Towards regenerative edible urban landscape through permaculture: A spatial planning perspective

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DECLARATION

I declare that this dissertation is my own work. All sources of information and material I have used (including the internet) have been fully acknowledged and properly referenced. This dissertation has not been submitted for any other degree or professional qualification.

DEDICATION

This dissertation is dedicated to my father, whose memory inspires my every accomplishment and my mother, brother, and boyfriend, whose consistent support and encouragement plays a crucial role in my every accomplishment. This work stands as a testament to the strength and resilience I've gained from the love and guidance of my family and loved ones.

PREFACE

I am pleased to present this dissertation, titled Towards regenerative edible urban landscapes through Permaculture: A spatial planning perspective, which represents the culmination of 3 years of research and scholarly inquiry. Throughout the process of conceptualisation, data collection, analysis, and writing, I have been fortunate to receive support and guidance from numerous role-players. In this preface, I will briefly outline the motivations behind this research, express gratitude to those who have contributed to its completion and provide insights into the journey that has led to the development of this dissertation.

Motivations

The impetus for this research stems from a deep-seated curiosity and a passion for sustainable and innovative urban planning advances to address modern day challenges. Throughout my academic journey, I have been intrigued by the complexities and nuances of permaculture and driven by a desire to explore this topic and contribute innovative knowledge and insights to the scholarly discourse of urban planning. This dissertation represents a culmination of my academic interests, intellectual pursuits, and a commitment to advancing knowledge in urban planning.

Conditions

The journey towards completing this dissertation has been marked by numerous challenges, setbacks, and moments of reflection. From navigating the complexities of data collection and analysis to overcoming unforeseen obstacles, each stage of the research process has presented its own unique set of challenges and opportunities for growth. Yet, it is through perseverance, resilience, and dedication to academic inquiry that I have been able to overcome these challenges and bring this dissertation to fruition.

Personal Comments

As I reflect on the journey that has led to the completion of this dissertation, I am filled with gratitude, humility, and pride. This research represents not only a scholarly attempt but also a personal journey of growth, discovery, and self-reflection. It is my sincere hope that this dissertation will contribute to the advancement of knowledge in urban planning and inspire future generations of scholars to explore new frontiers of inquiry. In conclusion, I would like to express my heartfelt thanks to all those who have supported, encouraged, and inspired me throughout this journey. This dissertation is a testament to the power of partnership, perseverance, and the pursuit of academic merit.

Denise Janse van Rensburg
22 March 2024

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ABSTRACT

With the global population increasing and urbanisation rates escalating, the challenge of food insecurity is growing, particularly in developing countries. This dissertation investigates the potential of permaculture as a planning tool to cultivate regenerative food systems within South African cities, and to combat the pressing challenge of urban food insecurity. In Paper 1, through a scoping review, the study assesses the existing academic landscape of permaculture, exploring its potential as a comprehensive and regenerative approach to food production. This method, grounded in principles of system regeneration and resilience, social empowerment, and sustainable food systems. In Paper 2, an empirical study employs a multiple-case study design, investigating four successful permaculture initiatives in South Africa. Spatial surveys and semi-structured interviews yield insights into the adaptability and transformative potential of permaculture within the complex urban environment. Key findings underscore permaculture's ability to address urban challenges through ecologically sound, socially inclusive, and economically viable food production. The study emphasises the need for tailored approaches based on local contexts and advocates for increased integration of permaculture principles within urban planning discourse. The dissertation highlights three core strategies for incorporating permaculture into urban planning: community engagement, physical design interventions, and adherence to permaculture ethics and principles. By engaging communities in the planning process, intervening at the physical design level, and aligning with permaculture values, urban planners can foster the development of food-sensitive urban systems. This research contributes to the evolving discourse on sustainable urban development by demonstrating permaculture's potential as a nature-based solution for food sovereignty. It underscores the importance of localised, community-driven approaches in addressing global challenges and calls for greater awareness and integration of permaculture within urban planning frameworks. Ultimately, this study offers practical insights and recommendations for leveraging permaculture as a transformative force in shaping resilient and regenerative urban food systems.

Key terms

Permaculture, urban planning, food insecurity, food sovereignty, urban food systems.

LIST OF ABBREVIATIONS

BGP	Borehole Garden Permaculture
CAS	Complex Adaptive System
CoP	Community of Practice
COVID-19	Coronavirus Disease 2019
CRF	City Resilience Framework
EDS	EBSCO Discovery Service
EC	European Commission
EGI	Edible Green Infrastructure
FAO	Food and Agriculture Organisation
FRACTAL	Future Resilience of Actual Cities and Lands
GI	Green Infrastructure
GIS	Geographic Information System
GST	General Systems Theory
HLPE	High-Level Panel of Experts
IUCN	International Union for the Conservation of Nature
IG	Infrastructure Gardening
MCZM	Mollison's Concentric Zoning Model
MENA	Middel East and North Africa
NBS	Nature-Based Solutions
NGO	Non-Governmental Organisation
NWU	North West University
RDT	Regenerative Development Theory
RF	Rockefeller Foundation
RST	Regenerative Sustainable Theory
RT	Resilience Theory
SACN	South African Cities Network
SDG	Sustainable Development Goal
SDT	Sustainable Development Theory
SoCR	State of Cities Report
TEEB	The Economics of Ecosystems and Biodiversity
UA	Urban Agriculture
UG	Urban Gardening
UN	United Nations
UN ECA	United Nations Economic Commission for Africa

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CHAPTER 1 : INTRODUCTION AND BACKGROUND

1.1 Overview and purpose of chapter

The purpose of this chapter is to contextualise the research presented in the dissertation. First, the chapter commences with an overview of global sustainability challenges, focusing on urban growth and food insecurity (1.1). Following the introduction are sections covering the research's guiding aspects: the problem statement (1.2), aims and objectives (1.3), primary and secondary research questions (1.4), purpose statement (1.5), and chosen methodology (1.6). The chapter ends with a summary of the dissertation's structure (1.7) and a conclusion. Figure 1-1 below illustrates the structure of Chapter 1 in relation to the entire dissertation.

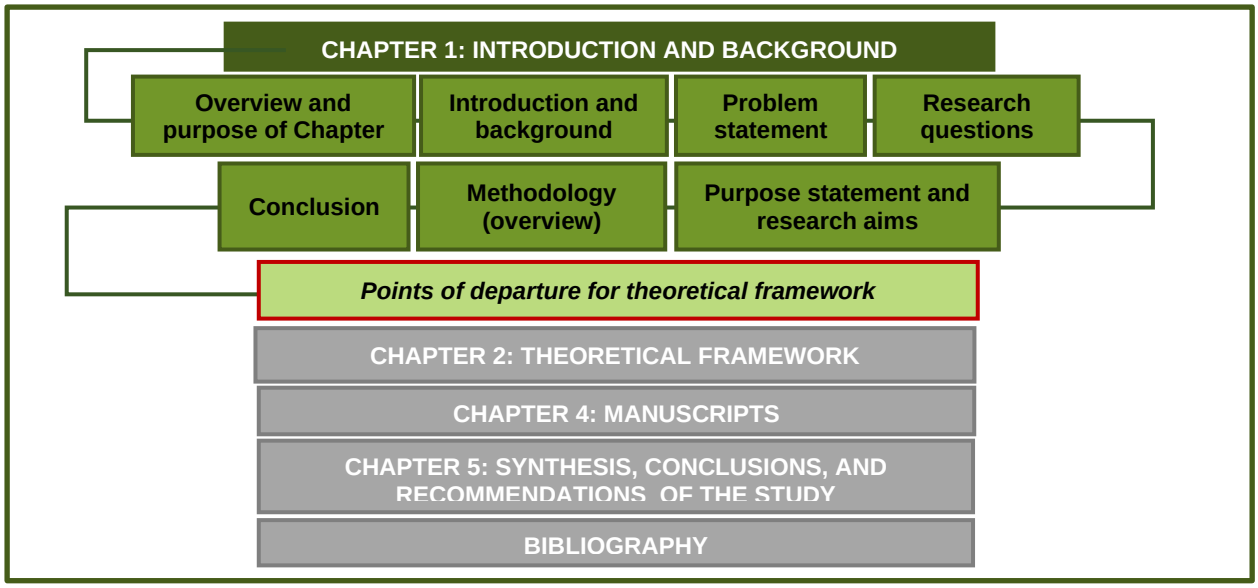


Figure 1-1: Structure and overview of Chapter 1.

Source: Author's compilation.

The dissertation was presented in accordance with the North West University Manual for Higher Degree Studies (2020) article option. Nonetheless, as mentioned in section 1.6, a number of chapters have been added to offer a more comprehensive explanation of the study that was conducted.

1.2 Introduction and background

1.2.1 Facing a global urban future: Population growth and urbanisation

Presently, the global population totals 8 billion individuals, with 56% residing in urban areas (Worldometer, 2024). However, more than 800 million people face inadequate access to food (Van Bavel, 2013:283; Escamilla, 2017:1; Worldometer, 2023). This burgeoning population is shaped by multiple factors, including elevated birth rates and diminished mortality rates attributed to improved health measures and medical treatments (Van Bavel, 2013:283, 285; Drummond *et al.*, 2014:7), with a simultaneous notable increase in urbanisation worldwide (Van Bavel, 2013:282). Over the past 70 years, global urbanisation rates have nearly doubled, and projections indicate that by 2050, 70% of the world's population will reside in urban areas (Van Bavel, 2013:282; Worldometer, 2022). These trends are particularly concerning in developing countries, where the poorest nations are expected to experience the highest population growth rates, leading to increased urbanisation (Van Bavel, 2013:283). Africa and Asia currently have the highest urbanisation rates globally (Van Bavel, 2013:285; Drummond *et al.*, 2014:4; Crush *et al.*, 2020:23). While South Africa is an African country that is almost past its population growth transition, the same challenges occur as those on the rest of the continent (Drummond *et al.*, 2014:7). In 2011, South Africa already had an urbanisation rate of 61.7%, while the current urbanisation rate is around 67% (StatsSA, 2011; Gambe *et al.,* 2023:2) - the reason why South Africa is regarded as one of the most urbanised African countries (Ruhiiga, 2014:610; Battersby & Crush, 2016:3; Haysom, 2021:290).

The global trend towards urbanisation, driven by population growth, poses a significant threat to the long-term sustainability of cities and their surrounding communities. Several serious issues are considered to be the face of the future including poverty, living in the periphery, overcrowding, and eventually ensuing hunger (Vasyviela & James, 2021:76). Regretfully, it is expected that the difficulties will continue (Almenar *et al.*, 2021:1), and it is especially concerning as urbanisation is a primary cause of the extreme poverty and hunger that exist today (Ashley, 2016:50; FAO, 2018:1).

1.2.2 Urban Food sovereignty with special reference to Africa and South Africa

Food insecurity is defined as the insufficient access and availability of food (Ashley, 2016:1; Dubbeling *et al.*, 2017:6). Consequently, the term food security has been a leading strategy, since 1974 for combating food insecurity, primarily concentrating on enhancing the accessibility and availability of food in affected communities (StatsSA, 2011:19; Ashley,

2016:1; Noll & Murdock, 2019:6). One concerning aspect is the continuous approach to food security that heavily relies on market food prices and the income levels of those facing food insecurity, often hindering these communities from obtaining the food that is available (Crush *et al.*, 2020:2). Since 1996, due to the neoliberal associations of food security, there has been a shift from emphasising "food security" to highlighting "food sovereignty" as a counter-concept for tackling food insecurity (Millner, 2017:767). This shift in focus directs attention to the availability, accessibility, and consistency of food ingredients (food sovereignty), rather than solely economic access and external dependence (food security) (Millner, 2017:767; Noll & Murdock, 2020:2). The concept of food sovereignty has gained prominence in global food-related studies (Ashley, 2016:172; Noll & Murdock, 2020:1). Food sovereignty goes beyond addressing access and availability; it empowers individuals to confront their food insecurity by producing their own food in culturally appropriate, sustainable, and resilient ways and also prioritises the needs of producers, distributors, and consumers over corporate profit goals (Arthur, 2012:4; Naylor, 2019:706; FAO, 2013:4; Noll & Murdock, 2020:3).

Food insecurity poses a significant and persistent challenge in African cities, and South Africa is no exception. As of 2010, South Africa has faced significant challenges associated with food insecurity, as indicated by statistics highlighting varying levels of hunger across different age groups (Stats SA, 2011:20, 48, 77, 108). These statistics revealed that 33.3% of children residing in South African households reported insufficient or severely deficient access to food (Stats SA, 2011). Thirteen years later, following the COVID-19 pandemic, the issue of food insecurity in South Africa persists, with recent data that indicates that approximately 21% (3.7 million) of South Africa's population is currently battling moderate to severe food insecurity and that about two thirds of households that experience hunger in South Africa reside in urban areas (Stats SA, 2023:10). This alarming statistic emphasises the urgent need for comprehensive strategies and interventions to address and mitigate food insecurity challenges, not only within South Africa but also across the broader African context.

The focus on food insecurity in global South studies has been driven by factors such as poverty, urbanisation, drought, poor governance, and the disconnection between food production systems and urban systems (Anand *et al.*, 2019:421; Noll & Murdock, 2020:2; Ruhiiga, 2014:614; Ashley, 2016:39; Dubbeling, 2017:1; Mauro & Martin, 2021:22; Zhong *et al.*, 2023:10). South Africa's food system is predominantly dominated by the food market, limiting access to local informal produce, and contributing to food insecurity (Battersby & Crush, 2016:14). This food insecurity directly impacts dietary intake, health, malnutrition, and undernourishment (Arthur, 2012:9; Battersby & Peyton, 2016:34; Escamilla, 2017:1). The consequences extend to poor development and health issues, affecting both children and

adults (Van Bavel, 2013:289; Escamilla, 2017:2). In anticipating future challenges, such as starvation, a leading side effect of food insecurity and closely linked with high urbanisation rates (Cabannes & Marocchino, 2018:3; Vasyviela & James, 2021:77), it becomes crucial to consider these factors when planning and developing urban areas.

1.2.3 Urban Food sovereignty and spatial planning

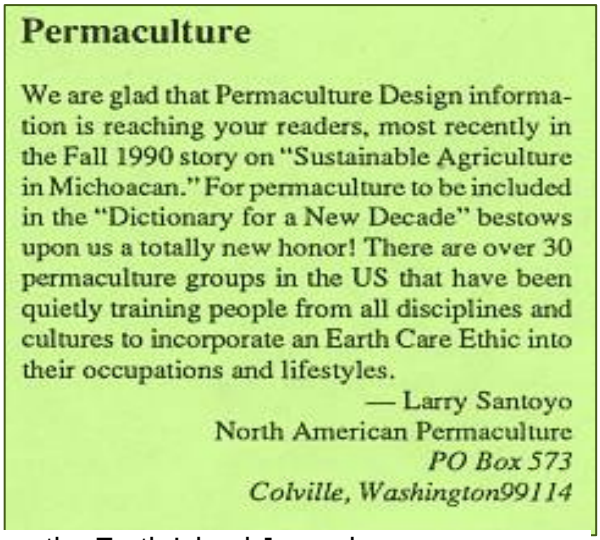
Addressing food insecurity from a spatial planning perspective is crucial and requires an approach that is sensitive to the lack of food in urban areas. Spatial planning encompasses the comprehensive analysis and organisation of both urban and rural landscapes, aiming to optimise land use and resource allocation while fostering sustainable development (Taylor, 1998:5; Acheampong, 2019:12). However, within this framework, addressing food insecurity within urban areas emerges as a critical focal point of this dissertation. To streamline discussions and analyses, the term "urban planning" will be utilised as a more specific branch of spatial planning throughout the remainder of this dissertation, focusing primarily on strategies and interventions pertinent to urban contexts. The term food-sensitive planning (FSP) may well be useful as this approach aims to proactively integrate food growing practises with infrastructure, urban systems, and governance to create sustainable, resilient, and regenerative urban environments (Haysom, 2021:290). Ensuring self-restorative and regenerative systems that provide for both people and nature is considered a critical component in future urban planning initiatives (Rhodes, 2015:403; Gibbons *et al.*, 2018:2; 5). Recently, nature-based solutions (NBS) have gained prominence as one of the most suitable strategies to promote sustainable development and confront urbanisation-related challenges in towns and cities (Howe, 2002:127; Viljoen *et al.*, 2005:21). NBS is recognised as a key intervention in the planning of systems that aim to facilitate the coexistence of people and nature (Eggermont, 2015:244; Yuan *et al.*, 2022:2). NBS encompasses the integration of green infrastructure, such as green roofs, vertical gardens, urban agriculture, constructed wetlands, rain gardens, etc., into urban environments to harness the benefits and services provided by natural ecosystems, including temperature regulation, water treatment, flood prevention, and renewable energy (Yuan *et al.*, 2022:1, 6; Almenar *et al.*, 2021:2) and address various urban challenges. It has also been explored regarding food sovereignty (Viljoen & Bohn, 2014; Yuan *et al.*, 2022) as a means to incorporate NBS for food production to enhance sustainability, resilience, and regeneration within urban systems.

Parallel to the rising awareness of NBS, a recent focus on edible green infrastructure has emerged as an important theme in literature related to addressing food insecurity (Yuan *et al.*, 2022). Edible green infrastructure can be integrated into various forms of green infrastructure

(GI), with urban agriculture (UA) and infrastructure gardening (IG) being some of the most prevalent approaches currently (Russo *et al.*, 2017:54; Krebs & Bach, 2018:4). While NBS, GI, UA, and IG are widely discussed topics in academic scholarship, permaculture, as a form of edible green infrastructure, has received extremely limited attention, especially in relation to urban planning. Permaculture represents a design approach for land use, arrangement, and system planning that emulates the activities and relationships found in thriving natural ecosystems (Holmgren, 2002; Moughtin & Shirley, 2005:116; Salleh *et al.*, 2018:2). Most discussions regarding the application of permaculture are focused on private properties (Rogerson, 2010:378), resulting in isolation rather than integration into urban systems. Despite some isolated case studies discussing permaculture, its integration into NBS, and particularly urban planning, remains largely unexplored, presenting an opportunity for further investigation. It is exactly this gap in current scholarship to explore permaculture as a possible instrument to integrate into urban planning to combat urban food insecurity that is the focus of this dissertation.

1.3 Problem statement

During the escalating global challenge of food insecurity and the prevailing issues within global food systems, academic and practical attention directed towards the food system has grown significantly (Battersby & Watson, 2019). Regrettably, despite the persistent challenge of food insecurity in urban areas and the continued reliance of urban communities on rural food sources, the potential of urban food systems remains largely under-revealed in academic literature and practice (Haysom, 2021:291). As a result, very little guidance exists for urban planners how to tackle food insecurity from a spatial perspective. Figure 1-2 below is an extract from one of the first journal publications on permaculture (Santoyo, 1991). Originally conceived as an approach encompassing agriculture for the design of environmentally sustainable, food-producing systems (Kennedy, 1991:210), permaculture has not received the attention it deserves in the field of planning. Moreover, its potential for addressing urban food sovereignty has remained largely unexplored. This study aims to confront the issue of poorly integrated food systems within urban settings, particularly in South African communities. There is a clear need for innovative urban planning to enhance food sovereignty. It is argued that permaculture, when integrated through planning, offers untapped opportunities to incorporate food production into urban systems.



