprocal relationships with their traditional lands since time immemorial (Atlas et al. 2021, Gauvreau et al. 2017, Mathews & Turner 2017). Upholding relationships and responsibilities to the natural world is an important aspect of cultural and community identity. Miltenburg identifies relationality, reciprocity, and responsibility as core tenets of Indigenous Food Sovereignty because they actively connect people to the land and foodways (2022). Through reciprocity and relationality, Indigenous foodways are stewarded through bi-directional

interactions between human and ecological systems with both receiving benefits through their reciprocal care for each other. Thus, the foundation of Indigenous Food Sovereignty is the resurgence of these reciprocal relationships that build ecological resilience and community resilience.

Community Resilience

Resilience is intergenerational, which I have attempted to capture through features of cultural sovereignty (figure 2): knowledge transmission, ceremonial use, and community cohesion (Donatuto et al. 2011). These characteristics lend themselves to intergenerational relationships within a cultural-ecological system that build long-term sustainability and resilience to disruption. They are features of resilience. Community resilience is the inherent ability of Indigenous Peoples, or any community, to maintain their cultural, ceremonial, and spiritual traditions despite chronic upheaval by settler colonialism. Community here is defined broadly to incorporate the intertwined societal and ecological relationships maintained through the survivance of cultural food systems. It is difficult to distill centuries of resilience down to a few general features that uphold cultural-ecological resilience. Three aspects of community resilience that I have identified are 1) sustainable and innovative knowledge systems, 2) holistic understandings of health across individual and community scales, and 3) resurgence of cultural practices, language, and ceremony.

Sustainable and innovative knowledge systems

Knowledge transmission lends itself to cultural-ecological resilience when it is sustainable across multiple generations and innovative; this builds situated resilience that is relevant to local contexts and is responsive to change rather than reactive (Raymond-Yakoubian et al. 2017). Revitalizing pathways of intergenerational knowledge transmission that have been

impacted by settler colonial assimilationist processes is important to building cultural resilience (Donatuto et al. 2011, Turner & Turner 2008).

Holistic Perceptions of Health and Wellness

Social-ecological resilience frameworks have many shortcomings in understanding resilience within a cultural context because they frame "health" through quantitative metrics of primarily physical or mental health. Many communities may define physical and mental health differently than western perceptions of health, such as through spiritual, community, or cultural measures of health. Ecological health indicators used by western scientists such as contaminant concentration may not be culturally relevant or appropriate either (Roe 2003). For example, pollutant levels deemed "safe" by western scientists might not be acceptable to Indigenous communities. On the other hand, pollutant levels deemed "unsafe" for consuming foods such as shellfish might not be culturally appropriate to communities that consider the spiritual or emotional wellness benefits of consuming those foods to be more important than the risk to physical health that may occur (Satterfield et al. 2017). Diverse communities have their own perceptions of what "healthy" means to individuals, communities, and the ecosystems they engage with, and so taking an individualized and integrated approach to measuring health in culturally relevant ways is important for understanding cultural-ecological resilience.

Resurgence of Culture, Language, and Ceremony

Finally, resurgence of Indigenous languages, cultures, ceremonies is another feature of Indigenous Resilience that lends itself to cultural-ecosystem resilience. Indigenous cultures, ceremonies, and languages were gravely impacted by settler colonial forces that sought to eliminate them. Therefore, their resurgence would build cultural resilience that had been upended by the social changes brought about by settler colonialism. These features of community

resilience lend themselves to ecological resilience through the ways in which they interconnect Indigenous cultural systems to ecological systems through culturally specific and sustainable interactions. Efforts to restore Indigenous cultural stewardship have led to increased ecosystem resilience that are complementary to the benefits Indigenous communities experience through cultural resurgence (Copes-Gerbitz et al. 2021, Kealiikanakaoleohaililani & Giardina 2016, Mathews & Turner 2017, Wilder et al. 2016). Through the resurgence of language, culture, and ceremony, Indigenous communities can build cultural-ecological resilience by reclaiming traditional knowledge and ways of being that exist outside of western contexts described by interactions such as those quantified by Ostrom's framework.

Conclusion

Resilience is a concept inherently understood by Indigenous communities whose lifeways have been fundamentally disrupted by settler colonialism. This strongly applies to Black communities and other communities that have been affected by the structures of settler colonialism. Resilience definitions provided by social-ecological systems thinking do not match the conceptualization of resilience that is held by communities and activists that engage in resilience work. Social-ecological systems define resilience based on how much disturbance a system can withstand before it reaches a critical threshold, or a tipping point. This deficit-based framework frames resilience as a product of external drivers influencing a system. It does not frame resilience as a feature coming from within the agency of actors within a system to self-define desirable social-ecological relationships that adapt with change. Simultaneous environmental and social catastrophes have already upended tribal communities' social-ecological relationships. When viewed from through a traditional SES lens, tribal communities have been pushed to their limits. Yet, these communities remain resilient, because resilience comes from within the community, emerging from qualities that traditional SES frameworks

have been blind to. In practice, tribal community resilience in the wake of large-scale disturbance brought about by settler colonialism has not been centered on absorbing disturbance, but rather re-building, reviving, and resurgence. What opportunities does this framing of resilience open in community-centered work? It is my belief that this framing of resilience makes it imperative for researchers to situate their research in a community and its specific historical context. Applying this framework to food systems will require researchers to interrogate the specific needs and desires of individual communities that already understand their own conception of what resilience means and are in the process of resisting the enduring impacts of political, economic, social, and environmental injustice. This process will look different for each community, and there is no one-size fits all solution. Rather, this framework connects broad themes that are commonly pertinent to sovereign nations that maintain unique cultural, environmental, and political relationships within a settler state.

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