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Soft adaptation: The role of social capital in building resilient agricultural landscapes

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The resilience of agricultural production is perpetually challenged by a wide range of disturbances from the impacts of climate change, to political instability and urbanization. At the same time, agriculture production also depends on relatively stable socio-ecological conditions to ensure quality and yield. Understanding how producers in agricultural landscapes can increase adaptive capacity, and remain resilient in the face of these challenges has become a priority for farmers, for researchers and national political agendas on a global scale. The current state of knowledge on adaptation tends to focus overwhelmingly on "hard" adaptation, such as infrastructure and technological inputs, rather than "softer" strategies, such as agroecological management or social capital, which are less easily measured. This research aims to explore soft strategies for adaptive capacity, in particular, the effect of social capital on the adaptive capacity of agricultural systems, using a case study of the agricultural landscape in the Okanagan Bioregion. The findings suggest that soft adaptation is a vital strategy for cultivating agricultural resilience, and underpins the ability of producers to use other soft and hard adaptation strategies. Participants in this research highlighted the importance of social connection, networks, reciprocity, learning and knowledge transferral, as key tools used to increase their adaptive capacity. They also highlight social capital as a building block for other forms of capital, such as financial, physical and environmental capitals. Despite this importance of soft adaptation, participants also indicated that they would be more likely to focus on implementing "harder" strategies that respond more directly and tangibly to key disturbances, rather than "soft" strategies. These results suggest a contradiction between the importance and value that producers place on social capital and "soft" adaptation, and the strategies they actually plan to implement. Further research is required to understand this contradiction, and to explore how to communicate the value of "soft" adaptation to producers in a way that makes the benefits more concrete and observable, and allows them to capitalize on the currency of connection.

KEYWORDS

resilience, social capital, soft adaptation, adaptive capacity, Okanagan

Introduction

Agricultural landscapes are pressured by a variety of changes to socio-ecological conditions, such as the impacts of climate change, destabilizing ecosystems, and biodiversity loss (Adger et al., 2013; Petersen-Rockney et al., 2021). Most recently, political instability, an accelerated competition for land and water resources brought on by increasing urbanization, and a series of global human health crises, have intensified long standing issues such as succession planning and supply chain disruptions (Howden et al., 2007; Young et al., 2010; Jamir et al., 2013; Anderson et al., 2019). Given the range of disturbances that destabilize agriculture, and the relatively stable socio-ecological conditions required to ensure quality and yield, agricultural systems have become acutely vulnerable, requiring flexible and adaptive management strategies to manage change and uncertainty (Nelson et al., 2010). Studies that examine the adaptive capacity of socio-ecological systems in the face of disturbance, particularly disturbances caused by climate change, focus overwhelmingly on "hard" adaptation, such as infrastructure and technological inputs (Marshall, 2010; Kenny, 2011). A reliance on hard adaptation often comes at the expense of "softer" strategies, such as agroecological management or the facilitation of social capital, further impeding socio-ecological resilience, given the importance of soft adaptation in building resilient systems (Jones et al., 2007; Cutter, 2016).

The aim of this research is to explore soft strategies for adaptive capacity, in particular, the effect of social capital on the adaptive capacity of agricultural systems. We will demystify the "softer" side of adaptation and resilience and identify the adaptation strategies that farmers can employ to leverage social capital and increase socio-ecological resilience. Socio-ecological resilience of agricultural landscapes is conceptualized as the ability of an agricultural system and its components to prepare, adjust, innovate or transform in the face of disturbance (O'Brien et al., 2012). In this research, the landscape of production is understood to be the collective of producers, their production activities, and the landscape itself, all of which are key to promoting resilient local food systems. Socio-ecological resilience requires producers to access and leverage social, human, ecological, physical and economic capital, to buffer, absorb or adjust to changing circumstances (Howden et al., 2007; Obrist et al., 2010; Cradock-Henry et al., 2020). Several studies have suggested that social capital, defined as the "features of social life – networks, norms, and trust – that enable participants to act together more effectively to pursue shared objectives" (Putnam, 1995, p. 664-665.), is vital for the development and success of small scale agricultural systems (Glowacki-Dudka et al., 2013; Bauermeister, 2016). Small scale producers rely on their social networks, a key indicator of social capital (Ifejika Speranza et al., 2014), for mutual support and resources, and meaningful places in agricultural systems, such as farmers' markets, facilitate these valuable connections (Schupp, 2017). While social networks are important for producer success, little is known about how the adaptive capacity of agricultural systems, and producers, are affected by social capital.

Literature review

Disturbance, vulnerability and adaptation in agricultural landscapes

Harmful disturbances can be categorized as either shocks or stressors, reflecting both their temporal scale and magnitude of influence. Shocks are acute drivers of change which occur suddenly and can threaten or cause an involuntary regime shift (Abel et al., 2016). To illustrate, earthquakes occur suddenly, with low duration but high magnitude of influence that often trigger "disasters" where the ability of the system to absorb the shock is breached, and the function of the system becomes dysfunctional under the new conditions. Correspondingly, stressors imply the opposite. They characterize chronic disruptions, such as climate change, which occur over long temporal scales, sometimes evading human detection and involve a lower-grade intensity that builds over time (O'Brien et al., 2012), slowly eroding systemic adaptive capacity that increases the likelihood of threshold transgressions, increasing the precariousness of the system that leads to vulnerability. Vulnerability is often considered the antithesis of resilience, as it is inversely correlated with adaptive capacity (Young et al., 2010). As Turner (2010) explains, the net impact of shocks and stressors depends not only on how intense the disturbance is, but on the degree to which the system, and its individuals, are vulnerable to that disturbance. A small amount of stress imposed on a system or individual that is highly vulnerable can have a substantial impact. For example, an early spring frost can kill or severely damage grapevine buds, limiting the season crop quality and yields, and therefore farmer income (Belliveau et al., 2006). Other crops that are not especially vulnerable to spring frosts, such as beets, are more resistant, and therefore, beet farmers will not be impacted in the same way. Thus, vulnerability occupies a critical nexus, which links disturbance to a specific individual or population's ability to respond (adaptation).