Permaculture

We are glad that Permaculture Design information is reaching your readers, most recently in the Fall 1990 story on "Sustainable Agriculture in Michoacan." For permaculture to be included in the "Dictionary for a New Decade" bestows upon us a totally new honor! There are over 30 permaculture groups in the US that have been quietly training people from all disciplines and cultures to incorporate an Earth Care Ethic into their occupations and lifestyles.

— Larry Santoyo
North American Permaculture
PO Box 573
Colville, Washington99114

Figure 1-2: Extract from the Earth Island Journal.
Source: Santoyo, 1991.

The most important problem due to this lack of research is that while urban food sovereignty has been explored to combat hunger (see, e.g., Arthur, 2012; Millner, 2017; Loker & Francis, 2020), permaculture (which provides promising prospects for regenerative edible urban systems that may well lead to supporting food sovereignty in the long run) has not received attention, and planners are not necessarily aware of the possibilities for integration in existing initiatives such as NBS.

1.4 Research questions

The primary research question that guided the study is "How can Permaculture be utilised as a planning tool to produce regenerative food systems (edible landscapes) in South Africa cities to combat food insecurity?" Secondary research questions include the following:

- **Secondary research question 1**: To what extent has permaculture been addressed in the literature and what are its prospects to inform urban planning in addressing food insecurity?
- **Secondary research question 2:** How can best practices of permaculture in South Africa inform future food-sensitive planning in South African cities?

1.5 Purpose statement and research aims

The purpose of this research is to explore permaculture through a planning lens, assessing its potential integration into the planning and design of urban systems to contribute to food sovereignty and formulate guidelines for food sensitive planning in urban areas. The **primary aim** of this research is to explore the role of permaculture as a potential regenerative planning tool to support urban food sovereignty in a South African context. The secondary aims of this research include the following:

- **Secondary aim 1:** To conduct a scoping literature review of existing permaculture literature globally and to reflect on the extent to which permaculture has been considered or integrated in urban planning scholarship.
- **Secondary aim 2**: To investigate the application of permaculture practices in South African case studies and its prospects for consideration in urban contexts in the future.
- **Secondary aim 3:** To explore possible guidelines for the integration of edible permaculture landscapes into the planning of urban areas to combat hunger in the future.

The following research objectives are formulated to provide direction for the study and ensure that the research aims are achieved:

- **Objective 1**: To establish a theoretical foundation that will inform the perspective from which the study is conducted.
- **Objective 2**: To establish a feasible methodology for this study and the data methods required to generate sufficient and valuable data.
- **Objective 3**: To collect and study a wide-ranging set of permaculture literature over the past eight years.
- **Objective 4**: Identify recurring themes within the selected literature to enhance our understanding of the scope of permaculture research.
- **Objective 5**: Extract meaningful conclusions from existing permaculture literature with potential relevance to planning.
- **Objective 6**: Identify and document permaculture practices in South Africa that offer valuable insights for a detailed case study.
- **Objective 7**: Conduct interviews with permaculturists in South Africa to gain insights into the practical realities of food growing systems from their perspectives.
- **Objective 8**: Identify overarching themes, lessons, and challenges from the selected cases that can inform planning practices.

- **Objective 9**: Synthesise findings from both the literature review and empirical study to establish comprehensive guidelines for integrating permaculture into planning approaches.
- **Objective 10**: Provide recommendations derived from the study to guide future considerations of permaculture by spatial planners.

1.6 Research methodology

Although the methodology is discussed in detail in Chapter 3, a brief description is provided here for the sake of orientation towards the study. In the literature review phase of the study, a scoping review was conducted to explore permaculture in academic literature in terms of its position, importance, scope, and presence or lack thereof in planning. Secondary research question 1 and aims 1 and 2 are addressed in the first paper ("*Fighting the Hunger Games through Permaculture: A scoping review to inform urban planning*") that was published in Volume 5 of the Journal Frontiers in Sustainable Cities on October 30, 2023, as part of a special edition entitled *Innovation and Governance.* In the empirical section of the study, a multiple-case study design was employed, where four in-depth investigations of successful South African permaculture cases were conducted to establish a nuanced understanding of permaculture as well as its application in the South African context. Secondary research question 2 and aim 3 are addressed in the second manuscript (*Cultivating Edible Cities: Lessons for Urban Planners from Permaculture Case Studies in South Africa*) that is prepared to submit to an accredited academic journal. Secondary question 3 and aim 4 are addressed in the final chapter of this dissertation. Regarding the empirical phase of the research, two qualitative research methods were used to generate data from multiple case studies across South Africa in order to obtain insights regarding the practical application and experience of permaculture. The two methods included spatial surveying of permaculture practices and semi-structured interviews with South African permaculturists. The empirical study was considered along with the literature review to identify the gaps and potential of permaculture as a planning tool, and the research aim was to provide recommendations for its implementation for this research.

1.7 Limitations of the study

Due to the COVID-19 pandemic, travel restrictions limited the ability to gather spatial information. After the pandemic, when interprovincial travel resumed, the distance between researchers' residences and the study locations posed additional challenges for site visits.

Time and cost constraints further complicated researchers' ability to visit research sites that are distributed over South Africa. To address this, much of the spatial data was collected using public Geographic Information Systems (GIS), digital platforms, and through existing documents. Contact persons from each case study were willing to assist and provide additional electronic information. The dissertation is divided into three main sections:

1.8 Dissertation structure

Section A: Theoretical and empirical contextualisation and framework (chapters 1–3). Chapter 1 outlines the problem statement of this study, provides a brief overview and background of the study, and highlights the aims and objectives that guided this study. Chapter 2 presents the theoretical framework, including the theoretical constructs that guide the study. Chapter 3 explains the research methodology that was used in this study, including the approach, the research design, data generation methods, analysis, trustworthiness, and ethical aspects.

Section B: Manuscripts (Chapter 4): Chapter 4 comprises two manuscripts: (i) Fighting the Hunger Games through Permaculture: A Scoping Review to Inform Urban Planning (a literature study), that was published in a special edition “Urban Governance” of the journal Frontiers in Sustainable Cities (Volume 5, date of publication: 30 October 2023); and (ii) Cultivating Cities for Tomorrow: Lessons for Urban Planners from Permaculture Case Studies in South Africa (an empirical based study) prepared to be submitted to a peer reviewed academic journal. The manuscripts are followed by a summary of the main findings from the study.

Section C: Synthesis and Conclusion (Chapter 5). Chapter 5 provides the conclusions from the study as well as a reflection on how the research questions have been answered and the aims have been addressed. The chapter is concluded by planning recommendations as well as recommendations for future research related to this study.

A simplistic presentation of the overall structure of each Section (A, B, & C) of the study is portrayed in Figure 1-3 and Figure 1-4 to follow. Table 1-1 illustrates the correspondence between the research aims and objectives with the respective chapters of the dissertation wherein they are addressed.

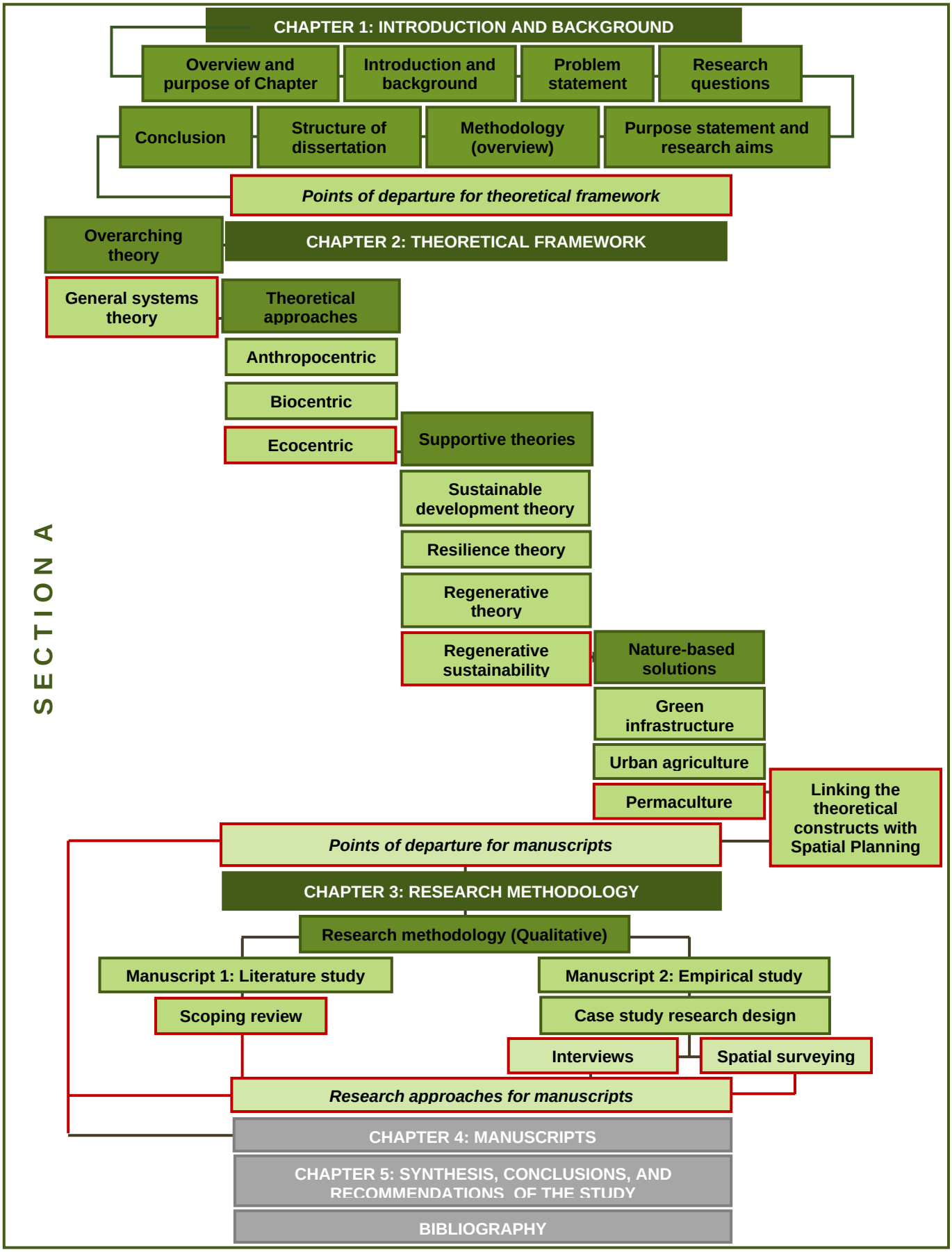


Figure 1-3: Structure of Section A of the dissertation.

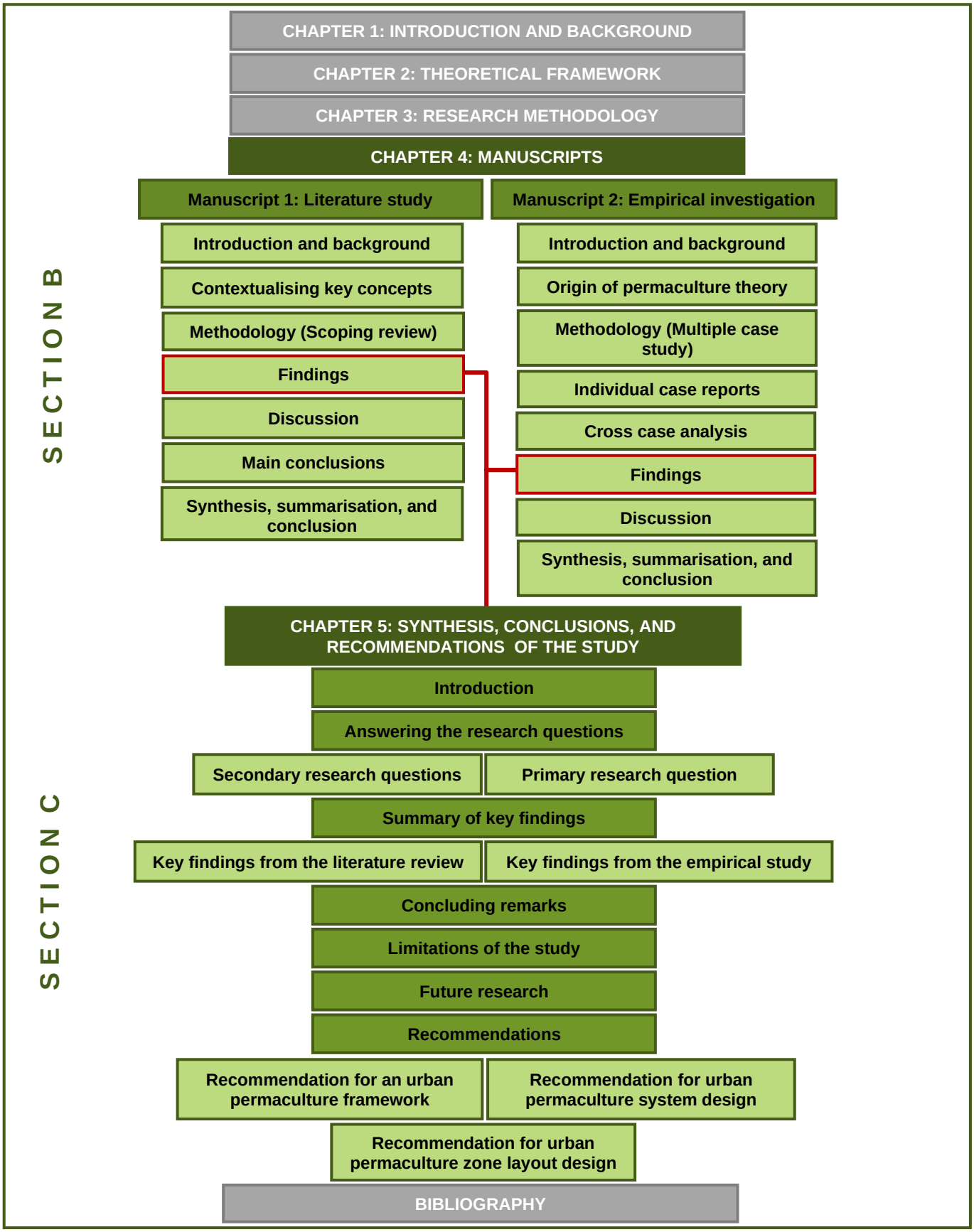


Figure 1-4: Structure of Section B and C of the dissertation.

Table 1-1: Correspondence of the research aims and objectives with the chapters of the dissertation.

	RESEARCH QUESTION	RESEARCH AIM	RESEARCH OBJECTIVE
SECTION A	CHAPTER 1		
	CHAPTER 2		**Objective 1**:To establish a theoretical foundation that will inform the perspective from which the study is conducted.
	CHAPTER 3		**Objective 2**: To establish a feasible methodology for this study and the data methods required to generate sufficient and valuable data.
SECTION B	CHAPTER 4: PAPER 1	**Secondary aim 1:** To conduct a scoping literature review of existing permaculture literature globally and to reflect on the extent to which permaculture has been considered or integrated in urban planning scholarship.	**Objective 3**: To collect and study a wide-ranging set of permaculture literature over the past eight years.
			Objective 4: Identify recurring themes within the selected literature to enhance our understanding of the scope of permaculture research.
			Objective 5: Extract meaningful conclusions from existing permaculture literature with potential relevance to planning.
	CHAPTER 4: PAPER 2	**Secondary aim 2**: To investigate the application of permaculture practices in South African case studies and its prospects for consideration in urban contexts in the future.	**Objective 6**: Identify and document permaculture practices in South Africa that offer valuable insights for a detailed case study.
			Objective 7: Conduct interviews with permaculturists in South Africa to gain insights into the practical realities of food growing systems from their perspectives.
			Objective 8: Identify overarching themes, lessons, and challenges from the selected cases that can inform planning practices.

SECTION C	CHAPTER 5	**Secondary aim 3:** To explore possible guidelines for the integration of edible permaculture landscapes into the planning of urban areas to combat hunger in the future.	**Objective 9**: Synthesise findings from both the literature review and empirical study to establish comprehensive guidelines for integrating permaculture into planning approaches. **Objective 10**: Provide recommendations derived from the study to guide future considerations of permaculture by spatial planners.

Source: Author's own compilation.

1.9 Conclusion

Chapter 1 provided a thorough account of the background, context, research questions, aims, and objectives of the dissertation. It has articulated the pressing issue of food insecurity within urban areas and the underexplored potential of permaculture in addressing urban food insecurity. The chapter has highlighted the need for innovative urban planning to promote urban food sovereignty, particularly in South African communities. Despite efforts to address urban food insecurity, permaculture remains largely overlooked in urban planning initiatives. This chapter has set the foundation for the research, outlining the structure of subsequent chapters, and emphasising the significance of exploring permaculture from a planning perspective to transform urban systems.

The subsequent chapters will delve into the theoretical framework, research methodology, empirical studies, and conclusions, contributing to transformative reform in urban systems. This dissertation represents a pivotal step towards fostering sustainable and resilient urban environments that prioritise food sovereignty and community well-being. Chapter 2 introduces the theoretical framework, incorporating general systems theory (GST), anthropocentric, biocentric, and ecocentric perspectives (see 2.3), sustainability, resilience, regenerative theories (see 2.4), and NBS (see 2.5). Chapter 3 outlines the research approach, design, methodology, and methods for data generation and analysis. Chapter 4 includes two prepared manuscripts for journal publication: a scoping review assessing academic permaculture literature trends and an empirical study on permaculture in the South African context. The final chapters synthesise the study, draw conclusions, and delineate contributions and recommendations for transformative reform in urban systems.

CHAPTER 2 : THEORETICAL FRAMEWORK

2.1 Purpose and overview of chapter

The purpose of this chapter is to provide the theoretical framework for the overall study. The chapter commences with theoretical constructs underpinning this research, including (i) general systems theory, (ii) worldviews, (iii) supportive development theories, and (iv) NBS with a specific focus on permaculture. The structure of this chapter is shown in Figure 2-1.

