Permaculture and Community Garden-Farming for Urban Food Production

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Abstract

This research project explored whether permaculture can be applied to community garden-farming for food production in urban environments. The research included a review of the local and international literature and interviews with community garden leaders and permaculture teachers. The results of this research project are intended to inform and guide the development of food systems, address food insecurity and increase access to fruit and vegetables.

This research project used qualitative descriptive methodology. Eight participants, four community garden leaders and four permaculture teachers were recruited for this project.
In-depth, unstructured interviews with open-ended questions were used to gather data. Four themes and associated sub-themes were identified using thematic analysis:

- Theme 1 - It will take a village: community, involvement, and connections
- Theme 2 - What is valuable differs from what is valued: moving beyond direct economic benefit
- Theme 3 - Self-determination is governed by who has title and control
- Theme 4 - 'Crisis': A vehicle for change

Based on a qualitative analysis, this thesis shows some potential ways that permaculture ethics, principles and design techniques can be applied to community garden-farming for urban food production. Permaculture and community garden-farming were found to provide food systems with ethical underpinnings to the three pillars of sustainability. More research is needed to investigate further ways permaculture can be applied to community garden-farming for urban food production and how policy can be implemented to achieve the 'safe operating space' and 'protected space' of community garden-farming.

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Attestation of authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Signed - Cameron Duff _____

Acknowledgements

Ethics Approval

This research project #20/141 was approved by the Faculty of Health and Environmental Sciences of Auckland University of Technology on 15th May 2020.

1   Introduction

Since the sixteenth century, humans have aggressively refined how we harvest the earth in our attempt to produce and consume our food (Harskamp, 2009). Sophisticated and efficient, we could grow food on the moon with today's technology, and yet we still have not solved the problem of hunger (NASA, 2007; Harskamp, 2009). Instead, the policies, procedures and practices that make up our systems for producing and consuming food promote a financially-incentivised economy that is toxic to the environment and amasses significant contributions to global emissions. The same systems simultaneously create food shortages while contributing to the rise of unhealthy diets and diet-related non-communicable diseases: all of which significantly impacts public health (Altieri, 2009; Altieri, 2009a; Dekker, 2014; Séralini, 2015; Swinburn et al., 2019). It is policy that allows this to happen (Dekker, 2014). Therefore, it is the duty of public health policy to correct this and investigate possible solutions. This thesis was undertaken to align with this and contribute toward finding potential solutions to the issues we face around our food systems and the broader impacts these have on people, our societies and the planet.

As a potential solution to the issues of our food systems, this thesis will explore the use of food production in urban environments: specifically permaculture and community garden-farming. Traditionally referred to as 'alternative', urban food production has a long and rich history, with its most extensive use being socially stirred in times of crisis. With the current Covid-19 pandemic, climate change, and other crises facing humanity, the importance of research into urban food production cannot be overstated (Bell &Cerulli, 2012; Bourque, 2000; Irvine et al., 1999).

This research project investigates the use of permaculture and community garden farming in urban environments to answer the research question: can permaculture be applied to community garden farming for urban food production? Interviews were used and qualitatively analysed to capture the experience of permaculture teachers and community garden leaders engaged in urban food production. Their captured experiences are used to answer the research question.

The background chapter gives an overview of the main concepts used throughout this study, including permaculture and community garden-farming, sustainable food

systems and the implications of climate change for public health. The local and international scientific literature in the main topic areas is discussed in the literature review chapter. This chapter also includes a more in-depth discussion about some of the broader aspects of the main topics, including sustainability, interdisciplinary approaches to food systems, environmental stewardship and permaculture systems. The methodology chapter elaborates on the theoretical frameworks that this research project takes place within and provides outlines of the qualitative research design, methodology, and analysis of participant interviews used to achieve the research aims. The data that was analysed from participant interviews is presented in the findings chapter. This data describes the subjective experience of urban food producers that is used to answer the research aims. In the discussion chapter, the main findings are presented. The main findings are then compared with the findings from the literature review. The researcher then provides discussion and interpretations from this comparison, and a conclusion is provided to answer the research question.

2   Background

2.1   Introduction

Various elements need to be considered for increasing fruit and vegetable production and consumption within food systems. Urban landscapes are of interest as alternative environments for achieving such changes. This research focuses on the combined use of two forms of urban food production, community garden-farming (CGF) and permaculture, to assess their viability for food production in urban environments.

This chapter provides discussion on sustainable food systems. Within the context of sustainable food systems, food production in urban environments is discussed. The accompanying policy and environmental implications of food systems are then discussed. Finally, the two forms of urban food production, permaculture and CGF, and where they sit within food systems, is explored.

2.2   Sustainable food systems

Sustainable food systems (SFS) are the marriage between systems theory, food systems (FS) and sustainability. Systems theory, or systems thinking, proposes that nothing exists in isolation and that understanding and addressing problems within societies requires investigation of the interactions as a whole, instead of as singular events (Head & Alford, 2015). A systems approach to FS implies a deep understanding of the relationships, linkages, interactions and behaviours between the elements of the entire system (De Savigny & Adam, 2009; Head & Alford, 2015). According to El Bilali (2019) and Grin, Rotmans & Schot, (2010, pp 93-101), from a systems theory perspective, FS can be conceptualised into what is referred to as a Multiple-Level Perspective, consisting of three hierarchical system levels: regimes, niches and landscape factors. Regimes are characterised as the array of conventional, mainstream and authoritative groups, e.g., governments, industries and institutions, who establish and stabilise the rules and practices of existing dominant systems. Niches exist outside of the regime and are characterised as actions and activities that do not directly pressure the dominant systems to change yet have the potential to do so. A contemporary example of this is organic agriculture. Landscape factors are exogenous to both niches and regimes yet can

impact and affect both. Examples of landscape factors are social activity and climate change (Ingram, 2018; Geels, 2019; Maye, 2018).

Defined as the encompassing local and global web of interlinked activities, FS involve the production, processing, distribution, consumption and disposal of food products originating from fisheries, forestry or agriculture, and the broader social, economic and natural environments they are fixed within (Nguyen-Viet et al., 2019). Within the web of FS are the sub-systems, e.g., waste management, supply chains and legislative regulations that interact with other systems at the local and global level, e.g., health systems, trade systems and energy systems (Nguyen-Viet et al., 2019). Governments, industry, and social mechanisms shape the environments that these sub-systems exist within and heavily influence how they operate and what is made available for public consumption, which directly affects outcomes for public health and the environment (Nguyen-Viet et al., 2019). The pattern FS have followed towards the end of the 20th century have focused exclusively on reducing cost by increasing production at the expense of foods being deficient in essential nutrients (Chan, 2018). This FS activity has coincided with the rise of unhealthy diets, diet-related non-communicable diseases (NCDs) and ongoing environmental destruction (Chan, 2018).

The United Nations define sustainability as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Annan-Diab & Molinari, 2017; Gimenez et al., 2012). Many authors have described sustainability as a contested and confusing subject, often criticising the non-specificity and interpretive aspects as too complex and not satisfactory for practical application or purpose (Annan-Diab &Molinari, 2017; Surampalli et al., 2020).

The *Eat-Lancet* commission (Willett et al., 2019) describes FS as the link between diets, human health and environmental sustainability. They also discuss the need for FS to ensure the secure generation of nutritious foods for all current and future generations without compromising economic, social and environmental sustainability: otherwise known as the three pillars of sustainability. For FS to achieve this and become sustainable, they must be (See Figure *1*: Sustainable food systems (SFS) (Adapted from Surampalli et al., 2020).):

- Perpetually profitable (economic sustainability).
- Directly and indirectly beneficial for society, e.g., by upholding workers, indigenous and human rights and promoting health, wellbeing, and inclusivity (social sustainability).
- Positive or neutral in its impact on the environment (Environmental sustainability).
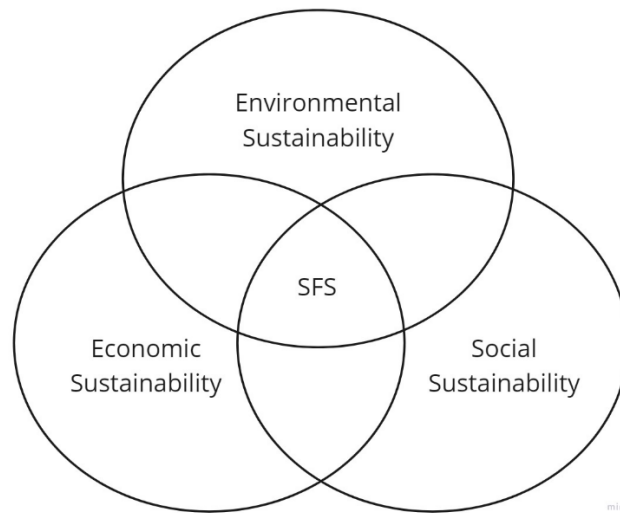
Figure 1: Sustainable food systems (SFS) (Adapted from Surampalli et al., 2020).

The report by Willett et al. (2019) provides a reference point and theoretical framework for global SFS. It aims to address long-term challenges relating to human health and the environment. The authors consider this to be a prerequisite to achieving the United Nations' Sustainable Development Goals depicted in Figure 2: Sustainable Development Goals (United Nations, 2020)..

Figure 2: Sustainable Development Goals (United Nations, 2020).

The Sustainable Development Goals and the *EAT-Lancet* commission report calls for a major transformation of food systems (Nguyen-Viet et al., 2019; Willett et al.,

2019). The need for this transformation is contextualised by the significant challenges imposed by globalisation, rapid population growth, urbanisation, growing wealth inequality, consumer patterns and behaviours, depleting natural resources, environmental degradation, and climate change (Nguyen-Viet et al., 2019). These challenges include the complexity of FS transforming to SFS and requires a more coordinated and holistic approach that transcends traditionally monolithic institutional, divisionary and disciplinary boundaries (Nguyen-Viet et al., 2019).

Globally this requires the construction and sustenance of interlinked global and local networks. These networks need to consist of systems thinkers and leaders covering a wide range of backgrounds and sectors that can facilitate the exchange and sharing of knowledge, challenges and good practices, and offer technical expertise and advice to countries. In an Aotearoa/New Zealand (NZ) context, these networks need to be adapted to the local social, cultural, and economic climate. These networks will need to include actors and stakeholders who can set up local knowledge generation and education dissemination systems, build clear pathways that bring sustainability knowledge to the field and link it to core knowledge providers, actors and stakeholders (Nguyen-Viet et al., 2019; Willett et al., 2019).

2.3   Food production in urban environments

Food production in cities and urban spaces is essential for the future of sustainable metropolitan areas (Bell & Cerulli, 2012). Historically, the integration of urban life and food production has a long legacy throughout Asia, Africa, and Latin America, although it typically has only occurred in times of crisis (Bell & Cerulli, 2012). In the nineteenth century and during the great depression, industrialisation displaced rural workers into cities which saw the first provision for allotment-style gardens in the UK and urban community gardens in the US (Irvine et al., 1999; Garnett, 2000). Disruptions to food imports and distribution networks during World War I and II also saw increased attention to urban food production by using all available land to compensate and contribute towards basic food security for the urban poor and unemployed (Bourque, 2000; Irvine et al., 1999).

Again, In the 1970s, economic recession, the oil crisis, and a mounting environmental movement motivated a surge of interest in urban food production and community gardens. The collapse of the real estate market in New York saw the city

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government transform publicly owned land, which was thought to be essentially worthless, into community gardens (Smith & Kurtz, 2003). In the 1990s, international interest was spurred by Local Agenda 21, which emphasised local level sustainable development (Ferris et al., 2001). Dubbed the 'Special period', the collapse of the Soviet Union and consequential financial loss and support for agricultural equipment and oil in Cuba sparked a revolution in urban and organic agriculture (Novo & Murphy, 2000).

The examples above showcase how 'crisis', be it political, ecological, or economic, has been a critical motivator for increased interest in urban food production. Recent concerns over the climate crisis, rising food costs, financial insecurities, and the ethical and environmental impacts of processing and production have led many consumers and communities looking for opportunities to grow food locally at home and in community gardens or allotments (Bell & Cerulli, 2012). Additionally, the New York Times reports that food insecurities due to the ongoing crisis of the Covid-19 pandemic has increased interest in urban food production (Wharton, 2020).

In response to crisis, local food production can be viewed in two ways. The first is that local agriculture provides a temporary stopgap for economic relief and food production, diverting attention from structural inequalities in the urban political and ecological systems and preventing fundamental and necessary change (Bell & Cerulli, 2012). While this increases the resilience of cities, it makes little contribution to improving long-term urban sustainability (Bell & Cerulli, 2012). Examples of this are the temporary use of available land during World War I and II, which ceased when the wars ended (Bourque, 2000; Irvine et al., 1999). The second is the opportunity to transform food systems by linking the changes observed in the crises to more comprehensive system change processes and transition to sustainability (Bell & Cerulli, 2012). For example, the current Covid-19 pandemic, as reported by Wharton (2020), has increased uptake in urban food production due to food supply chains breaking down. The observed change could be linked to more permanent measures that lessen future dependency on supply chains (Bell & Cerulli, 2012).

2.4   Food policy and environmental implications

Diets have the potential to nourish human health and nurture environmental sustainability. However, what is currently consumed and produced threatens human

health and the environment (Willett et al., 2019). Current agendas underpinning FS also favour economic gains over health and environmental outcomes, hindering political urgency and policy writing (Swinburn et al., 2019). For instance, to keep pace with increasing population growth, FS have increased global production. Concurrently, 800 million people still lack sufficient food to achieve healthy diets (Willett et al., 2019). Furthermore, the calorie-dense and low-quality foods produced have resulted in micronutrient deficiencies. These deficiencies have contributed to the rise in obesity and diet-related NCDs, which pose a greater risk of mortality and morbidity than the combined use of drugs, alcohol and tobacco (Chan, 2018; Willett et al., 2019).

Through policy, governments can heavily influence the environments that sub-systems conduct themselves within. Changes implemented by governments that affect particular sub-systems can also impact other sub-systems and potentially the entire food system. From the interconnection between health, diet, and the environment, a change to food policy could positively impact the environment, human health, and the entire FS web (Springmann et al., 2016; Willett et al., 2019).

This approach to FS policy can also impact the social determinants of health (SDH). Defined by Dekker (2014), SDH are the individual lifestyle, environmental, social and cultural conditions influencing the factors that, in turn, determine health and health outcomes. Dekker (2014) further elaborates SDH as issues of 'access' to income, employment services, safe living environments, nutritious food, stable housing and other basic needs.

Climate change, social determinants of health (SDH) and resilience
Through complex and interconnected relationships, SDH are compounded by climate change (Dekker, 2014; Swinburn et al., 2019). For example, through global bio-continental/regional shifts in temperature, there will be increases in extreme weather, rising sea levels and natural disasters. These temperature and weather changes negatively impact ecosystem health and crop yields (Dekker, 2014; Swinburn et al., 2019). Additionally, poor air quality created by pollution increases the occurrence of respiratory conditions. Subsequently, an increased inability to work and generate income will also be felt (Dekker, 2014; Swinburn et al., 2019).

When SDH and climate change policy agendas are viewed side by side, common ground and overlapping aspects are observed: particularly mitigation, sustainability and growth (Dekker, 2014; Swinburn et al., 2019). It is therefore recommended by Dekker (2014) and Swinburn et al. (2019) that these commonalities be used as a new model and framework for policy design whereby double or triple-level interventions can be introduced to address these issues simultaneously.

Additionally, it is also suggested that new frameworks and policies will need to be "resilient" (Dekker, 2014; King, 2008; Pomeroy, 2016; Swinburn et al., 2019). Traditionally, resilience has been thought of as a means to bounce back or recover from adversity. Linkov et al. (2014) demonstrate this by using the example of the human body's perseverance through disease or severe infection. Policy mimics this type of 'resilience' by reacting to a threat and reducing what makes something vulnerable in times of crisis.

What is known and understood about the complexities of a threat determines the 'what' (the economy, food systems, transportation and critical infrastructure) will be resilient and the 'how' (policy) it will be done (Dekker, 2014; Linkov et al., 2014). Given this, what is actually considered a threat does not always have unilateral agreement (Dekker, 2014).

Within the academic field of disaster and emergency management, climate change is considered a threat because of the potential catastrophe it can bring (Cutter et al., 2013; Linkov et al., 2014). While it is known that increases in the severity and frequency of extremes brought about by climate change will occur, no current technology or method available can predict the long-term and evolutionary distribution of potential events, nor the impacts of these on societies or their infrastructure (Linkov et al., 2014).

Therefore, in its traditional sense of remedying the situation, resilience policy is no longer sufficient to address the unknowns that climate change will bring in the future. Therefore, this new framework needs to transition away from 'reactive' policy towards 'proactive' policy. This can be done by imbuing the 'what' with resilience-engineering (e.g., self-healing, adaptive materials and automated, energy-self-sufficient technologies) in its design and modelling the 'how' to accommodate resilience (proactivity) (Cutter et al., 2013; Dekker, 2014; Gould & Rudolph, 2015).

2.5   Permaculture and food systems

Classified as a grassroots movement and defined as a formal, pattern-based design system, the term "permaculture" is a portmanteau of the Latin words' permanent': meaning to persist throughout or endure indefinitely, and 'culture': the activities that distinguish and support human communities (Bane, 2012; Hemenway, 2012; Paull, 2011; Mollison, 1988; Smith et al., 2017).

Permaculture is diversely influenced, drawing inspiration from natural farming as proposed by Masanobu Fukuoka and Howard T Odum's work in ecological system design, anarchism or the absence of power structure as proposed by Peter Kropotkin, and the architectural pattern-language of Christopher Alexander (Bane, 2012; Hemenway, 2015; Ingram, 2018; Mollison,1996; Paull, 2011). Indigenous wisdom, ethnobiology, and landscape geography, among other schools of thought, have all shaped the philosophy of permaculture which, "*is one of working with, rather than against, nature; thoughtful and protracted observation rather than thoughtless and protracted action; of looking at systems in all their functions, rather than asking only one yield of them; and allowing systems to demonstrate their own evolutions"* (Bane, 2012; Hemenway, 2015; Ingram, 2018; Mollison, 1988, p. *ix,* Mollison,1996; Paull, 2011).

Underpinned by three ethical principles, earth-care, people-care and fair-share — and twelve design principles (described below), permaculture is an applied holistic design system used to develop sustainable and regenerative human settlements. Its application universally empowers everyday people to solve real-world social, economic and environmental issues at the local level (Holmgren, 2004; Salleh et al., 2018; Stojanovic, 2019). Within a food system context, permaculture aims to empower people to move away from being consumers relying on external systems for their food, water, shelter, energy, and other material and non-material needs and help them become producers of their own material and non-material needs (Mollison, 1988).