Adaptation is the process of implementing strategies that adjust for or absorb "waves of adversity" (Obrist et al., 2010). It can be understood to center around resilient livelihoods, such as agricultural livelihoods, and involves adjusting system process, structures, and capital flows, to reduce or minimize exposure and vulnerability (Howden et al., 2007; Cradock-Henry et al., 2020). As The United Kingdom Department for International Development posits, the ability to adjust for or absorb disturbance is enabled or constrained by access to, but also the

ability to mobilize: human, social, natural, physical and financial capital (Obrist et al., 2010) all overlay by symbolic capital, or the amount of power-related resources, prestige and privilege one has access to (Obrist et al., 2010).

Given that these five forms of capital are not uniformly distributed spatially and temporally, adaptive capacity becomes embedded in place and historical determinants (Adger, 2006; Young et al., 2010; O'Brien et al., 2012). In other words, adaptation is mediated by the characteristics of place as well as the processes and capacities of the people who occupy and have occupied that space, all of which affect the configuration of social, human, physical, natural, and financial capital (Bryant et al., 2000; Adger et al., 2013). For example, two agricultural communities of a similar size in different places and socio-ecological contexts may differ in their ability to adapt to a threat.

There exists a plethora of contextual factors that affect adaptive capacity in terms of its influence on capital in the academic literature. Supplementary Table 1 assembles the most prominent of those discussions as the ideas developed during the early phase of its development (e.g., Howden et al., 2007; Young et al., 2010; O'Brien et al., 2012; Adger et al., 2013; Vermeulen et al., 2013; Wilk et al., 2014).

Social inequities are often exacerbated and reproduced in the process of making adaptation decisions. Even in democratic societies, not all voices appear to have an equal stake. Instead, an "illusion of inclusion" (Few et al., 2017) is at play, or an illusion that all voices and values have equal opportunity to be heard and headed (Adger et al., 2013). Institutional and societal structures often create invisible enablers for some voices to be heard, and barriers for other, usually marginalized, voices (Adger et al., 2013). Food and wine producers, particularly in developing contexts, can be located outside of the decision-making sphere, and, in some instances, have poor political representation. Therefore, there can be variable control over the outcomes of adaptation planning (Tanner et al., 2014). While some producers have access to the socio-political status required for their voices to be heard, many others, particularly those that belong to other marginalized groups, do not. Researchers have called attention to the fact that every adaptation that benefits some aspect of the Social Ecological System (SES) comes with inherent trade-offs and potentially negative outcomes for other aspects of the system – and therefore, there are always winners and losers of adaptation (Smit and Skinner, 2002; O'Brien et al., 2012).

While other forms of capital have been emphasized in the literature, such as physical and financial capital (Marshall, 2010; Kenny, 2011; Petersen-Rockney et al., 2021), the role and importance of the socio-cultural side of agricultural adaptation is not as well understood. Studies have demonstrated that a culture of reciprocity, sharing and strong, supportive social networks are strongly correlated with adaptive capacity (e.g., Marshall, 2010; O'Brien et al., 2012; Adger et al., 2013; Ifejika Speranza et al., 2014; Spector et al., 2019); however, social capital still remains a "nice to have", rather than an essential component of agricultural landscapes. In many agricultural landscapes, researchers have observed that high levels of competition, social tension, and fragmentation are often connected to a perceived or real scarcity or inequitable distribution of valued resources – such as money or water – and are connected to environmental, political and economic forces, such as drought, famine, war and global market fluctuations (Jamir et al., 2013; Ruiz Meza, 2015). To add to this, agricultural adaptation depends not only on stakeholders' knowledge of how to adapt to changing circumstances, but also the knowledge transfer that occurs between them, cooperation, and openness to try new practices or technologies (Cradock-Henry, 2021). In sum, social capital is, indeed, often a precursor for other forms of capital, and is necessary for system resiliency.

Adaptation to disturbance

The impact of combined disturbance and vulnerability on food and wine production is well documented in the global literature (e.g., Bryant et al., 2000; Marshall, 2010; Young et al., 2010; Kenny, 2011; O'Brien et al., 2012; Cradock-Henry and Mortimer, 2013; Hammond et al., 2013; Jamir et al., 2013; Maru et al., 2014; Tanner et al., 2014; Ruiz Meza, 2015; Abel et al., 2016; Costa et al., 2016; Cradock-Henry and Fountain, 2019; Spector et al., 2019; Cradock-Henry et al., 2020). Patterns of vulnerability are interwoven into the global geography of food and wine production, reflecting the socio-ecological context in which production is situated. For example, "developing" countries in the Global South are often dependent on agricultural incomes derived from a dominant crop such as the soya bean, which reduces their flexibility and adaptive capacity and increases their vulnerability (Maru et al., 2014). They are at the same time disproportionately at risk and impacted by shocks and stressors such as drought, famine, poverty, and ecological degradation, which reflect the human and physical geography of that place, as well as the systemic path dependencies defined by the larger global SES (Adger et al., 2013; Maru et al., 2014; Ruiz Meza, 2015).

Table 1 summarizes disturbances to global agriculture most prominent in the literature since approximately 2000 when Bryant et al., 2000, initiated the conversation. As the table indicates, institutional, environmental, social, and economic disturbances have resulted in a huge variety of risks for agriculture on a global scale.

Adaptive capacity, social capital, and soft adaptation in resilient agricultural landscapes

One of the most common conceptualizations of resilience originates with the IPCC (2012): "… the ability of a system and

TABLE 1 Disturbances to global agriculture.