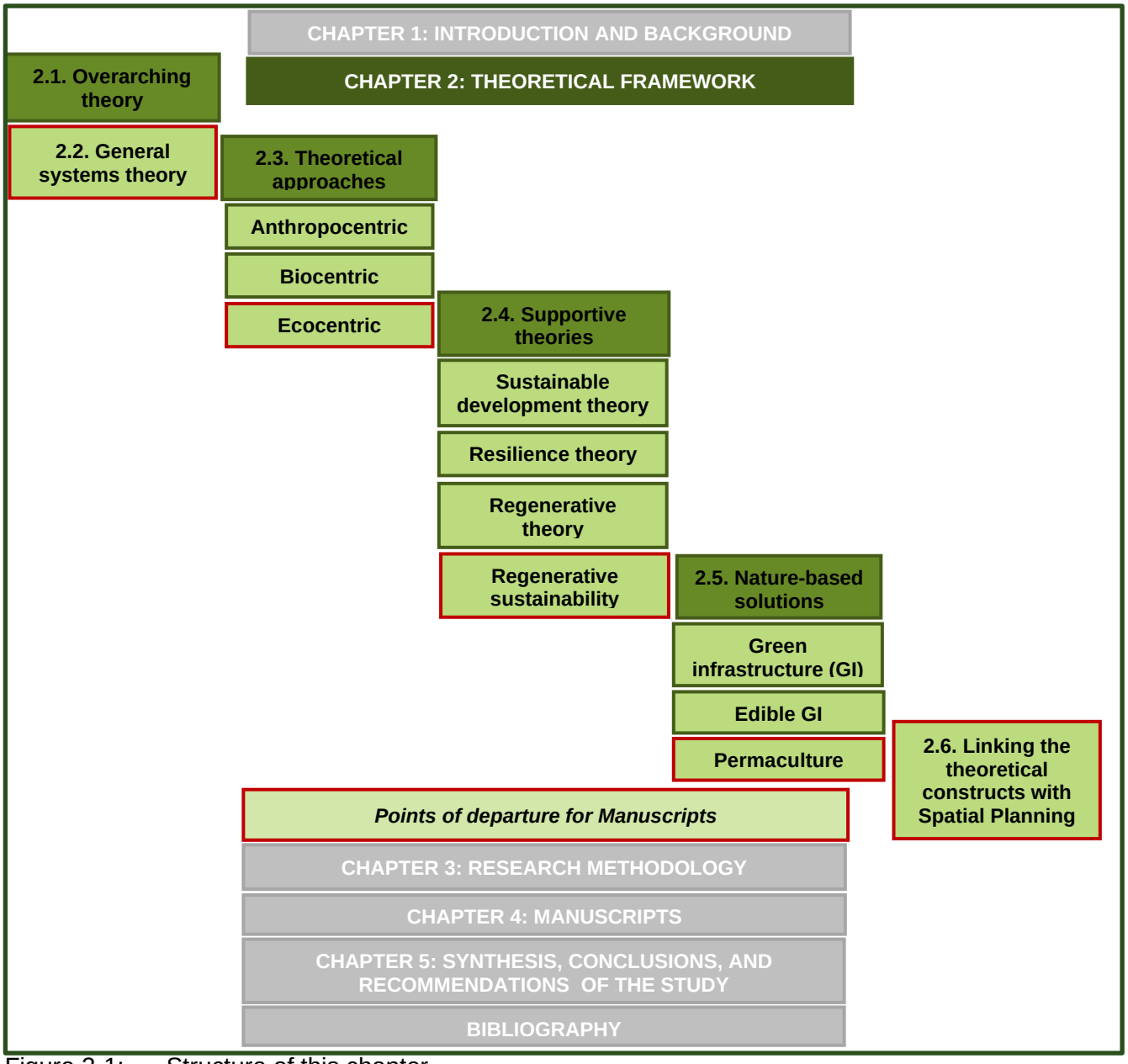


Figure 2-1: Structure of this chapter.

2.2 Introduction

This chapter lays the overarching theoretical foundation for the research, considering permaculture from a planning perspective within the framework of the general systems theory with an ecocentric viewpoint. It explores various people-environment relationships, encompassing anthropocentric, ecocentric, and biocentric perspectives. Following these approaches, the chapter discusses three supportive theories: sustainable development theory, resilience theory, and regenerative development theory. Finally, NBS are examined to pave the way for permaculture as the central focus of the dissertation. Throughout the ensuing discussions on systems theory, including general systems theory, simple systems, complex systems, and complex adaptive systems, the people-environment relationship emerges as a focal point. These discussions offer nuanced insights into the intricate dynamics between individuals and their environment, enriching the comprehension of the research context.

2.3 General Systems Theory (GST) as overarching theoretical construct

This study is informed by a systems approach to people and the environment, where people and the environment are interrelated components of a system. Systems theory is useful to explain the interaction between various components within a system (Teater, 2014:16). According to Teater (2014:23), systems theory provides a conceptual framework that empowers researchers to observe the functionality of a system, identify problems within a system, and determine the most effective intervention strategies to improve the functionality and interdependence within a system. Therefore, systems theory is a macro-level theoretical approach that is used to understand the structure and function of systems in nearly any discipline (Lai & Lin, 2017:2; Teater, 2014:16). These systems refer to the relationships, interdependence, and interactions that emerge between various components within a system.

2.3.1 Origin of systems theory

The original systems theory was founded based on biology, and in 1968, von Bertalanffy founded the general systems theory (GST), which paved the way for the systems theory as it is known today (von Bertalanffy, 1968:30). The purpose of developing systems theory was to explore and explain the sometimes-complex interaction between components in a system and how their interplay generates a fully functioning system in which no component is replaceable or superior (Teater, 2014:16). Systems theory thinking enables one to recognise valuable components and dynamics within systems, identify problems within almost any discipline, and explore intervention opportunities to improve the interaction between each component within the said system (Mang

& Reed, 2012:5; Lai & Lin, 2017:2). Since its origin in the late 1960s by Ludwig von Bertalanffy (1968:178), GST has grown exponentially in various disciplines. Disciplines that have significantly reflected GST in recent years include environmental management (e.g., Aprile *et al.*, 2023), engineering (e.g., Naletov *et al.*, 2023), and social sciences (e.g., Shin *et al.*, 2022; Zengaya *et al.*, 2023).

2.3.2 Types of systems

Systems can be categorised into open and closed systems (Von Bertalanffy, 1968:39). A closed system functions in isolation from its surrounding environment, such as a clock or watch that consistently keeps time, unaffected by external events. In contrast, open systems exhibit continuous interaction between their components, characterised by inflow and outflow, contributing to the system's self-maintenance (Carmichael, 2019:244; Batty *et al.*, 2019:25). The components of an open system can vary widely and may include everything from insects in a field, cells in the brain, atoms in a weather system, and individuals in a city (Carmichael, 2019:1). Systems typically operate most efficiently when they are in a state of equilibrium, where all internal components function optimally. However, any unexpected disturbance or alteration in the system's conditions can push it beyond or below its regular threshold, leading to the classification and differentiation of systems (Carmichael, 2019:2). Systems can be further distinguished as either simple or complex systems (Bak, 1996). Danish physicist Per Bak (1996) was among the first to establish the categorisation of systems into simple and complex systems (Bak, 1996). A simple system exhibits minimal variation and a high degree of uniformity throughout (Bak, 1996:80). In contrast, complex systems are characterised by continuously changing components with strong interactions among various elements both within and around the system (Bak, 1996:19). Complex systems are shaped by interactions between several components within the system and their dependability on each other. Complex systems are also shaped by the unpredictability of internal and external shocks to the system and their ability to adapt patterns based on feedback from these disturbances (Miller & Page, 2007:15; Carmichael, 2019:1).

Over recent decades, spatial planning and built environment disciplines have established that urban systems are complex systems, and, moreover, complex adaptive systems (CAS) (Ilmola, 2016:209). In any CAS, the components of a complex system can adapt to external shocks and disturbances to better regulate and endure in their environment (Carmichael, 2019:1). CAS evolve by retaining and adapting their structure, functionality, and thresholds to disturbances and shocks (Carmichael, 2019:2; Batty *et al.*, 2019:27). Authors, e.g., Hu (2002:39) and Batty *et al.* (2019:25), highlight the co-dependent nature of man-made and natural systems and have thus established a firm foundation for integrated systems, e.g., what is found in permaculture systems.

2.3.3 People-environment systems as a complex adaptive system (CAS)

Complex systems can be deterministic or adaptive. Complex deterministic systems involve structures and behaviours within a system that are intricate but lack adaptive capacity. In contrast to complex adaptive systems, where entities can alter their behaviour based on interactions and feedback, complex deterministic systems adhere to predetermined reactions without adapting to external disturbances (Von Bertalanffy, 1968:16; Condorelli, 2016; Lai & Lin, 2017:4; Kvan & Karakiewics, 2019:27). Adaptive complex systems thus imply a dynamic capability for components in a system to adapt their behaviours in response to interactions, feedback, and external disturbances, allowing for flexibility and responsiveness to changing conditions. This adaptability enables adaptive complex systems to show evolving properties and self-organisation, contributing to their resilience and capacity to evolve over time (Condorelli, 2016:433).

It is argued in this case that the relationship between people and the environment cannot be dismissed and is crucial for the long-term perseverance of the natural environment, the built environment, and the quality of life of components within both environments (Hu, 2002; Demerath & Suarez, 2019:223). People's activities have vast effects on the natural environment and vice versa; occurrences within natural systems also have immense effects on people and the built environment (Condorelli, 2016:433; Kvan & Karakiewics, 2019:1). Natural components within a people-environment CAS could be anything from weather and temperatures to animals and organisms, whereas man-made components within a people-environment CAS could be anything from people and cars to buildings and roads. Natural occurrences that directly affect people within people-environment CAS include droughts, climate change, epidemic outbreaks, and floods, and man-made occurrences that directly affect the natural environment within people-environment CAS include development, deforestation, mass gathering events, and agriculture. In both instances, natural and man-made occurrences (often as a reaction) impact each other immensely and, more often than not, in a negative way. This interrelated and dynamic relationship between people and their environment emphasises that people-environment systems are not only complex systems due to their level of interaction with each other, dependence on each other, and their effects on each other, but also as CAS where both natural and human components within larger systems affect, react to, and adapt regardless of each other (Bronfenbrenner, 1977:517; Kvan & Karakiewics, 2019; Carmichael, 2019).

This section explores various approaches to the interaction between people and the environment, including anthropocentric, biocentric, and ecocentric perspectives. It aims to build a stronger foundation for this study, specifically embracing an ecocentric view of the people-environment as a CAS (Cocks & Simpson, 2015:216).

2.4 Perspectives on people-environment complex systems

Although numerous perspectives of people-environment interaction exist (e.g., socio-cultural, political-economic, and geographical), the three that are considered in this dissertation include the anthropocentric perspective, biocentric perspective, and ecocentric perspective. The reason for the emphasis on these is to pave the way for this study to be considered from an ecocentric perspective.

2.4.1 Anthropocentric perspective (People oriented)

Since the 1970s, the developing world has been dominated by an anthropocentric worldview where people considered themselves the most valuable component in the development and growth of the planet and that nature should serve the interests of people (Cocks & Simpson, 2015:218). Rooted as far back as Aristotle (384–322 B.C.), the anthropocentric perspective aims to preserve human welfare above the welfare of any non-human entity (Hu, 2002:40; Rottman, 2014:1). Aristotle upheld the idea that the natural environment and all its resources exist merely for the sake of satisfying and sustaining people (Hu, 2002:40). The deep-rooted anthropocentric perspective has since been criticised for its role in the global environmental problems faced today (Hu, 2002:40; Rottman, 2014:1; Kopnina, 2016:141). The anthropocentric perspective can be divided into “weak” or “strong” anthropocentrism (Lanza & Berman, 2009:89; Cocks & Simpson, 2015:1). Strong anthropocentrism is the view that natural resources serve no other purpose than purely as a product to be used by people for their survival (Cocks & Simpson, 2015:220). Weak anthropocentrism implies that the natural environment exists to help people feel good about themselves by caring for and consuming something that is not man-made; thus, the natural environment is measured by its value to people.

The anthropocentric perspective paved the way for an industrial society that has built an economic empire, neglected to preserve the earth’s natural capital, and brought people’s values under question (Eggermont *et al.*, 2015:243; Fremaux, 2019:44). In recent years, shifts have begun to emerge from anthropocentric perspectives to more biocentric or ecocentric perspectives.

2.4.2 Biocentric perspective (Nature oriented)

In contrast to anthropocentrism, biocentrism positions people as less valuable than other living entities (Fremaux, 2019:140; Hu, 2002:2). The biocentric viewpoint advocates the idea that human influence should be nonexistent in ecological systems, promoting the notion that these systems ought to operate autonomously, free from any impact or alteration caused by human

activities (Rottman, 2014:1; Fremaux, 2019:140). Despite the resolute assertion of biocentrism that humans should not interfere with ecological systems (Hu, 2002:2), critics argue that this perspective is impractical, given the inherent interconnectedness between people's existence and the natural environment (Fremaux, 2019:13). Among the three perspectives, biocentrism is notable for its spiritual underpinnings, portraying nature as a sacred and divine creation tainted by people's activities (Rottman, 2014:1). Lanza and Berman (2009) highlight environmental consciousness and self-perception as pivotal determinants of biocentrism. Despite its spiritual depth, the biocentric perspective often faces limited consideration and implementation compared with anthropocentrism, potentially due to the scepticism surrounding the scientific validity of spiritual beliefs.

Considering Bronfenbrenner's (1977) ecological perspective on general systems theory (GST), it is noteworthy that neither biocentrism nor anthropocentrism adequately acknowledge the significance of fostering a mutually beneficial relationship between people and nature. This perspective overlooks the potential co-dependency of people and nature as integral components of complex systems.

2.4.3 Ecocentric perspective (People-nature oriented)

Equidistant from biocentrism and anthropocentrism is ecocentrism. The ecocentric perspective argues that biocentrism and anthropocentrism are opposite extremes and that a middle ground should be found between the two (Cocks & Simpson, 2015:218). The ecocentric perspective evolved from the global environmental crises the world has faced in recent decades and still faces today, for example, natural exploitation, natural disasters, urbanisation, industrialisation, technological power, pandemic outbreaks, and overall capitalism (Fremaux, 2019:1). Due to the challenges faced by humankind and the natural world, people are urged to alter their mindsets from being people-centered to valuing the importance of people-environment relationships to ensure sustainable, resilient, and regenerative development. People's activities should be carefully integrated with ecological systems, recognising that people are an intrinsically valuable component of the Earth's ecosystem, just as the natural environment is essential for human existence (Bronfenbrenner, 1977:528; Hu, 2002:21; Fremaux, 2019:125).

Subsequently, ecocentrists believe that people are rightfully dependent on nature's products and services to survive and should not extort them to the extent of natural degradation (Hu, 2002:14; Cocks & Simpson, 2015:217–218; Kopnina, 2016:141; Fremaux, 2019:29). This study is grounded in an ecocentric perspective. An ecocentric view could establish a mindful basis for urban development that ensures that people continue to benefit from the resources provided by

the natural environment while regenerating and preserving ecosystems as a key component in the survival of humanity and cities. Urban communities constitute a significant portion of the built-up environment; however, they frequently lack the assurance of food sovereignty and guaranteed survival at all levels (Nenguda & Scholes, 2022:1). Consequently, there is an urgent need for regenerative sustainable development approaches from spatial planners and developers (Naya *et al.*, 2018:180; Nenguda & Scholes, 2022:9). This calls upon spatial planners to adopt a stewardship mindset toward the complexity of people-nature systems. The ecocentric perspective is supported by various theories that aim to balance and/or improve people-environment systems as complex adaptive systems. The next section focuses on these theories.

2.5 Supportive theories to optimise people-environment systems as a complex system

Following a systems theory framework, Caniglia *et al.* (2020:43) identify supportive theories that foster the importance of people-environment interaction in development. These theories include sustainable development theory (SDT), resilience theory (RT), and regenerative development theory (RDT).

2.5.1 Sustainable development theory

Since 1987, the term "sustainability" has been defined in various ways, often with conflicting interpretations and significance (Pohoata *et al.*, 2020:8). Nevertheless, it has become a global buzzword applied to a wide range of practises worldwide, symbolising a commitment to environmentally conscious approaches while still maintaining the status quo from its inception (Du Pisani, 2007:83). The Brundtland Report by the United Nations (UN) defines sustainable development as development that fulfils the needs of present generations without compromising the needs and abilities of future generations (Brundtland Report, 1987). The report also explains that this definition consists of two parts: that priority should be given to current generations and that limitations are to be established on the environment to secure the abilities of future generations to fulfil their needs. Underpinning most definitions of sustainable development is the desire to harmonise people, nature, and prosperity for existing and future generations (Caniglia *et al.*, 2020:35).

2.5.1.1 Origin and background of sustainable development

The concept of sustainability has been around for more than a century, related to issues of deforestation and soil degradation in French, German, and Dutch civilisations. In its simplest

explanation, sustainability was known as “maintaining the everlasting youth of the earth” (Du Pisani, 2007:85). It was only in the late 1900’s that sustainability became a coined term and sustainability theories began to evolve and develop.

2.5.1.2 Development of sustainability theory

2.5.1.2.1 The sprouting period (before 1972)

The sprouting period for sustainability regarded the use of natural resources and the prevention of natural depletion (Meadows *et al.*, 1972; Shi *et al.*, 2019:4; Du Pisani, 2007:91). The concept of sustainability has been vested in Chinese philosophy for centuries and in the following civilisations since (Shi *et al.*, 2019). Equivalent terms that represented sustainability in traditional philosophy were, for example, “stable society," “limited growth," and “ecological stability” (Meadows *et al.*, 1972; Du Pisani, 2007:91). The sustainability theory was sculpted over the ensuing decades and evolved with time. From the presence of the concept of sustainability in Chinese philosophy in the early 1900s and its inauguration in 1972 at the UN Conference of the Human Environment to how the theory of sustainability is understood today, the notion has undergone a lot of evolution and improvement to what it represents today.

2.5.1.2.2 The sculpting period (1972 – 1987)

(i) The UN Conference on the Human Environment (1972):

The first official sustainability conference was the UN Conference on the Human Environment in 1972. The conference was held in Stockholm as a response to the need for a guide for the people of the world for the preservation and enhancement of the human environment. The main topic of this conference revolved around poverty and underdevelopment as a result of population growth (United Nations, 1972). The conference was anthropocentric in its views, as people were regarded as the most important element in the world at that stage. Industrialisation and technological development were encouraged at the conference with the view that human development should be conserved and preserved for future generations. As an effect of this conference, 26 principles were assembled to guide and prioritise human environmental development.

(ii) Our Common Future (1987):

Also known as the “Brundtland Report," Our Common Future 1987 was published as a guide for environmental sustainability in the long term (World Commission on Environment and Development, 1987). The report was a global call, in response to the effects of the Second World War, to return to multilateralism. The realisation that the industrial revolution was causing

devastation to the natural environment encouraged this publication. Global warming was announced in this report as a result of the extreme development of the previous decade, and ecological concerns, still faced today, started to emerge. However, the message of the report still came down to economic growth and the need to expand natural resources to combat poverty in developing countries. As a result of yet another anthropocentric publication, the effects of human activities on the natural environment were identified in this report (changes in rainfall, loss of biodiversity, deforestation, global warming, etc.); however, the focus of development was still people orientated.

2.5.1.2.3 The improvement period (1992 – present)

(i) The United Nations Conference on Environment and Development (1992):

The conference was held in Brazil and was fuelled by the fast-progressing challenge of climate change and the loss of biodiversity due to human activities. The focus started shifting towards a more ecocentric view, and 27 principles were presented to encourage global environmental action (United Nations, 1992). Following the realisation that the natural, social, and economic environments were affected by human activities, the conference dealt with each element individually. The focus was diversified, and the natural environment started to gain more and more attention.

(ii) The United Nations Millenium Summit (2000):

This assembly marks the first true action and realisation of the environmental aspect of human development (United Nations, 2000). The assembly notices that past “sustainability” achievements are not enough and need to be improved on continuously. The Millennium Development Goals were presented at this summit, and the lack of consideration for the natural environment was emphasised. Unfortunately, amid a technological era, the answer to sustainable development remained entrusted to technological and economic growth, and environmental conservation remained low on the priority list.

(iii) The United Nations Conference on Sustainable Development (2012):

The conference was held in Brazil again. At this conference, the term "green economy" emphasises the importance of maintaining the Earth’s ecosystems along with its aim to eliminate poverty, sustain economic growth, and improve social inclusion and human welfare. At some point, the UN highlights the global challenge of hunger and the fact that everyone has the right to have access to nutritious and sufficient food. A segment of the conference regarded “sustainable cities and human settlements,” where it called upon planning to ensure affordable, all-inclusive, and environmentally sustainable societies. Ultimately, the conference promotes the Millennium Development Goals of 2000 as a useful tool for sustainable development.