Permaculture ethics
Mollison (1988) developed permaculture while researching community ethics adopted by indigenous, cooperative and religious groups. He found these groups to be seeking universal principles to guide their actions and, while with them, discovered "three ethics of permaculture", which aimed to unify people so that

common goals could be achieved (See Figure 3: The three ethics of permaculture (O'Brien, 2017).) (Mollison, 1988). The ethics offer a unifying framework that binds adopters of permaculture to personally take responsibility for the earth and each other, in whatever way possible, to ensure that support is withheld for destructive systems and that we "cease to invest our lives in our own annihilation" (Mollison, 1988, p. 1).

The three ethics of permaculture:
- CARE OF THE EARTH or EARTH CARE: Provision for all life systems to continue and increase.
- CARE OF PEOPLE or PEOPLE CARE: Provision for people to access those resources necessary to their existence.
- SETTING LIMITS TO POPULATION AND CONSUMPTION or FAIR SHARE: "By governing our own needs, we can set resources aside to further the above principles" (Mollison, 1988).

Figure 3: The three ethics of permaculture (O'Brien, 2017).

Permaculture principles
The permaculture principles are the guiding principles for designing permaculture systems (Mollison, 1988). In the co-originator's original work, Mollison (1988) describes over thirty principles ranging from thermodynamics and energy auditing to beneficial authority and strategies for alternative nations: all accompanied by commentary and visual concept designs. While Mollison's 1988 *Permaculture: A*

Designer's Manual is considered the "bible" of permaculture, Holmgren (2004) repackaged the principles into the now popularised "twelve principles of permaculture" depicted in Figure 4.
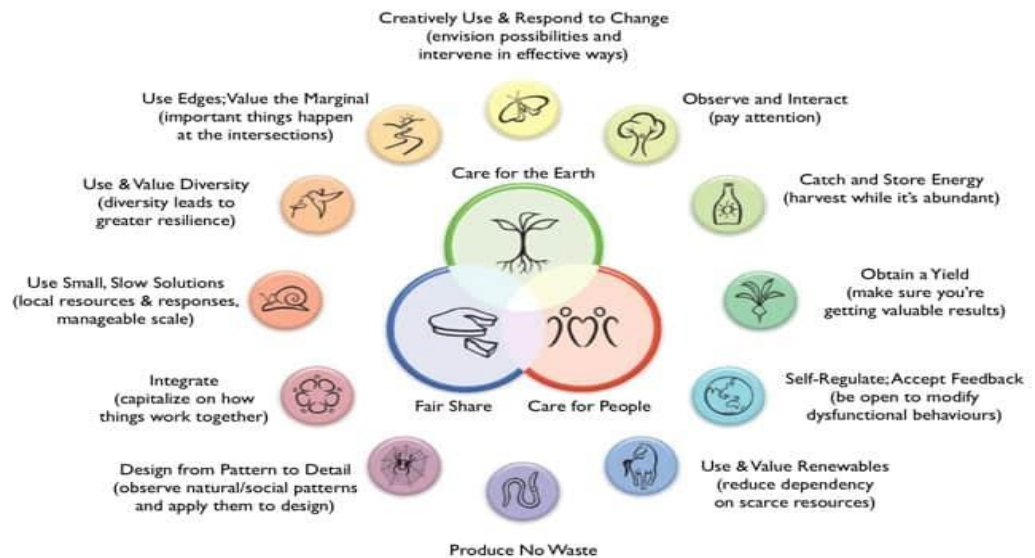
Figure 4: The twelve principles of permaculture (Holmgren, 2004).

Domains

As the concept of permaculture has progressed from the original meaning of 'permanent-agriculture' to the more holistic and inclusive 'permanent-culture', it has evolved to include the social and cultural aspects of sustainable systems (Bane, 2012; Holmgren, 2004).

The purposeful and sought-after inclusion of the social and cultural domains allows participation and engagement in the pursuit of sustainability that will not interfere with local culture or customs (Annan-Diab & Molinari, 2017). Because it is the very people who live there within their cultures who make the decisions, it also protects their cultures and customs from falling victim to unnecessary change, appropriation and adulteration, in the name of sustainability (Annan-Diab & Molinari, 2017; Surampalli et al., 2020).

The 'permaculture flower' depicted in Figure 5 shows the seven domains of permaculture action (Holmgren, 2004).

> *The spiral path beginning with ethics and principles suggests a*
> *knitting together of these domains, initially at the personal and*
> *the local level, and then proceeding to the collective and global*

level" (Holmgren, 2004).
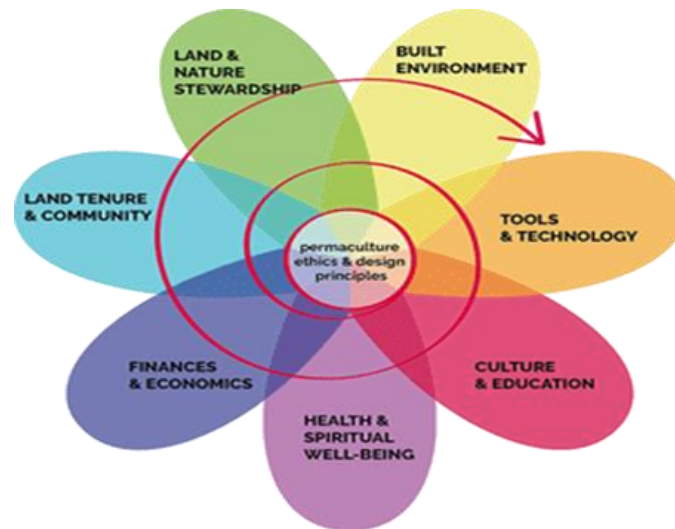
Figure 5: Permaculture flower (Holmgren, 2004).

<u>Education</u>

In 1984 the first permaculture curriculum and formal certification were codified with the Permaculture Design Certificate (PDC) (Holmgren, 2004). Most PDCs are 72 hours of formal tuition time covering core subjects including the philosophy, ethics and principles, design – methods and strategies, soil nutrients and health, natural and renewable energy, and water harvesting, amongst others. Some PDCs also cater for different use environments, focussing more on urban, rural or social application (Holmgren, 2004; Ingram, 2018; Permaculture in New Zealand, 2020; Smith, 2012). Additionally, students learn various design techniques such as 'zones' where sites are divided into areas depending on the frequency of use, and 'stacking functions' where a single element of a system is employed to provide more than one function or yield, and important functions are supported by multiple elements (Mollison, 1988). A common example of this is chickens, as they provide pest control, eggs, manure, and several other functions (Holmgren, 2004; Mollison, 1988).

While sustainability education and self-empowerment are at the forefront of permaculture, there is an array of other reasons that draw people to take up permaculture (Hemenway, 2012). Most first encounter it as a kind of method for food production. For others, it is about activism and social justice (Hemenway, 2012). Permaculture education is an ideal tool for empowering local community leaders, community champions, groups, businesses and organisations to

successfully tackle urban FS problems and transition away from our currently employed self-destructive systems to ones that are sustainable (Mollison, 1988; Permaculture in New Zealand, 2020).

2.6 Community garden-farming (CGF) and food systems

CGF can be understood as the combination, intersection, and integration of farming, garden-farming, and community gardens (Bane, 2012; Chicca & Pederson-zari, 2017; Ingram, 2018). Existing within the regime, farming is defined as "the business of raising animals, growing crops, etc., on a farm" (Cambridge University Press, 2020). With it comes the implications of enterprise, employment, professionalism, government funding and protection, scientific and technological integration, and large-scale application (Ingram, 2018; Willett et al., 2019). As a niche outside of the regime, garden-farming is the term used to describe the historical and contemporary efforts of rural/community/tribal people to grow their own food (Bane, 2012; Ingram, 2018). The implications of garden-farming include self-sufficiency, integration of food production and living environments, and human-scale application (Bane, 2012). Another niche, referred to as community gardens, is understood as a modern variation of garden-farming, particularly for use in urban spaces (Chicca & Pederson-zari, 2017; Ingram, 2018). Community gardens offer local and 'whole of community' opportunities for food production (Lovell, Husk, Bethel & Garside, 2014). Additionally, an increase in access, awareness, literacy and security of food has been noted with the use of community gardens. They (as niches) provide a socially orientated protected space that guards it against intrusion from conventional authoritative and institutional bodies (Chicca & Pederson-zari, 2017).

From a Multiple-Level Perspective, on the edges of these spaces (farming, garden-farming, and community gardens) are the 'boundaries of intersection' where conventional (regime) approaches meet and intertwine with non-conventional (niche) approaches, referred to as niche-regime interactions (See Figure 6) (Maye, 2018). Not to be confused with barriers that restrict, interfere and limit, boundaries are fluid, complex and messy, providing a valuable framework to conceptualise exchanges between food system actors and stakeholders (Ingram, 2018; Maye, 2018). This framework underpins community garden-farming.
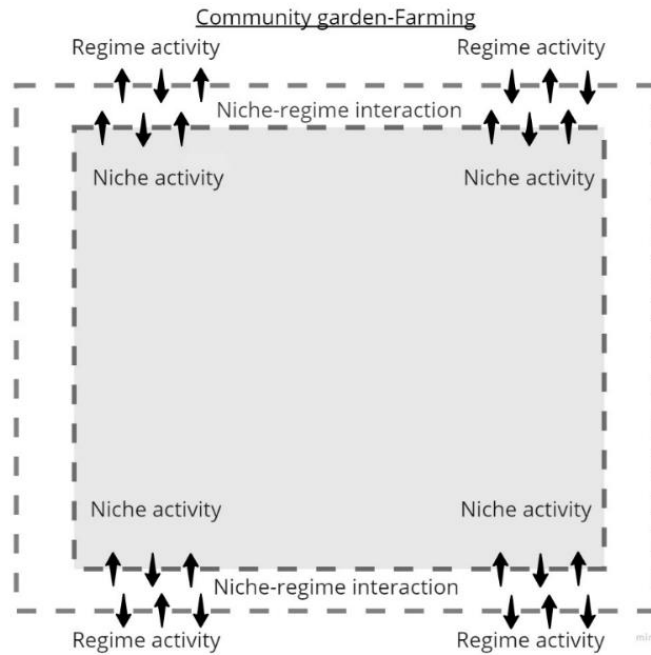
Figure 6: Community garden-farming. Own work.

Willett et al. (2019) explain that the scale of change needed to positively transform food systems has never been deliberately attempted. Their report states it will take an integrative framework, scientific targets, fresh perspective, and knowledge integration, and that *"achieving this will require a rapid adoption of numerous interventions and unprecedented global collaboration and commitment: nothing less than a Great Food Transformation".*

Additionally, the report by Willett et al. (2019) discusses what they refer to as a "safe operating space". This safe operating space consists of theoretical scientific targets that attempt to define sustainable food production and healthy diets and can be used to guide actors, businesses, and policymakers of food systems.

In a more 'local' and 'literal' sense, this thesis proposes that both the 'protected space' and 'safe operating space' mentioned above are implied by the term 'community garden-farming'. CGF would offer a literal 'protected space' for the 'safe operating space' to be conducted so these targets can be measured out, studied, and achieved (see Figure 7). These spaces would allow sustainable diets to be produced locally that also allow for ecological and environmental protection and restoration.

Additionally, the protected space would keep industry, government, and authoritative (regime) activities outside the boundary of CGF, protecting the area

from their direct actions and activity. While industry and government contributions of technology, policy protections, funding etc., are welcome, they can only enter the space of CGF through the intersection of niche-regime interaction.
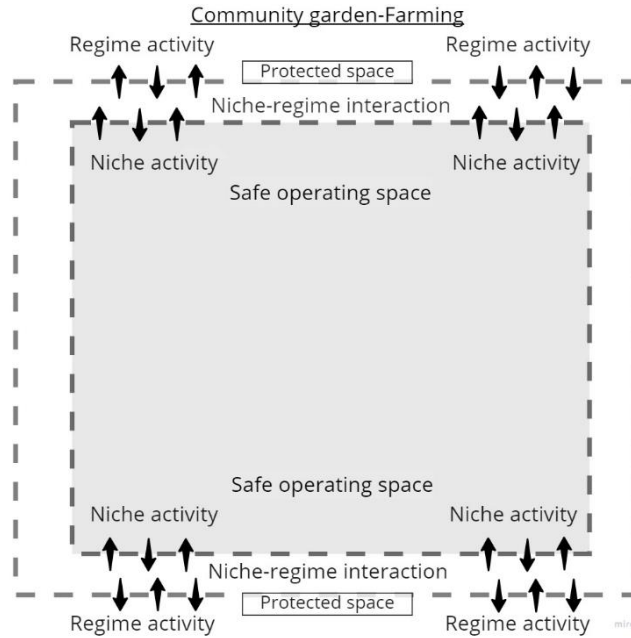
Figure 7: Community garden-farming as the protected space and safe operating space. Own work

CGF purposefully seeks to create a window of opportunity where FS actors, stakeholders, businesses, and policymakers can collaborate and work within the protected space and boundaries of intersection of the niche-regime interactions to achieve a more empowering and integrated SFS, designed using permaculture (see Figure 8).
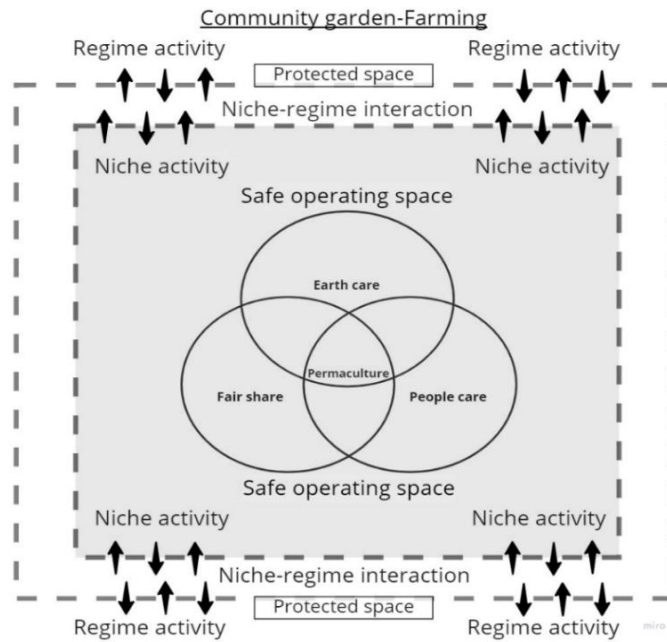
Figure 8: Community garden-farming as the protected space and safe operating space, designed using permaculture. Own work.

2.7 Summary

Food systems are complex with wide-reaching implications. The economically incentivised agendas underpinning food systems place human health and environmental outcomes as secondary: the effects of which will be compounded by climate change. Transforming to sustainable food systems will require a more proactive and integrated approach to food systems and public health. Community garden-farming designed using permaculture is presented as an interdisciplinary framework for a more integrated, empowering, and sustainable food system.

3   Literature review

3.1   Introduction

This chapter presents a review of the literature on the role of community garden-farming (CGF) and permaculture in urban food production. This review focused on the literature around the use of permaculture, its ethics and design principles and CGF, and their implications for public health, sustainable food systems and the environment. The review aims to investigate the following questions: How do permaculture and CGF contribute to sustainability?, and; What impacts would permaculture and CGF have on public health, food system, and environmental policy?

This review will focus on five key themes associated with permaculture and CGF. These are: interdisciplinary approaches, collective responsibility, environmental stewardship, low-income neighbourhoods, and traditional practices and innovation. The review begins by discussing the role of holistic approaches in sustainable food systems and how these relate to the need for collective responsibility (community input) and environmental stewardship in CGF and permaculture practices. It will then discuss the above themes regarding ways permaculture and CGF can positively impact low-income neighbourhoods. The review will draw on the importance of traditional practices and innovation in sustainable food systems and where they fit within permaculture and CGF.

3.2   The interdisciplinary approach of community garden-farming (CGF)

Community garden-farmers purposefully seek a holistic approach to food systems through *interdisciplinarity* between farming, garden-farming, and community garden food-producing specialist approaches. Interdisciplinarity is defined as the progressive combination of several fields of study beyond the limits and dynamics that typically house the traditions associated with singular schools of thought (Maye, 2018). From a Multiple-Level Perspective, the intersections of niche-regime interactions (See Figure 6) used in CGF are the ideal environment for Interdisciplinarity (Annan-Diab & Molinari, 2017; Maye, 2018). Interdisciplinarity creates an environment where the lines between different disciplines become blurry, facilitating problem-solving and expertise exchange in ways that are not limited by conventional orthodoxy (Annan-Diab & Molinari, 2017; Maye, 2018).

Rowat et al. (2019) stress the urgent need for Interdisciplinarity in sustainable food systems because these approaches have broader effects on food systems' personal and political aspects by increasing food and sustainability literacy at multiple levels. This finding agrees with Dorninger et al. (2020), who, in their systemic review, quantified sustainability intervention research into food systems for their potential for system-wide change and sustainability transformation. They found that deep leverage points – the goals, intent, values, perspectives, paradigms, and rules of the system – are largely missing from the literature, even though these aspects almost entirely shape and constrain understanding of where interventions in systems can occur. They state that sustainability research needs to better understand the interconnections between different systems characteristics, and therefore recommend shifting from disciplinary optimisation of subsystems to an interdisciplinary approach spanning the design, intent, values and other aspects of deep leverage points (Dorninger et al., 2020).

Harmful impacts of conventional approaches

Mesnage & Séralini (2018) recommend that because the issues related to food systems, i.e., human health, biodiversity conservation and agrochemical use, have political, social, ethical, health and legal implications, interdisciplinary approaches need to be embraced. For example, the study of the health effects of industrial activity, e.g., petrochemical use, is highly specialised, and little research addresses the critical and complex questions from an interdisciplinary point of view (Mesnage & Séralini, 2018). For example, the debate on glyphosate (Roundup) is constrained because it is a commercially protected product, and so research is partly unavailable to independent scientists, regulators, and the public (Cuhra, Bohn & Cuhra, 2016). While industry provides assurances on its safety, which has led to exponentially amplified modern use, Nicolopoulou-Stamati et al. (2016) and Séralini (2018) found poor chemical hygiene controls of the same industry. Furthermore, they found that current regulations allow pesticide residues in multiple everyday foods and human breast milk samples, raising concerns about prenatal exposure and health effects in children (Aloizou et al., 2020; Nicolopoulou-Stamati et al., 2016).

The reliance on practices that cultivate herbicide-resistant crop strains can also negatively impact soil microorganisms: particularly nitrogen-fixing bacteria and mycorrhizal fungi that help plants absorb nutrients. They also have adverse effects

on earthworm growth rate and mortality, and have toxic effects on beneficial insects, mites and spiders. Non-target weeds develop Roundup resistance and cross-pollinate with non-transgenic species, imparting expressions, e.g., insect resistance, that can affect natural ecosystems (Altieri, 2009; Mesnage & Séralini, 2018; Séralini 2015).