Disturbance Type	Risk Factor
Institutional/ political	· Regulatory complexity and inefficiencies · Poor political representation and disconnect between producer needs and policy decisions · Political instability and civil unrest · Poor or non-existent top-down risk management and land-use planning · Access to government assistance and subsidies · Changes to international trade agreements (e.g., NAFTA)
Environmental/Biological	· Climate change (flooding, drought, wildfire, extreme and unpredictable weather patterns) · Changes in landscape stability and composition · Loss of ecosystem services (incl. decreasing biodiversity) · Rapid-onset natural hazards (e.g., earthquakes, landslides, tsunami etc.) · Biosecurity issues, and pest and disease outbreaks · Decreasing pollinator and beneficial insect numbers · Human disease outbreaks (e.g., COVID-19, leading to governmental intervention, market closures and labour interruptions
Social/Human	· Poor access to health and well-being services; information and education; basic resources (e.g., transportation, food, income) · Urbanization, intensification of human development and population increase (leading to loss of farmland · Deteriorating social cohesion in agricultural communities · Resource conflicts · Human factors: lack of diversity in farmer skillset; unwillingness to learn and adapt; cultural rejection of new technologies; and overconfidence in the ability to adapt · Changing consumer preferences and/or knowledge
Economic	· Market volatility: supply/demand dynamics, supply chain shortages, recessions, crises etc.; unstable farm revenues · Consolidation of farmland · Inflation: land, agricultural inputs, living · Lack of access to credit · Unbridled economic growth, development, and material accumulation · Uneven distribution of accumulated wealth · Uneven global (core-periphery) socio-economic relationships · Access to qualified and reliable labour · High producer debt-to-income ratio · Interrupted or poor market access · Lack of pluri-activity and livelihood diversity (income, and/or production type)
Technological	· Serial engineering, or technocratic problem solving, overreliance on and overconfidence in technologies · Low rates of agricultural innovation · High input production systems (dependence on externally controlled systems)

(Bryant et al., 2000; Smit and Skinner, 2002; Hall, 2003; Adger, 2006; Belliveau et al., 2006; Getz and Brown, 2006; Marshall, 2010; Young et al., 2010; Kenny, 2011; Crawford and MacNair, 2012; O'Brien et al., 2012; Adger et al., 2013; Cradock-Henry and Mortimer, 2013; Hammond et al., 2013; Jamir et al., 2013; Lawrence et al., 2013; Maru et al., 2014; Tanner et al., 2014; Ruiz Meza, 2015; Abel et al., 2016; Costa et al., 2016; Anderson et al., 2019; Cradock-Henry and Fountain, 2019; IPCC, 2019; Nygrén, 2019; Spector et al., 2019; Cradock-Henry et al., 2020; Petersen-Rockney et al., 2021; Ricciardi et al., 2021; Tacconi et al., 2022)

its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions." Given the imminence of global climate change, and recognition that current systems will have to transform, functionally and structurally to meet the changes predicted to occur over the century (O'Brien et al., 2012; Wise et al., 2014; Abel et al., 2016; Bloemen et al., 2018), transformability and innovation should also be considered fundamental components of resilience. While transformative resilience is not a concept that is commonly employed in the resilience literature, mainly due to the inherent tension between "bouncing back" and establishing new functional and structural norms (Walker et al., 2008; Costa and Kropp, 2013; Ifejika Speranza et al., 2014; Spector et al., 2019), climate change is pushing the resilience community to adopt transformation. Thus, an evolved conceptualization of resilience involves the ability of a landscape and its components to adjust to, absorb or buffer disturbances in a way that preserves the essential functioning of the original system, or allows for an adaptive transformation.

Understanding the role of social capital in food systems is an important task, as social capital influences many aspects of community including: quality of life (Peters, 2017); the status of community health (Folland, 2007); community collective action and the capacity to adapt to climate change (Adger, 2003; Grootaert et al., 2004); community crime rates (Lederman et al., 2002) and individual community member well-being (Yetim and Yetim, 2014). In their meta-analysis of 240 published and peer reviewed articles on social capital,

Fulkerson and Thompson (2008) show that social capital has been explored by a wide range of researchers and explain that the majority of this work refers to a conceptualization formulated by Robert Putnam who defines social capital as the "features of social life – networks, norms, and trust – that enable participants to act together more effectively to pursue shared objectives" (Putnam, 1995, p. 664-665.).

The approaches to understanding social capital and the methods used to measure and observe it are also wide ranging. Networks and trust, are the most common indicators used to measure social capital and are observed in a variety of different contexts (Liu and Besser, 2003; Pelling and High, 2005; Campbell et al., 2010; Kitchen et al., 2012; Stanley et al., 2012; Chazdon et al., 2013; Ferragina, 2016; Petzold, 2016). Networks refer to the informal and formal social ties that exist between people (Ferragina, 2016) and are the most common indicator used in social capital measurement studies (Grootaert et al., 2004; Fulkerson and Thompson, 2008; Stanley et al., 2012). The extent of an individual's social networks indicates the strength of social capital (Chazdon et al., 2013; Ferragina, 2016) and networks can be assessed through interview questions (Campbell et al., 2010; Stanley et al., 2012; Petzold, 2016). Trust, in social capital theory, is described as a feature of social life that enables people to work together to achieve a shared goal; in general, the more we interact with people the more we trust them (Putnam, 2000). Commonly found in quantitative social capital survey assessments (Pelling and High, 2005; Chazdon et al., 2013), trust is measured by: the level of trust an individual has in general (Kitchen et al., 2012); the level of trust in community members (Liu and Besser, 2003; Petzold, 2016); the level of trust in local institutions (Ferragina, 2016; Petzold, 2016); and by the level of trust in people from different social backgrounds (Chazdon et al., 2013).