(iv) United Nations Sustainable Development Summit (2015):

The latest and most relevant conference currently is the Summit on Sustainable Development that took place in New York in 2015. It presented and outlined the 17 Sustainable Development Goals (SDGs) (see Figure 2-2) as a guide for developing social, economic, and environmentally sustainable cities by 2030 and demanded unprecedented awareness on the challenges across social, economic, and environmental spheres faced globally (United Nations, 2015). SDG 11 (sustainable cities and communities) is the main driver behind this study. Table 2-1 summarises the development of the sustainability theory as discussed in the foregoing paragraphs.



Figure 2-2: SDGs of the United Nations.

Source: United Nations (2015).

Table 2-1: Synthesis of the development of the sustainability theory.

Eras of ST	Event / publication	Result of the event:
The sprouting period (before 1972)	Chinese philosophy and other publications regarding development and natural degradation	Rationalisation of natural resources.
		Challenge of notions like progress, growth, and development.
		Concepts of stable society.
		Concepts of economic and ecological stability.
The scul ptin		The sustainable development concept introduced.

	The UN Conference on the Human Environment	Northern hemisphere focused on environmental sustainability.
		Southern hemisphere focused on economic sustainability.
	Publication of "Our Common Future"	SD is systematically defined.
		"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs".
		First mention of three pillars (economic, social, and environmental).
The improvement period (1992 – present)	The United Nations Conference on Environment and Development	First time ever SD strategy was implemented from concept into a global action by the signing of Agenda 21.
	The United Nations Millennium Summit	The Millenium Devel Goals are established in an international framework.
		The focus is to eliminate poverty.
	From Sustainable Development to Sustainability Science	Sustainability becomes a scientific subject as the National Research Council publishes a report:
		Our common future: A transition towards sustainability.
	The United Nations Conference on Sustainable Development	A fourth pillar is added to SD (Governance) to encourage green economy as the key to sustainability conflicts
	United Nations Sustainable Development Summit: Transforming our World: The 2030 Agenda for Sustainable Development	The 17 SDGs are announced for inclusive growth socially, economically, and environmentally.

Source: (Meadows *et al.*, 1972; Shi *et al.*, 2019; Du Pisani, 2007; United Nations, 1972; WCED, 1987; United Nations, 1992; United Nations, 2000; United Nations, 2012; United Nations, 2015).

From the start, SDT was concerned with mainly three (eventually four) components, the social, economic, and environmental, that went on to become recognised as the pillars of sustainability. In 2012, governance was introduced as the fourth pillar of SDT.

2.5.1.3 Pillars of sustainability

As the concept of sustainable development has evolved over the decades, the main components of sustainability have been channelled into social sustainability, economic sustainability, and ecological sustainability (Kruger, 2015:454; Shi *et al.,* 2019:5). Figure 2-3 presents the four pillars of sustainability.

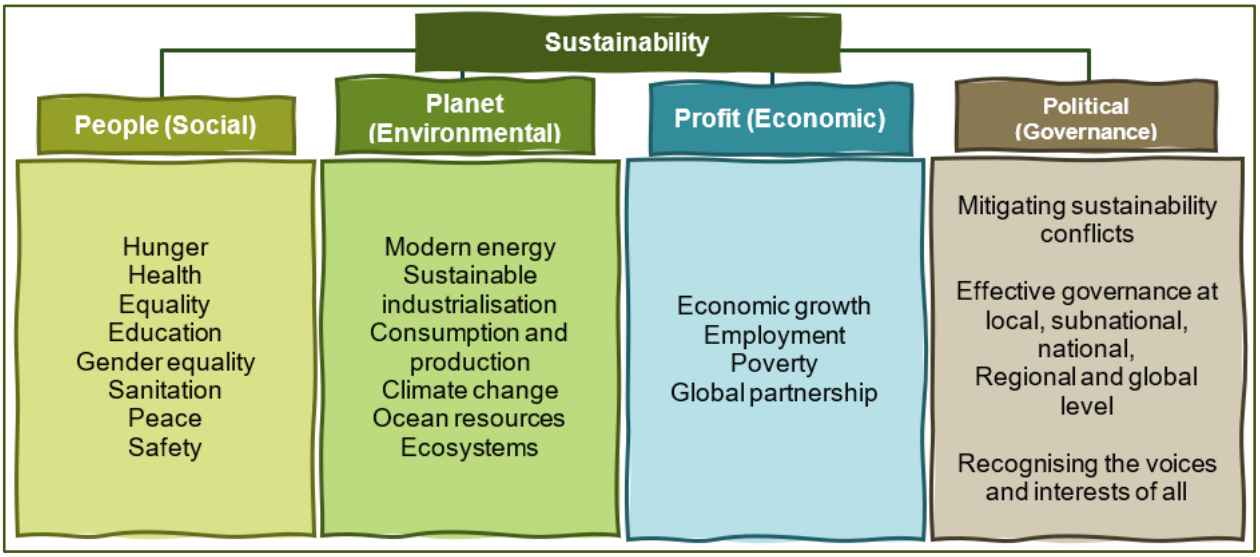


Figure 2-3: The pillars of sustainability.

Source: Author's adaption.

Since their origin in 1987, the pillars have developed into a dependent measure for sustainability. Shi *et al.* (2019:7) break down the concept of sustainability further by distinguishing between weak and strong sustainability that eventually culminated in alternative theories than sustainability.

2.5.1.4 Weak versus strong sustainability

The evolution of thought within the realm of sustainability has led to the classification of sustainability into weak and strong forms, based on their consideration of natural capital. Weak sustainability adopts a people-centred perspective and operates on the belief that man-made capital can replace natural capital as long as the total capital stock continues to grow. It places greater emphasis on the well-being of people over the well-being of the natural environment (Ang & van Passel, 2012:253; Ahuerma *et al.,* 2019:2). Within the framework of weak sustainability,

natural capital is considered interchangeable with other forms of capital, and the depletion of natural capital is deemed acceptable as long as it is offset by the growth of other types of capital. This view places a greater focus on achieving economic, social, and environmental equilibrium within a system (Ahuerma *et al.,* 2019:7). In contrast, strong sustainability takes an environmental-centred approach, asserting that natural capital is irreplaceable and should not be substituted or interchanged. This perspective emphasises the importance of respecting environmental limits in human activities (Ahuerma *et al.,* 2019:2, 5).

Within the framework of strong sustainability, it adopts an ecocentric perspective, where the economic dimension is nested within the social dimension, which, in turn, is embedded within the environmental dimension. This perspective contends that the consumption of natural resources should be carefully managed to ensure their availability for future generations. It also emphasises that natural capital cannot be substituted by any other form of capital and advocates for the preservation of the integrity of all natural systems (Ang & van Passel, 2012:252; Ahuerma *et al.,* 2019:7). Consequently, the social and economic dimensions of sustainability are intricately dependent on the environmental dimension and the availability of natural resources. Figure 2-4 illustrates the difference between weak sustainability and strong sustainability.

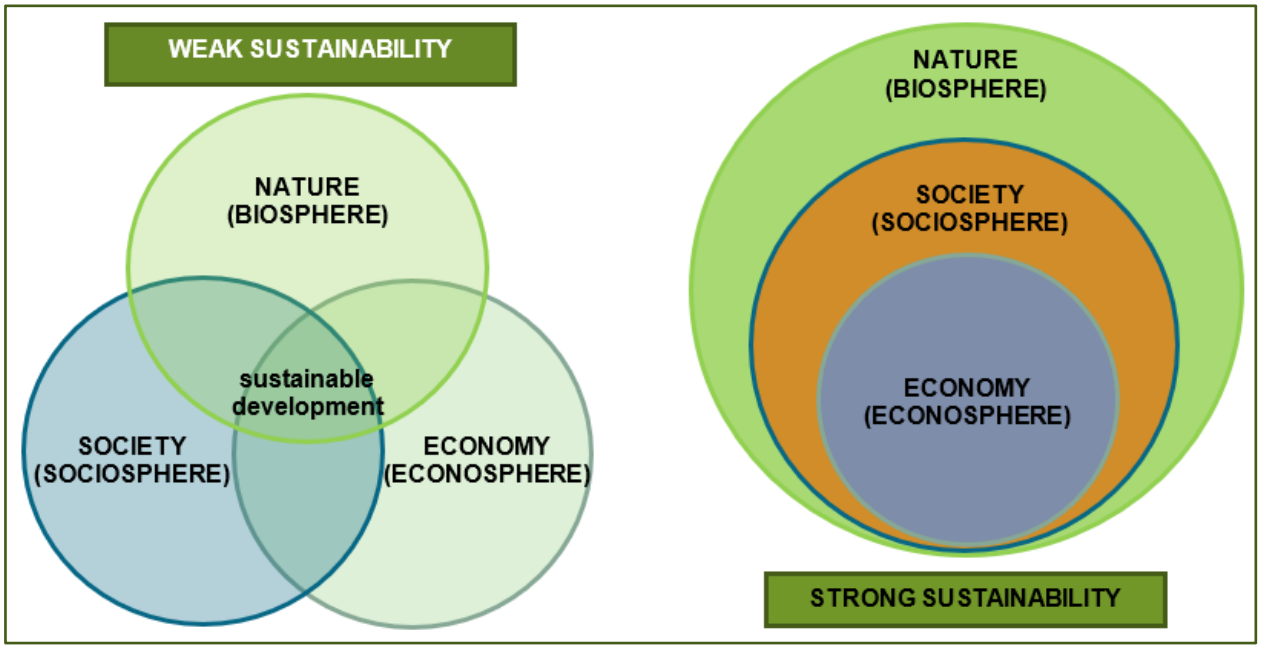


Figure 2-4: Weak vs strong sustainability.

Source: Author's compilation from WCED (1987); Ang & van Passel (2012); Ahuerma *et al.* (2019).

2.5.1.5 Critique against sustainability

Caniglia *et al.* (2020:35) suggest that sustainability represents the aspiration to balance the three P's—people, prosperity, and planet. However, Caniglia *et al.* (2020:36) also point out that there is a lurking presence of the precautionary principle in sustainability, that allows for business as usual as long as we actively monitor thresholds and indicators that may pose a threat to future generations. Furthermore, Caniglia *et al.* (2020:36) argue that sustainability is often employed as a concept that can simultaneously appease those seeking economic growth and expansion as well as those concerned about environmental degradation. In alignment with Caniglia *et al.*'s (2020:36) and Pohoata's (2020:15) perspectives, this study acknowledges that the conventional definition of sustainability only captures its essence but fails to fully satisfy both society's relentless drive for lasting economic growth and its commitment to safeguarding the Earth's natural capital. Sustainable development is increasingly viewed as an ineffective approach to addressing the complex challenges the world confronts today. It is often perceived as a term used to provide an ethical cover for maintaining the status quo, a direct result of weak sustainability (Shi *et al.*, 2019:10).

Acknowledging its benefits, and limitations, SDT has sparked innovative perspectives, leading to post-industrial theories where a growing global population is actively addressing the planet's genuine needs. Notably, resilience theory (RT), partly arising from sustainable thinking, takes a prominent place (Caniglia *et al.*, 2020:37). The global ambition aligns with SDG 11, emphasising the necessity for 'inclusive, safe, resilient, and sustainable' cities. This call underscores the urgency to not only embrace inclusivity and sustainability but also fortify urban systems against challenges. Through examining resilience, it becomes clear that building cities capable of withstanding and recovering from disruptions is integral to realising the broader vision of urban development as outlined in SDG 11. In 2020, the COVID-19 pandemic disrupted global urban food supply systems, leading to restricted food access and a surge in prices. This crisis exemplified a shock that exposed the vulnerability of communities lacking sufficient resilience (Loker and Francis, 2020:1122).

2.5.2 Resilience theory

The RT is considered an independent instrument for achieving sustainable development (Nassauer, 2013:101). This section systematically delves into the RT by exploring its definition, origin, and development.

2.5.2.1 Definition of resilience

Holling (1973) characterises resilience as a system's ability to handle disturbances without major adjustments, emphasising self-reorganisation to its original structure. Erayden and Kok (2013:6) break down resilience into three facets: (i) the ability to withstand shocks while retaining functions, (ii) self-reorganising after disturbance, and (iii) learning and adapting for future resilience. Resilience, historically present in psychology and biology, is also defined in terms of food systems, emphasising the ability to maintain food production in the face of disturbances (Bullock *et al.*, 2017:880; Maruyama, 2016:4).

2.5.2.2 Origin of resilience theory

C.S. Holling originated the concept in ecology in 1973, integrated it into various disciplines, and developed it by ecologists to model system behaviour in response to external disturbances (Masnavi *et al.*, 2018:572). Holling's 1973 definition underscores a system's ability to absorb changes and endure (Holling, 1973:17).

2.5.2.3 Development of resilience theory

Initially cultivated in psychology and ecology, RT expanded its scope over time, transitioning into resilience thinking and becoming an integrated social-ecological system within urban contexts (Walker & Salt, 2006; Pickett *et al.*, 2013:1; Masnavi *et al.*, 2018:572-573). It evolved into a comprehensive framework addressing vulnerabilities in urban areas, known as urban resilience.

2.5.2.3.1 Cultivation of Resilience theory (1973)

Holling introduced resilience as a system's ability to assimilate disruptions, undergo reorganisation, and maintain its fundamental function, structure, identity, and feedback mechanisms (Masnavi *et al.*, 2018). His contributions laid the groundwork for resilience thinking and urban resilience.

2.5.2.3.2 Growth of Resilience theory (2000s – Present)

Interpreted in various ways since 1973, RT saw further development in 2006 when Walker and Salt introduced resilience thinking. This approach addressed natural resource management, recognising complex human and natural systems continually adapting through cycles of change (Erayden & Kok, 2013:3; Pickett *et al.*, 2013; Maruyama, 2016:3). Masnavi *et al.* (2018:571)

further introduced the three phases of resilience thinking as recovery, adaptation, and transformation, describing a system's responses to shocks and disturbances, and presenting a nuanced view of resilience thinking (see Figure 2-5 for phases).

- **Resilience as recovery** refers to a system's ability to "return to the past" or recover from a change or pressure factor, measured by the time taken for a community to recover. The more resilient a system is, the faster it can return to its previous state, while a less resilient system may take longer or may not recover at all. Main characteristics of resilience as recovery include the capacity to recognise pressures, maintain basic structures during disturbances, and the ability to recover after an event. Resilience as recovery is also the traditional conception of resilience.
- **Resilience as adaptation** refers to a system's capacity to tolerate or absorb disturbance before transitioning to another state. In this context, resilience involves adapting to change and refers to the capacity to absorb pressures or disturbances through adaptation.
- **Resilience as transformation** refers to a system's adaptive response to change, emphasising a positive transformation to withstand future disturbances rather than simply returning to its previous state. Resilience as transformation is associated with concepts of renewal, regeneration, and self-reorganisation by highlighting the potential for transformation through external change and emphasising change through resilience.

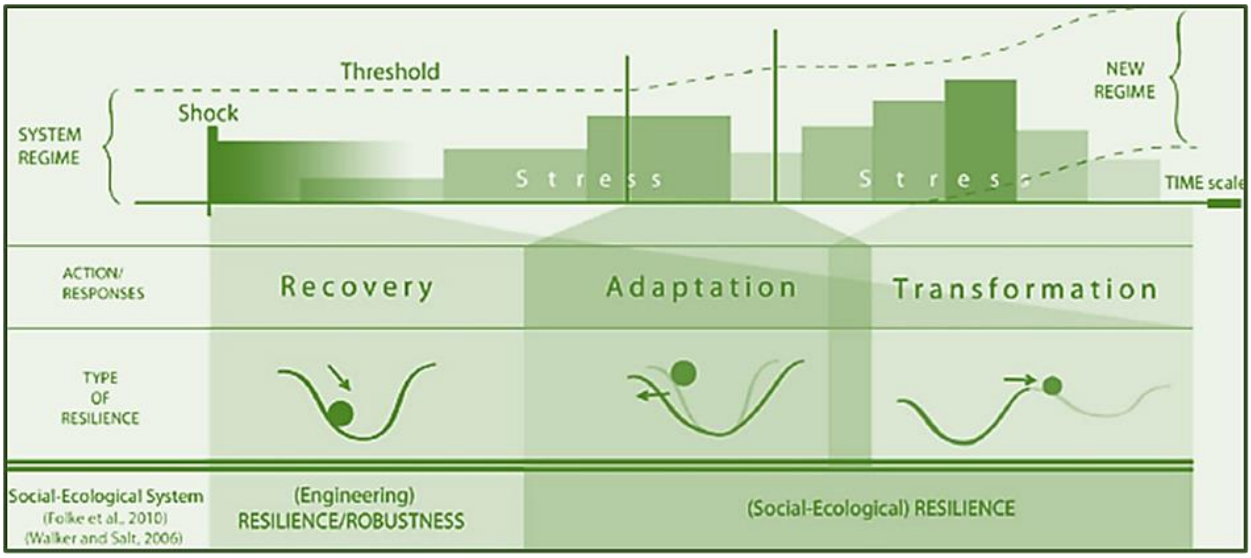


Figure 2-5: Development of resilience thinking.

Source: Masnavi *et al.* (2018:571).

2.5.2.3.3 Urban resilience

It is suggested that beyond climate change and its detrimental effects, urban systems are just as vulnerable to social and economic disruptions (inequality, increasing living costs, urbanisation, crime, etc.) and are faced with more realities than merely reinforcing their physical structure but also restructuring their societal and economic structures to be more comprehensively resilient (Steele & Mittal, 2012:193; Glaeser, 2022:4,25; Koutra *et al.*, 2022). In 2013, The Rockefeller Foundation (RF) acknowledged the critical importance of urban resilience and launched the "100 Resilient Cities Program," initiating a pivotal movement to promote resilience in urban settings (Rockefeller Foundation, 2015). The movement aimed to cultivate healthy relationships between urban systems and their social, economic, and environmental components.

Subsequently, in 2015, the RF introduced the City Resilience Framework (CRF), a guide for cities to manage these intricate relationships. The CRF's pillars encompassed the economy, health and wellbeing, infrastructure and the natural environment, and leadership and management, aligning closely with the core pillars of sustainability (Nassauer, 2013:101). This framework equipped cities to learn from past challenges, preparing them to adapt and transform to withstand future shocks (Masnavi *et al.*, 2018). South Africa has actively participated in attempts to equip its cities to withstand challenges and promote urban resilience.

2.5.2.3.4 State of urban resilience in South Africa

The relevance and discussion of urban resilience in South African is most evident through the successive State of Cities Reports (SoCRs) over the last 17 years (2004 – 2021). The SoCR's offer valuable insights into the changing dynamics and persistent challenges faced by South African cities.

The State of Cities Report I (2004) delved into the impact of city development strategies on economic growth and service provision, emphasising the enduring legacy of apartheid.

The State of Cities Report III (2011) marked a turning point by making urban resilience a focal point. Themed "Towards resilient cities," it shifted focus to assessing developmental metropolitan governance's effectiveness in improving socioeconomic and environmental conditions. Though the positive impact was ambiguous, the report suggested interventions like integrated spatial development, sustainability, and climate resilience, to addressing the vulnerability of South African cities (SACN, 2004; SACN, 2011; SACN, 2021).

The State of Cities Report V (2021) painted a less optimistic picture, stating that South African cities are still unprepared for climate emergencies and impending challenges. Despite a well-considered constitutional framework, inequality, unsustainability, and low capacity in informal settlements and townships persist. The report highlighted the crucial role of cities in global sustainability and resilience and underscored the potential for change in the approach to urban infrastructure to enhance urban resilience. Initiatives like the Future Resilience of Actual Cities and Lands (FRACTAL) project (see FRACTAL, 2021), involving cities such as Cape Town and eThekwini since 2015, emphasise collaborative research in South Africa for co-producing knowledge and encouraging urban resilience. The FRACTAL project stresses the importance of comprehending water, energy, food, and climate issues to build urban resilience in southern African cities (SACN, 2021).