Additionally, pesticides and their metabolites can directly impact human and animal health (Mesnage & Séralini, 2018). During the process of assimilation, human and animal bodies may metabolise, excrete, store or bioaccumulate pesticides in body fat (Nicolopoulou-Stamati et al., 2016). The adverse health effects include changes in gene expression as well as gastrointestinal, endocrine, dermatological, respiratory, reproductive, neurological and carcinogenic effects, and death (Cuhra, Bohn & Cuhra, 2016; Mesnage & Séralini, 2018; Nicolopoulou-Stamati et al., 2016). Some of the most recent research has linked pesticide use to metabolic degradation, cognitive dysfunction, Alzheimer's and dementia (Aloizou et al., 2020).

A lack of personal control over these effects raises ethical questions around current food system practices and the legislation that allows this to happen (Benachour, Moslemi, Sipahutar & Séralini, 2007; Benachour & Séralini, 2009; Cuhra, Bohn & Cuhra, 2016; Rather, Koh, Paek & Lim, 2017; Séralini, 2015; Séralini, 2018). Therefore, interdisciplinary approaches to food systems will be able to provide checks and balances on a more holistic level to address these ethical questions and transition food systems to being sustainable (Dorninger et al., 2020; Maye, 2018; Rowat et al., 2019).

3.3   Collective responsibility (Community input)

Willett et al. (2019) explained that unprecedented and urgent collective action, collaboration, and commitment at all levels would be required to transform food systems away from remaining the major global drivers of poor health and environmental degradation.

This need for collective input is exemplified in the case study by Gupta (2014). Gupta (2014) investigated the fifth most populated island of Hawaii, known as Molokai, and the inhabitants' place-based approach to regional self-sufficiency and sustainability, referred to as "aloha aina" or love for the land. Aloha aina is a practice in which the island's residents have a shared sense of responsibility to care

for the land and desire for self-reliance. From the perspective of the residents of Molokai, sustainability means being able to practice aloha aina. However, this localised sustainability focus can lead to conflict and problems between its residents and the non-localised state, national and global social, political, and economic systems and agendas (Gupta, 2014). For example, to support the overconsumption of energy on other islands, wind farms were constructed on Molokai to secure extra energy for other islands. According to national policy, state-led initiatives of sharing resources, and global priorities of combating climate change, 40% of all electricity must be generated from renewable sources by 2030. However, these kinds of developments jeopardise Molokai's rural environments, natural landscapes, and ability to practise aloha aina. This 'sharing of resources' instigated by the state brings about a trade-off for the residents of Molokai in balancing the needs of their island with that of the state and the planet.

As pointed out by Gupta (2014), the ethical dilemma boils down to the question of what is most essential to sustain: Molokai's self-sufficiency, the state's energy security, or the global climate? (Gupta, 2014). As Gupta (2014) states, while the industrial ecologist will argue that sustainability can only exist at a planetary scale, for a resident of Molokai, aloha aina is their path to sustainability.

Community agency and social responsibility

Dekker (2014) and Linkov et al. (2014) define a community as a group with shared interests. However, Ikerd (2001) argues that community means far more than this, in that community embodies that which can't exist in individuals alone. Ikerd (2001) explains that community is the connections, relationships, and the sense that the individual is part of something beyond just themselves or the relationships between individuals.

According to Brown and Westaway (2011), adaptation is essential for transformation at the individual and community levels. However, the ability of individuals and communities to transform is determined by their adaptive capacity, which is ultimately determined by available resources, individual and community resilience, well-being, and, in particular, the role of agency (Brown & Westaway, 2011). Agency is defined as the independent ability to act without impediment (Brown & Westaway, 2011). Similarly, community agency can be understood as the ability of a group with

shared interests to act independently and without impediment (Brown & Westaway, 2011; Dekker, 2014; Linkov et al., 2014).

Leonard, McCrea & Walton (2016) state that to increase personal agency and social responsibility within food systems, increasing the agency of the community that individuals live and operate in should be a focal point for change. This is because agency can be leveraged more within local domains, e.g., schools, supermarkets, or workplaces, for small changes. Multiple small changes by individuals can build into community agency, which enables community action and broader social change that can then "reorient systems" (Swinburn et al., 2019).

While the importance of community agency is stressed, it does not mean communities should be left to their own devices (Leonard et al., 2016). Leonard et al. (2016) demonstrated that local and regional governance bodies can be significant facilitators of forums for all stakeholders to exchange information and skills, develop trust and resilience, and plan, development, action, and citizen activities.

Two international studies —Wakefield, Yeudall, Taron, Reynolds & Skinner (2007) and Kingsley, Townsend & Henderson-Wilson (2009) — used semi-structured qualitative interviews to ascertain the health and social well-being impacts of the community gardens on participants. Similar benefits were identified in both studies around the positive psycho-social influence the gardens offered, particularly the individual well-being associated with a sense of belonging and being part of a community that fosters building connections with like-minded citizens of their neighbourhood. Both studies identified improved access to locally grown and nutritious foods, increased gardening knowledge and skills, increased physical activity and overall improvements in physical health.

Earle (2011) investigated community gardening as a 'public health intervention'. She found evidence of health inequalities when comparing Pakeha to Māori, Pacific, South-Asian and other marginalised groups in NZ and, in particular, poorer access to nutritious foods due to the abundance of "unhealthy" food outlets and lack of affordable healthy food options (Earle, 2011). This agrees with Wakefield et al. (2007). They state that participants felt the gardens helped break down barriers to accessing nutritious foods by aligning them with their cultural ways of being.

Morel, Léger and Ferguson (2019) state that 'taking personal responsibility' is one of the critical elements for empowering people to cooperate. Cooperation has a positive role in managing human-environment relations to meet food and resources needs and increase ecosystem health (Morel et al., 2019).

<u>Collective responsibility and permaculture</u>
As previously explained, for adopters of permaculture, the three ethics (earth-care, people-care, fair-share) require practitioners to take personal and social responsibility for their actions (Mollison, 1988). However, Mollison (1988) also extends this notion of taking responsibility in "The prime directive of permaculture", stating that, "The only ethical decision is to take responsibility for our own existence and that of our children" (Mollison,1988, p. 1). Mollison (1988, p.2) also explains that "life *is* cooperative rather than competitive", referring to this as the "Principle of cooperation", stating that "Cooperation, not competition, is the very basis of existing life systems and of future survival." (Mollison,1988, p.2). Pickerill (2013) demonstrates that communities which have been able to use permaculture have incorporated their local food production, livelihoods and housing in ways that incorporate unity and encourage people to take personal and shared responsibility for their communities and environments. The community spaces then become natural laboratories for empowerment, where local sustainability solutions are experimented with and actioned by the local stakeholders (Pickerill, 2013).

Upon review, permaculture has been largely absent from scientific literature (Holmgren, 2004; Krebs & Bach, 2018). The systemic review of international permaculture literature by Ferguson & Lovell (2014) agrees and found that permaculture is not often associated with scientific or academic investigations of public health and sustainable food systems, in the global or NZ context (Ferguson & Lovell, 2014; Ferguson & Lovell, 2015; Ferguson & Lovell 2017; Spangler, McCann, & Ferguson, 2021). The majority of permaculture literature has been published in books written by permaculture experts rather than by academics or scientists (Ferguson & Lovell, 2014). In addition, most permaculture sites and gardens around the globe and in NZ are in rural areas, in small-scale farms as opposed to urban applications (Smith, 2012; Tóth & Feriancová, 2015; Kazakova-Mateva & Radeva-Decheva, 2015).

In their review, Krebs & Bach (2018) show evidence for all twelve permaculture principles, as set out by Holmgren (2004) (see Figure 4). This agrees with findings by Altieri & Nicholls (2005) and Ferguson & Lovell (2014) in that permaculture principles strongly align and overlap with agroecology principles and the discipline of applying ecological processes in agricultural systems. In particular, the overlap can be seen in the principles related to creating synergies by integrating different elements of systems (integrate rather than segregate) and building up storage of water and fertile soils (catch and store energy). There is further overlap between agroecology and permaculture as both promote polycultures, agroforestry, and animal integration (Altieri & Nicholls, 2005; Holmgren, 2004). However, Krebs & Bach (2018) point out that in contrast with agroecology, permaculture goes far beyond cultivation. While agroecology focuses solely on crop production and ecological health, permaculture is used to design, implement, and maintain the resilience and sustainability of whole systems.

Furthermore, while the goal of agroecology is food production, from a permaculture standpoint, food production is a by-product of a successful system design. Additionally, permaculture includes the broader human and environmental aspects of whole systems and societies in its design framework, whereas agroecology does not (Krebs & Bach, 2018).

In the only study of its kind, King (2008) compared permaculture gardens with community gardens for their contribution to ecological and community resilience. Both community gardens and permaculture gardens reduce demand for less sustainable options by offering self-sufficiency and produce exchange. Regarding community resilience, permaculture gardens maintain networks for exchange and contribute to creating self-sufficiency, deliberate learning, and small business niche market opportunities. Community gardens enhance the space for communication, deliberate co-learning, and information sharing by creating a flexible social institution. The study also found that permaculture enhances biodiversity (King, 2008).

3.4   Community garden-farming (CGF) and environmental stewardship
Defined by Bennett et al. (2018), environmental stewardship is the action of protecting, caring for, or taking responsibility for environments in pursuit of social and environmental outcomes. In its applied sense, it can be described as

environmental conservation and restoration or sustainable management of resources at the local or global level (Bennett et al., 2018). The many issues surrounding global food systems and climate change can lead to the perception that local action does not meet these challenges (Bennett et al., 2018). However, one of the most effective ways to participate in and respond to these challenges is engagement in local and proximal environmental stewardship action and initiatives that are relied on for livelihood and subsistence (Bennett et al., 2018).

Directly creating spaces that invite people to participate in small-scale environmental stewardship endeavours is one goal of CGF. By participating in CGF, people can take part in acts of environmental stewardship such as carbon sequestration, water management and composting (Graetz, 2020; Okvat & Zautra, 2011). Removing carbon from the atmosphere and capturing carbon released from soils can mitigate or reverse climate change, making it an essential element of environmental stewardship (Graetz, 2020; Okvat & Zautra, 2011). CGF attends to removing carbon from the atmosphere and mitigating its release from soils in several ways (see Figure 9) (Graetz, 2020; Okvat & Zautra, 2011).
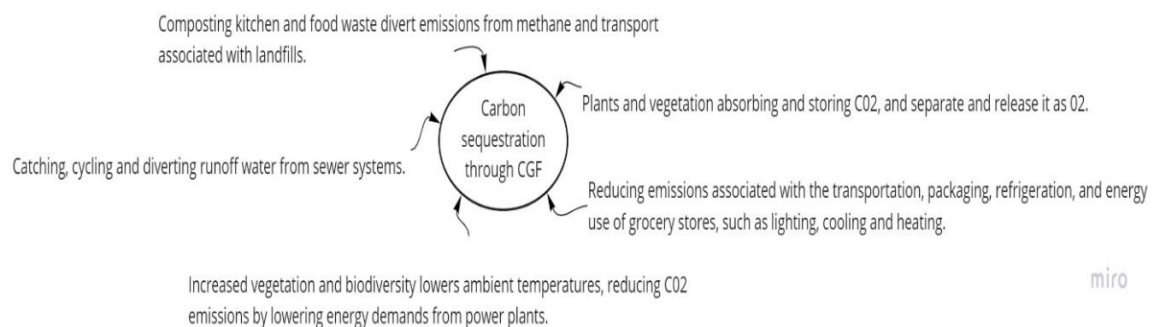
Figure 9: Carbon sequestration through CGF. Own work.

Additionally, Hathaway (2016) adds that the ability of CGF to capture carbon makes them front runners in terms of food-producing systems. This agrees with findings by The Rodale Institute (2014). They state that the methods used in CGF, which rebuild organic soil components, increase carbon capture by 1% annually, reaching 30% after thirty years and sequester 8,233 Kgs of CO_2/hectare per year.

According to Okvat & Zautra (2011), the methods for measuring soil carbon are not only complex, but there is also no single formula that exists for measuring carbon per cubic foot of soil in a garden. One estimate by Meadows (2000) of carbon

sequestration by community gardens showed that an 0.4-acre organic communal garden had sequestered 19 tons of carbon over ten years and increased organic matter in the top 8 inches of soil from 1% to 7.7%. This single community garden can be said to have offset roughly three years of an average American's emissions of 6-6.5 tons of carbon each year. If the scale of the garden is more extensive and the organic matter in the soil is deeper, this number would increase (Okvat & Zautra, 2011).

Additionally, there are an estimated 10,000 community gardens in the US. Suppose the same calculation for the single community garden above is roughly applied to this number. It can be estimated that community gardens in the US have sequestered 190,000 tons (172,365,101 kg) of carbon over the past ten years, offsetting one year's worth of carbon emissions from 30,400 Americans.

CGF indirectly impacts the environment by providing a place of learning where members can gain education, awareness and demonstration of environmental stewarding actions (Graetz, 2020). As the study by Wakefield et al. (2007) showed, members of community gardens gain a deeper understanding and awareness of environmental and climate issues. Particularly, CGF provides a space where people can learn and teach about climate change and its processes and gain education focused on sustainability. It also provides an opportunity to develop an awareness of the connection between the environment and human actions and demonstrate how consumer choices and food systems impact climate (Graetz, 2020; Wakefield et al., 2007).

Krasny, Tidball & Blum (2017) looked at indirect environmental impacts regarding community gardens as heterogeneous learning environments. Using various data collection methods, including interviews, questionnaires and surveys, they determined that participants began to draw connections between soil health and propagation after learning about and examining compost and soil organisms. Participants also became more aware of grown foods' cultural relevance, the significance of community gardens, and their role in sustainable and environmental practices (Krasny et al., 2017).

Permaculture systems
One of the outcomes within a permaculture system is building healthy soils to

provide nutrients for plant life and capture carbon (Altieri 2009; Krebs and Bach, 2018). This is achieved by harnessing the breaking down of organic matter as seen in natural systems (Altieri 2009; Krebs and Bach, 2018). Examples of this approach within a permaculture system include cyclic cover crops, on-site produced animal manures, companion planting, and guild matrices (synergistic interplanting of several companion species that mimics a nine-layer natural ecosystem) (Altieri 2009; Hathaway, 2016; Krebs & Bach, 2018).

Additionally, these approaches help achieve closed-loop nutrient systems where the system produces all necessary inputs to keep it healthy and functioning long-term. This results in outside resources and inputs, such as chemical fertilisers, not being needed for soil health and fertility (Altieri 2009; Hathaway, 2016; Krebs & Bach, 2018).

Closed-loop permaculture systems also make it possible to reduce or altogether avoid the need for petrochemicals, including pesticides (Hathaway, 2016; Lepine, Scott, Leung, Hansen & Porter, 2004). In conventional agriculture, large-scale singular crops, or monocrops, are the primary method of production used (Hathaway, 2016). Due to a lack of diversity, monocrops lack biological defences. This makes them vulnerable, so pesticides are used to lessen the damage and mitigate crop loss. However, in permaculture systems, species that deter pests and protect from disease are also interplanted as part of the guild matrix, meaning there is no need for pesticides (Hathaway, 2016; Lepine et al., 2004; Yuen, Anda, Mathew & Ho, 2001).

According to Hathaway (2016), farms in Cuba that have adopted more permaculture approaches to agriculture have reduced their agrochemical inputs by 77% and increased production by 145% since 1988. The drop in fossil fuels used to produce agrochemicals, as well as the drop in emissions from chemical fertilisers, has also significantly reduced greenhouse gas emissions.

The energy efficiency (total energy output to input) of permaculture systems far exceeds that of industrial farming (Altieri, Funes-Monzote & Petersen, 2012). In Cuba, some small farms have reported permaculture system energy efficiencies ranging from 10:1-30:1, in comparison to industrial approaches with efficiencies of 1:1.5 or less, meaning more energy is put into the system than comes out of it

(Hathaway, 2016). Similarly, when comparing large-scale organic to non-organic production, organic US farms use 15-45% less energy than non-organic (Gomiero, Paoletti & Pimentel, 2008).

3.5   Low-income neighbourhoods

As previously explained, the social determinants of health (SDH) are issues of access, and those with lower socioeconomic status (SES) are disproportionally affected as their access is impacted more than those privileged with high SES. Climate change compounds these issues (Dekker, 2014). Dekker (2014) gives an example of climate change causing droughts, affecting crop yields and supply chains and raising prices. For those with privilege and high SES, the effects are negligible. At the same time, those with low SES are now forced to choose cheaper and low-nutrition foods, resulting in malnutrition and deficiencies and negatively impacting health (Dekker, 2014).

Additionally, access to and consumption of healthy foods, such as fruit and vegetables, is limited in low-income neighbourhoods by a lack of access to businesses that supply these kinds of produce. Even when these products are available through local "corner stores", they are typically more expensive (Gudzune et al., 2015). There is interest from residents of low-income neighbourhoods to purchase fruit and vegetables from corner stores (O'Malley, Gustat, Rice & Johnson, 2013), and when there is more variety of produce available, it is more likely to be purchased (Martin et al., 2012). Store owners report stocking challenges due to high prices from wholesalers and improper storage facilities (Gudzune et al., 2015; Hu, Acosta, McDaniel, & Gittelsohn, 2013).

In addition to the access and availability of healthy foods being negatively affected in low-income neighbourhoods, these areas are typically more prone to being spaces in which nefarious activities occur. Crime, violence, and drug use significantly impact individual and community mental health and well-being (Bell & Cerulli, 2012; Meyer, Castro-Schilo, & Aguilar-Gaxiola, 2014). This demonstrates a need to ensure there are alternative ways that people and communities can access fresh produce, regardless of affordability and access (Bell & Cerulli, 2012; Gudzune et al., 2015; Meyer, Castro-Schilo & Aguilar-Gaxiola, 2014).

Food justice and the protected space

Sovereignty over the mechanisms and policies of food systems and the removal of food insecurity, economic pressures and other barriers to food-sovereignty are the goals of food justice (Alkon & Mares, 2012). The work of Alkon & Mares (2012) demonstrates the impediments to food justice and food sovereignty for low-income communities in urban United States. They found that the broader political and economic forces of the "neoliberal" agendas underpinning food systems constrained projects associated with food sovereignty and justice (Alkon & Mares, 2012). The authors explain that half the reason for this was that local activists did not recognise or were unaware of neoliberalism's effect in creating issues of access and food insecurity (Alkon & Mares, 2012). One example is that activists involved emphasised taking a market-based approach in a local food production initiative. This kept locally produced food out of reach for the food-insecure residents they were supposed to be for. In conclusion, they suggest that for food sovereignty and food justice to be successful, it is necessary to acknowledge and resist neoliberalism (Alkon & Mares, 2012).

The protected and safe operating space of CGF has the potential to positively impact the issues of food justice and sovereignty for low-income communities by offering unique and diverse inclusion opportunities. This increases the availability of fresh and local products alongside creating local spaces to build and enhance sustainability literacy. Stakeholders can then also enhance their civic engagement, self-determination, agency, and increase social capital across many different ethnic- and age-diverse communities (Alaimo, Beavers, Crawford, Snyder & Litt, 2016; Glover, Parry & Shinew, 2005; Saldivar-Tanaka & Krasny, 2004; Twiss et al., 2003).