Studies that evaluate social capital at the community scale, do so in order to examine its role in policy (Campbell et al., 2010), its use as a tool in rural revitalization (Chazdon et al., 2013), its relation to community involvement (Liu and Besser, 2003), its connection to community adaptive capacity (Petzold, 2016) and its influence on social exclusion (Stanley et al., 2012). Only a few studies have explored the role of social capital in agricultural landscapes, and none have yet explored this in the Okanagan Bioregion. Community collective action and adaptive capacity is influenced by community level social capital (Adger, 2003; Grootaert et al., 2004) and social capital plays a role in resiliency and the success of local agricultural systems (Glowacki-Dudka et al., 2013). Social connectivity is the basis for economic exchange in community based food systems and it facilitates essential collaboration between food system actors (Bauermeister, 2016; Goldenberg and Meter, 2019).

Soft vs. hard adaptation

Adaptation can be categorized either as "soft" or "hard", usually depending on the level of tangibility and flexibility, or the ease at which the strategy can be reversed (Hallegatte, 2009). Hard adaptation usually focuses on strategies related to technology, physical assets, infrastructure and engineering, and usually incur greater sunken costs, which soft strategies are typically less tangible or more easily reversed, such as investing in social capital, building preparedness plans, land-use planning, investing in insurance schemes, etc. These soft adaptation strategies, particularly social capital, are not well represented in the resilience literature, primarily because they are difficult to model and quantify (Kalaugher et al., 2013). The literature on agricultural adaptation focuses overwhelmingly on technological "fixes", or hard strategies, to remedy the issues affecting production (Smit and Skinner, 2002; Kenny, 2011).

This tendency to focus almost solely on "hard" strategies has led to a focus on growth models that are resource intensive and depletive, rather than extensive and regenerative, and has contributed to the rise of many modern issues, such as the destruction and collapse of global ecosystems and climate change (Lein, 2017). Other research has suggested that this over-emphasis on "hard" adaptation has degraded resilience in certain circumstances, by locking producers in to certain pathways, for example, by investing in infrastructure that is capital intensive and systems that require many inputs, and may also lead to a "levee effect", where producers believe that technology will continue to expand, innovate and keep up with risks (Bryant et al., 2000; Smit and Skinner, 2002; Adger, 2006; Marshall, 2010; O'Brien et al., 2012; Lawrence et al., 2013). Soft strategies may offer more flexible solutions to modern agricultural issues, and more research is required to understand how the softer side of adaptation can be used to complement hard adaptation, in a way that reduces risk, decouples producers from centralized forms of power, and enables flexibility.

Study area, methods and methodology

Study area

This is an exploratory case study of the Okanagan bioregion, a historically important and unique agricultural landscape in British Columbia, Canada (Senese et al., 2011). A bioregion is an area with similar human, cultural, and ecological characteristics, such as climate, hydrology, topography, which all support social and economic activity within a region (Thayer, 2003). It provides a useful scale to conduct this research, as it reveals the socio-ecological linkages within the local food system, and the landscape of production within this system. The Okanagan bioregion is unique in Canada, given the semi-arid climate and glacially-formed landscape that supports the production of soft fruits like peaches, cherries and wine grapes that are rarely viable in Canadian growing regions (Shepherd et al., 2006). The

Okanagan is also representative of many agricultural regions in developed countries that face overlapping shocks and stressors related to climate change and pressures from increasing urbanization. Local food and agriculture play a significant role in the bioregion's culture, identity, and economy, specifically as it makes a significant contribution to the regional tourism product (Regional District of the Central Okanagan, 2018). Also like many other increasingly urbanized agricultural regions, local food movements have grown in strength and popularity in recent years (Regional District of the Central Okanagan, 2018).

In the Okanagan bioregion, producers are experiencing many of the same challenges and most frequently cite climate change as a challenge to local food and wine production. In particular, the bioregion has been vulnerable to flooding and landslides, warming temperatures, heatwaves and drought, increasing weather viability, and has experienced severe and prolonged wildfire seasons (Polar Geoscience, 2012; Bjarnason et al., 2016; Climate Projections for the Okanagan Region, 2020). Wildfire has become a major instrument of landscape change in areas of agricultural production, with far-reaching and cumulative implications for the local ecology, producer livelihoods, and the local economy due to the impacts of wildfire smoke on tourism (Nitschke and Innes, 2008; Bjarnason et al., 2016; Climate Projections for the Okanagan Region, 2020). Water rights and allocation is another key issue associated with climate change (Neale, 2005). Warming temperatures are increasing irrigation requirements in the region (Polar geoscience); however, over-use of irrigation to manage drought and heatwave conditions may threaten long-term resilience (Young et al., 2010; Cradock-Henry and Mortimer, 2013), as water sources in the region are already overallocated and water supply over the growing season is expected to continue to decrease over the coming decades (Climate Projects for the Okanagan Region, 2020).

Other commonly cited human and economic disturbances to food and wine production in the Okanagan include pressure associated with population growth, rising land prices and increasing urbanization. The access to, and ability to mobilize financial capital, qualified and reliable labor exist in a regulatory environment that is complex and often described as inefficient. The Okanagan is the most populous region in British Columbia's interior and is expected to grow by 77% to 641,176 residents between 2018 to 2031 (Robert et al., 2018). This growth will impact the region in many ways, including increasing the likelihood of water-related conflict due to tensions in allocations, increasing the demand for urban and commercial development, which often competes for the same limited land base as agricultural production, as arable land often overlaps with the developable land base in the Okanagan or is close to amenities such as lakes and hillsides that increase land values (Noble, 2004; Grifone, 2017). This competition for land and water sets limits to the expansion of agriculture in the bioregion, and could threaten the sustained existence of the production landscape, particularly if the Agricultural Land Reserve is not upheld.