2.5.2.4 Paving the way for regenerative development theory

In 2020, local and global urban food supply systems experienced increased disruption due to the COVID-19 pandemic which caused increased limitations on food access, increases in food prices, and exposed the incapability of food systems in developing countries. The pandemic also highlighted the vulnerability of communities that do not possess adequate resilience (Loker and Francis, 2020:1122). Urban resilience, dynamically adapting to changing environments, remains a complex yet essential concept, ensuring system resilience at micro and macro scales (Palazzo & Steiner, 2012:265; Masnavi *et al.*, 2018:571; Wilkonson, 2018:10-12; Koutra *et al.*, 2022:4, 11). Having elucidated theoretical underpinnings, the focus transitions from urban resilience to its connection with RDT. Urban resilience, evolving within continuously changing systems, has given rise to progressive development theories like RDT. This theory empowers systems to regenerate and self-transform in response to shocks, enhancing resilience beyond mere preparation, withstanding, and recovery (Gibbons *et al.*, 2018:5; Caniglia *et al.*, 2020; Holden *et al.*, 2016:295, 313).

2.5.3 Regenerative development theory

More recently, regenerative development has become the preferred approach to achieving prosperity by linking natural systems and manmade systems (Caniglia *et al.*, 2020:38). Regenerative theory stretches beyond the achievement of sustainable and resilient systems to a transformative state where systems can produce and reconcile damaged systems to provide abundantly for people's needs (Rhodes, 2015:404, 405; Caniglia *et al.,* 2020:38).

2.5.3.1 Origin and background of regenerative development theory

In the late 1970s and early 1980s, Medard Gabel and Robert Rodale, respectively, campaigned for the concept of regenerative agriculture (Giller *et al.*, 2021:14). This was the foundation for years of regenerative studies. Regenerative agriculture was broadly described as a farming system that seeks to increase productive resources, emphasises the interrelatedness of all components, and minimises disruptions to the system components (Giller, 2021:14). The RDT within the built environment is a moderately recent approach researched in the built environment and spatial professions and originated, partially, from the sustainable development and resilience theories (Cole, 2012:1; Izadi *et al.*, 2020:159). Regenerative development has the potential to reveal the potential in all living systems and ensure that these systems are self-managing and self-sufficient in the future and can continue to function should any one component in the system fail (Mang & Reed, 2012:2; Rhodes, 2015:404). Regeneration, as defined by Rhodes (2015:404), refers to a system's ability to sustain itself amid external disturbances. Stemming from resilience thinking, regeneration involves the system's capacity to transform in response to shocks (Mang & Haggard, 2016; Gibbons *et al.*, 2018:2, 5). While resilience focuses on the system returning to its original state after a shock, regenerative thinking goes further by enabling self-adaptation and adjusting thresholds for future disturbances (Caniglia *et al.*, 2020:4). The following paragraphs discuss the development of the regenerative theory.

2.5.3.2 Development of regenerative theory

Although originating from resilience notions, regenerative theories has not remained stagnant but has evolved from its roots in ecological and social resilience to a more holistic and dynamic approach that encompasses diverse sustainability principles, addressing ecological, social, and economic aspects. Regenerative theory differs from RT in that it places a greater emphasis on proactive interventions and the intentional self-improvement of a system. Regenerative theory is characterised by a focus on fostering positive feedback methods, regenerative cycles, and the continuous improvement of the overall health and vitality of the system (Cole, 2012:5; Gibbons *et al.*, 2018:3; Caniglia *et al.*, 2020:4).

The RDT, originating in agriculture, has permeated built environment disciplines such as architecture, engineering, and urban planning (Cole, 2012:1; Mang & Haggard, 2016; Caniglia *et al.*, 2020). Manifested through regenerative design, development, and urban development, it seeks to reform and enhance existing urban systems for self-sustainability and efficiency (Mang & Haggard, 2016). From a planning perspective, regenerative development involves translating these principles into making urban systems more self-sustaining and co-evolutionary with the natural environment (Mang & Haggard, 2016:36).

2.5.3.3 The Seven First Principles of regenerative theory

Caniglia *et al.* (2020:4) present an explanation of regenerative development in an urban context and view it as a unique approach to systems theory due to its ability to adapt to disturbances and adjust its threshold for future disturbances. The Seven First Principles of Regeneration, recently presented by Sanford (2020:26), aim to conceptualise and explain regenerative development.

(i) To view a living system as a whole rather than fragmented parts.
(ii) To identify a living system's potential rather than try to improve it to meet certain ideals.
(iii) Embracing a living system's essence instead of categorising and dividing its essences into distinctly functioning parts.
(iv) Engage with living systems to express the essence of the system and integrate human life and functioning into the system.
(v) Accept that nothing exists independently and design systems with the idea that everything is nested within a smaller or larger whole, including human life.
(vi) Identify and intervene at the nodal points of a system in a way that would not change or harm the existing function of the system.
(vii) Evolve the capacity of a system by improving it in a way that will benefit all life within the system, not only human life (every man for the system).

These Seven First Principles of Sanford (2020:31) aim to bring about a consciousness where people do not act on situations by being within them but with the mindset of taking into consideration the effects of an intervention on the entire system.

2.5.3.4 Regenerative theory as initiator for Regenerative Sustainable Theory (RST)

In advancing the regenerative theory, Gibbons (2020:4) advances it further by introducing the RST. The objective is not only to create systems capable of regenerating themselves in the future but also to establish prosperous, thriving, and interdependent systems and to encourage people to adopt a lifestyle that is mindful of all living systems and to comprehend every interrelated part of such systems (Holden *et al.*, 2016:313; Gibbons, 2020:3; Izadi, 2020:158). Regeneration requires designing systems that can withstand external shocks, reconcile damages, and continue providing for consumers. Permaculture, emphasising regenerative food systems adaptable to any scale, incorporates principles like minimising waste and maximising diversity (Mollison and Holmgren, 1990:6; Janse van Rensburg & Puren, 2023:4) and through closed-loop systems, permaculture aims to meet present needs and regenerate resources for future generations, offering a powerful tool for health-conscious and environmentally friendly food systems.

This study aims to explore whether planning and designing regenerative sustainable systems could ensure that urban systems have the potential to provide for people's needs like food sovereignty, enduring disturbances, and shocks, and organising themselves to ensure prosperity on all levels for themselves and future generations. This study has explored this aim by researching the application of a particular nature-based solutions (NBS), namely permaculture, as a potential solution to address food insecurity in urban areas through spatial planning. The main drivers behind the recent upsurge in research around NBS are sustainability, resilience, and regenerative theories and their significance within urban systems.

2.6 Nature-based solutions (NBS)

Within urban contexts, NBS has its roots and is fundamentally grounded in sustainability, resilience, and regenerative theories. They aim to address issues and shocks that have occurred previously (Zwierzchowska *et al.*, 2019:161; Yuan *et al.*, 2022:1). NBS refers to approaches that utilise the power of nature to address various societal challenges, including environmental, social, and economic issues. NBS involve the use of natural processes, ecosystems, and biodiversity to provide sustainable and resilient solutions (Yuan *et al.*, 2022:1). These solutions are designed to deliver ecosystem services, for example enhancing biodiversity, improving water and air quality, mitigating climate change, and promoting human well-being. NBS emphasise the integration of nature into various aspects of urban systems, recognising the inherent value of ecosystems and the services they provide. Because NBS integrates the integration of people and environment (in the case of ecosystems), ecosystems will be discussed as an introductory part. From ecosystems, springs ecosystems services as part of this discussion (TEEB, 2010:7, 34).

2.6.1 Ecosystems and ecosystem services as context for NBS

2.6.1.1 Ecosystems

Ecosystems refer to the interconnected communities of living organisms (plants, animals, and microorganisms) and their physical environments, functioning as a organised unit (Deeksha & Shukla, 2022:2). These interactions entail the exchange of energy, nutrients, and matter, thereby contributing to the overall equilibrium and sustainability of the ecosystem. Natural ecosystems are regarded as the foundation and template for complex adaptive systems. They are interactive dynamic systems wherein all components are interconnected, and the diversity of these components are adaptive to facilitating solutions and improvements in response to changes (Kvan & Karakiewics, 2019:30).

2.6.1.2 Ecosystem services

Ecosystem services are the processes and benefits that natural ecosystems provide, especially to humans and can be categorised into four main types (TEEB, 2010:7; van Beukering *et al.,* 2013:3). The four types of ecosystem services are shown in Table 2-2. Global environmental degradation and depletion is rapidly decreasing natural ecosystem services, biodiversity, and planet well-being. By incorporating ecosystem services into urban systems, the pressure on natural ecosystems and biodiversity might be slightly relieved and encouraged (Everard, 2016:152.

Table 2-2: Types of ecosystem services.

Type of ecosystem service	Description and example of service
Provisioning	Resources provided by an ecosystem, including food, water, minerals, timber, etc
Regulating	Processes provided by an ecosystem that regulate environmental conditions for example, water purification, carbon sequestration, temperature regulation, and disease management.
Supporting	Services provided by an ecosystem that are necessary for the production of all other ecosystem services, such as nutrient cycling, soil formation, and photosynthesis.
Cultural	Non-material benefits that people obtain from ecosystems, such as recreational opportunities, spiritual and aesthetic values, and cultural identity.

Source: Author's compilation from: TEEB (2010:7), van Beukering *et al.* (2013:4), Everard (2017:117), Deeksha & Shukla (2022:2)

Recognising and understanding ecosystem services holds crucial significance for the ensuing discussions of NBS, which directly pertain to incorporating ecosystem services into urban systems. The global promotion and application of integrating ecosystem services into urban systems have been underway for some time and can manifest in various forms (Liquete *et al.,* 2016:1).

2.6.2 Defining nature-based solutions

NBS is a relatively recent phenomenon that has either limited implementation or ineffective application in development practises and policy (Grace *et al.*, 2021:56). Unlike most of the preceding notions, NBS has a very universally accepted definition that varies only in the slightest

amongst researchers and practitioners. Almenar *et al.* (2021:1) express it best by stating that NBS are sustainability and resilience-oriented and consider the interrelationship between ecosystems, NBS, and the challenges of the built-up environment. The European Commission (EC, 2020) defines NBS as “solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social, and economic benefits, and help build resilience." Such solutions bring more and more diverse natural features and processes into cities, landscapes, and seascapes through locally adapted, resource-efficient, and systemic interventions." The International Union for the Conservation of Nature (IUCN) (2021) defines NBS as an action that protects, restores, and sustainably manages ecosystems and addresses urban challenges while also enhancing human health and natural diversity. While various narrative definitions for NBS exist, Eggermont *et al.* (2015:244) provide a disassembled definition for NBS where they classify the term into three portions:

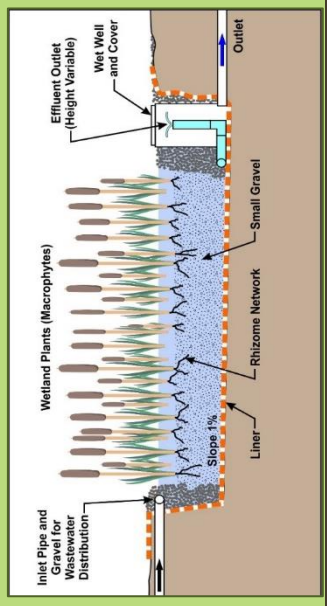
- *The improved use of existing ecosystems*: to utilise ecosystems in such a way that they provide natural services in urban systems, for example, water purification, air quality improvement, food provisioning, carbon sequestration, and even temperature regulation.
- *The design and planning of new ecosystems*: to integrate natural systems into urban systems to create interconnected systems that are sustainable, resilient, and regenerative.
- *Sustainably managing existing and new ecosystems*: to consider and incorporate existing natural systems in the design of urban communities.

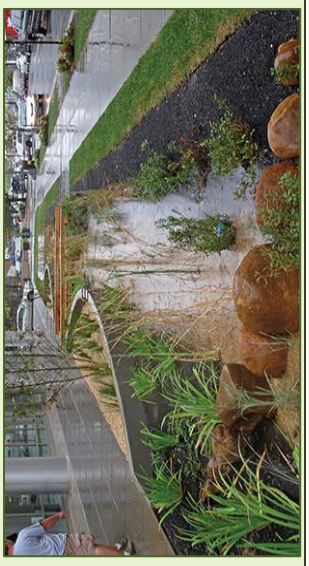
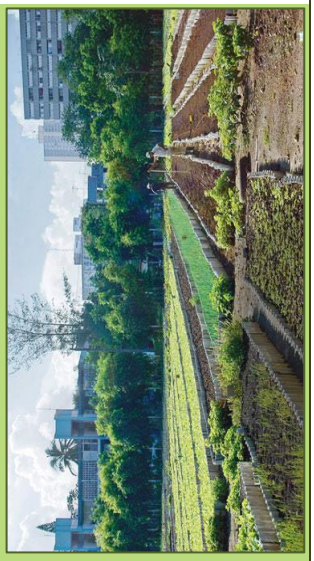
NBS has strong climate change adaptation and mitigation capabilities and is mainly known for providing ecosystem services within non-natural environments to create sustainable and resilient urban systems (Russo & Cirella, 2017:53; Yuan *et al.,* 2022:1).

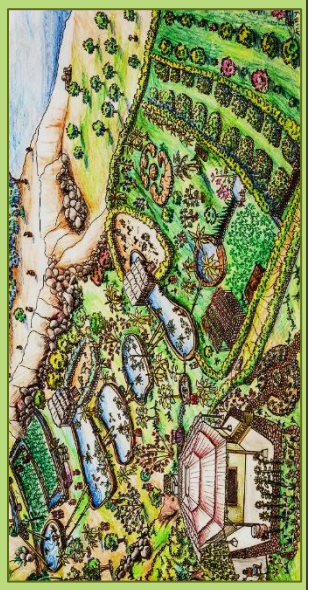
2.6.3 Types of nature-based solutions

NBS serves as an overarching notion for green infrastructure and edible green infrastructure and includes interventions like rain gardens, urban wetlands, urban forestry, urban agriculture, urban gardens, and permaculture (Kabish *et al.*, 2017; Zwierzchowska *et al.*, 2019:161; Wild *et al.*, 2019:255; Almenar *et al.*, 2021:2; Yuan *et al.*, 2022:2). In this section, NBS are dispersed into two categories, namely green infrastructure (GI) and edible green infrastructure (EGI), and each category is discussed in this section with elaborate descriptions of each typology (Yuan *et al.,* 2022:2). Table 2-3 summarises some of the main types of NBS and is followed by an in-depth discussion of relevant concepts.

Table 2-3: Different types of NBS and their application

Types		Description	
GREEN INFRASTRUCTURE	Ecological engineering	Ecological engineering aims to protect, restore, modify, and build new ecological systems to achieve more sustainability. Ecologically engineered systems are mostly employed as a sustainable development approach that increases the quality and quantity of ecosystem services in a greater system. Ecological engineering is also often employed for the rehabilitation of deconstructed and damaged ecosystems and is commonly present in existing ecosystems but features greatly in urban environments. Constructed wetlands are the most common ecologically engineered practises and are man-made wetlands that simulate the functioning of natural wetlands. Bioswales are another example of ecological engineering and are characterised by vegetated urban water networks that aim to reduce water flow speed and improve the purification of urban water. Bioswales are also used to reduce flooding and improve stormwater infiltration.	
	Green roofs	Green roofs are the result of the application of gardening practises to the roofs of buildings and structures. Green roofs have gained a lot of attention in the last decade as an aesthetic feature in urban environments. Vegetation on the roofs of buildings has been argued to serve as an isolation layer that can ultimately mitigate the direct effects of urban heat islands. Green roofs have also received a lot of criticism. The main critique is that green roofs cannot be applied to any buildings as they require structures with specialised drainage systems, regular irrigation, and regular fertilisation. Ultimately, green roofs are very costly and often ineligible as a sustainable development approach as they are solely dependent on frequent maintenance and human intervention .	

	Green walls	Similar to green roofs, green walls are especially popular for their aesthetic appearance. Green walls are also argued to mitigate the effects of urban heat islands. Green walls are often integrated with vertical farming to produce food but have limited overall implementation as they require immense structural support, irrigation, fertilisation, and persistent maintenance.	
	Rain gardens	Rain gardens are a common system applied to many private properties as a means to accumulate rainwater, store it on site, and use it to irrigate gardens and for further domestic activities. Rain gardens are commonly characterised by roof water runoff gutters, certain slopes, and watercourses on the property to direct the runoff water to a certain catchment area on the property. The water accumulated from rain gardens is often used to irrigate food gardens. Rain gardens are mostly applied in urban areas and are argued to relieve some of the pressure on urban stormwater systems. Rain gardens provide ecosystem services, for example, stormwater management, flood risk reduction, and improving water quality. Bioswales are a popular rain gardening method where surface runoff channels are covered with layers of soil and vegetation to eventually slow down, reduce, and filter the water on its way to the designated catchment area.	
EDIBLE GREEN INFRASTRUCTURE	**Urban agriculture (UA)**	UA is an innovative and sustainable land use where large and medium-scale agriculture is integrated into urban systems to mainly provide food and ecosystem services to the surrounding urban areas. UA is argued to minimise the environmental effects of urbanisation whilst creating employment opportunities within cities. UA also provides several ecosystem services, such as disaster risk management, flood risk reduction, food provisioning within urban systems, and addressing the effects of urban heat islands. However, UA is another costly process that requires traditional sowing, ploughing, and reaping techniques. UA is also often overlooked as it requires large spaces within or near urban communities with healthy soil quality.	

	Urban Gardening (UG)	UG is a small-scale traditional practise of growing food in a backyard or communal space. UG is the unstructured planting of edible plants, mostly for self-sustaining and domestic food provisioning. UG is based on the same execution methods as UA, for example, turning the soil, irrigation, fertilising, and using pesticides. UG is a much more personal and extemporising-to-personal-like type of food growing practice. UG is still an easy and effective way to bring biodiversity into urban communities, however, UG systems are not interconnected with external ecosystems and can be viewed as closed systems. UG is also the most common type of food gardening used in community gardens and school gardens.	
	Permaculture (Permaculture)	Permaculture is a small-to-large-scale food-growing technique based strongly on principles to guide its implementation. The design of a permaculture system requires detailed planning and experimentation. Ultimately, permaculture systems are known for their direct representation of natural ecosystems, their interconnectivity with external ecosystems, and their integrated design that makes them part of a larger system. Permaculture relies on heavily structured design principles (see following sections) and is based on three crucial ecocentric ethics, namely, caring for the earth, caring for the people, and redistributing the surplus. If designed and implemented correctly, permaculture systems are meant to be self-sustaining and regenerative in the sense that they ought to adapt to external disturbances, readjust their threshold for future disturbances, and remain to provide food and ecosystems in abundance. Permaculture is regarded as an effective tool for sustainable development and also to design aesthetically appealing systems that have a positive physical and spiritual impact on their components and surroundings. However, a thriving permaculture system is not just achieved by growing some fruits and vegetables; it is also timely. Permaculture provides various ecosystem services, including, food provisioning to its direct area, improved drainage, air purification, onsite water management, and reduced effects of heat.	