Low-income neighbourhoods and community gardens

Armstrong (2000) found that of the 63 community gardens surveyed in New York, USA, those in low-income neighbourhoods are four times more likely to use community gardens as community hubs to address and solve local community issues such as crime. They also found that these spaces offer beautification and leisure activity and are stress-relieving (Wakefield et al., 2007).

Graetz (2020) also highlights that while the benefits of community gardens in poorer communities can be seen in the examples above, these benefits are also relevant in community gardens, "no matter the context". Although low-income neighbourhoods

benefit from CGF, more affluent neighbourhoods have also been found to benefit from CGF.

Graetz (2020) points out that in the study by Kingsley et al. (2009), where the area is more affluent and 70% of participants are females over the age of 50, the same or similar benefits of social, physical and mental well-being are seen. Graetz (2020) also notes that the range of activities available in community gardens is inclusive for everyone as it is suitable for all ages, levels of fitness, body types, and genders.

Similarly, in the study by Bell & Cerulli (2012), although the limited quantity of production couldn't meet the total dietary needs of participants, the gardens made significant contributions to the diets and lives of participants, transforming a once abandoned and degraded estate into a thriving, beautiful space where the low-income community can come together, learn about and grow their own food and contribute to their own sustainability. The case study illustrates a fundamental difficulty with the implementation of permaculture and CGF. If there is government involvement, it isn't easy to get things off the ground (Bell & Cerulli, 2012). Bell & Cerulli (2012) explain that, although the factors of squatting, prostitution, poor lighting and drug-use created conditions that led to the supportive intention from developers and local government, which allowed the community gardens emergence, no direct or formal access to resources or support were granted (Bell & Cerulli, 2012). Initially, the community garden was designated as a 'regeneration' site in 1997. Three planned attempts and 14 years later, the developer and local government partnerships were still working on 'their' final plans for the site. So, while the intention of developers and local government's intention to provide support was present, they failed or were unwilling to provide support (Bell & Cerulli, 2012).

To combat the difficulties that arise in implementing permaculture and CGF, Dekker (2014) and Swinburn et al. (2019) recommend double- or triple-level policies that address the overlapping aspects of relevant SDH and climate change agendas, such as those suggested by Stephens, Chicca & Adams (2014). These include the formalisation of government support for CGF and permaculture food production systems. They also recommend establishing clear policy that integrates appropriate land tenure, use, plans and maps and strengthening coordinator roles and capacity, alongside establishing an ombudsperson. It is also recommended that policy identifies and integrates opportunities to build into the cityscape and support municipal green infrastructure. These should be included in review processes of

neighbourhood planning and soil conservation programmes. Programmes should include the integration of collection and distribution programmes for composting and encourage off-site approaches within member communities (Stephens, Chicca & Adams, 2014; Dekker, 2014; Swinburn et al., 2019).

3.6   Innovation and traditional practices

To have sustainable food systems, we will need to be 'innovative': allowing new ideas, new ways of thinking and interacting with the world to develop that challenge dominant paradigms and the modes by which they advance (Maye, 2018). Innovation allows 'transition' to take place by creating a 'window of opportunity' between the dynamics of niche-regime interactions such as community gardens and the involvement of local government (Maye, 2018). In terms of sustainable food systems, two types of innovations have been identified: incremental innovations — generated by governments, institutions and industry that maintain the status quo, and radical innovations – socially generated niches outside the regime that respond to the contradictions within the regime (Ingram, 2018). A contemporary example of this is organic agriculture. As a radical innovation that challenged the regime of its time, it brought about transition and transformation (Maye, 2018).

Another example of radical innovation is seen in Luna, Dávila & Reynoso-Morris (2018), who used permaculture to develop a solution to address the injustice of local 'food deserts'. Food deserts are areas where access and affordability of healthy food are absent (Luna et al., 2018). These have led to iron and protein deficiencies in the Monte Plata community in the Dominican Republic. Purposefully opting not to follow conventional modalities of learning, with the use of 'experts', instead, they "honoured… each person's contributions for innovation" and constructed an aquaponics system to provide protein —through fish and iron — through spinach. While successful, it was noted that this system alone is not adequate to produce food for the entire community. However, if further efforts dovetailed to these radical innovations, such as collaboration between governments and community gardens, the community's nutritional needs could potentially be met (Luna et al., 2018).

A traditional yet innovative permaculture and CGF example includes urban forest gardening and food forests. Food forests are multi-storey polyculture food systems that mimic the natural patterns of self-sustaining nine-layer ecosystems, ranging

from the canopy, shrub and herbaceous layer to climbers, ground covers and mycelial/fungal layer (Park, Kramer & Rhemtulla, 2019). To assess the potential of urban food forests for increasing food security and mitigating malnutrition in urban areas, Nytofte & Henriksen (2019) quantified the annual yield and nutritional value of produce in a 26-year-old, 0.08ha sized food forest, consisting of 99 different species of edible vegetation. Their results showed that the systems produced 713 kg's (9868 g protein, 8394 g lipids and 85627 g carbohydrates), equating to over 400000 kcal annually, which is enough to provide 6-10 people with their recommended daily intake of macronutrients and energy needs. Given this, the authors point out that the diets produced from this particular system were lacking in proteins and lipids. The authors recommend integrating a variety of species such as beans, nuts and seeds to provide larger-scale communities with nutrients (Nytofte & Henriksen, 2019).

As demonstrated in Lepine et al. (2004), the traditional method of on-site water harvesting is another innovation that can be used in CGF. They showed the value of water conservation practices using drip irrigation and mulching. They found that these practices stopped evaporation, slowed infiltration and held moisture in the ground longer, reducing soil erosion and enhancing landscape remediation and rehabilitation (Yuen et al., 2001).

Closed-loop waste and nutrient management systems are similarly innovative by integrating animals into the system to exchange organic waste materials for manure that is then composted and applied to garden beds to feed and replace nutrients that the plants use as energy (Lepine et al., 2004; Yuen et al., 2001). The ecological relationship that is enhanced with the use of manure is further benefited with the purposeful diversity of annual and perennial intercropping that acts as pest management by utilising species that deter pests through allelopathic qualities or some other form of deterrent action (Lepine et al.,2004; Yuen et al., 2001).

Indigenous Traditional Knowledge
"21st century thinking to replace the extractive, polluting, individualistic, and materialistic concepts" of current food systems is needed (Swinburn et al., 2019). Indigenous peoples' traditional knowledge and practices can provide the innovative basis for the kind of thinking needed to transform food systems to be more sustainable (Willett et al., 2019; Swinburn et al., 2019).

In an NZ context, Heke (2019, as cited in Swinburn et al., 2019) stresses the importance of traditional knowledge because authoritative institutions providing nutritional and physical activity initiatives are under the impression that they know "what's better for Māori than they do themselves… It's likely that the answers to Indigenous health problems already exist in their communities, but have been forsaken for the new brand of medical autonomy that has side-lined indigenous ways". Swinburn et al. (2019) therefore recommends establishing a Seven Generation Fund: "The Iroquois concept of seven generation stewardship urges the current generation of humans to live and work for the benefit of the seventh generation into the future".

Similar to the Seven Generation Fund, Heke (2019, as cited in Swinburn et al., 2019) proposes the Atua Matua Māori Health Framework: an approach that centres on and synthesises indigenous and non-indigenous thinking, traditional knowledge and contemporary interpretations to rediscover "new old ways that look to the past to navigate the future". Swinburn et al. (2019) add that platforms for action and decision-making, such as Atua Matua, support traditional and indigenous scientists and their populations' health, well-being, and heritage rights, which supports the planet's well-being.

Permaculture and indigenous knowledge
Caradonna & Apffel-Marglin (2018) compared permaculture approaches with the indigenous systems of Kichwa-Lamistas chacra (farms) in Peru. They found parallels and synergies between both systems in that they favour the use of closed-loop, polyculture and agroforestry-based food production systems (Caradonna & Apffel-Marglin, 2018).

Caradonna & Apffel-Marglin (2018) also found that because of "permaculture's rootedness in scientific, materialist, and universalist traditions… [permaculturists] ultimately treat the natural world as other… as objective and made up of spiritless resources". Indigenous people see the natural world as intimate kin and co-creators, while permaculturists see it as something that needs to be "managed", "stewarded", and "designed". The cultural, spiritual and ritualistic components of indigenous systems are voluntary and optional to permaculturists (Caradonna & Apffel-Marglin, 2018). Caradonna & Apffel-Marglin (2018) argue that, while well-meaning, the

differing perspectives means permaculture runs the risk of neo-colonial cultural appropriation and exploitation of indigenous knowledge.

When this argument is viewed alongside the findings of Ferguson and Lovell (2015), the potential for appropriation grows. They found that there is a "white supermajority" of permaculture practitioners amongst ethnic groups, causing permaculture to fall short of creating a diverse and inclusive movement.

However, Caradonna & Apffel-Marglin (2018) also argue that permaculture has a place amongst indigenous practices. According to Caradonna & Apffel-Marglin (2018), indigenous systems were essentially already a kind of permaculture, so their re-introduction is easier to justify in areas that have "lost it" due to colonialism. For CGF, which uses permaculture, to be successful, it "cannot allow itself to become yet another form of well-meaning cultural and ecological imperialism—the Global North trying to "save" the Other by remaking the Other in its own image." This recommendation can also be applied to any neo-colonial and western approach (Caradonna & Apffel-Marglin, 2018). Caradonna & Apffel-Marglin (2018) also make the following recommendations:

> *It is legitimate, in our view, for Western permaculturists to work with and even assist non-Western peoples, but only if permaculturists are explicitly invited to do so, and only if they work with long-established local biocultural realities, including native flora, spirituality, and rituals, local microclimates, and the needs, will, and practices of the local inhabitants. Otherwise, it is not philosophically distinct from bringing chemical fertilisers and herbicides to places that never had them before.*

Although permaculture shares similarities with indigenous knowledge systems around earth-care, people care and fair-share and approaches to food production, alignment with indigenous systems is needed to ensure that indigenous health is addressed alongside food systems transitioning to sustainable food systems (Caradonna & Apffel-Marglin, 2018). If CGF is practised in a safe and protected space, it may help break down the barriers to diversity that permaculture faces (Ferguson & Lovell, 2015).

3.7 Summary

The local and international scientific literature reveals that permaculture and CGF offer a range of approaches that are well suited to integration within sustainable food systems. The interdisciplinary approach of CGF can help address the issues of

food systems by providing a space where the interconnections of FS can be utilised beyond what is possible using conventional means. The alignment of the interdisciplinary approach of CGF with permaculture can bring about radical change to FS by innovatively addressing the values, intent and design aspects that shape FS.

4   Research design/Methodology/Analysis

4.1   Introduction

This study explores the role of permaculture and community garden-farming in food production in urban environments. The research investigates how permaculture, its ethics and design principles, could be applied to community garden-farming and looks at implications for public health and food policy directions.

This chapter covers the research design, methodology, and analysis used to answer the research question. The study utilised radical theory to underpin the methodology and methods in this research. This approach used qualitative descriptive methodology to gather perspectives and experiences from key permaculture and community garden-farming practitioners in New Zealand. This chapter outlines this theoretical framing and the methodological processes used in the study.

4.2   Theoretical framework — Radical research theory

This project used a radical research theory approach when designing the study processes. Radical research theory aims to bring about social change and focuses on critiquing dominant social and cultural norms (Grant & Giddings, 2002). Originating from the work of Kuhn (1970, as cited in Schostak & Schostak, 2007), radical research theory stems from two central bodies of social theory: critical social theory and feminist theories (Grant & Giddings, 2002; Schostak & Schostak, 2007). Radical research often takes the subjectivity of realities and turns it into motivation and activism. It becomes a positive driving force for individual empowerment so that individuals can enrich their lives. This has primarily been used in research focussed on marginalised groups in society (Schostak & Schostak, 2007).

In social contexts, such as those covered by public health, radical research implies radical questioning of the powerful or dominant practices to the point of challenge. (Schostak & Schostak, 2007). This political dimension is what makes research 'radical', by suggesting the possibility of overthrowing dominant orthodoxy and social constructs. Because food policy, agriculture and health are often influenced by social and political orthodoxy, exploitation, and commercial gains, radical social change away from the destructive systems is necessary for well-being and

increased access, security, and sustainability of food systems (Schostak & Schostak, 2007).

For example, the following studies have applied radical theory to similar investigations of the social aspects of food systems and sustainability. Specifically, in Gilbert & Williams (2020), a radical approach was used to investigate the social movements that drive reparations of food injustice in the USA. This also included those trying to gain equitable access to land, which would provide opportunities for healing the intergenerational trauma caused by colonialism. They point out that while most reparations are centred on financial compensation, this fails to provide healing and access, which social movements prioritise as critical outcomes. Their research provides a contextualisation and demonstrates how social movements for food justice can provide alternative pathways for reparations by providing opportunities that heal intergenerational trauma and equitable access to land (Gilbert & Williams, 2020).

Sandover (2020) takes a place-based scholar-activist approach to tackling issues of distanciated food systems, food insecurity and food justice for community households in Exeter city, UK. The radical approach of scholar-activism allowed the researchers to blur the boundaries of thinking, and doing, so they could both reflect on and act with the food movement being investigated. What was demonstrated was an insider perspective on the necessity of a place-based scaled approach to food policy and social welfare. It also highlighted the meaningful engagement this type of research can have, affording opportunities to develop an in-depth understanding of a situation alongside the challenges and process of rolling out a programme of action (Sandover, 2020).

This research project attempts to adopt this same radical approach in its framework by demonstrating that current approaches to producing and developing SFS are inadequate and that sustainable alternatives are possible if we seek them from outside conventional and orthodox spaces (Castro, 2019; Swinburn et al., 2019). As food is at the heart of many social and cultural activities and is required by everyone to sustain them, safe, nutritious, and accessible produce should be a priority and human right (Castro, 2019). However, current food policies and food systems not only do not prioritise or achieve this, but they are simultaneously some of the leading contributors to food injustice and insecurity, loss of biodiversity and climate

change in the world (Swinburn et al., 2019). Approaches such as permaculture and CGF have the potential to provide solutions to SFS challenges (Castro, 2019; Swinburn et al., 2019). Given this, there is a lack of research investigating the role and contribution of permaculture ethics and design principles and community gardens in creating SFS.

4.3 Positionality of the researcher

As the primary researcher, it is important to discuss my positionality and the lens through which I carry out the research (Berger, 2015). This positionality is that of a thirty-five-year-old Pākehā male raised in Aotearoa/ New Zealand with left-leaning political values, such as social equality. A strong family influence from my grandfather sparked my interest in home gardening from a young age, eventually extending to an interest in nutrition and volunteering at community gardens. These experiences led me to pursue academic study in clinical naturopathic, nutritional and herbal medicine and work full time for an Auckland Council subsidiary, managing green spaces, such as community gardens. At one of the community gardens I worked at, I first came in contact with and started learning about permaculture. My personal, professional and academic experience has heavily influenced why I took up this project and the lens I bring with me. These experiences have helped me see first-hand the potential of CGF and permaculture to make positive changes within our food systems.

I have acquired a permaculture design certificate during the process of writing this research project. As my level of understanding of permaculture has grown and changed with this, my line of thinking and questioning during interviews evolved as a student of permaculture. According to the formulation of Berger (2015), this is because my reflexivity as a researcher has moved from being an outsider of permaculture to an insider during the course of my studies. This forced me to re-examine my own biases and understandings of accepted generalisations using what I have now learned and what has been written in the literature. Now, being more informed, I am better able to connect concepts and design elements during discussions. This learning journey has also influenced the approach I took during interviews with participants. Rather than seeing myself and being an outsider who doesn't share the experience with participants, I found myself being viewed as someone who understood and acknowledged participants experiences. Berger

(2015) states that participants who perceive the researcher in this way, as being sympathetic to their situation, may be more willing to share experiences and knowledge. This changed the dynamics of the researcher-research relationship, allowing for deeper questioning from me, the researcher and richer responses from participants.

4.4   Methodology

This research project used qualitative descriptive methodology, in the form of in-depth unstructured interviews with open-ended questions, to answer the research question. Qualitative descriptive methodology is a widely used qualitative methodology employed to understand and gain insight into health-related phenomena (Kim, Sefcik & Bradway, 2017). As there is limited scholarly inquiry between public health, food systems, permaculture, and CGF, a foundation of understanding is required to build upon. According to Kim et al. (2017) and Bradshaw, Atkinson & Doody, 2017, this makes qualitative description appropriate when gathering information on the basis and functionality of phenomena, directly from those having the experience. Additionally, qualitative description allows flexibility in the framework and design of discussion based on the participants' narrative, answers, and explanations (Kim et al., 2017). By using open-ended questions, this flexibility can be utilised to its fullest extent to acquire valuable insight and understanding directly from those having the experience (Kim et al., 2017). Knowledge gathered from those on the ground can then influence future research and policy design. A qualitative descriptive approach encourages the depth and richness of data required to facilitate knowledge gathering and understanding (Bradshaw et al., 2017). Qualitative description also allows the subjectivity of realities that individuals experience to be understood. Using qualitative description in this project allowed understanding and insight into the intertwined relationship of policy, food systems, permaculture and CGF from a range of perspectives (Kim et al., 2017).

4.5   Recruitment strategy and sampling

This research project utilised purposeful sampling to identify and select participants. Purposeful sampling is a widely used qualitative research technique (Palinkas et al., 2015). It helps identify and select individuals that possess knowledge and experience of a phenomenon of interest (Palinkas et al., 2015).

Currently practising community garden leaders and permaculture teachers were purposefully sampled for this research project. Permaculture teachers and community garden leaders were already engaged in the activities of their respective disciplines or positions of authority. This allowed them to operate in a space outside conventional and orthodox approaches and possess the subjective experience of permaculture and CGF.

Recruitment was undertaken by contacting key networks and national organisations by email, e.g., Permaculture in New Zealand and Grandview Community Garden Trust. With permission, an advertisement for this research project was sent to their networks, asking for volunteers. Additionally, during initial contact, permission was asked for the details of suggested and recommended persons to contact, and the same advertisement was sent to them. Interested participants then replied directly to the researcher via phone or email. Participation was voluntary, and those interested were provided with information about the study before taking part.

<u>Inclusion and exclusion criteria</u>

Inclusion criteria consisted of being a currently practising community garden leader or permaculture teacher living in the Auckland or Waikato area, eighteen years of age or older and English speaking. Interested individuals who met the inclusion criteria were provided with an information sheet explaining the research project, participation requirements and researcher contact information. This also included privacy and confidentiality information. Once participants had read the information sheet, they were provided with a consent form. If this was signed and returned, the participants were recruited into the study. Those who were not currently practising community garden leaders or permaculture teachers, not living in the Auckland or Waikato area, were under eighteen years of age and not English speaking were excluded.