Okanagan producers also experience fiscal challenges related to increasing costs of operation, such as wages, property taxes, equipment repair, water, fuel and other inputs, which are growing faster than farm revenues (MNP LLP, 2020). In the Okanagan, producers have reported insufficient access to capital and also tend to be highly dependent on external inputs, such as plastic, rubber, paper, pesticides and fertilizers (MDB Insight, 2019). This is creating issues for producers, given variable market conditions and rising input prices, which are not easily transferred to consumers (Crawford and MacNair, 2012). More recently, between 2020 to 2022, dependence on inputs and disruptions to transportation have also led to disrupted access to processors and markets, and supply chain woes due to the COVID-19 pandemic and catastrophic flooding events in British Columbia (Jackson, 2021).

In the Okanagan, costs of operation and supply chain disruption are compounded by unstable farm revenues (Crawford and MacNair, 2012), which affect the ability of producers to access and mobilize the financial capital required for operations and to purchase farm equipment and technologies that increase market competitiveness (MDB Insight, 2019). The profitability of orchards had fluctuated over that past century, and orchardists have generally struggled with issues of unstable and insufficient farm revenues. During the 1930's, during the Great Depression, for example, Okanagan orchardists famously developed the slogan "a cent a pound or on the ground", indicating that they would rather let their fruit rot than sell them at a loss (Garden of Eden, n.d.). Margins on apples have not improved much over the years. In 2010, apple producers were selling their product at a loss - at 0.13 cents versus their product costs at 0.23 cents per pound (Crawford and MacNair, 2012). This led many apple orchardists to swap out their trees for other niche/commodity crops such as wine grapes, which are much more profitable (MDB Insight, 2019).

Agricultural businesses in British Columbia face one of the largest labour shortages relative to demand in Canada (Canadian Agricultural Human Resource Council, 2015). In the Okanagan Bioregion, orchards and viticulture have experienced sustained challenges in securing qualified and reliable labour

(Crawford and MacNair, 2012). Although this also relates to geopolitics and other externally controlled forces, it is intricately linked to the rising unaffordability in the Okanagan and other place-based factors such as seasonality, the location of agricultural jobs in rural communities that lack services, and competition with other primary industries that may pay higher wages (Canadian Agricultural Human Resource Council, 2015). The Okanagan is a challenging place for agricultural laborers to reside, given the high costs of living and low wages offered by employers (Hessing, 2010).

The inability to secure labour domestically means that many producers must turn to the temporary foreign workers program

to fill labour gaps. In 2018, for instance, over 21% of BC's jobs in agriculture were filled by temporary foreign workers (MNP LLP, 2020). This dependence on the temporary foreign worker's program creates vulnerabilities to disruptions caused by border closures and travel restrictions, as seen during the COVID-19 pandemic (Statistics Canada, 2020). Additionally, access to temporary and foreign labour is challenged by the temporal needs, which can span from a couple of weeks to multiple seasons, and capital costs required to procure and house these people (MDB Insight, 2019). Simply put, the temporary foreign workers program is not available to all agricultural businesses.

Finally, agriculture in the Okanagan bioregion is embedded in a complex regulatory system, involving multiple levels of government and regulatory bodies. Land use is regulated largely through local

(bylaw/municipal/regional districts), provincial, and federal governments (City of Kelowna, 2017), while other government bodies (e.g., Interior Health) and regulatory agencies (e.g., CanadaGAP and CFIA) govern other areas such as harvesting, processing and health standards. Various governmental agencies are responsible for upholding different federal legislation and agricultural Acts, such as the Seeds Act,

Fertilizers Act and Farm Product Agencies Act (City of Kelowna, 2017). The fragmentation and complexity of agencies with different and sometimes overlapping jurisdictions make it difficult for producers to find information, communicate with the right regulatory bodies and be included in production decision-making (Crawford and MacNair, 2012). Producers in the bioregion have noted that policies are often disconnected from their needs (Crawford and MacNair, 2012), indicating a lack of vertical social capital and inclusive governance.

Methods

The connection between social capital and agricultural resilience in the Okanagan bioregion was explored through two rounds of qualitative, semi-structured interviews completed over a period of three years. In the first stage of the research, twenty-two interviews were conducted between October and November 2019 with a wide range of local food system actors for the purpose of exploring participant perspectives on the role of social capital in the landscape of production. The researchers obtained approval from the UBC Board of Behavioural Research Ethics to conduct these interviews. Participants in the first round of interviews included local food producers, local food processors, members of farm organizations and local food activism groups, and community members who shopped at farmers markets. A second round of data collection was conducted between September and October 2021, in which eleven participants, including small-scale fruit and vegetable, wine, livestock, and honey producers, and industry stakeholders, completed adaptation pathways interviews with the goal of understanding how producers could adapt over time in worst case climate change scenarios. The two rounds of data collection have allowed for a broader range of participants in a form of longitudinal analysis between 2019 and 2021 when the pressures of climate change and urbanization were overlapped again by the stressors and shocks of the COVID 19 pandemic.

The study population for both rounds of interviews was selected using an accidental quota sampling procedure, meaning that the participants were chosen haphazardly, based on interest in participating and availability (Bouma, Ling and Wilkinson, 2012). A representative sample was not required or necessarily desired for this research as the aim was not to generalize results across the communities of producers and local food system actors but rather to explore the experiences and situated knowledge of a group of individuals who participate as stakeholders in food and wine production in the bioregion. These perspectives were used to form a normative understanding of resilience, from the perspective of food system stakeholders who understand the perspective of agricultural producers, and understand the challenges and enabling factors for resiliency in the agricultural landscape of the Okanagan bioregion.