Source: Authors compilation from: Kennedy (1991:211); Howe (2002:127); Philips (2013:45); Viljoen & Bohn (2014:8); Eggermont (2015:243, 244); Cilliers & Cilliers (2016); Salleh *et al.* (2018:2); Zwierzchowska *et al.* (2019:162); O'Sullivan (2019:133); Russo & Cirella (2019:1) and Wild *et al.* (2019:255).

2.6.4 Green infrastructure

GI refers to strategically planned networks where grey infrastructure is designed with environmental components to mainly deliver fundamental ecosystem services to its direct and surrounding areas. GI aims to improve urban ecosystem services, living conditions, and demographic challenges (Zwierzchowska *et al.*, 2019:162). Green infrastructure includes all the natural, semi-natural, and man-made ecosystems within an urban system and includes, inter alia, ecological engineering, rooftop gardening, vertical gardens, etc. (Cilliers & Cilliers, 2016:10; Russo & Cirella, 2019:1).

2.6.4.1 Benefits of green infrastructure

Generally, green infrastructure (GI) is predominantly adopted by higher-income communities to enhance the visual appeal of their surroundings and deliver ecosystem services within urban systems, rather than serving as a direct tool to address socio-economic challenges such as hunger (Choudhary & Rawat, 2021:212; Cilliers & Cilliers, 2016:7; Russo & Cirella, 2019:1). Rooftop and vertical gardens are among the most popular and most explored GI practices. GI has also been explored in some cases as an innovative means to produce food within urban systems, but mostly with a primary focus on profit-driven food production. Notable benefits of green infrastructure include its ability to provide ecosystem services in urban systems, including reducing the effects of urban heat island effects, stormwater management, and noise reduction (Russo & Cirella, 2020:1; Chernova *et al.*, 2020:1). GI practises are often also implemented as urban greening projects to create more aesthetic urban communities and improve sense of place (Chernova *et al.*, 2020:1). Although a widely celebrated concept, GI has several constraints that limit its applicability in poor urban communities and contribute to food sovereignty.

2.6.4.2 Critics against green infrastructure

Although GI is an established urban greening practice, it is not generally intended to provide other food in urban areas or to address the socio-economic challenges in urban systems. GI has also faced considerable criticism for its cost-ineffectiveness in tackling poverty-related concerns due to its substantial installation expenses and the necessity for consistent, costly maintenance of the infrastructure by stakeholders. GI heavily relies on external resource input, demands high levels of maintenance for its ongoing viability, and rarely can self-sustain (Cilliers & Cilliers, 2016:1; Ekren, 2017:56). Ultimately, GI could also be classified as a commercialised practise where food production is not the main priority but rather incorporating ecosystem services and elevating urban aesthetics. More recently, GI has been equipped to include food growing practises like UA, but it

has also been recognised that the weight of the resource input required by green infrastructure and the space required by UA does not justify the weight of the labour-profit relationship generated thereby (Skar *et al.*, 2020:5). Although concepts of GI are relevant for a focus on edible green infrastructure (EGI), a detailed explanation of GI falls outside the scope of this study. The focus in the next section is on EGI, and specifically urban agriculture (UA), to give context and reason to the study of permaculture as a food-growing practise (the primary focus of this investigation).

2.6.5 Edible Green Infrastructure

Edible Green Infrastructure (EGI) is essentially an advanced form of GI designed to provide food in addition to its standard ecosystem services (Russo & Cirella, 2020:2). EGI primarily consists of urban agriculture (UA) and other green infrastructure adapted for food production, such as vertical vegetable gardens, vegetable rain gardens, and edible green walls (Russo and Cirella, 2019:1). UA is commonly a large-scale practise that requires ample space for traditional agricultural techniques to be implemented within urban areas (Davies *et al.*, 2021:2).

2.6.5.1 Urban agriculture (UA)

UA originated as a descendant concept of Ebenezer Howard's Garden City concept in 1898 (Philips, 2013:8; Cabannes, 2015:383). When comparing the work of O'Sullivan (2019:133) and Philips (2013:45), both concur that UA, in its widest sense, is the practise of producing food within urban areas and distributing that food throughout the city and its peripheries. Since its growing interest in academic literature over the past decades, UA has been extensively researched as an urban greening approach for urban systems (Davies *et al.*, 2021:3; Steenkamp, 2021).

2.6.5.1.1 Defining urban agriculture

Dubbeling *et al.* (2017:4) understand UA as the production, marketing, and distribution of food within urban areas and go on to state that UA is a multifunctional practise that regards the production of food on available space within a city, at any scale. Ultimately, UA can be defined as an innovative and sustainable land use where traditional agriculture is integrated into urban areas to provide food to the surrounding areas while also delivering many benefits (O'Sullivan, 2019:133; Philips, 2013:45). Karg and Drechsel (2018:4) and Viljoen *et al.* (2005:21) both hold that UA has the potential to provide a wide range of social, economic, and environmental benefits for urban areas and improve the quality of life. It is apparent that the integration of urban areas and agriculture directly reflects the fundamental concepts of ensuring sustainable development.

UA is mainly practised on private land, requires ample space and agricultural techniques for its succession, and mostly supplies bulk and monocultural produce (Dubbeling *et al.*, 2017:4). UA has been increasingly integrated with green infrastructure in an attempt to address some of its limitations and vice versa (Skar *et al.,* 2020:5).

2.6.5.1.2 Benefits of urban agriculture

Urban agriculture (UA) offers numerous benefits, as highlighted in academic literature. According to Karg and Dreschel (2018:4), UA has the potential to mitigate environmental impacts in urban areas, contribute to carbon sequestration, provide food, and generate employment opportunities within cities. Additionally, it facilitates the supply of fresh produce to local environments, reducing import distances and costs (Howe, 2002:127; Viljoen & Bohn, 2014:8; Cilliers *et al.*, 2020:2). Given the context of food scarcity in South Africa, UA emerges as an effective means of meeting essential food needs in people's daily lives. Despite its capacity to generate income and economic feasibility, Olivier (2019:17) notes that UA is often inaccessible to low-income and deprived communities. The association of UA with wealthier classes poses a challenge in securing funds for projects in lower-income areas, as individuals tend to prefer initiatives with personal benefits over what they perceive as "waste of funding" in low-income UA projects (Olivier, 2019:17).

2.6.5.1.3 Critique against urban agriculture

Commended for its advantages in urban contexts, UA faces criticism for its incompatibility with urban systems primarily because UA demands significant space within urban systems to be effectively applied. A study by Badami and Ramakutty (2015) reveals that for UA to be viable in low-income cities like Bangladesh, the Democratic Republic of the Congo, Ethiopia, Nigeria, and Tanzania, each country would need more than 100% of their existing urban space to address food insecurity at its minimum threshold. Land scarcity and tenure issues hinder UA implementation for addressing food concerns (Horst and Hoey, 2017:290; Davies *et al.*, 2021:9). Furthermore, UA projects are often profitable only below certain scales in urban areas (Stutchtey & Vahle, 2019:62; Davies *et al.*, 2021:9). Another drawback of UA is its focus on bulk plant-based foods in urban systems without incorporating diversity in food groups (proteins and calories) (Stutchtey & Vahle, 2019:62). Malnutrition, often resulting from monotonous diets lacking diverse nutrients and minerals, is linked to food insecurity (Escamilla, 2017:1; Crush *et al.*, 2020:6). Finally, UA systems heavily rely on external resources for success and are rarely self-sustaining. As a large-scale monoculture practice, UA requires traditional agricultural techniques and treatments, such as ploughing, sowing, pesticides, and fertilisers, that are considered harmful and

unhygienic in more compact urban environments (Olivier, 2019:17; Russo & Cirella, 2019:5; Stutchtey & Vahle, 2019:62).

While UA may be viewed as an efficient way to use large urban spaces for food production, it operates as a costly, disconnected agricultural activity. To move away from commercialised (GI) and industrialised (UA) urban food production practices, permaculture is proposed as an earnest approach. It offers a more integrated, flexible, and regenerative food system capable of application on any scale, providing a less harmful alternative for urban systems (Janse van Rensburg & Puren, 2023).

2.6.5.2 Permaculture

In the late 1990s, Taylor (1998:28) presented anti-urbanism as a valued launching point for integrating food-growing practises into urban areas, much like Howard's Garden City in the late 1800s (Cabannes & Marocchino, 2018:19). More than a century later, Howard's idea of a sustainable environment through food production is echoed in Moughtin and Shirley's (2005:1) claim that planning and design practises have barely any meaning if they do not harmonise with their direct natural environment. They go on to say that food production in urban areas is a concept that should be seen as a key element in dynamic urban systems planning and that there must be a balance between human activities and the natural environment (Moughtin & Shirley, 2005:1).

2.6.5.2.1 Origin of permaculture

Permaculture, a longstanding term derived from permanent agriculture, was created in 1978 by its founders, Bill Mollison, and his partner David Holmgren (Mollison & Holmgren, 1990:1; Salleh *et al.*, 2018:2). They describe permaculture as a form of organic farming focused on natural capital conservation and sustainability (Mollison & Holmgren, 1990:9; Holmgren, 2002:i). Functioning as an ecosystem-based, sustainable design system, permaculture aims to create agricultural ecosystems that mimic natural systems, provide ecosystem services, food, and biodiversity, and require minimal maintenance (Holmgren, 2002:xix; Moughtin & Shirley, 2005:116; Salleh *et al.*, 2018:2). Developed as a design system for human environments and food production, permaculture is based on the principles of natural ecosystems. Its goal is to integrate individuals with their surroundings to meet basic needs such as food, shelter, water, and other materials (Moughtin & Shirley, 2005:116; Mang & Reed, 2012:2). Coined by Mollison and Holmgren in the 1970s, permaculture was intended to operate independently from the industrial support of conventional agriculture, aligning with the aim of food sovereignty: separating oneself from the avaricious industrialised food system (FAO, 2013:4).

2.6.5.2.2 Defining permaculture

Permaculture is a design approach for land use, arrangement, and planning of systems that mimic activities and relations seen in thriving natural ecosystems. It is set on 12 design principles and 3 ethics derived from complex system thinking and is considered an effective tool for sustainable development (Philips, 2013:68). However, a thriving permaculture system is not just achieved by growing fruits and vegetables. It is a timely and demanding process that will require an individual to obtain knowledge and experience about many contributing factors of permaculture design. Kennedy (1991:211) visualises permaculture as an aesthetically pleasing practise that has a positive physical and spiritual impact on its surroundings. Permaculture is centred around its three beliefs or ethics and its ensuing 12 principles, as published by David Holmgren in 2002. These beliefs and principles are discussed in the following section.

2.6.5.2.3 Permaculture principles and beliefs

Holmgren (2002) presented a set of permaculture design principles, strategies, and methods that can assist in designing farming spaces that are mostly fixated on self-sufficiency and creating sustainable settlements (Holmgren, 2002; Salleh *et al.*, 2018:2). These principles are presented in Figure 2-6.

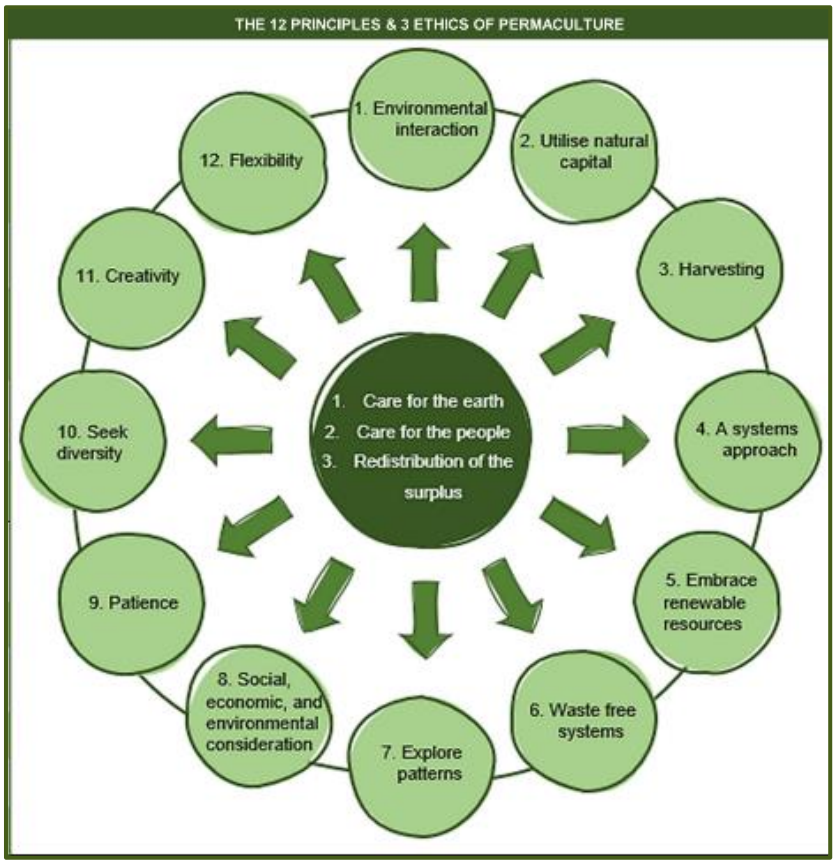


Figure 2-6: Holmgren's (2002) principles and ethics.

Source: Author's compilation from Holmgren (2002).

Holmgren (2002) asserts that adhering completely to permaculture principles would lead to a prosperous and sustainable food system characterised by resilience and regeneration. Chapter 4 in the first manuscript delves into the intensive study of permaculture's benefits and criticisms. One key focus is on the ecosystem services it provides, such as food provisioning, improved drainage, air purification, and mitigation of heat effects, establishing an independent service system (Kennedy, 1991:211; Salleh *et al.*, 2018:2). In contrast to urban agriculture (UA), permaculture also relies on traditional methods but distinguishes itself by standing out as a scale-flexible and specific food-growing practice. Originally conceived as a small-scale approach, permaculture's design flexibility enables its application on any scale. Its distinctive features lie in its scale adaptability and flexibility compared to other food-growing practices. Permaculture is adaptable to any land size, with site-specific adjustments for each case (Mollison & Holmgren, 1990:6). What sets permaculture apart from other urban food-growing practises is its departure from traditional agricultural methods that require regular replanting and sowing. Instead, it is designed to establish a permanent system that regenerates and maintains itself over time.

2.6.5.2.4 Permaculture as focus: bringing together regenerative development theory, NBS, edible GI and permaculture

Undeniably, permaculture holds the power to generate people-nature systems that foster natural resources for future generations, provide abundance for current generations, are resilient against external shocks, and can regenerate and sustain themselves (Rhodes, 2015:405; Fiebrig *et al.*, 2020:381). However, permaculture has not yet been implemented as a strategy in spatial policies and agendas to address the challenges of urbanisation and population growth, especially urban food insecurity. Fiebrig *et al.* (2020:380) and Lopes and Oliveira (2020:32) suppose that permaculture should be recognised in development agendas and policies. While permaculture is primarily a privately practised natural-based solution (NBS), this research will investigate its viability for integration into planning, with a focus on engaging urban communities to actively participate. This exploration aims to establish self-sustaining, regenerative food systems where both nature and people play interdependent roles within these systems (Kennedy, 1991:211). The consideration of permaculture as an NBS to foster food sovereignty has seen limited adoption within the realm of planning practise and research (Grace *et al.*, 2021:2; Almenar *et al.*, 2021:2). Despite the growing interest in food production across various fields, there remains a noticeable overlooking from planning to incorporating permaculture into urban communities, particularly in poverty-affected countries such as South Africa.

2.7 Linking planning and permaculture

Based on the discussion in the preceding sections (2.1 - 2.5), it is clear that permaculture, as an NBS, offers an alternative to traditional urban greening and urban food approaches. Permaculture distinguishes itself by offering a regenerative path rather than merely maintaining the existing status quo, as advocated by sustainability theory. Furthermore, it embraces the concept of people and nature's interdependence, adopting an ecocentric perspective while operating within the framework of a complex adaptive system.

2.7.1 Spatial planning

Traditional planning, also known as physical planning, initially focused solely on the physical aspects of cities (Taylor, 1998:6). However, it was only after the Second World War that the concept of planning began to encompass social and economic considerations (Taylor, 1998:5). Physical planning gradually evolved to integrate social and economic factors into the spatial organisation of towns, cities, and rural hinterlands. It was not until the late 1980s and early 1990s that planning started giving significant attention to the environmental dimension of urban spatial arrangements (Taylor, 1998). This shift towards considering the natural environment in planning was closely tied to the rise of sustainability principles, ushering in an era of planning for sustainable cities with a focus on minimising environmental impact and acknowledging the importance of the natural environment (Taylor, 1998:149). In contemporary perspectives, spatial planning involves the arrangement of components within systems at the local, regional, national, and international levels (Achaempong, 2019:6). While spatial planning has a broad definition, it typically includes elements such as town planning, land-use planning, transportation planning, urban design, community planning, environmental planning, and regional planning. The primary goal of planning is to determine the optimal placement and distribution of land uses and components in urban and rural systems to ensure their efficient and beneficial functioning. While the physical layout and land use remain important aspects (Wilson & Piper, 2010:10; Acheampong, 2019:12). Spatial planning encompasses the comprehensive analysis and organisation of both urban and rural landscapes, aiming to optimise land use and resource allocation while fostering sustainable development. In this context, spatial planning delves into the intricate dynamics of urban and rural environments, considering factors such as infrastructure, environmental sustainability, and socio-economic equity (Taylor, 1998:5; Acheampong, 2019:12). Within this framework, addressing food insecurity within urban areas emerges as a critical focal point of this dissertation. To streamline discussions and analyses, the term "urban planning" will be utilised as a more specified division of spatial planning throughout the remainder of this dissertation, focusing primarily on strategies and interventions pertinent to urban contexts.

The integration of planning practises with ecocentric perspectives (refer to Section 2.3.3) has been a subject of ongoing debate and has yielded varying conclusions over the years (see, e.g., Carmona, 2009; Cilliers & Cilliers, 2016; Horst & Hoey, 2017; Carmona, 2019; Asaad *et al.*, 2020:262). The relationship between urban theories and intervention practises in the city is one of the most challenging issues addressed in advanced design courses. Resolving the complexity of persistent urban challenges cannot be easily achieved through design-based approaches alone or traditional planning (Naya *et al.*, 2018:179). The built environment entails the physical, social, economic, and environmental components and how these components symbiotically function to create quality urban systems (Carmona, 2019:1). While planning and design were closely linked in the early stages of planning, they have recently started to merge again in the context of place-making approaches (Carmona, 2009:48; Asaad *et al.*, 2020:261). These place-making approaches aim to design quality urban systems by recognising the importance of each component for the whole system.

This study argues that an integrated and inclusive approach is essential for planning with a focus on food sovereignty and incorporating it into a complex regenerative urban system. Effective planning considers the full impact of land use and its relationship with the natural features and cycles of a region. As Kennedy (1991:214) suggests, sustainable planning strives to develop self-reliant cities through bottom-up public participation in policymaking. Furthermore, Kennedy (1991) highlights that sustainable planning for cities brings multiple benefits, including (i) the preservation and enhancement of ecosystems, (ii) the reduction of food costs in terms of both production and transportation; and (iii) the potential for increased community participation and a sense of ownership among citizens.