4.6   Data collection

This study recruited eight participants for in-depth interviews over four weeks. Four of the participants were community garden leaders, and four were permaculture teachers. Unstructured interviews with open-ended questions were used to gather data from participants. Examples of questions included:

- What is community garden-farming?
- What is permaculture?
- What are the strengths/challenges of community gardens?
- What are the strengths/challenges of using permaculture in community gardens?
- How can permaculture be applied to community garden-farming for food production in urban environments?

The same set of open questions were used for all interviews. The entire question schedule is available in the appendices (Appendix A). In-depth interviews took an average of one hour to complete, with some extending to approximately one and half hours. A recording device was used to capture interviews. The data collected from the interviews was transcribed from audio to text using the application Otter.ai on the recording device. The transcripts were checked against the recordings for accuracy. A copy of the transcribed interview was sent to participants for validation. Follow up appointments were organised at this time. During follow up, the privacy and confidentiality of participants were discussed. This included any alterations to the interview and participants' approval for their use. Those with approval made up the final data pool. All participants approved.

<u>Participants</u>
Participants have been assigned pseudo names to uphold confidentiality and keep participants' identifying information private (below). A short description of participants roles is also provided:

- Sue - Volunteer - Community garden coordinator
- Arthur - Employed - Coordinator and advisor to local council and community gardens
- Stacy - Employed - Community garden manager
- Russell - Employed - Volunteer coordinator for a community garden
- Daniel - Employed - Permaculture teacher and manager of two community gardens and community orchards
- Carey - Employed - Permaculture teacher and sustainability consultant
- Matthew - Employed – Permaculture teacher and community garden educator and coordinator

- Eliza - Volunteer – Permaculture teacher and educator at four community gardens

4.7 Covid-19 safety protocol and Interview locations

Due to the Covid-19 pandemic, social distancing, hand hygiene practices and mask-wearing protocols advised by the Ministry of Health were followed at all times when conducting interviews. Before conducting interviews, participants were made aware of these protocols and provided all necessary safety products to uphold these protocols, i.e., face masks and hand sanitiser.

Interviews were organised with participants so as to abide by these regulations, and telephone or online communication, e.g., zoom, were offered as alternatives to face-to-face interviews. To ensure both interviewer and participant safety was upheld, the research supervisor was made aware of interview locations and times, and confirmation of arrivals and departures from interviews were made.

Two interviews took place in the Waikato area, and the remaining six took place in the Auckland area. Two interviews took place at the participants' home residences. Three took place at the community garden/permaculture site participants were involved with. Three took place in cafés of the participants' choosing. These included two at Two Birds Eatery in Hamilton and one at Williams eatery in Auckland.

This research project was given ethics approval by AUT University. This research project adhered to all ethics approval requirements in keeping participant information private and confidential at all stages of this project, and all information will remain private and confidential.

4.8 Analysis

This research project used thematic analysis to analyse the data. Thematic analysis has been used in various qualitative research investigations and across multiple disciplines (Terry, Hayfield, Clarke & Braun, 2017). The theoretical independence and flexibility offered by thematic analysis for identifying, analysing, and reporting themes within the data allows understanding of people's everyday experience of reality so as to gain an understanding of the phenomenon in question directly from those experiencing it (Braun & Clarke, 2006; Braun & Clarke, 2012; Terry et al.,

2017). In the case of this research project, participants discussed their views and experiences of permaculture, CGF and what they see as critical to the future of sustainable food systems. Given the radical framework of the study, thematic analysis allowed a semantic and inductive element that provided a strong reliance on participants' experiences and understanding of themes. This ensured that new and emerging themes and perspectives were captured, challenging traditional perspectives and systems.

This research project used the six-phase process of thematic analysis put forward by Terry et al. (2017). The word 'phase' highlights that processes are not strictly linear and that the researcher may move back and forth between the different phases (Terry et al., 2017).

<u>Thematic analysis process</u>
There are six phases in the thematic analysis undertaken in this study.
Phase one involved *familiarisation* with the data to get a thorough overview. This was initially carried out during the transcription process, where data was transcribed from audio to text. Checking the text against the audio for accuracy and taking initial notes throughout this process also helped the researcher become familiar with the dataset.
In phase two, *coding* of data was undertaken. This was done by highlighting phrases, sentences or sections within the data and applying shorthand labels or "codes" that described their content (see Figure 10).

Figure 10: Example of phase two.

Phase three involved *generating themes.* To do this, the previously created codes were analysed for recurrence, agreement/disagreement, and similarities or 'patterns'. These patterns, which involved combining several codes, were then used to identify and generate initial 'themes'. Additionally, codes that were also identified as not relevant or too vague to provide meaning or were not relevant to the research aims were removed. The generated themes were transferred to a thematic map. A thematic map is a visual aid for identifying potential patterns, relationships and boundaries between initial themes and how they work to tell the overall story (Appendix B).

To ensure themes accurately represent the data, phase four involved *reviewing themes.* This was done by returning to the original data set and comparing the generated themes against it to see if anything was missing or if any changes were needed.

Phase five involved *defining and naming themes.* This was accomplished by looking at the themes and determining what was implied by participants perspectives and how themes reflected their perspectives. The themes were then adjusted to provide more meaning (Appendix C).

In phase six, or *writing up,* the final themes are presented. This includes a description of each identified theme and its meaning in relation to the data. This can be found in chapter 5 (see Figure 11) (Terry et al., 2017).

4.9   Summary

This chapter covered the research design, methodology, and analysis approach used to answer the research question. The academic activist and social change aspects of radical research were explained to align with the worldview and values the researcher brings with them to this research project. The alignment of the researcher's positionality and qualitative tools pursued in this research project were designed to foster experiences of social change needed within sustainable food systems.

5   Findings

5.1   Introduction

The study aimed to examine the application of permaculture and community garden-farming (CGF) for urban food production. To answer the research question, in-depth interviews were undertaken with permaculture teachers and community garden leaders. This was done to gain their perspectives and experiences of using community gardens and permaculture for urban food production. Using thematic analysis, data from interviews were used to identify key themes that reflect participant perspectives and experiences. The data analysis found four key themes:

Key themes:

- It will take a village: community, involvement and connections
- What is valuable differs from what is valued: moving beyond direct economic benefit
- Self-determination is governed by who has title and control
- 'Crisis' a vehicle for change
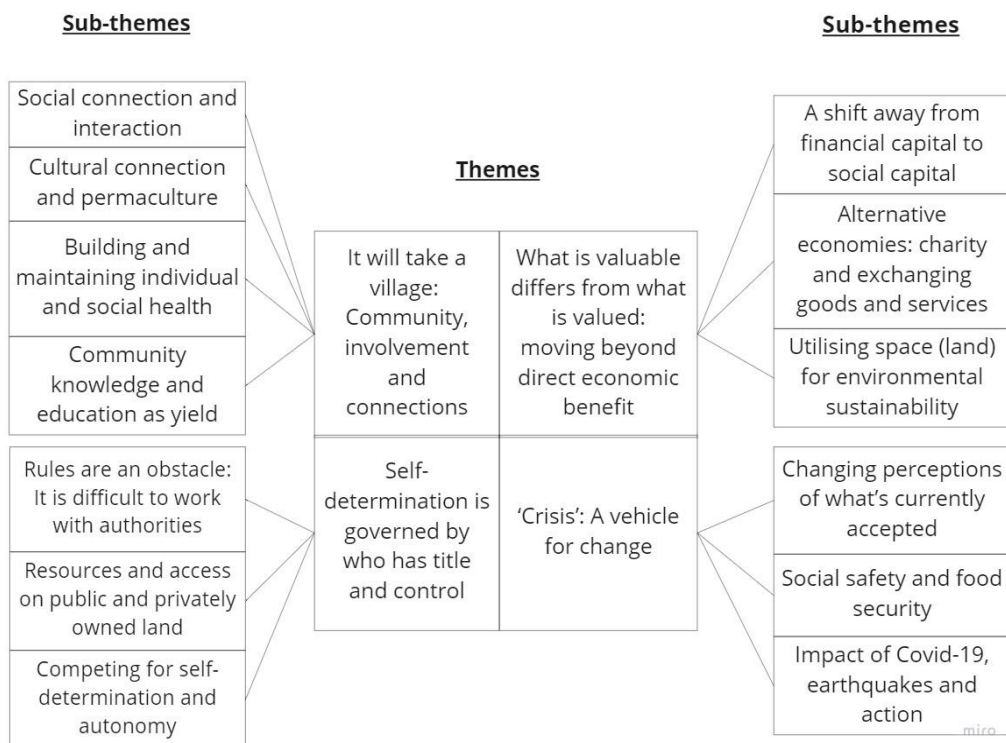
Figure 11: Thematic map of identified themes and sub-themes associated with using permaculture and community garden-farming for urban food production.

Figure 11 provides an overview of the key themes identified during analyses. The four identified themes provide an overview of participants' experience using community gardens and permaculture for urban food production. The identified themes and sub-themes will be discussed in the following sections of this chapter.

5.2 Theme one: It will take a village: community, involvement and connections
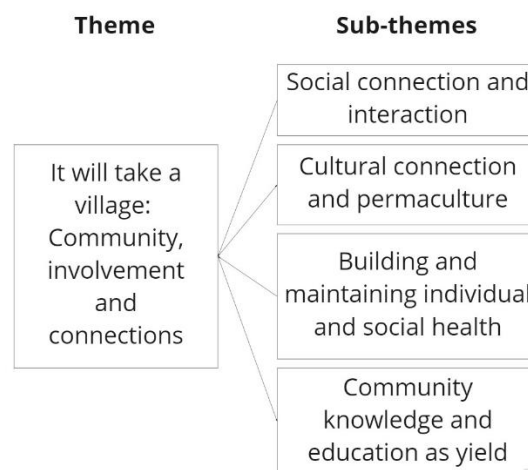
Figure 12: Theme one and identified sub-themes.

It will take a village: community, involvement and connections, encapsulates the emphasis on 'community' that participants perceive permaculture and CGF practices to hold. Participants shared that community will need to be the foundation that CGF is built upon. When participants have community, social connections are made where shared interests and values can be aligned, and common ground can be found. When common ground is shared between participants, it is empowering because they become part of something beyond themselves as individuals. According to participants, permaculture and CGF empower and educate the community by "activating spaces" for common ground to be found, transforming these spaces into "the beating heart for the community". Russell, a community garden volunteer coordinator shares that these spaces are "an opportunity for people who live in the same local area to collaborate… for a range of purposes", and where they can all come together as one village.

Daniel, a permaculture teacher and community garden/orchard manager with over 20 years of experience teaching at community gardens, stressed the importance of having community act as the glue that binds and underpins CGF. Daniel shares, "I've learned after many issues, that if you don't deal with the community, first, you do not have a garden to follow … people are the community… a community garden is 50% community management". Daniel continues by emphasising that "build[ing] the community… maintaining community… making decisions as a community… catering for your community" is how CGF becomes successful.

Eliza, a permaculture teacher and volunteer community garden educator who teaches those in her community about permaculture and growing their own food, shared her insight into how CGF connects diverse groups and builds communities. She shares:

> [Community garden-farming connects]….*all ages, all backgrounds to come and gather together and learn together, start to teach each other about food production, about the food that they bring from their ethnic background or growing up background. And… ideally produce a little bit extra that can be shared out to people in need, who don't have the luxury or the time.*

> Eliza, permaculture teacher and volunteer community garden educator

As defined by Dekker (2014) and Linkov et al. (2014), a community is a group with shared interests. However, Ikerd (2001) argues that community means far more than this, in that community embodies that which can't exist in individuals alone, such as the connections, relationships, having a sense that the individual is part of something beyond just themselves, or, that which only comes about among and between individuals. This understanding of community by Ikerd (2001) was observed in participants' responses. Specifically, participants shared four key areas of community involvement that support CGF. These were: social connection and interaction, cultural connection and permaculture, building and maintaining individual and social health, and community knowledge and education as yield.

<u>Social connection and interaction</u>
Participants shared a need for connection amongst their communities and an understanding that social interactions were a key element of making that happen. Participants explained that this involved sharing, discourse, and learning. These are important elements that protect the opportunities offered by CGF, such as sharing

values and food production. Carey, a permaculture teacher and sustainability consultant who works with her community to develop sustainability literacy, expressed that the community gardens she has been involved with cater for shared interest and that the community provided "a social circle [which provided] opportunities to learn new things and then by learning, helped… with… food security".

Stacy, in her role as a community garden manager, shared her insight into the importance of social connection that she has observed at her site and how the gardens provide a central point where such experiences and understanding can be shared. She shares:

> *[At our community garden] We had a lovely old couple… now he can't drive, but they still want to come down and visit. They still like that connection with people, you know, "oh how's so and so doing?*
> *They were down the other day, and I was telling them about "oh no, he's split up with her now" and "she's really pissed". And that's sort of, that's a community, you know, so people feel part of something. They belong somewhere… it's the gardens bringing the people together*
>
> Stacy, community garden manager

According to Arthur, who liaises between the local Council and community gardens, building social connection was a "huge" aspect of community gardens. From his experience, he states that:

> *[A crucial aspect of CGF will be facilitating the] socialising and meeting with other people… the whole community aspect of community safety, collaboration, getting neighbours to have a common purpose or an excuse to reach across their back fence and talk to somebody else. Just enormous benefits in terms of community safety, community connectedness*
>
> Arthur, coordinator and advisor to local council and community gardens

Daniel added that from his perspective, the social connection built using CGF is as vital for some community members as the growing of food is for others. Enabling communication pathways for shared interests and values to be voiced is an essential part of building community. Daniel states:

> *There's some people the garden isn't the issue, it isn't a thing they're there for, it's the community… a cup of tea and a chat is the most important part of some peoples week. We are a community orchard and if I don't have*

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chocolate biscuits on the table, and I run out of tea, holy crap, someone's running out of the office.
They follow the team to make sure that they go up to the shop to get that stuff. Because that sense of community, people coming together for that chat, is equally important for many people as the good we do for growing native plants.

Daniel, permaculture teacher and community garden/community orchard manager

Daniel suggested reciprocity with the community as a measure of when 'success' is achieved and embracing 'celebration' as a means to positively reinforce and build community connections and interactions. From his experience of managing community gardens for over 20 years, he recommends:

[CGF will need to focus on] community good over production. That means stopping and... celebrating spring. Let's all come together for a picnic. Let's have a harvest festival. Celebrate successes. It's a big, big, big thing, always celebrate successes. So whether it be the spring harvest festival, or spring festival or harvest festival, woohoo, new shed, and it's only a shed for Christ's sake, but it's a shed, you know, celebrate it and you will be surprised how community forms, it's cool.

Daniel, permaculture teacher and community garden/community orchard manager

Participants experiences showcase how community is at the centre of their approaches. Because the connections and other social aspects that participants value stems from their communities, its importance requires emphasis.

Cultural connection and permaculture

Connection, in a cultural sense, was discussed by Matthew, who, in his role as a permaculture teacher, community garden educator and coordinator, states, "in our [western] culture, the way it's designed… has become a great inhibitor for change". In contrast, permaculture is said to help build cultural connection because it consists of the purposeful use of multiple indigenous and ethnic practices observed all over the globe that many people can personally relate to. Eliza, a permaculture teacher, states:

This sort of multifaceted approach of permaculture often incorporates very old practices that have been used all over the world. People from many ethnic backgrounds can find themselves and the practices of their ancestors in permaculture. And so I find it… very connecting… for the sheer fact of that… in countries that haven't really [used]… the word permaculture… they

would still agree on the principles

Eliza, permaculture teacher and volunteer community garden educator

This shows the value created by CGF by providing space and opportunity for cultural connection to build through the social aspects inherent in community gardens. Within this, permaculture principles provide inclusion and expression of opportunities for culturally appropriate practices and technology.

Building and maintaining individual and social health

Participants felt that CGF aids in building and maintaining individual and social health by providing a "safe place" to gain connection. As described by Daniel, "you never know where the connections are made. And you can't write that into a plan… the community outreach is huge". In Daniel's work, alongside his roles as a permaculture teacher and community garden educator, his job is also to make the spaces he works in facilitate community connection and outreach. Daniel gives an example of this from his experience in these roles at one of his gardens:

> *A guy that [had been working with me] for six months didn't make a bloody noise... I keep getting his name wrong, it's because he didn't speak, and one day he spoke at morning tea, everyone stopped as he said, "how's it going?". Because he felt confident, he came out. And so, for us, it was a huge success, that he had come out, talk[ed] to us, [as] part of the team... Our job was to be a safe place. And that's what a community garden facility can do. And it's not part of the grown food. But beneficial for society health*

> Daniel, permaculture teacher and community garden/community orchard manager

From this example, it can be understood that the individual health benefits fostered in CGF include access to fruit and vegetables, opportunities to build different kinds of connections, the safe place it provides, building self-confidence and enabling participation in food systems. By increasing the community by another member, thus increasing the number of possible connections, and through the removal of barriers and increased access opportunities for both individuals and their communities, the social determinants of health are greatly impacted by CGF, greatly impacting public health (Dekker, 2014; Swinburn et al., 2019).

Community knowledge and education as yield

Increased personal and community education and empowerment was another value expressed by all participants as an essential part of what CGF and permaculture

offer. In particular, Carey spoke on the permaculture principle of 'obtain a yield' and how it is one of many holistic aspects that connects people with CGF and permaculture. She explains:

> *When we talk about community gardens, I guess I also in my mind had like school gardens. Which to me, that's more like a learning resource. It's not actually about how many broccoli you make, it's about the process of growing. I feel like permaculture gardening, could be that as well. But it's also about… the yield doesn't necessarily have to be vegetables, it could be knowledge*
>
> Carey, permaculture teacher and sustainability consultant

Carey also states that community gardens provide "opportunities to learn new things", thus increasing literacy by "learning to eat seasonally [and] the ability to have something fresh on the table". Carey adds that it means there is something "I can take home to my own garden. But also… the food that is grown, will go to people that might… be facing some food insecurity. At a few of the gardens I go to that's what happens". Carey shares an experience of one of her community projects and describes the knowledge gained by the work they do. She explains:

> *It's a community garden based on permaculture… and we use it to grow food, but it's actually the yield there, I see it more as being education. We run classes… it's about empowering people who don't grow food yet, to do so and learn about the food growing, and for experienced gardeners to come and share their knowledge... The yield is the education and knowledge*
>
> Carey, permaculture teacher and sustainability consultant

When specifically discussing permaculture, Carey described it as something that "helps your sustainability because… we produce locally in our backyard and down the street". Additionally, increased waste literacy was a focal point when discussing permaculture education with Arthur, who added, "It's really about teaching people how to reuse the waste back into producing better soils for the environment".