Individuals contacted were involved in local food and wine activities, such as horticulture, dairy, livestock, viticulture, arable crop farming, beekeeping, wild food collection. Some also identify as local food or wine experts, agricultural advocacy representatives, local food system consumers, and members of local government or Indigenous groups. The sample was designed to represent the North, Central and South Okanagan areas and participants were recruited using publicly available sources, such as farmers' market directories, food and wine association websites and social media. Third-party organizations also helped to distribute the interview invitation through their e-mail lists and social media channels. Organizations who distributed the invite included: The North Okanagan Organic Association (NOOA), The North Okanagan Land to Table Network, Young Agrarians BC, The South Okanagan Organic Producers Association (SOOPA), Sustainable Winegrowing BC (SWBC), The North Okanagan Beekeepers Association, the Certified Organic Association of BC (COABC), Urban Harvest Organic Delivery, the Vernon Farmers Market, Central Okanagan Community Farm Society, and Food Action Society of the North Okanagan. Participants were invited to participate *via* e-mail and were asked to fill out a form of consent once a time and location was scheduled for the interview.

The interviews took place *via* Zoom, over the phone, and in-person and lasted 1-2 hours. In the first round of interviews, participants were asked questions about the connection between social capital and agricultural landscapes in the Okanagan Bioregion. They were first asked if, and how, they thought agricultural systems impacted their community, and then were

asked specific questions about the relationship between agricultural landscapes and key indicators of social capital (social networks, reciprocity, trust). Lastly, participants were asked what the agricultural landscapes in the Okanagan Bioregion will look like under future scenarios (population increase, climate change, demand). The second round of interviews were separated into 3 parts. In the first part, the researcher asked participants questions related to their relationship to local food and wine and the community production assets that they would like to see persist or exist in the future. In the second part, the researcher presented a worst-case climate change scenario based on the findings of the Climate Change Projections for the Okanagan Region Report (…) and asked participants to envision, verbally or using drawings, how they might adapt to these kinds of conditions now (1-5 years), later (6-50 years) and much later (51-100 years). Participants were not limited to considering the conditions presented in the scenario. Finally, in part 3, the researcher asked participants to identify which types of strategies will be most important to the current and future resiliency of food and wine production in the Okanagan Bioregion.

The interviews were recorded and then transcribed by hand by two of the authors. NVivo software was then used to inductively code interview data and identify themes. This allowed any theories to emerge from the patterns and themes derived from participant views identified in the interviews, as per grounded theory, across cases (as in case studies), using a constant comparative method (Glowacki-Dudka et al., 2013; Creswell, 2014). Grounded theory is used in this research to analyze the data collected as it provides a context to derive a general theory grounded in views of participants (Creswell, 2014).

Theoretical approach/Positionality statements

We adopt a social science and interdisciplinary perspective for this research, which focuses on the causes and outcomes of human activity, and often uses human desires and beliefs to explain human action (Graham, 2005). This is an epistemological approach that is humanist and pragmatic emphasizing human agency and the characteristics of human action such as intentionality, rationality and reflexivity (Graham, 2005). As researchers, we understand that our identities, the epistemic position that we assert ourselves, and our personal values have an important impact on the outcomes of our research. They either facilitate or hinder our ability to engage with participants, and affect the way that we construct, warrant, and use knowledge (Muhammad et al., 2015). As the collectors of these primary data, we also acknowledge our personal and academic privileges, and our power and status as middle-class, visible majority, females. We understand that the way that we have framed resilience, as a normative concept defined by the researchers and participants involved in this research, does not represent or encompass the broad range of perspectives of all stakeholders in the bioregion. As researchers, we are able to assert an agenda or to reinforce hegemonic discourse by controlling who has the privilege of being heard. In particular, Indigenous perspectives on agricultural resilience were not included due to lack of representation. We acknowledge that this presents a limitation to the findings. Lastly, we acknowledge that we personally place significant value on local food systems, emphasis on small-scale production, connection to place, and the consumption of place. This affects the way we have framed this research and the research questions we have asked, which also colors the range of answers and results that could emerge.

Findings

The findings from the two data sets yielded complementary results. Interview results from the first and second phase of this research suggest that the adaptive capacity of producers and agricultural landscapes is unavoidably connected to their ability to access and mobilize social capital, and use "soft" adaptation strategies to adjust and transform proactively, and as shocks and stressors emerge. Participants in both phases emphasized "soft" adaptation strategies, such as building social networks, utilizing sites of social connection, building reciprocal relationships, and social learning/knowledge transferal. These "soft" strategies are all linked to our proposed concept of *the currency of connection*, which refers to the different forms of capital, social, economic, physical, environmental, etc., which can be gained through social connection with others and the interlinked processes of knowledge transferal, social learning, and reciprocity. The currency of connection is both intangible and tangible, in that it is often accumulated in the form of relationships (intangible) that allow producers to leverage other forms of capital, such as labour or shared equipment (tangible). These tangible benefits are often not linked to the intangible prerequisites, and so the idea of a currency of connection attempts to reinforce and communicate the idea that soft adaptation can lead to both hard and soft benefits for producers. The findings in this section are organized into the key themes that emerged from this research, which are linked to the currency of connection and building resilience for agricultural landscapes.

Social connection, networks and reciprocity

Social connection, building networks, and reciprocity are the essential elements needed to leverage the currency of connection. Our research suggests that producers must establish relationships based on trust, safety, and a shared

sense of reciprocity in order for other elements, such as knowledge transferal and social learning to occur. Participants indicated that the social connections that a farmer brings to a production landscape is critical to its sustainability and resilience. As one participant reflected, "I know that one of our biggest assets in the … industry is my dad himself and the decades of networking that he's done in those relationships and connections that he has with other producers" (Participant 23, "P23"). Building relationships has allowed this participant's father to increase tangible aspects of farm operations, such as purchasing power and the ability to negotiate prices to buffer some of the risk of price shocks. However, building relationships has also contributed to "getting you those opportunities you wouldn't normally have" (P23). For instance, developing relationships with community and other local businesses was by other participants seen to:

1. Facilitate knowledge transfers between producers;
2. Increase access to resources, aid and improve business longevity;
3. Increase business through exposure to other social networks, for example, *via* a restaurant partnership,
4. Improve the chances of securing reliable local labour; and
5. Improve the personal resilience of farmers, by fulfilling their need for social connection and making them feel valued.