2.8 Linking permaculture with planning for urban food sovereignty

Planning has always been embedded in the social, natural, and economic aspects of towns and cities. However, intervention approaches tend to be isolated from other disciplines and perspectives and may be limited, conventional, and monodisciplinary (Kelly *et al.*, 2019:150; Resta, 2021:21; Neuman *et al.*, 2022:1013). From a planning perspective, innovative and interdisciplinary tools and approaches like permaculture must be pursued and developed to address the ongoing challenges in growing urban systems (Neuman *et al.*, 2022:1013).

Acheampong (2019:25) identifies that planning has evolved with time from being a land-use and design-oriented practice to embracing the various dimensions of development, including the social, economic, political, and environmental dimensions. He goes on to clearly state that

planning should seek to manage spatial development at different scales to ensure sustainable development and that planning should ultimately eradicate the negative disturbances in human settlements (Acheampong, 2019:25). Also, the need for urban planning to take a harder look at the social, cultural, and environmental side of human settlements to identify solutions to address specific challenges within urban settlements is endorsed (Acheampong, 2019:25). Skar *et al.* (2020) and Oliveira and Lopes (2020:32) advocate that integrated approaches should happen on various levels, from citizen-led initiatives to policymaking, and should be aimed at regenerative practices to fight the challenges of urbanisation like food insecurity, thus calling for regenerative planning solutions to provide food sovereignty in urban communities.

2.9 Synthesis and conclusion

In this chapter, the purpose of the theoretical framework was to establish a comprehensive foundation for understanding the key concepts that underpin the research. The overarching theories of sustainability (2.4.1), resilience (2.4.2), and regenerative development (2.4.3) play a crucial role in shaping the perspective from which the research approaches the topic of food sovereignty. Within the framework of sustainability, resilience, and regenerative theory, various NBS (2.5) have emerged to mimic the complexity of urban ecosystems and provide essential ecosystem services. These solutions encompass a range of strategies, including green infrastructure (2.5.4), edible green infrastructure (2.5.5), and more specifically, permaculture (2.5.5.2).

Permaculture, a design system that mimics natural ecosystems to create sustainable and regenerative human habitats, is argued to be a valuable tool for planners seeking to contribute to urban food sovereignty. Despite its widespread recognition, there is a notable gap in research from a planning perspective on permaculture and its potential applications. Notably, permaculture stands out for its flexibility and adaptability, making it particularly relevant to the dynamic nature of urban environments. Thus, the study aims to delve into the phenomenon of permaculture, exploring its intricacies and potential contributions to the development of regenerative edible urban landscapes. The scientific foundation of this investigation will be further elucidated in the following chapter.

CHAPTER 3 : RESEARCH METHODOLOGY

3.1 Purpose and structure of chapter

This chapter provides a detailed overview of the research design, methodology, and data generation methods that informed the data component of this study. A qualitative research methodology was employed, incorporating a scoping literature review of permaculture literature in the first manuscript. The research design adopted for the second manuscript was a multiple-case study, integrating spatial data obtained through surveying and input from key stakeholders. Additionally, textual data was gathered through interviews. The first manuscript was published in volume 5 of the journal Frontiers in Sustainable Cities on October 30, 2023 (see Janse van Rensburg & Puren, 2023). The second manuscript is still to be submitted to an academic journal for consideration. The structure of this chapter is shown in Figure 3-1.

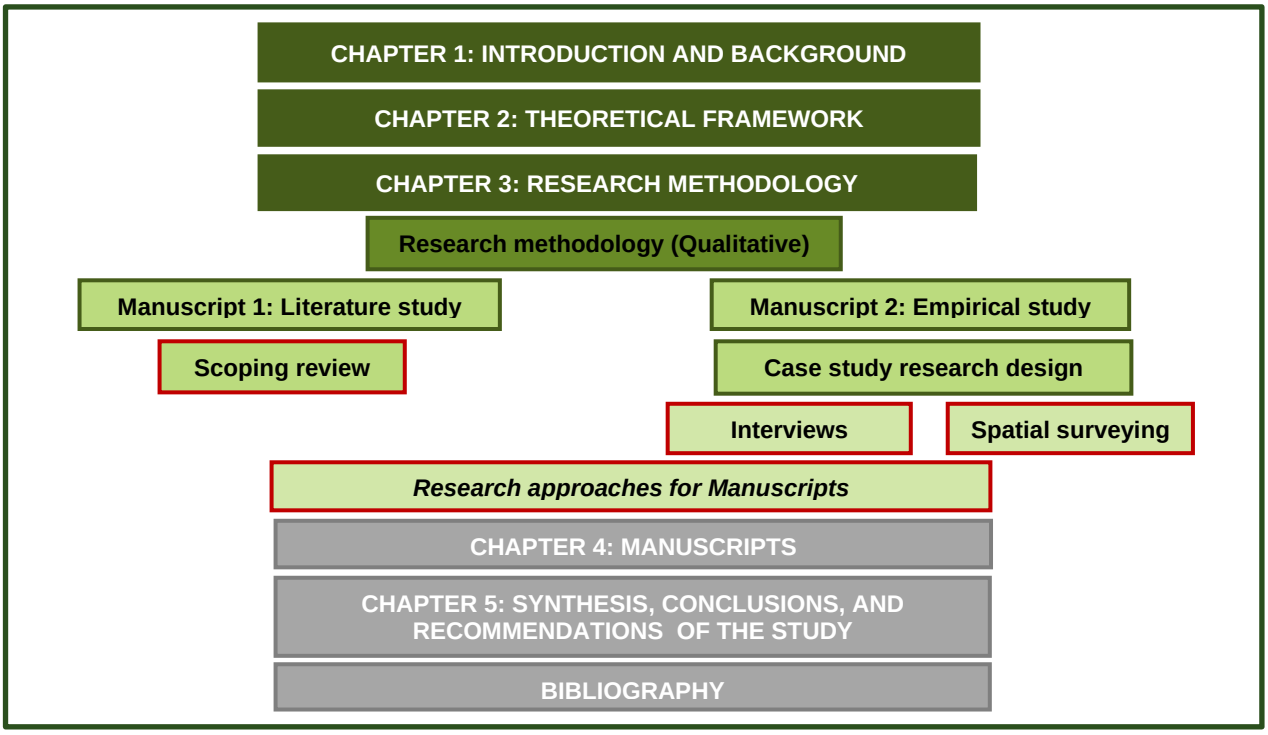


Figure 3-1: Structure of this chapter.

Source: Author's compilation.

3.2 Introduction

Research methodology is how research methods are used and describes how data is collected for a study (Strydom, 2005:252). This study intends to explore permaculture from an academic point of view (scoping review) and from a practical point of view (multiple-case study). Research can be qualitative, quantitative, or mixed methods. A qualitative research methodology was thus chosen for this study to explore the social, practical, and personal dimensions of permaculture to inform the planning of urban systems. Planning professions commonly employ qualitative research for this specific reason, to obtain more grassroot level understanding of a phenomena in urban context as urban systems exist for and revolve around human activity (De Vos *et al.*, 2005:19; Kindon, 2007:170).

3.3 Research methodology

While there are three main research approaches: qualitative, quantitative, and mixed methods (Tracy, 2020:2), this study leans towards a qualitative approach for its versatility and ability to capture grassroots, social, and participatory aspects. Table 3-1 describes each of the research approaches.

Table 3-1: Research approaches.

	Description	Common data generation methods
Qualitative	Qualitative research entails perspectives, qualitative data, and an in depth understanding of a phenomenon where the researcher serves as the key instrument in collecting the data.	Photos, maps, interviews, observations, surveys, questionnaires, case studies.
Quantitative	Quantitative research entails numerical or statistical data generation methods that are expressed as quantities and variables and includes the correlation of the relationship between the variables.	Statistical data, numerical data.
Mixed methods	A mixed methods approach entails a combination of qualitative and quantitative research methods.	A combination of qualitative and quantitative methods.

Source: Kothari (2004:3); Marczyk *et al.* (2005:17); Neuman (2013:51); Yin (2018:39); Tracy (2020:4).

Qualitative research is defined differently in the literature. Some define it by the type of data collected, while others emphasise the interpretation of a body of data (Padros, 2021:19). Tracy (2020:2-4) sees qualitative data as emphasising the researcher's perspective, contextual interpretation, and depth of explanation. Qualitative data relies on the researcher's ability to synthesise data and interpret it to draw meaningful conclusions (Saldana & Omasta, 2017:30; Flick, 2018:4; Mwita, 2022:619). Qualitative approaches are praised for describing social realities and revealing perceptions, attitudes, and experiences through interactive data collection (Nowell *et al.*, 2017:1; Mwita, 2022:619). Qualitative data excel in providing an in-depth understanding of phenomena, offering flexibility, creativity, and integration of data collection methods (Stake, 2010:16; Jarzabkowski *et al.*, 2021:71; Mwita, 2022:622). However, qualitative research has limitations, as with any approach, such as the potential for contextual interpretation and subjectivity (Tracy, 2020:314). One debated limitation is its smaller, more intimate samples compared to quantitative data, leading to a perception of bias (Mwita, 2022:622). Despite this, the quality of qualitative data can compensate by revealing aspects of context hidden in quantitative data, such as opinions, perspectives, experiences, and grassroots realities (Jarzabkowski *et al.*, 2021:78).

This qualitative study aims to explore aspects including understanding, expert perceptions and opinions, spatial patterns, and practical applicability to gain an in-depth insight into permaculture practises in South Africa, guiding future research on their connection to urban planning. Qualitative data, in the form of photos, maps, interviews, observations, and documents, enable a comprehensive exploration of real-world issues, identifying specific problems in processes and practises (Groat & Wang, 2013:234; Neuman, 2013:51; Flick, 2018:7).

3.4 Research design

The research design refers to the basic process of how research was conducted to answer the primary and secondary research questions (Marczyk *et al.*, 2005:2). Marczyk *et al.* (2005:123) explain that there are three categories of research designs: experimental, nonexperimental, and quasi-experimental. Experimental designs are quantitative and rely mainly on randomised and unbiased samples or groups. Quasi-experimental designs are also quantitative research and are used when randomised data is not feasible, and they begin to allow the examination of real-world phenomena. Nonexperimental (qualitative) designs examine real-world phenomena (Marczyk *et al.*, 2005:123–147). All three research design categories consist of various specific research designs. This study has a nonexperimental research design with a case study approach (Seidman, 2006:37; Brinkmann, 2013:83). Case studies are very valuable and informative research approaches that require in-depth information and knowledge to develop insights into

trends and/or behaviour (Marczyk *et al.*, 2005:148). In qualitative research, four dominant types of case study designs are recognised: single intrinsic, multiple intrinsic, single instrumental, and multiple instrumental. Figure 3-2 illustrates these four case study designs.

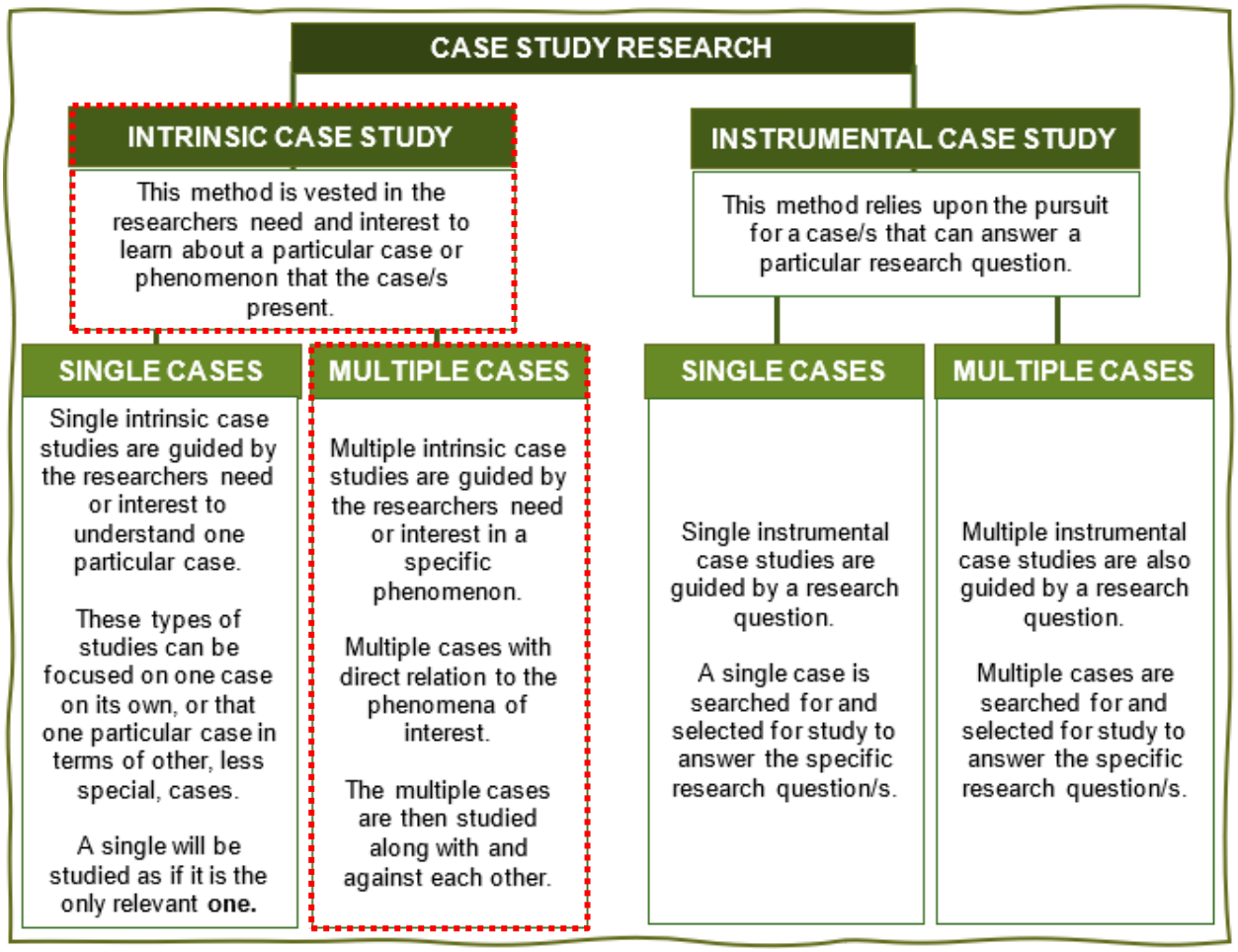


Figure 3-2: Types of case study research.

Source: Stake (1995); Stake (2005:1,3,4,89); Mills *et al.* (2010:8); Tracy (2020:61).

To anchor the empirical investigation in theory, the case study research was preceded by a literature review that aimed to explore the extent of existing permaculture literature, especially in the African and South African contexts where food sovereignty is a huge challenge, as explained in Chapter 1. The literature review is also intended to generate themes that emerge from existing permaculture research (see Section B: Chapter 4, Paper 1). The case studies were mainly explored from a spatial perspective to establish layout patterns, resources, and other contextual characteristics of permaculture practises in South African contexts and to draw spatial findings from them.

3.5 Data generation methods

The research was conducted in two phases: a literature study and an empirical study. The literature study was conducted using a scoping review method, and the empirical study consisted of a multiple-case study that used two data generation methods, namely spatial surveying, and interviewing. First, the literature study used a scoping review to investigate existing permaculture research and theoretical trends. Second, during the multiple-case study, four South African permaculture case study sites were spatially surveyed to identify spatial features and patterns. Semi-structured interviews were also conducted for the case studies to explore stakeholder experiences with permaculture at the grass-roots level. These methods crystallised into two manuscripts that are presented in the following chapter:

- ***Manuscript 1*: Fighting the hunger games through permaculture: a scoping review to inform urban planning.** This manuscript comprises a scoping review reflecting on existing Permaculture research over a period of 8 years.
- ***Manuscript 2*: Cultivating cities for tomorrow: Lessons for urban planners from permaculture case studies in South Africa.** This manuscript examines four permaculture case studies in South Africa to obtain valuable lessons for urban planners.

The first manuscript was submitted and published in volume 5 of the journal Frontiers in Sustainable Cities on October 30, 2023 (see Janse van Rensburg & Puren, 2023). The second manuscript is also being prepared for submission to a peer-reviewed academic journal. This manuscript consists of a multiple-case study design to investigate the current status of permaculture application in South Africa. The methodology for each manuscript is unpacked in the ensuing sections.

3.5.1 Data generation: Phase One – Literature review (First Manuscript (Literature study) (Fighting the hunger games through permaculture: a scoping review to inform urban planning)

There are various types of literature reviews, the main types being scoping reviews, systematic reviews, qualitative reviews, and integrative reviews (Jesson *et al.*, 2011:106; Snyder, 2019; Mak and Thomas, 2022:565-567). Although common characteristics are shared among the different types of literature reviews, they differ in terms of purpose, selection processes, assessment criteria, synthesis, and analysis.

The typology of the review is partly determined by the research questions, research aim, and research design. (Coughlan & Cronin, 2017:15). Table 3-2 explains the different types of literature reviews and their applications.

Table 3-2: Types of literature reviews.

	Description
Scoping review	Scoping reviews are flexible and can be useful in qualitative, quantitative, and mixed-method studies. Scoping reviews explore the need for a full-scale systematic literature review by providing a broad description of existing research on a phenomenon and identifying a gap for future research.
Systematic review	Systematic reviews are primarily associated with quantitative studies and are known for their demanding and scientific stance on assessment, synthesis, and analysis. A systematic review constitutes a thorough and rigorous research approach characterised by strict search strategies and selection criteria for article inclusion. A systematic review aims to integrate findings from diverse studies, convey evidence on a specific question that can influence policy and practice, and incorporate all pertinent empirical evidence meeting pre-defined criteria to address a specific research question or hypothesis.
Integrative review	Integrative literature reviews report an extensive number of academic studies, regardless of the research approach, and consist of thematic synthesis and analysis to provide descriptive data interpretation. An integrative review assesses and synthesises the literature to develop new theoretical frameworks for a research topic. It offers an overview, critical review, and potential reconceptualisation of the topic's theoretical foundation. This method involves creatively collecting data, combining perspectives from various fields, rather than covering all available articles.

Source: Author's own compilation from: Jesson *et al.* (2011:106), Mak and Thomas (2022:565-567), Snyder (2019).

3.5.1.1 Data generation method 1: Scoping Review

For the first manuscript, a scoping review was selected as the method to explore and synthesise the extent of the existing and emerging permaculture literature. Unlike a systematic review, which is highly focused and specific, a scoping review is employed to address broader and less specific research questions where multiple research designs may be relevant (Arksey & O'Malley, 2005:20). Scoping reviews investigate the nature and volume of research in a particular field and serve as a precursor to the potential need for and value of a systematic review (Jesson, 2011:82; Miller & Colquhoun, 2020:54). Scoping reviews are also useful for synthesising the scope of research on a particular phenomenon and mapping key concepts in a research field that may not have undergone a comprehensive review previously (Arksey & O'Malley, 2005:21; Miller & Colquhoun, 2020:53). According to Arksey & O'Malley (2005:21), the four primary reasons for conducting a scoping review are: (i) to examine the nature and origin of research activity; (ii) to assess the need for a systematic review; (iii) to summarise and report research findings; and (iv) to identify gaps in existing research.

In Chapter 2, a comprehensive background study was conducted to identify relevant theoretical constructs that would serve as a foundation for the subsequent research. The goals of the scoping review were fourfold: (i) to provide an overview of scholarly work on permaculture over the past eight years; (ii) to examine its economic, social, and environmental dimensions in a spatial context; (iii) to identify emerging theoretical trends; and (iv) to define disciplinary boundaries while assessing the extent to which permaculture was integrated as a design tool in spatial planning. This study follows the framework for conducting a scoping review as proposed by Arksey and O'Malley (2005:22–23) as a guideline. Their framework offers a step-by-step approach and is detailed in Table 3-3.