According to Warren, Archambault & Foley (2014), empowerment and sustainability literacy is linked with education. These subjects must be woven into the framework of educational programmes so people can articulate understanding that can safeguard the earth. The need for people to receive permaculture education, to increase sustainability and food production literacy, was discussed by Carey, who explained:

I'd like to see a lot more sustainability education in general, permaculture education and values education embedded into mainstream education because I feel like I've had to learn a lot of that as an adult, and I'm still way at the beginning stages of learning. Even though this is my job, but I'm still learning. And I feel that if it can start earlier, and it can be embedded into formal learning and informal learning more... it wouldn't just be a thing that you can choose to have in your life

Carey, permaculture teacher and sustainability consultant

The permaculture principle of obtain a yield was again used to describe how permaculture and participant values align. Carey explained, "the yield doesn't necessarily have to be vegetables… the yield is the education and knowledge". According to Carey, CGF is where people of the community can go to "learn about the food growing" and "for experienced gardeners to come and share their knowledge or to learn". The necessity of CGF using permaculture design principles as spaces where such education is available was justified by Eliza, who found wastage to be a big motivator for changing practices:

I see a lot of food wasted in community gardens. Might be that people don't really know when to harvest or what to do with it, or sometimes they're too polite and want to leave it for others. So nobody eats it.

Eliza, permaculture teacher and volunteer community garden educator

When discussing investment in CGF and permaculture for educational purposes, Arthur spoke from a local government point of view, stating:

[Within local Council] we don't invest a lot in that space yet [CGF]. We've probably invested more in the past… they carry out quite a different role… schools… visitors… groups coming through… food hubs that are teaching how to cook this stuff… significant educational programs, as well as community centres… and that would probably be quite a healthy way to do it [CGF]. Because then those people are invested in growing their own food, they have a relationship with the food, and they start to have a relationship with each other. Because they're all in it together

Arthur, coordinator and advisor to local council and community gardens

Daniel described the difficulty in quantifying the value of education in permaculture and CGF as: "so there's two ways of measuring [value for money]. One is hard numbers, kilos sold over the gate, and the others are the stories ..."This is life-changing", "I've learned so much", I go for the stories because I'm dealing with people". Daniel continued:

[When speaking with local Council] I can say I've sold 15,000 plants this year, that's a fixed amount of dollars…but you taught 100 people, you've shared 1000 seeds, the tomatoes are going to bloom through the local area next year, and the kids will come up, and the neighbours will see it. And there's this huge plus…But how do you quantify that… our accounting system doesn't count that very well.
It's actually… acknowledging the social good… just as much as food good. And this is hard to quantify, real hard to quantify, asking people to do the annual report is almost impossible… but we know the community sees it's a plus…. So I love having photographs of people doing stuff and having people saying how good it was

Daniel, permaculture teacher and community garden/community orchard manager

From participant experiences, it can be understood that the permaculture principle obtain a yield can apply to many aspects of their food systems. From getting a harvest of fruit and vegetables and sharing to learning to eat seasonally and building social capital, obtaining a yield has multiple applications. Given this, quantifying the value of this within conventional food systems is difficult for participants.

5.3 Theme two: What is valuable differs from what is valued: moving beyond direct economic benefit
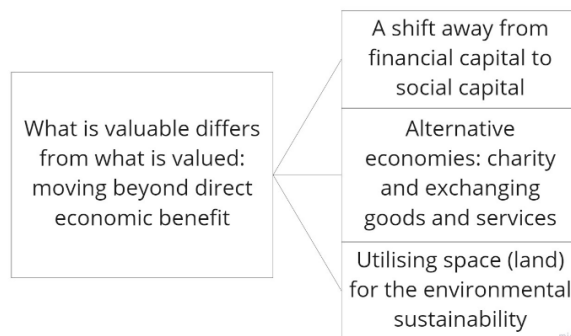
Figure 13: Theme two and identified sub-themes.

The 'value' seen in CGF and permaculture that is shared by participants and how this differs from what is 'valuable' to conventional farmers, officials and academics was another main theme expressed by participants. While multiple definitions and interpretations of 'what is valuable' were given by participants, three sub-themes came through: a shift away from financial capital to social capital, alternative economies and utilising space (land) for environmental sustainability.

<u>A shift away from financial capital to social capital</u>

The economic and financial aspects of food systems valued by governments and institutions differ from the social relationship building of CGF and permaculture that participants value. Regarding the economics of CGF, Arthur said that from a local government point of view, it is "cost-effective 10 – 1… a huge saving to the city [waste management streams]… the cost of mowing a lawn versus the cost of having a community garden that doesn't require mowing or tending or maintenance is an economic benefit that sits there".

Daniel also spoke on his experience relating the value he sees in CGF with the value local government sees in economic profit and how there is a need to re-evaluate what we value within food systems. He shared:

> *How do you define profit? How do you define production? If production is ideas and knowledge, then running compositing, the seed saving, feeding people... we have that issue all the time. Because we get money from Council, we get money from the government and trying to show the value of that money.*
> *It's very hard to say that someone came back after five years because we had a planting day… How do you value that?*
>
> Daniel, permaculture teacher and community garden/community orchard manager

Stacy also added that the current system of economic exchange for food makes it difficult to quantify and compensate for the building of social capital that participants value in terms of monetary exchange. From her point of view, our systems need to look at and include the cost of human resources that are not usually factored into funding. She shares:

> *In society in which profit looks like... we are used to now buying everything online and buying things we don't really need. And I think if you're using permaculture to grow your food… there's a lot more people involvement… So you are expending a lot of energy in producing your food, and that can't be related back to dollars. Really, you can't be compensated on what we're used to now as an hourly rate for growing that sort of food*
>
> Stacy, community garden manager

<u>Alternative economies: charity and exchanging goods and services</u>

Participants shared that the economic benefits of community gardens go beyond

monetary profit in that they also generate and enable surplus to be given out and charity for others not physically using the space themselves. Stacy, a community garden manager, explains:

> *[Anyone using one of our gardens] would be doing it for economic reasons. There are some charitable benefits, if people are doing it for, to donate because it might have an economic benefit to someone, in that the charity doesn't have to go pay for it themselves*
>
> *Stacy, community garden manager*

The non-monetary value of permaculture was advocated for by Daniel, a permaculture teacher and community garden/orchard manager, stating that this notion is encapsulated in the permaculture principle of obtaining yield. Daniel explains:

> *[In any one of my gardens] If we have excess… we'll… give that away, rather than take it to market… we see social value… helping those who need the most help… providing more community engagement services …So for us, that's the value. It's not the monetary value. If we have excess, you know, that's a dream for us here*
>
> *Daniel, permaculture teacher and community garden/community orchard manager*

Carey also agreed with the value CGF and permaculture have in going beyond economic exchange in that, in her job, they teach students and communities how to create and utilise different avenues of trade and exchange for goods and services instead of money:

> *[I have learned that] permaculture values different economies beyond just a financial system. Going off one of our work experiences, it's called alternative economies… we have… a time bank… a repair club and… a crop swap. So the idea of goods and services being exchanged without the use of money… because some people are money rich and time-poor, and some people are time rich and money poor… if we have a diversity of ways of exchanging goods and services, then that [CGF] can take into account the differences*
>
> *Carey, permaculture teacher and sustainability consultant*

Utilising space (land) for environmental sustainability
Belief in the value of purposefully utilising space (land) for the environmental benefits (carbon sequestration, food production and improved soil and biodiversity

health) associated with both community gardens and permaculture was expressed by participants.

The improved access to composting and waste diversion from landfills that CGF and permaculture enable, and the beneficial environmental impacts this has by sequestering carbon, improving soil health and water drainage capacity was emphasised by Arthur, who explains:

> *[From a council perspective] The strengths* [of CGF and permaculture] *are obvious, in particular…, it is more about the reduction that we get from pouring waste into the waste stream itself, reduction and landfill… biggest one* [strength]*… it's just the right thing to do for the planet. The more waste we can sequester back into the ground, the better. But it's the sheer cost of, of taking waste to landfills is enormous to the city. And it's an enormous cost to us in terms of the amount of land we have to use to just dump it*
>
> Arthur, coordinator and advisor to local council and community gardens

Arthur then spoke on the further benefits of permaculture and CGF, in that not only are there financial savings and environmental benefits for local government, but the value of the social and health impacts of CGF and permaculture is also "immeasurable". He shares:

> [Where CGF and permaculture are practised] *there's better drainage outcomes, there's less flooding, there's better quality soils, that in turn increases an increase in the local flora and fauna, local insects. So you hear that whole environmental positive outcome that we get from permaculture practices... far outweighs not doing anything. But then when you add to that the health, the mental health outcomes, the social outcomes... Those are immeasurable*
>
> Arthur, coordinator and advisor to local council and community gardens

From her experience interacting with local authorities, Eliza spoke of the misuse of land and the competing value these bodies put on land use. While she sees value in utilising these spaces for different practices of community empowerment and education, she explains that the local bodies would rather withhold the use of land for these purposes and instead pay to keep them unused. She states:

> *KiwiRail has a lot of land set aside for, you know… the rail corridors to the airport or to this, to that. It's land that they have to manage, but they're not very forthcoming with it… someone just told me they asked for some land, and the price was gobsmacking for the lease, which was like prohibitive, which basically means like it's still an unused channel going right through Auckland, which they have to manage and pay for. They rather do that than allowing… there's a lot of unused land that Council just by principle won't*

give away. Same with Auckland Transport, there could be many little…
underused corner parks could maybe provide… orchards, or fruit tree
plantings

Eliza, permaculture teacher and volunteer community garden educator

In contrast, Eliza also gives an example of her local Council implementing a project that utilises unused land for a community food project. She states, "our local board has been really good. They consulted around a really big park not far from here, and people want it for trees. So they had a contractor plant like 100 citrus trees". This example shows that the rules can be bent or broken despite the "principles" that authoritative bodies abide by.

5.4 Theme three: Self-determination is governed by who has title and control

Theme   **Sub-themes**

Self-determination is governed by who has title and control

Rules are an obstacle: It is difficult to work with authorities

Resources and access on public and privately owned land

Competing for self-determination and autonomy
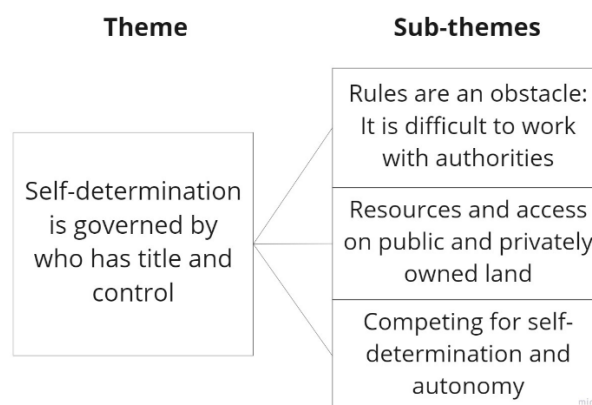
Figure 14: Theme three and identified sub-themes.

The theme of self-determination is governed by who has title and control emerges from participant discussions about interacting with authorities, the enforced rules and regulations on public land, and how these create a competitive environment for expressing autonomy. Daniel, a permaculture teacher and community garden/orchard manager, explains that when it comes to "community spaces… [land] title and control is a really serious issue" and "a difficult conversation" for all parties involved to have. Daniel continues: "[while] we have altruistic dreams… the harsh reality [of using public land for CGF and what it entails] has made me pull [my approach] back in a bit" He shares that the main difficulties are said to arise because "you need organisation and rules [to govern and run CGF], but structure

and rules freaks people out" because it limits the independence of individuals to make their own decisions.

From a local council point of view, Arthur mentions that "the council wants funds spent in the community" and that "the empowerment team advocates for… resources to be poured into the community, depending on need." However, Daniel mentions that this is also done for other reasons. He explains that local council involvement is all about maintaining control over the space and only giving the impression that they are supporting initiatives, so they can appear to be doing 'good' in the public eye. Daniel explains:

> *Council wants us to be on a community garden register so they can say Auckland Council is overseeing so many or is allowing so many… That way the council never lost control over the land…. we are under great sufferance on the list*
>
> Daniel, permaculture teacher and community garden/community orchard manager

The participants specifically discuss key areas: the difficulty of working with authorities, resources and access to public and privately owned land and competing for self-determination and autonomy.

<u>Rules are an obstacle: It is difficult to work with authorities</u>
When participants spoke of interacting with the different regulatory bodies, it was clear that it was troubling for them. Daniel explained, "dealing with council is problematic". Eliza added, "it's not easy to work with council. The departments that usually are involved seem to be somewhat incredibly inflexible. Which isn't really how community works but other groups suffer the same", and "council normally takes two to three years of paperwork" (Daniel).

Stacy spoke about the problems she has experienced in dealing with Council when consultation about future plans for her community garden. She explains how her community feel left out of the process and that those who are making the decisions about what will happen aren't part of their community (or even in the same country). She shares:

> *[Currently] we are still in a little bit of limbo, in knowing quite where our boundaries are. We assume we are still part of it. We haven't had any* [consultation], [although] *plans have been drawn up. At the moment, the*

> *government's sent it off to Australia for plans. Somebody in Melbourne draws up a plan* [for the community]

> Stacy, community garden manager

Daniel also spoke about only being able to do things "according to the rules" set out by the local council. As part of these rules, there are safety requirements around food production at community gardens, including the use of herbicides and pesticides. He explains that the regulations force him to use practices that do not align with his values or those of his community and that instead, they will actively inhibit the public from wanting to participate in CGF using permaculture. He states:

> *So I think a permaculture design because it's organic, it's a safe place to work… According to the rules, we should be spraying for myrtle rust with fungicides. I've worked in the greenhouse industry, and if I walked out in the moon suit, which is what I'll be using because fungicides kill you… Nerve toxin type warfare stuff. If I came travelling past in a moon suit going* (Sprayer noises). *It's all right. Well, I'm all right, [but] I would not have any volunteers, that'd be gone*

> Daniel, permaculture teacher and community garden/community orchard manager

Having local government involved and abiding by conventional rules and regulations can be seen as a perplexing situation for participants. Uncertainty and difficulty arise when interacting with government, and ultimately, the rules and regulations that are imposed are at odds with participant values.

Resources and access on public and privately owned land
When discussing the use of public land supplied by Council for community gardens, participants discussed "rules" and the "do's and don'ts", making it difficult for groups to get set up and apply for funding and resources. Daniel shared that "you need 'history' to get funding", implying that you need special treatment for your request to be taken seriously. Eliza added that when setting up projects, "what was a bit easier was some redundant Auckland Transport properties" to apply for because they were seen as less valuable by the council. Additionally, Eliza mentioned that the reasoning behind the rules set out by the council can also be inconsistent. While they say one thing to justify their stance, they can contradict themselves and do the opposite. Because of this, participants felt there was a lack of understanding on the government's part, which builds distrust between the community and government bodies, as Eliza explains:

In Auckland City Council… it's hands off our property, and then they come with all sorts of excuses. I've heard many things [as to why you can't set up a project]*… So, of course, half of Auckland's parks are on landfill sites. So they always talk about contamination, but they weren't even ready to do contamination testing.*

Eliza, permaculture teacher and volunteer community garden educator

Eliza also added that this same reasoning creates further problems because it is also used to justify not allowing facilities and resources on sites that would allow permaculture to be practised. Eliza used the example of water collection to describe the lack of investment by local governments. In response to a lack of infrastructure, she shares, "But again, same problem. No toilets, no structures, often no roofs to collect water".

According to Daniel, the same issues arise on sites where public and private ownership intersect, such as state-owned housing, where food gardens at the residences would be both not allowed and purposely destroyed. He shares:

[A few years ago] we had a situation… where social welfare, so Housing New Zealand now, would pull out veggie gardens, they wouldn't allow them. I'm renting, but the landlord doesn't want me to garden. I can see the marks on the property where they used to be. The fruit trees down the back, he said no one wanted them for 20 years, no one wanted fruit off them

Daniel, permaculture teacher and community garden/community orchard manager

Daniel then explained that this action by Housing New Zealand had a generational impact on people, resulting in a reliance on supermarkets and backyard gardening skills being lost. "So we've gone through a situation where there's a couple of generations that have gone to the supermarket and got frozen something or tin something" (Daniel).

When establishing CGF, Daniel stated, "My view would be [it's] much better to be on private land, where you can close the gate" to avoid council involvement. "Whenever there's council involved, I usually advise people to find other land because it works out better for both parties" Daniel gave two reasons for this. Daniel's first reason was the "right of access to anyone" in using public land supplied by the Council. "Right of access to anyone" gives a false sense of entitlement to access the site and steal foodstuffs that are grown there. He explains:

> *We've had people come in at night and see people foraging through the gardens and say, "Excuse me, what are you doing?"* And they say, *"OH, it's a community garden, I'm a member of the community, I can take it"… It's just disheartening.*
>
> Daniel, permaculture teacher and community garden/community orchard manager

The second reason Daniel gave was, "It's all because of… our council has a big stress issue of giving the rights of ownership to outsiders [for CGF]. Because of these issues that councils have with control, "we've lost 100 years of culture on how to do community gardens" (Daniel). From a council perspective, Daniel explains: "The worry is people set up and come on board, start gardens and walk away. And councils are left with a mess":

> [The fear of having to clean up makes the Council] *very cagey about allowing people to have title on council land. So for that reason, I'd usually recommend anything but council land… We [also] don't call our garden here a community garden for that very reason* [Council involvement]… *We absolutely avoid the name, community garden…* [Instead] o*ur volunteers, we… we call it a teaching garden.*
>
> Daniel, permaculture teacher and community garden/community orchard manager

Within the perplexing situation, a need can be observed in participants to separate themselves and their food systems from local government involvement. Opting to prioritise using private land for their food production as to avoid involvement from local government as far as possible.

Competing for self-determination and autonomy

When discussing the political implications of community gardens, permaculture and CGF, all participants shared a feeling that they're in competition with local authorities, which makes self-determination difficult. Hiratsuka et al. (2017) define self-determination as the ability to exercise, express, and pursue independent control and representation over one's own welfare, sufficiency, and economic, social, and cultural aims.

Eliza expressed that the self-determining nature of CGF using permaculture may not be welcome in some political circles as it is harder to govern a populous who are

more educated and self-sufficient:

> *I do think that it's probably not welcome* [self-determination] *in every country that people can see more than through a tunnel lens. Because it's much harder to govern people who have a broad understanding of society in politics than to govern people in a very narrow view*

> Eliza, permaculture teacher and volunteer community garden educator

Eliza further explained that the cooperative nature of permaculture, stemming from the third ethic of fair share and the principle of cooperation, is at odds with the agendas and values of the political establishment. She states that, because of the differing values of permaculture and CGF, they may not be welcome within the political sphere or would require very democratic politics for it to be successful:

> *I guess I see the politics of* [permaculture]… *it's not about competition. It's about equality and equity, sharing in the community, communally owned... communities... communally shared resources… it's cooperative, not competitive, in how I see it, which I guess is about the fair share of resources… So I'm not sure that, other than very democratic politicians would, you know, welcome such an interconnected philosophy. Because it might open people's eyes to a lot of other things. Nevertheless, it would, of course, be great.*

> Eliza, permaculture teacher and volunteer community garden educator

An example of the local council limiting the self-determination of participants by not cooperating effectively and withholding resources was expressed by Russell. In his role as a volunteer coordinator for a community garden, Russell explains that his community has experienced difficulty acquiring access to resources (a water tank key) in their garden due to the bureaucracy of the local council. This resulted in his community almost losing their garden due to drought. Russell explains:

> *In the gardens, we'd prefer the tank to be full because we're worried about another drought. We'd like to be able to have control over that. It's been agreed to, in principle by Council… But actually getting someone to give you the key, that's another question because that's a different department. I'm about ready to break the lock because that basically almost ended the garden, well… that drought, that we had here in Auckland, just about killed the garden… and everyone here knows that*

> Russell, volunteer coordinator for a community garden

In contrast, Russell expressed that what his community values is the anarchistic nature of permaculture and the absence of hierarchy and taking personal

responsibility to do things themselves. Russell stated, "It's easy to make change [yourself], just get on and do it. Get some mates together and roll up your sleeves and do something, you know, you'll achieve more change quickly than any other method known to man".