In addition to producers creating networks, other food system actors cite cultivating networks through their participation in the food system. However, the value of networks varies between producers and other food system actors. In the first interview process, the definition of networks was left undefined, which allowed for participants to conceptualize networks for themselves. Local food consumers defined members of their food system social network as other food system actors they saw regularly (even if they may not know their name), friends, or acquaintances. Producers defined their network differently. One producer explained their network was largely made up of other producers, and their network serves a social, yet functional purpose: "Yeah, I mean that is our social network … That's the only people we can actually relate to anymore … It's really important to have a network of people who can relate to doing something so incredibly challenging and not monetarily rewarded" (P13). Results indicate that producers connect with one another to share knowledge, advice, experience and to socialize. Producer networks facilitate critical support and play a vital role in producer success and resilience to disturbances. Therefore, the most valuable networks established in the agricultural landscape are those made between producers.

Networks are formed over shared experiences and facilitate trust building and reciprocity between producers. In the first interviews, a level of reciprocity seemingly exists between some local food consumers and producers, occurring mostly between participants having an existing relationship established at farmers markets. This research indicates that a stronger sense of reciprocity exists between producers in the Okanagan bioregion. Thirteen participants in the first interview phase described situations where producers help each other, with examples coming from both producers and other food system actors. Despite being competitors, one small scale meat producer shared equipment with another producer after a crisis: "the other big one in town burned down at the beginning of the season … And so, we let them operate out of my farm, they use our abattoir here" (P11). A sense of reciprocity is a key indicator of strong social capital, and is demonstrated when community members do favors or seek information from each other (Chazdon et al., 2013; Bauermeister, 2016). We found that producers have networks of other producers who they reach out to for support or aid, and that support is often reciprocated.

Spaces for building social connection

Interview participants suggested there are important spaces in agricultural landscapes that facilitate social connection between producers and other food system actors. For instance, participants noted the importance of events such as farmers' markets, agricultural community events and activities, such as seed swaps, in providing a fori for producers to share their stories, passions, and develop reciprocal relationships within their community, and the broader communities in which they are embedded. Different social groups, networking events, and research and development partnerships as important enablers of community connection and relationship building.

The results indicated that these spaces and enablers of connection translated into unexpected and more tangible benefits for producers, such as business partnerships and collective agreements. For instance, one participant noted that their relationship with a local restaurant owner has led to countless unexpected benefits. They recounted a time when the restaurant staff showed up and they had beers and a salsa tasting competition at the farm, or another time when they unexpectedly showed up and helped out with the labour around the farm, without expectation of anything in return. These relationships between small-scale producers and restaurants appear to be critical for the sustainability of small-scale food production in the Okanagan. As the participant concluded, "You know, these relationships with these chefs who come into the farm or the household customers who come into the farm, it just adds to my pride about what I'm doing and It reinforces that what I'm doing, at least to some people, is valued and important" (P32).

Another way that these spaces of connection be translated into tangible benefits, such as financial capital, is through the formation of farmer group purchasing agreements, for example

co-purchasing inputs in bulk, co-ops where physical capital is shared, and local circular economies, which both depend upon and reproduce social capital. In the interviews, circular economies were understood to confer multiple benefits to local farms, such as reducing waste, reducing the cost of inputs and the relationship of dependence on externally controlled input systems, creating new jobs for local people, supporting local businesses, and increasing social capital. As the participants pointed out, creating a circular food economy is predicated on connection. This reinforces the need to establish relationships and build social capital as a "first step". Once relationships are secured, producers can begin developing reciprocal trade agreement amongst themselves. For example, one participant indicated that they donate their B-grade apples to a local cattle and pork producer, who then turns the apples into manure that is re-distributed to them and applied as fertilizer on the orchard. These kinds of relationships are perceived to be highly sustainable and may be reproduced at larger scales over time as social capital increases.

Social learning and knowledge transferal

Related to the themes of connection, social networks, and reciprocity, social learning and knowledge transferral were found to be critical aspects of the resilience of agricultural landscapes. Social learning and knowledge transfer emerged in the interviews in several different ways. For example, participants indicated that the knowledge of the producer(s) is one of the most, if not the most, important asset of the farm. The knowledge that a farmer holds, whether gained through formal education or experience and experimentation, is critical to the success of the farm, but it is also critical to neighboring producers and the next generation of producers who will inherit this knowledge and experience. Thus, knowledge is diffused, or transferred through social learning, both spatially and temporally, to increase adaptive capacity. Participants highlighted the importance of succession plans and the opportunity to connect with the younger generation, who appear to be increasingly disinterested in agricultural careers, to agricultural resilience.

Participants in the second phase of this research expressed hope for the resilience of local agriculture, based on the ingenuity of the younger generation of agri-entrepreneurs, who are more educated and are starting to think of new agricultural models, such as urban agricultural schemes, that may help to sustain local food production. These young farmers require support and experiential knowledge from the older generation; however, some of the younger participants indicated that this is already occurring, and that the older generation is searching for and eager for opportunities to pass down their knowledge. For example, participant (P29) expressed that "[p]eople that have paid their dues, that don't really need to be there [at agricultural events], don't really need to be paying attention to these young guys, they'll sit beside me and talk with me and have this incredible conversation. And then I realized afterwards, that he is the owner of, you know, a huge seed company or something, that always thought highly of. It's like, oh, well, he didn't need to be sitting there talking to *me*". Succession plans and the transferral of this knowledge, and the willingness of older and retiring farmers to connect and share with the younger generation, who will need traditional knowledge to ground their ethic of innovation, will be necessary for the resilience of agriculture in this region.

While participants agreed that more multi-directional learning in partnership with institutions and research and development partnerships are needed, the consensus was that producers learn best when they learn from other producers, and multi-directional learning can occur. As participants conveyed, not all producers have the resources and flexibility to innovate. For instance, a farmer just starting out whose main concern is keeping their business running is not likely to take on the risk of planting a quarter acre in a new and experimental crop. Whereas a more established producer with greater financial flexibility may not be as risk-averse or may be in a position to manage risk. Thus, knowledge sharing becomes critical in giving producers with less capacity the ability to learn from the lessons of those with greater capacity. Participants shared that knowledge sharing is facilitated in social settings as discussed, such as farm walks, farmers' markets, or seed swaps, within programs and organizations designed for sharing best practices. Knowledge can also be transferred between regions *via* "armchair traveling" or connecting with producers in other regions of the world. They also emphasised that knowledge transferal has to happen within communities, and not only "top down", from relevant authorities and organizations. As Participant (P30) recounted, "communities have longer memories [than institutions] and individual people who are in an industry like agriculture. They're not generally fly-by-night operators. They've generally made an investment or their families have made an investment in the community". Thus, communities are integral stakeholders in the process of knowledge transferral as well, through social memory.

Lastly participants also indicated that connecting with local food consumers is a critical component of building resilience. They suggest that the opportunity to connect with consumers, and to communicate how the local food system supports their community, builds trust and relationships between producers and consumers. Opportunities to create stronger educational content has been supported by COVID-19 support grants provided by the Government of British Columbia, by, for example, supporting the transition of storefronts to online stores, where e-learning can take place. As one participant suggested, making sure that people connect with and support their local food system is the strongest form of food security (P30).

Soft adaptation and producer prioritization

Despite the clear importance of different "soft" adaptation strategies associated with social connection, networks, reciprocity, learning and knowledge transferral described, at the end of the interviews in the second phase of this research, all participants indicated that these "soft" strategies would be their lowest priority to manage current and future challenges. Instead, participants indicated they would prioritize "hard" activities such as preparing for extreme and unpredictable weather, securing water quality and quantity, and identifying long-term strategies to manage worsening pests and disease conditions. As indicated in the sections above, "soft" adaptations that build social capital are critical to resilience; however, because they are "softer" and therefore often not immediately tangible, the benefits associated with them may not be as readily recognized by producers, or even attributed to them. Building relationships, for example, is often a process that takes place over time and does not yield instant gratification. Similarly, a lack of "soft" strategies, such as knowledge sharing, can be a detriment to local growers and the larger production landscape, impeding innovation and encouraging stagnation, for example. While other issues, such as securing water, appear more pressing and have more immediate consequences, it is important that producers do not deemphasize the importance of "softer" adaptation strategies that anchor and regulate the landscape of production, and food systems more broadly.

Conclusions

Soft adaptation, including cultivating the currency of connection, is vital to agricultural resilience in the Okanagan Bioregion. Participants in this research highlighted the importance of social connection, networks, reciprocity, learning and knowledge transferal, as key parts of how they increase their adaptive capacity, as well as the building blocks for other forms of capital, such as financial, physical and environmental capitals. This affirms findings from previous research in different geographical areas, which describe connection, learning and knowledge sharing as a way to enhance adaptive capacity, by developing relevant skills, local knowledge, increasing social cohesion, financial security and land tenure, increasing farmer self-efficacy, etc. (Marshall, 2010; Adger et al., 2013; Cradock-Henry and Mortimer, 2013; Kalaugher et al., 2013; Ifejika Speranza et al., 2014; Wilk et al., 2014; Butler et al., 2016; Bloemen et al., 2018; Bosomworth and Gaillard, 2019); suggesting that these findings transcend the context of the Okanagan bioregion study area, and that, "soft" adaptations are important for agricultural production in many different contexts.

Despite this importance, participants in the second phase of this research suggested that they are deprioritizing "soft" adaptation, in favour of "harder" strategies that respond more directly and tangibly to key disturbances, such as the increasingly evident impacts of climate change. This suggests that there is a contradiction between the importance and value that producers place on the currency of connection or "soft" adaptation, and the strategies they actually plan to implement. Given the limited sample in this research and the fact that this was a coincidental finding, rather than the focus on this research, further research is required to confirm and investigate this contradiction, and to determine how "soft" adaptations can be emphasised and prioritized by producers, in a way that does not compromise their ability to respond to pressing threats, but enhances their ability to respond. In further research, we will propose a conceptual framework for building adaptive capacity, using the idea of the currency of connection, to link the less tangible aspects of "soft adaptation", to the concrete and observable benefits that are often conferred through processes like the ones discussed in this paper, social connection, network formation, reciprocity, and learning and knowledge transferal.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by University of British Columbia Okanagan Campus Research Ethics Board and the Kwantlen Polytechnic University Ethics Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AG completed the second phase of this research, and assumed lead authorship of this article. CE completed the first phase of this research, and assumed a second-author role for this article. KM supervised phase one of the research and contributed as a supporting author for this article. DS supervised both phases one and two of this research, and contributed as a supporting author for this article. Funding acquisition for this research was completed by AG and CE, under the supervision of DS and KM. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors of this article declare that this research was conducted in the absence of any relationships that could be potentially construed as a conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fagro.2022.980888/full#supplementary-material

SUPPLEMENTARY TABLE 1
Capitals Context of Adaptation Decision Making.

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