This was in agreement with Daniel, who, in his experience, has also come to value the anarchistic nature of permaculture, or the absence of power structures, because of the empowerment it brings. He gives the example of growing your own food as an empowering act of self-determination. He explains:

> [Growing your own food] *It's the biggest act of self-determination you can do. To be self-sufficient in your own food means you can say no, I'm okay, thanks. You wanna… avoid the banking system, grow your own food. You wanna avoid the oil industry, grow your own food. It is the biggest single mark of anarchy you can do…*
> *I've grown up with lots of friends in the anarchy movement that like to smash the state, or the rest of it,* [but] *do you have a garden?*
> *Where do your cigarettes come from, where do your Doc Martens come from? The moment you grow your own food and you're self-sufficient, you can tell the world to piss off without having a handout. So I think it's the single biggest move you can [do to] be independent*
>
> Daniel, permaculture teacher and community garden/community orchard manager

Using the permaculture approach of 'stacking functions', where a single system element such as a chicken is employed to provide more than one function or yield, and important functions are supported by multiple elements (Mollison, 1988), Eliza gives an example of how CGF could bring about community self-determination through stacking the function of 'water storage', 'civil emergency functions', and 'seed-saving':

> *The garden there has gotten a significant amount of water storage. So if there was an emergency, people could still come and get drinking water… but it's not a civil defence sort of space, but together with some other functions that, for example, the clubhouse there has the bowling clubhouse, it could well be a civil emergency function. And then saving seeds and distributing seeds, I feel is another core thing that* [CGF] *could or should engage in*
>
> Eliza, permaculture teacher and volunteer community garden educator

The need for participants to separate themselves and their food systems from local government involvement is a perspective shared by many. These experiences show

that when forced to be in competition with conventional approaches, participants demonstrate a need for disassociation from conventional approaches to food systems.

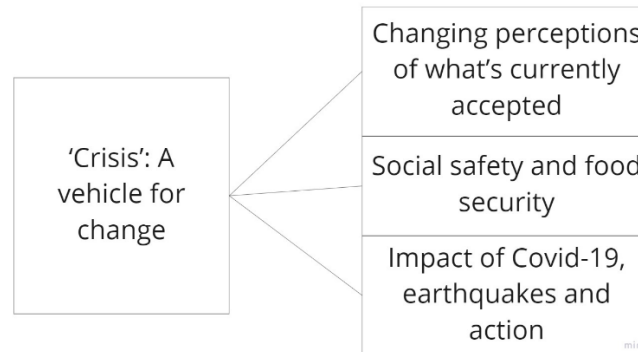## 5.5 Theme four: 'Crisis': A vehicle for change

Figure 15: Theme four and identified sub-themes.

Crisis was raised as a driver for change and within participants' experiences, a driver for the uptake of CGF and permaculture practices, as well as drops in funding from local government. While there is no universally agreed-upon definition of crisis, it can be understood as any kind of threat to the existence of a person's or stakeholder's property, the social order, or the environment, for which there is no immunity (Coombs, 2004).

Changing perceptions of what's currently accepted

Perception as an inhibiter to change was discussed by Matthew. He explained that societal norms and pre-conceived ideas hinder social change, "But I think our minds are great inhibitors. And the way we in our culture [western], the way it's designed… has become… a great inhibitor for change".

Similarly, perceptions of what is understood as valuable in the face of crisis by the permaculturists can conflict with what is understood as valuable by regulatory bodies and government entities. Eliza states, "Political ideologies that don't value those things [self-determination etc.] as much, it might be in conflict to them". Eliza elaborated this by mentioning that politicians think of food as less important than other aspects of society, stating:

> *The political* [bodies] *or politicians have resorted to declaring food as a minor* [issue]. *Well, let's put it the other way, rent shouldn't be the highest part of your salary that you spend your salary on. It should actually be much lower.*

But food should actually be much higher.

Eliza, permaculture teacher and volunteer community garden educator

Furthermore, Arthur spoke of other stakeholders, such as the food retailers who, from their perspective, value economic growth and how that conflicts with the charitable value of CGF, stating:

> *There's the, of course, the argument for that, you're always gonna get from big food sellers and producers about you know, "You're not doing my business any good by giving food away"… but food is food, and people are really struggling and don't have money to buy food, and they're not really losing anything if somebody else supplies it.*

Arthur, coordinator and advisor to local council and community gardens

The public's perception of what food and agriculture are supposed to look like, shaped by what is currently practised, was another perception barrier mentioned by Daniel, who states, "But you go to the supermarket, it must be perfect" (a tomato)… "we think of vegetable gardens as in Victorian straight lines" [even though there are numerous alternatives].

To shift the perceptions of all the different stakeholders towards ones that are favourable to CGF and permaculture, Arthur suggests that there needs to be an organisation with resources and infrastructure, saying:

> *But to do that [CGF], we're going to need an organisation that has the infrastructure, the equipment, the tractors, the ploughs to be able to go through and do that. Collection and distribution process to be able to move it all around the community.*

Arthur, coordinator and advisor to local council and community gardens

Participants' experiences show that in the face of crisis, perception plays a major role in inhibiting or determining what actions are taken moving forward. Perceptions of what is valuable in times of crisis are seen as different between participants and government.

Social safety and food security

While there is no immunity to crisis, taking steps to ensure resiliency, safety and security for themselves and their food supply was an important theme expressed by participants. Matthew, a permaculture teacher and community garden educator and

coordinator, expressed the need for people to have social and food security as "people are very dependent on the feeling of security. And often we seek security in so many different things, but actual physical securities, is a really, really important thing".

The perceptions that lead to a lack of preparation and anticipation of crisis by stakeholders, the systems we rely on and how they intertwine with the social safety and food security provided by CGF were important considerations for participants. Matthew added:

> *As soon as something changes, because our systems are not really designed to adapt to changes easily, people feel very insecure very quickly, at the supermarket just... Covid* (crisis) *happens, Oh, my gosh, where does my food come from, they run to the supermarkets and buy toilet paper, you know… which shows that there's a lot of fear bottled up... I feel* [CGF], *even though I wouldn't say they're the only solution, they're just a fragment… in the whole makeup of change, but I think they can give a bit of security, that security back to people*
>
> Matthew, permaculture teacher and community garden educator and coordinator

Arthur added that CGF would increase perceptions of security, safety and resilience because CGF provides other aspects that empower communities, such as environmental stewardship (reserve cleanliness) and access to healthy food:

> [CGF] *will increase the perceptions of safety, and it would increase how tidy that particular reserved space was. So we combine that with a… healthy kai approach… trying to increase the amount of vegetables… providing fresh vegetables for local communities and local people and providing a plot of land, and in Auckland lands… pretty valuable in terms of finding a space to garden.*
>
> Arthur, coordinator and advisor to local council and community gardens

Matthew adds that perceptions of social safety are intertwined with that of food security. He explains that food security is empowering for social safety by provisioning the needs of people and that viewing food security, provided by CGF, as part of social safety can also help change perceptions, making us more resilient to crisis, adding:

> *Our* [social] *security is so dependent on outside factors… for a lot of us, security is not in our hands. It feels like that, anyway… but food, I think it's really important that we start seeing food as part of a feeling of security.*

Seeds have the ability to… provide ourselves [with] *the things that are essential for life. But in other ways than just making money… This is really something that also makes us more resilient towards the future… and the more… we can take into our own hands, the more resilient we are… and the more adaptable we are… so, the more… we can be secure in ourselves, the easier we can respond as a culture to a challenge* [crisis]

Matthew, permaculture teacher and community garden educator and coordinator

Impact of Covid-19, earthquakes and action

The crisis of Covid-19 has had an impact on the CGF community. Specifically, participants found a drop in the number of users of community gardens. Stacy mentioned that Covid-19 has negatively impacted the number of people attending their community garden: "We've lost about five people through the Covid thing". Arthur added that it had affected funding from council: "The Covid thing came in, and it really destroyed the amount of funding that was available through council".

Russell mentions another impact of Covid-19 was a shift in perceptions to a "new normal". He explains that the pandemic has spurred some people to think about where their food comes from and take it upon themselves to grow their own food, stating:

So one of the things we need is... this is a debate I've been having with some other mates about this whole… so-called new normal that everyone has been talking about during the first lockdown… I'm gonna be doing this, I'm gonna be doing that [take up producing my own food]. *Now we've had a second impact, there's probably a few more people who will be thinking that "oh nah actually, it's not going away and we actually need to sort our shit out* [food shortages], *there's gotta be a better way of doing this"* [accessing healthy food].

Russell, volunteer coordinator for a community garden

Eliza added to this by discussing the hardships Covid-19 has created with people losing their jobs, food shortages at the supermarket, and how it will spur a change in perceptions favourable to establishing CGF using permaculture, stating:

I believe with more and more people struggling to find work, especially after Covid now, there will be an even greater uptake [of CGF]… *we see all the photos that went around before the first lockdown when the seed shelves were raided, and the seedling shelves were completely raided.*

Eliza, permaculture teacher and volunteer community garden educator

In contrast, Russell also added that while he had perceived a shift in perceptions because of the crisis of Covid-19, he believed it still wasn't enough to consolidate change. However, if crisis keeps happening, it will happen in the future. He states:

> *But I actually think it's going to take a few more* [crises]… *a lot more time to get to this point. And I think we need a number of… more of these lockdowns… which will come. It'll be… the normal, up and down, up and down for quite some time. And I think once that's happened for a certain amount of time, I think there will be probably more motivation for people to* [take up CGF]

> Russell, volunteer coordinator for a community garden

The crisis of the Christchurch earthquake was also mentioned during participant discussions. When referring to the effect it had, Arthur discusses the government overriding their own policies in times of emergency (crisis) to allow food growing in places that were previously not allowed: "Christchurch did do it during the earthquake when they just did a blanket [policy], you can use reserves for all these purposes [growing food]. And in an emergency, it's done. And then they've never changed it back." This example shows that governments and authorities' enforced rules and regulations can be changed overnight if they want to, although it only happens in times of crisis.

Eliza added that while there were changes in perception, as seen with the Christchurch earthquakes changing policy and Covid-19 increasing interest in growing your own food, similarly to Russell, she also believed it still isn't enough yet, and more crises are needed to solidify social change, stating:

> *And so I'm not holding my breath that it* [perception] *changes until something really bad happens. So, unfortunately, like the Christchurch earthquake or even Covid… it always takes something really bad to bring people together. So that's why I think some people just can't* [change their perceptions]*. Some of us can't wait for crisis to come*

> Eliza, permaculture teacher and volunteer community garden educator

From participant responses, it can be seen that crisis disrupts multiple aspects of food systems. While disruptive, crisis also presents an opportunity for changes in perception and subsequent action. However, participants reveal that not enough

crisis has occurred to create social change at the scale required for permaculture and CGF to be used in urban food production.

5.6 Summary

Participants emphasised the importance of community underpinning CGF because of the community connections that it enables and the empowerment it yields. Conventional values, rules, and regulations are at odds with participants' values and create a competitive environment for expressing self-determination. CGF can provide a protected space for self-determination, and permaculture ethics and design principles can help bridge connections between diverse communities. Crisis is a great motivator for change. However, participant experiences reveal that not enough crisis has happened to solidify the social changes needed for CGF to be embraced.

6   Discussion and Conclusion

6.1   Introduction

The aims of this research project were to investigate the role of permaculture and community garden-farming (CGF) in urban food production. The study investigated how permaculture could be applied to CGF practices and its impact on urban food production.

The findings of this research project indicate an emerging need for CGF and permaculture ethics and design principles in urban food production within communities. As participants shared their experiences, key findings centred on the value participants see in the social benefits of CGF and permaculture. Participants shared that both CGF and permaculture provided a space for common ground, where participants could identify, share and align their values and build their community. The potential yields offered by CGF: to form connections, participate in sustainability education opportunities, and control their food security, are empowering for participants. Participants discussed alternative economies, where exchanging goods and services and forms of charity were key social benefits that the community could tap into. The third theme found regulations from regulatory bodies created a competitive environment where what participants valued seemed to be in direct competition with what local council and government valued. Such differences makes the use of CGF and permaculture difficult to align with current practice. The final theme discussed the potential for crises like Covid-19 and the Christchurch earthquakes to be motivators of the type of social change that favours the conditions required for CGF and the implementation of permaculture ethics and design principles. Given this, participants also revealed that it would take increased levels of crises to achieve the level of social change required for CGF and permaculture to be used in urban food production.

6.2   Collective Responsibility, empowerment, and self-determination within the food system

One of the more prominent aspects observed in this research project is the lack of personal and community control, contribution, self-determination and agency within current food systems (Benachour, Moslemi, Sipahutar & Séralini, 2007; Benachour & Séralini, 2009; Cuhra, Bohn & Cuhra, 2016; Rather et al., 2017; Séralini, 2018). From the participants' point of view, the more government involvement there is, the

less direct and indirect opportunity there is afforded to participants' self-determination to use permaculture and CGF for food production in urban environments. Participants in this study pointed out that when they attempted to participate in their own food systems, they felt these efforts competed with the rules and regulations imposed by their local government. This competitiveness is a barrier to their agency and control, making self-determination difficult.

Extending from the 'deep-leverage points' (goals, intent, values, perspectives, paradigms and rules) of the system, this competitive nature is also underpinned by current agendas that favour economic outcomes over health or environmental outcomes (Dorninger et al., 2020; Swinburn et al., 2019). This has led to food systems becoming hostile, creating an inhospitable environment led by commercial interest that prevents competition, creates food insecurity, and hinders political urgency and subsequent policy development (Altieri, 2009). Ultimately, this has led the food system itself to become the major global driver of both poor health and environmental degradation (Dorninger et al., 2020; Ingram, 2018; Swinburn et al., 2019; Willett et al., 2019).

What is particularly troublesome for participants involved with CGF or permaculture is the difficulty they experience when consultation with government occurs, making them feel partially or completely left out of decision-making processes. One participant explained that they felt they were in "limbo" after the process and that the plans for their site were being sent overseas to Australia, removing them from the decision-making process. Similarly, in Bell and Cerulli's (2012) case study of community gardens, they share that this difficulty is common in farmers' experience when trying to work with authorities. They report that fourteen years after approving the site, the developers and local government had not contributed and were still working on 'their' final plans because the conditions were not yet satisfactory for them (Bell & Cerulli, 2012). Participants in this study had a similar experience when trying to acquire access to resources. Even with a prearranged agreement with their local council, bureaucratic mechanisms led to a water tank key being withheld, almost ruining the community garden.

The case study by Gupta (2014) on the Hawaiian island of Molokai examined the community garden-farmers place-based approach to sustainability known as "aloha aina" or love for the land. Gupta (2014) also describes the hostile relationship that participants in this study experienced due to the conflicting needs, values and

priorities of the island's residents and the state. In the case of Molokai, to support the overconsumption of energy on other islands, the local approach to sustainability —aloha aina — was pushed to the side to make way for wind farms because the state has decided so. While well-meaning, the state and globally-determined needs ran the risk of disregarding local approaches in the name of sustainability.

As found by Caradonna & Apffel-Marglin (2018), these westernised approaches, as demonstrated in the case of Molokai, run the risk of becoming another form of "cultural and ecological imperialism… that ultimately treat… local customs and culture as voluntary and optional". This inhibition of autonomy resulting from the need to compete for title and control and the rules and regulations subsequently introduced by those in positions of power has led to a loss of skills, knowledge and relationships related to food production in urban environments. This has also influenced public perceptions: particularly the conditioning around what food looks like, how it is grown and the increased reliance on supermarkets to acquire food. From being advised by one participant to avoid working with local government, if given the option, coupled with the refusal to use the term "community garden", it is evident that the contentious environment has ultimately created a need for participants to disassociate from current food systems. This disassociation calls for more investment from local council and regulatory bodies to develop CGF and increase skills around permaculture design practices.

6.3   Holistic approaches to food systems

The findings of this research project build on existing evidence that for sustainable food systems to manifest, a more holistic, responsible, ethical and people-centred approach is urgently needed (Annan-Diab & Molinari, 2017; Willett et al., 2019). While the existing literature and the findings of this project build on the evidence that a more collective approach to food systems is needed, it has never been deliberately attempted (Willett et al., 2019).

This research project found that conventional approaches offer only incremental changes towards food systems sustainability (Willett et al., 2019). The ability for this 'incremental' change to achieve the type of 'radical' change that is urgently needed is limited (Ingram, 2018; Maye, 2018). Simply altering how sub-systems operate and pollute less or achieve reference points doesn't challenge the agendas and deep-leverage points that perpetuate the status quo that is driving poor health and

environmental destruction. The kind of radical change which food systems require can only be achieved by transcending and transforming the agendas and paradigms that are protected by the different authoritative bodies that currently make up the food system (Dorninger et al., 2020; Ingram, 2018; Maye, 2018).

Sustainable food systems must ensure the security and generation of nutritious foods for all current and future generations without compromising economic, social and environmental sustainability (Willett et al., 2019). This study found that holistic approaches such as CGF using permaculture can achieve what sustainable food systems are intended to by providing spaces for radical innovation and change within food systems (Ingram, 2018; Nguyen-Viet et al., 2019; Salleh et al., 2018; Stojanovic, 2019). According to Annan-Diab & Molinari (2017), CGF does this through being intentionally inclusive and collaborative and by understanding and purposefully utilising the interconnecting elements of food systems to achieve system-wide change and sustainability transformation (Dorninger et al., 2020). As opposed to the goals, values, perspectives, and other deep leverage points of food systems operating unchallenged in isolation, the holistic systems approach of CGF and permaculture imbues the food system with the wants, needs and values of the people and their communities.

According to participants of this study, having a space to align shared values and social connection empowers participants to become part of something beyond just themselves as individuals and form a village of communities. As discovered through this study, not only is it essential for people and their communities to be involved in transforming food systems, but the community aspect itself and the connection, education, empowerment and safety that is yielded are valued by participants more than any kind of financial gain. For participants in this study, the community aspect of CGF enables the agency needed to become educated and literate in expressing self-determination. From that position, they can be included in decision-making about their own food security. The holistic nature of CGF and permaculture also enables participants to employ non-monetary economies and alternative methods of exchange to take place. In both instances, participants in this study relate these potentials to the permaculture principle of 'obtaining a yield'.

6.4 Holistic Systems involve local communities and people

Given the many complexities of food systems, international organisations, governments, the private sector, communities and individuals alone cannot solve the problems or provide solutions that will bring about the transition needed for transformation (Geels, 2019; Head & Alford, 2015; Maye, 2018; Savigny & Adam, 2009). Transcending the boundaries of what caused the problems to arise in the first place, a shift from a reductionist and monolithic based system to a holistic and inclusive system is necessary (Annan-Diab & Molinari, 2017; Head & Alford, 2015; Nguyen-Viet et al., 2019; Savigny & Adam, 2009).

According to systems theory, nothing exists in isolation, and so sustainable food systems will only be possible if the entire system is understood and actioned as a whole (Head & Alford, 2015; Savigny & Adam, 2009). Part of this whole is the local community of place and the individuals who make it up. The involvement of these people and their communities as part of this whole is just as important as the economic and environmental aspects. Only when all three 'pillars of sustainability' (see Figure 1) are upheld do you have a sustainable food system (Willett et al., 2019). Sustainable food systems must ensure the security and generation of nutritious foods for all current and future generations without compromising the economic, social and environmental sustainability of food systems (Head & Alford, 2015; Lovell et al., 2014; Savigny & Adam, 2009). This study found it is important for participants to have a food system that operates in this way because they understand and value the wider benefits that whole systems enable, in particular: the social benefits of improved access to nutritious foods, connecting with community and the positive physical and mental health implications.

6.5 An ethically unified and cooperative sustainable food systems

This study found that CGF, together with permaculture, is a potential alternative for bringing about transition and transformation to sustainable food systems and for producing food locally within urban environments. CGF and permaculture do this by offering an ethically unifying framework (the three ethics of permaculture) that integrates heterogeneity of all the different groups of people and focuses on sustainability, innovation and resilience (Ajibade & Adams, 2019; Gould & Rudolph, 2015; Mollison, 1988; Surampalli et al., 2020). When the three pillars of sustainability are overlayed with the three permaculture ethics (See Figure 16), it takes the ambiguous notion, and ethically absent suggestion of being sustainable

and transforms it into an ethical basis for decision making. Economic sustainability becomes fair share, where limits to consumption are set, and resources are redistributed according to need. The same applies to the food systems' environmental and social aspects by underpinning sustainability with the ethical action of caring for the environment and caring for people.
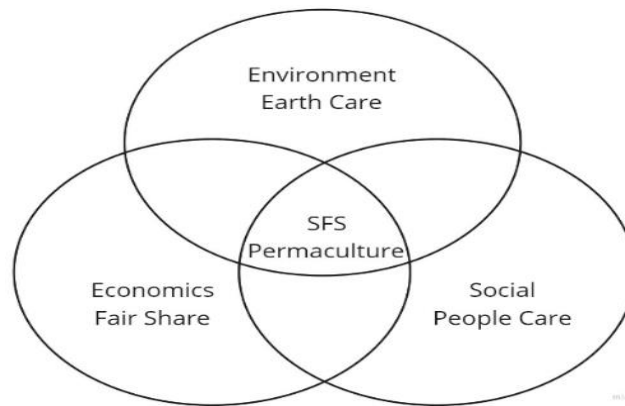

Figure 16: Overlay of permaculture ethics and sustainable food systems.

As participants in this study explain, they value the ethical unification that CGF and permaculture enable. One example given by participants was the belief that the permaculture ethic of 'fair-share' and the principle of cooperation can bring equality, equity and cooperation to sustainable food systems.

The unification that CGF enables connects people because the permaculture principles transcend cultural and linguistical barriers, encouraging inclusion and expression of culturally appropriate practices.

6.6   The safe and protected space

In addition to an ethically unifying framework, CGF and permaculture offer 'safe operating spaces' and 'protected spaces' (see Figure 17). The safe operating space takes the theoretical scientific targets proposed by Willett et al. (2019) to be used to attempt to define sustainable food production and healthy diets and uses them to define a literal space and environment.
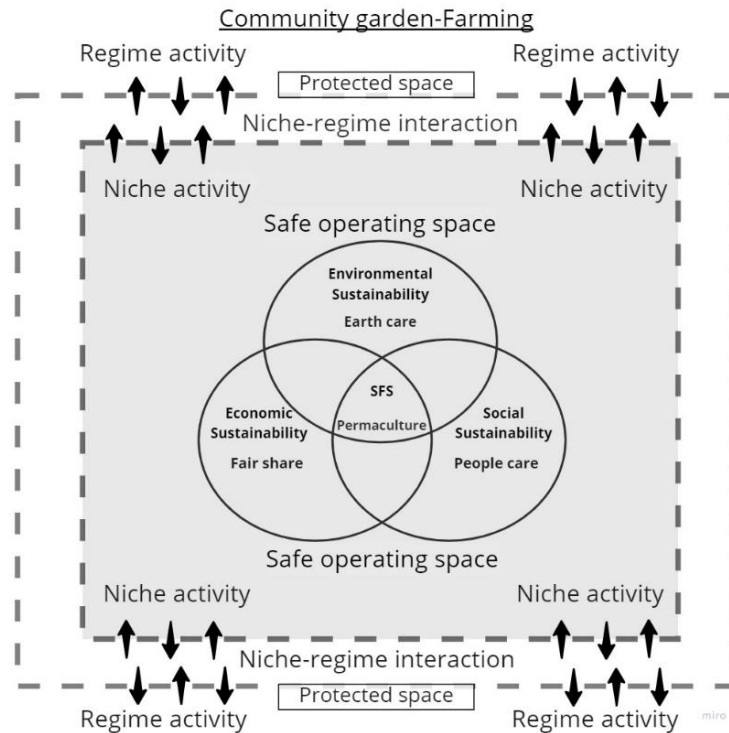
Figure 17: Combination of community garden-farming, permaculture ethics and sustainable food systems.

Within Figure 17, regime activity represents the conventional industry, educational and political approaches of food systems. Niche activity represents non-conventional approaches to food systems such as community gardens and permaculture. The niche-regime interaction space refers to the 'boundaries of intersection' where conventional (regime) approaches intersect with non-conventional (niche) approaches.

Instead of attempting to define and disseminate no longer fit-for-purpose approaches, CGF designed using permaculture would embrace the holistic approach and encourage interdisciplinarity in its discovery and dissemination of knowledge (Annan-Diab & Molinari, 2017). As the issues of food systems have political, social, ethical, health and legal implications, and interdisciplinary approaches offer a better understanding of deep leverage points to address these issues, CGF using permaculture ethics and principles would help to better understand where interventions in food systems should take place (Dorninger et al., 2020; Rowat et al., 2019).

In the current study, some participants were already utilising their spaces to protect what they value and to provide safety for what their communities value and need.

This study showed that their roles as community garden leaders and permaculture teachers also include providing a safe place to encourage their communities to participate in their own food systems. By fostering opportunities to connect, CGF empowers participants and their communities to be confident in self-determining how they participate in their food systems.

The 'protected space' offered by CGF and permaculture would help ensure that a hostile environment and the competitive nature of conventional authorities cannot sway or dictate what happens inside of this protected space. This study also found that while it has been established that participants have developed a need for disassociation from government involvement in food systems, to transition to sustainable food systems and truly be holistic, government and other authorities must also be part of the shift (Leonard et al., 2016). As facilitators between conventional and non-conventional stakeholders who can help build, develop and exchange skills, information and action, government and other authorities have a role to play in sustainable food systems (Annan-Diab & Molinari, 2017; Leonard et al., 2016; Willett et al., 2019). Additionally, as was observed in this study, the policies, rules and regulations that typically harbour the hostile and competitive environment of the different authorities were altered during the Christchurch earthquake crisis. The government could implement the same or similar changes to provide and enforce a protected space for CGF and permaculture.

6.7 The crisis of climate change: An inevitable opportunity for change

There is no immunity to crisis, and its appearance is inevitable (Bell & Cerulli, 2012). This study found that participants' experience of crisis recognises it as a powerful tool to motivate the uptake and use of CGF and permaculture in urban environments. It does this by stimulating change in public perceptions of what is accepted as valuable in times of need. Participants in this study recognise the inevitability of crisis and use it as an impetus to prepare and take steps to ensure safety and security for their own food. Current food systems appear to ignore crisis; they are either still striving for economic gains over all else, or have failed to acknowledge and change accordingly (Bell & Cerulli, 2012; Ferris et al., 2001; Novo & Murphy, 2000; Smith & Kurtz, 2003).

With the impending climate crisis at our doorstep, urgent steps need to be taken to ensure food security within food systems (Dekker, 2014; King, 2008; Pomeroy,

2016; Swinburn et al., 2019). When crisis strikes, every part of the supply chain within current food systems is affected (Dekker, 2014; King, 2008). As climate change will inevitably cause a global crisis on scales of severity that we are not prepared for, it can be assumed that supply chains and the entirety of food systems will be affected (Bennett et al., 2018; Dekker, 2014; Meyer, Castro-Schilo & Aguilar-Gaxiola, 2014; Bell & Cerulli, 2012). As people are dependent on food systems for survival, any disruption to the systems threatens human survival. This inaction to prepare for the inevitability of crisis is in itself evidence that the social and political sectors of food systems are not addressing the urgency of climate change (Dekker, 2014; King, 2008; Swinburn et al., 2019).

As opposed to traditionally remedying, responding and 'reacting' to crisis, CGF and permaculture would seek to encourage a resilient, self-determined, and 'proactive' approach to crisis (Dekker, 2014; Cutter et al., 2013; Linkov et al., 2014; Gould & Rudolph, 2015). This study found that participants embrace the anarchistic nature of permaculture because it empowers them to make change themselves. This anarchistic mode would be adopted by CGF and permaculture spaces to empower people to take personal responsibility for and proactively determine their food systems.

CGF would also seek to imbue local infrastructure, economies and food systems with resilience-engineering, e.g., self-healing, adaptive materials and automated, energy-self-sufficient technologies (natural systems and patterns), to empower pro-activity of stakeholders independently of the food system (Cutter et al., 2013; Dekker, 2014; Gould & Rudolph, 2015). An example of this can be seen in the participant example of 'stacking functions' where community self-determination is increased through stacking 'water storage', 'civil emergency functions', and 'seed-saving'.

6.8 Limitations

The generalisability of the findings in this research project are limited by a small sample size of eight participants. The findings can also not be applied outside of the Auckland and Hamilton areas. These two areas were chosen as recruitment sites due to the researcher's connection and familiarity with CGF and permaculture spaces and networks in these areas. Further research investigations are needed to

gain understanding from CGF and permaculture practitioners outside of these areas.

Given the dearth of literature in this area, the study set out to provide more understanding around CGF and permaculture. Qualitative descriptive methodology was used to encourage the depth and richness of data facilitated by qualitative description. Given this, the experiences of participants may differ from other community garden leaders and permaculture teachers in rural and other sectors. Furthermore, the researcher brings with them their own experiences and worldview, which may influence the research process and findings. As this project required interpretation when analysing the data using thematic analysis, the researcher's observations and interpretations affect consistency and reliability of the data and information (Jason & Glenwick, 2016). Therefore, further research is needed in other regional areas and with other practitioners to increase the reliability of research findings.

6.9   Recommendations

Based on the review and investigations presented in this research project, the study provides five key recommendations for policymakers:

- The formalisation of government support for urban food production and urban food production systems, such as community garden-farming and permaculture.
- The formalisation of community garden-farming policy for both a 'safe operating space' and 'protected space' within food systems.
- The formulation of public health, food system and environmental policies that incorporate the permaculture ethics – earth care, people care and fair share.
- The incorporation and integration of permaculture design techniques, such as 'stacking functions' into public health, food systems and environmental policy design and urban planning.
- The incorporation and integration of permaculture principles, such as 'obtain a yield', into public health, food systems and environmental policy design to increase social capital and community education opportunities.

The Role of Government

The recommendations of this research project have been made to aid the transitioning of food systems to sustainable food systems. One of the government's

main roles in sustainable food systems will be facilitation. By formalising their support for urban food production systems, such as permaculture and CGF, the government can facilitate the transition process. Through facilitating the formalisation of CGF policy for a 'safe operating space' and 'protected space', the government can help create a literal space for interdisciplinarity in specialist approaches to urban food production. The safe and protected space can be used to protect urban food production from conventional competition and be used to measure out, study, define and achieve sustainable food production and encourage healthy diets. As facilitators, the government can support the incorporation of the permaculture ethics of earth-care, people-care and fair-share into food system policy alongside the three pillars of sustainability to bring about an ethically unified sustainable food system. By facilitating the incorporation of permaculture design techniques, such as 'stacking function', and permaculture principles such as 'obtain a yield' into public health, food systems and environmental policy design, governments can align food systems with the proactive, self-determining and non-monetary aspects of permaculture and CGF that is valued by the community, increasing social capital and community education.

6.10 Conclusion

Based on qualitative analysis of the responses from community garden leaders and permaculture teachers, this thesis shows some of the potential ways that permaculture can be applied to community garden-farming for urban food production. Permaculture and community garden-farming provide food systems with alternative ways to bring balance and ethical underpinnings to the three pillars of sustainability, bringing the social and environmental aspects of food systems to the forefront within currently siloed and competitive-inducing economic aspects of food systems. The community aspects of community garden-farming bring into existence connections that an individual can't produce on their own and money can't buy. As participants' most valued aspects of food systems, these connections, and the social benefits they yield, will be essential building blocks for the transformation of sustainable food systems. By exploring the subjectivity of permaculture teachers and community garden leaders experience of the phenomena of urban food production, this thesis provides new insight into the everyday experience of the reality of transforming our food systems into sustainable food systems. While the sample size and number of locations limit the generalisability of the results, this research project provides new insights into possible futures for sustainable food

systems. As CGF and permaculture have never been deliberately attempted as a way to transform food systems into sustainable food systems, more research is needed to investigate further ways permaculture can be applied to community garden-farming for urban food production and how policy can be implemented to achieve the 'safe operating space' and 'protected space' of community garden-farming.

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Appendices

Appendix A – Interview question schedule

Interview question schedule

The study aims to:
- Explore the role of permaculture in community garden farming for food production in urban environments.
- Explore the political, procedural and practical implications of permaculture to identify sustainable options and alternatives compared to those currently used.
- Explore the potential impacts permaculture may have on environments.
- Explore how the identified environmental impacts can be used to guide environmental and food policy.

In your own words:

What is a/are community gardens?

What is/would be community garden farming?

What is permaculture?

How can permaculture be used at your community garden/permaculture farm?

What can community gardens offer society? e.g. sustainability, social interaction, food security…

What can permaculture offer society? e.g. sustainability, social interaction, food security…

What are the strengths/challenges of community gardens?

What are the strengths/challenges of permaculture?

What are the political, environmental, economic and health implications of community gardens?

What are the political, environmental, economic and health implications of applying permaculture approaches to urban farming? And community gardens?

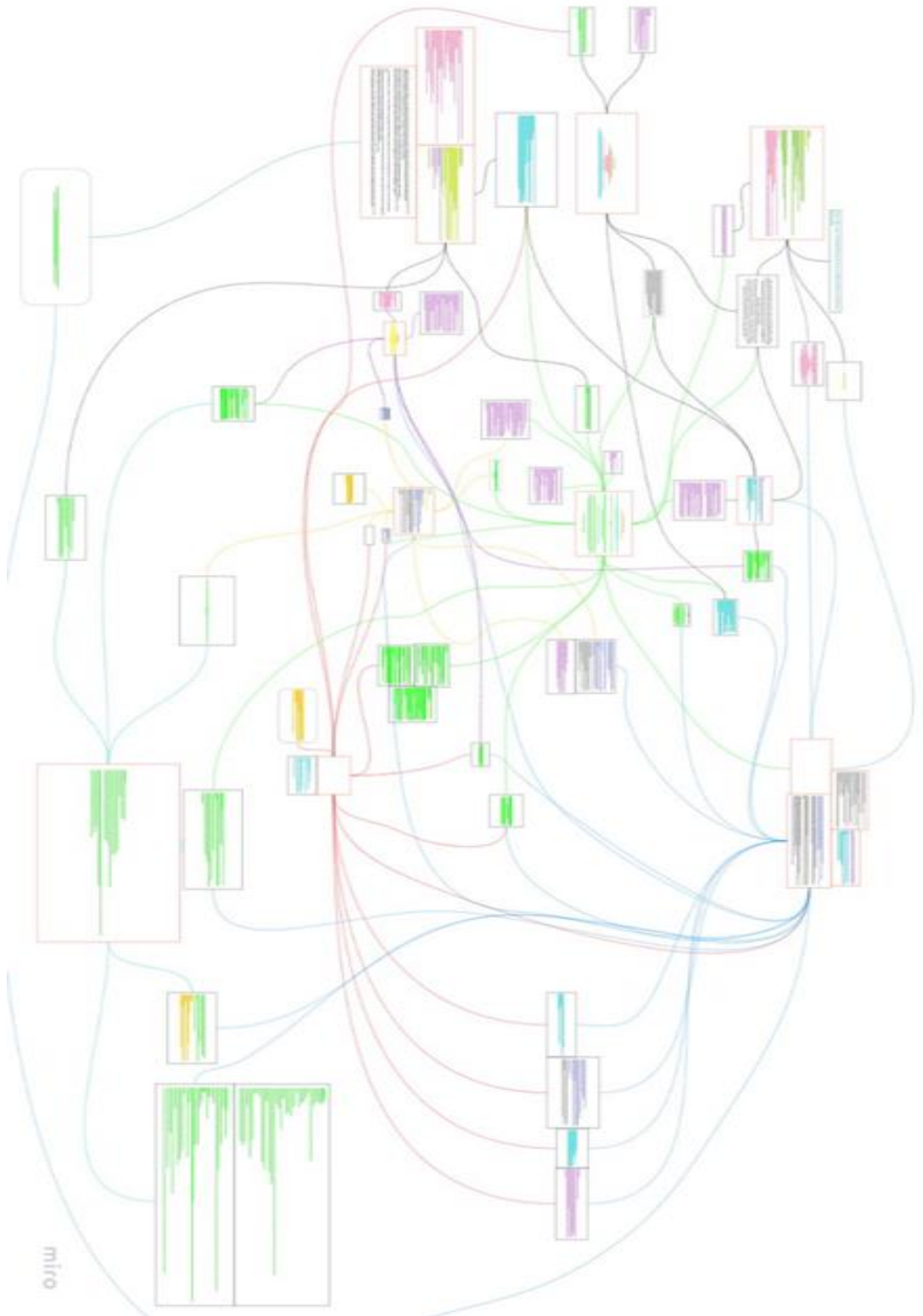How can permaculture be applied to community garden farming for food production in urban environments?

What would that look like to you?

How would it be done?

What are the challenges?

Is there anything else you would like to say in regard to anything we have discussed?

Appendix B – Thematic map

Appendix C – Defining and naming themes