Table 3-3: Arksey and O'Malley's (2005:22-23) framework for conducting a scoping study.

	Arksey and O'Malley's steps:	Implementation of the framework
Step 1	**Identify a research question**	The primary research question is: How can Permaculture be utilised as a planning tool to produce regenerative food systems (edible landscapes) in South Africa cities to combat food insecurity? The secondary research question that guided the scoping review is: To what extent has permaculture been addressed in the literature and what are its prospects to inform urban planning in addressing food insecurity?

Step 2	**Identify relevant literature**	The literature that will be used to conduct a scoping review will be sourced from the “EBSCO Discovery Service (EDS)” at North-West University.
Step 3	**Study selection and identifying limiting search factors**	- Only literature with the term “permaculture” in the article title. - Only literature published between 2015 and 2023. - Only peer reviewed literature with full text available on the “EBSCO Discovery Service (EDS)”. - Only academic papers.
Step 4	**Charting the relevant literature**	The selected literature will be databased and will include: the authors; the date published; the title; the discipline; and the geographic location. From there, the literature will be categorised according to the discipline in which it was researched.
Step 5	**Organise, summarise, and report the results of the literature**	The literature will be summarised, and the results will be reported. The most relevant, more relevant, and relevant literature will make up the content of the scoping review in the first manuscript.

Source: Arksey and O’Malley (2005) and Mak and Thomas (2022).

The research procedure for the scoping review included a search strategy for eligible literature, literature selection, and a scoping analysis of the literature.

3.5.1.1.1 Identifying relevant literature - search strategy

Due to its well-established foundation and clear nomenclature, identifying literature on permaculture presented no significant challenge. However, to ensure thoroughness and reliability, the search also encompassed the terms "permanent agriculture" and "permanent culture" within the same search constraints applied to "permaculture." The literature was sourced through the EBSCO Discovery Service (EDS) at NWU, which consolidates over 3.7 billion records from the world's top publishers and information providers from almost 400 databases. To be deemed eligible, studies were required to incorporate the search terms in their title, utilise specific expanders, and adhere to set limiters. Additionally, only academic papers were taken into consideration. The eligibility criteria were primarily delineated by the academic disciplines in which permaculture research had been conducted in the preceding 8 years (2015–2022). The decision to focus exclusively on peer-reviewed papers was rooted in their elevated level of credibility and accuracy within the realm of scientific publications. The research time frame was confined to 2015–2022 to ensure that the scoping review considered only the most recent permaculture

research. Furthermore, the search exclusively included research papers published in academic journals to uphold authenticity and validity. The limiting factors for the literature search strategy are shown in Figure 3-3.

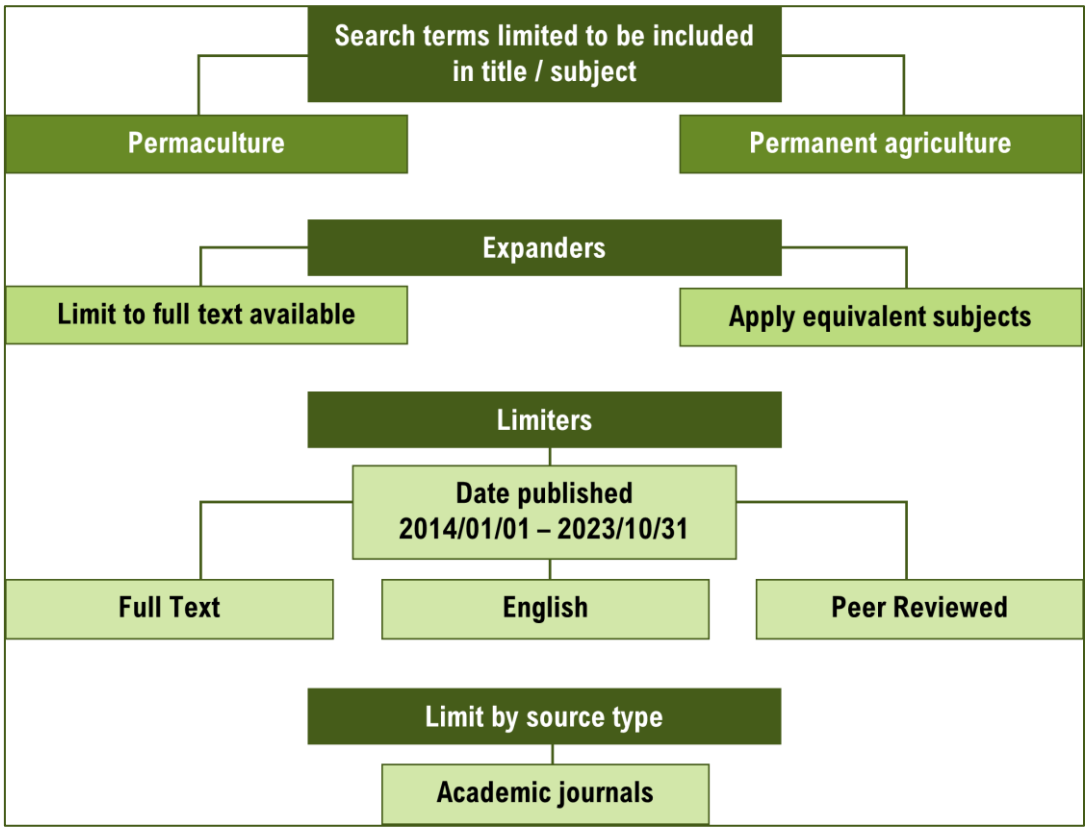


Figure 3-3: Search strategy and limiting factors for literature sourcing.

Source: Author's own compilation.

Ultimately, the search for permaculture literature within the limiters, expanders, and time frame yielded 113 results. Of the 113 results from the *EDS platform*, 4 sources were unavailable in English, 5 sources were unavailable in full text, 14 sources were not journal articles, and several were duplicate results. Conclusively, a total of 46 peer-reviewed journal articles between January 2015 and December 2022 were eligible for the selection process. To ensure that earlier trends in permaculture literature are not overlooked, a brief search (with the same limiting factors) was conducted for the years 1985 to 2014. For trustworthiness and thoroughness, papers produced during this time were scrutinised to ensure and confirm that this scoping review does not explore a topic that has trended in the past.

3.5.1.1.2 Study selection and identifying limiting search factors

The selection of academic literature for the scoping review relied on the relevance of eligible literature to the research topic and its alignment with the study's objectives (Miller & Colquhoun, 2020:53). The aim was to ascertain if permaculture had been investigated within a planning framework and to determine the pertinent disciplines engaged in permaculture research. In accordance with the overarching planning perspective of this study, papers from the built environment disciplines—such as planning, architecture, and urban design—were promptly identified and deemed most significant. Furthermore, papers originating from social and environmental study disciplines (such as agriculture, biology, ecology, sustainability, sociology, philosophy, anthropology, and cultural studies) were deemed highly significant. This determination was based on the fact that these disciplines have generated the largest volume of permaculture literature, suggesting a more comprehensive understanding of the phenomena within these fields.

The selection process also encompassed a third group of study disciplines, specifically business-related disciplines and education and teaching disciplines, covering subjects like marketing, business management, economics, and education, due to their regularity and popularity. Notably, papers from various disciplines, including tourism, psychology, engineering, religious studies, and political fields, were excluded from the scoping review as their content was deemed irrelevant or unrelated to the study's focus. Ultimately, 31 journal articles were selected for the scoping review.

3.5.1.1.3 Charting the eligible literature

The literature was charted and highlighted according to discipline: blue (business and economics), green (environmental), yellow (social), or red (built environment and spatial sciences), with their authors, publishing years, and titles in Table 3-4.

Table 3-4: Academic papers from January 2015 – January 2022 that were eligible for the selection process.

Year Published	Authors	Title of Academic paper
2015	Akhtar, F., Lodhi, S.A. and Khan, S.S.	Permaculture approach: linking ecological sustainability to businesses strategies.
	Lebo, N.	Cultivating Attitudes and Trellising Learning: A Permaculture Approach to Science and Sustainability Education.
	Ferguson, R.S. and Lovell, S.T.	Grassroots engagement with transition to sustainability: diversity and modes of participation in the international Permaculture movement.
2016	Akhtar, F., Lodhi, S.A., Khan, S.S. and Sarwar, F	Incorporating Permaculture and strategic management for sustainable ecological resource management.
	Mancebo, C.A. and de la Fuente de Val, G.	Permaculture, a tool for adaptation to climate change in the communities of the Laguna Oca Biosphere Reserve, Argentina.
2017	Vitari, C., and David, C.	Sustainable management models: innovating through Permaculture
	Aiken, G.T.	Permaculture and the social design of nature.
	Grant, K.J.H. and Yasue, M.	The effectiveness of a Permaculture education project in Butula, Kenya
	Ferguson, R.S. and Lovell, S.T.	Livelihoods and production diversity on U.S. Permaculture farms.
	Jelinek, R	A Permaculture primer: Using eco-theory to promote knowledge acquisition, dissemination and use in the sales organisation.
	Harland, M.	Permaculture: Tools for Making Women's Lives More Abundant.
	Millner, N	The right to food is nature too": food justice and everyday environmental expertise in the Salvadoran Permaculture movement.
	Symanczik, S., Gisler, M., Thonar, C., Schlaeppi, K., Van der Heijden, M., Kahmen, A., Boller, T. *et al.*	Application of Mycorrhiza and Soil from a Permaculture System Improved Phosphorus Acquisition in Naranjilla.
2018	De Tombeur, F., Sohy, V., Chenu, C., Colinet, G. and Cornelis, J.T.	Effects of Permaculture Practices on Soil Physicochemical Properties and Organic Matter Distribution in Aggregates: A Case Study of the Bec-Hellouin Farm (France).
	Babac, S. and Belic, D.	Permaculture zone planning using the triangular method.
	Henfrey, T.W	Designing for resilience: Permaculture as a transdisciplinary methodology in applied resilience research.

	Caraway, R.T.	The Spiritual Dimensions of the Permaculture Movement in Cuba.
	Karim, M.E.	Exploring the Impact of Climate Change on the Outbreak of Early Twenty-First-Century Violence in the Middle East and North Africa and the Potential of Permaculture as an Effective Adaptation.
	Krebs, J., and Bach, S.	Permaculture—Scientific Evidence of Principles for the Agroecological Design of Farming Systems.
	Luna, J.M., Dacila, E.R. and Morris, A.R.	Pedagogy of Permaculture and Food Justice.
	Rivett M.O., Halcrow, A.W., Schmalfuss, J., Stark, J.A., Truslove, J.P., Kumwenda, S., Harawa, K.A., *et al.*	Local scale water-food nexus: Use of borehole-garden Permaculture to realise the full potential of rural water supplies in Malawi.
	Maye, D.	Examining Innovation for Sustainability from the Bottom Up: An Analysis of the Permaculture Community in England.
	Rosier, A.R., Azambuja, R. and Islam, G.	Alternative visions: Permaculture as imaginaries of the Anthropocene.
	Salleh, A.M., Rosli, F.M., Esa, N., and Ibrahim, M.H.	Permaculture Design: Linking Local Knowledge in Land Use Planning for House Compound.
2019	Fadaee, S.	The Permaculture movement in India: a social movement with Southern characteristics.
	Shaojie, Z., Zhang, Y.L., Shuhan, Z., and Tong, Z.	Study on learning landscape outdoor space of primary school campus based on Permaculture and symbiotic theory——Hefei Experimental School as an example.
	Masicotte, M.J. and Bisson, C.K.	What is wrong with Permaculture design courses? Brazilian lessons for agroecological movement-building in Canada.
	Didarali, Z. and Gambiza, J.	Permaculture: Challenges and Benefits in Improving Rural Livelihoods in South Africa and Zimbabwe.
	Hirschfeld, S. and Van Acker, R.	Permaculture farmers consistently cultivate perennials, crop diversity, landscape heterogeneity and nature conservation.
	Ulbrich, R., and Wostl, C.P.	The German Permaculture Community from a Community of Practice Perspective.
2020	Putro, R.H., and Miyaura, R.	Indonesian Permaculture: Factors shaping Permaculture farm systems in humid tropical Indonesia.
	Stodulka, T.	Worlding Permaculture School Gardens: Trans local Connectivities and Minor Utopias in Timor Leste.
	Lapoutte, A.	The problem is the solution: Can Permaculture management regenerate social economy enterprises?
	Oliveira, H., and Lopes, G.P.	Permaculture in Portugal: social-ecological inventory of a re-ruralizing grassroots movement.

	Kolarova, M.	Climate Change and the Transition Movement in Eastern Europe: The Case of Czech Permaculture.
	Fiebrig, I., Zikeli, S., Bach, S. and Gruber, S.	Perspectives on Permaculture for commercial farming: aspirations and realities.
	Von Cossel, M., Ludwig, H., Cichocki, J., Fesani, S., Guenther, R., Thormaehlen, M., Angenendt, J., *et al.*	Adapting Syntropic Permaculture for Renaturation of a Former Quarry Area in the Temperate Zone.
	Chakroun, L. and Droz, L.	Sustainability through landscapes: natural parks, satoyama, and Permaculture in Japan.
	Caraway, R.T.	The greening of Cuba? A case study in religion and Permaculture in Santiago.
	Caraway, R.T.	Deep Green and Social Permaculture, Spirituality, and Society in Cuba.
2021	Flores, J.J.M. and Buot, I.E.	The structure of Permaculture landscapes in the Philippines.
	Finn, R. and Phillips, L.G.	On the certainty of entanglements with ecocide: pragmatic action for responsive pedagogy inspired by ecological psychology and Permaculture.
	Spangler, K., McCann, R.B., and Ferguson, R.S.	(Re-)Defining Permaculture: Perspectives of Permaculture Teachers and Practitioners across the United States.
	Epuran, G., Tescasiu, B., Tecau, A.S., Ivasciuc, I.S. and Candrea, A.N.	Permaculture and Downshifting-Sources of Sustainable Tourism Development in Rural Areas.
	Hinton, R.G.K., Macleod, C.J.A., Troldborg, M., Wanangwa, G., Kanjaye, M., Mbalame, E., Mleta, P., *et al.*	Factors Influencing the Awareness and Adoption of Borehole-Garden Permaculture in Malawi: Lessons for the Promotion of Sustainable Practices.
	Genus, A., Iskandarova, M. and Brown, C.W.	Institutional entrepreneurship and Permaculture: A practice theory perspective.
2022	Oliveira, L.F.C., Tega, D.U., Duarte, G.H.B., Barbosa, L.D., Ribeiro, H.C., Castello, C.D., Sawaya, A.C.H.F. *et al.*	Foodomics for agroecology: Differentiation of volatile profile in mint (Mentha × gracilis Sole) from permaculture, organic and conventional agricultural systems using HS-SPME/GC–MS.
	Rocha, S.S.R.	Degrowth in Practice - Developing an Ecological Habitus within Permaculture Entrepreneurship

Source: Author's own compilation.

3.5.1.1.4 Structure of the scoping review

The structure for the scoping review is reviewed in Table 3-5.

Table 3-5: Structure of Paper 1: Scoping review.

	Content of each section
Introduction and background	In this section, the problem statement, research question, research aims, and some contextual background is specified.
Methods	In this section, the process of searching and selecting literature for the scoping review is discussed in detail and the strategy of the scoping review is underlined.
Results	In these sections, the findings from the selected literature are grouped according to themes and expanded. Permaculture is studied within the three (3) main emerging fields of disciplines and the built environment discipline to establish the current extent of permaculture. The four fields within which the literature is explored are environmental sciences, social sciences, business sciences, and built environment studies. This section also draws from the selected literature to highlight the challenges, motivations, and benefits of permaculture application through planning.
Discussion	
Synthesis and summarisation	This section summarises the findings of the scoping review and gives feedback on the conducted study. The strengths and limitations of the study are assessed, and the gaps that emerged from this study are presented.
Conclusion	The entire study is reflected upon to provide a reliable conclusory statement.

Source: Author's own compilation.

3.5.2 Data generation: Phase Two – Empirical study (Cultivating cities for tomorrow: Lessons for urban planners from permaculture case studies in South Africa)

The second manuscript is an evidence-based empirical study that relied on qualitative multiple-case studies in the procurement of physical application and grassroots understanding of permaculture (Marczyk *et al.,* 2005:6). As explained under heading 3.2, the empirical manuscript has a case study design approach where the spatial arrangement of the cases was surveyed and was accompanied by semi-structured, in-depth interviews.

3.5.2.1 Case study research

Case study research enables a researcher to link micro-level practices and processes to macro-level structure and progress. It allows the reshaping of theory by exploring in-depth processes, elements, and complexity within specific cases with similarities and differences (Neuman, 2013:42). Neuman (2013) also elaborates on the strengths of case study research (see Table 3-6).

Table 3-6: Strengths of case study research.

Theoretical soundness	Case study research reveals real concepts or elements that could have fundamental significance in theory.
Exploratory impact	Case study research explores and contributes to the growth and development of new theories and concepts within fields and presents respectable problem-solving insights.
Identification of informal practices	Case study research can reveal methods and processes not visible from "outside" a system.
Ability to capture complexity and discover methods	Case study research can capture complexity within systems over time and space.
Measurement	Case study research can uncover useful measures of abstract notions in real-life circumstances.
Holistic explanation	Case study research elaborates on a process or system as a whole and incorporates various interpretations and perspectives.

Source: Author's compilation from Neuman (2013:42).

Although the case study approach originated as a type of qualitative research, Yin (2018:7) argues that case studies often tend to follow their own adapted research procedure that is guided by the stance of the data and is often supported and supplemented by additional data collection methods and approaches.

3.5.2.1.1 Types of case studies

In qualitative research, four dominant types of case study designs are recognised: single intrinsic, multiple intrinsic, single instrumental, and multiple instrumental. Figure 3-2 in Section 3.4 illustrates these four case study designs. A multiple intrinsic case study was decided upon to apprehend the complexity of the practical application of permaculture throughout South Africa and systematically investigate the diverse understandings of permaculture in South Africa (Mills *et al.*, 2010:289). Another significant purpose of the integrated intrinsic case study is to explore how permaculture is physically applied throughout South Africa, how it functions in different settings,

and the realities of existing practises for implementation through food-sensitive planning (Stake, 2005:23). To strengthen the report, the cases were studied parallel to each other, and the generated data was used to produce a knowledgeable and intellectual study (Mills *et al.,* 2010:201).

3.5.2.1.2 Multiple case studies

The second manuscript has a multiple-case study design and was conducted in two phases. The first phase was a spatial survey of the multiple case studies (collective case study) to establish a physical framework for permaculture application in South Africa. The spatial surveys were conducted to identify important features, explore physical patterns and trends in and around the multiple study areas, and compare the spatial features of the case studies. The second phase made use of semi-structured interviews for data generation. The interviews were conducted to gain understanding and expert perspectives on permaculture and its application in South Africa. The research procedure for the multiple-case study included searching, selecting, and profiling cases. The following sections discuss the search, selection, and profiling of the case studies in more detail.

3.5.2.1.3 Search strategy for case studies

The search strategy employed in this study aimed to identify and select specific cases within South Africa engaged in permaculture. The approach involved a combination of convenience sampling and theoretical sampling methods, guided by the study's overarching goal of contributing to the development, critique, or utilisation of existing theories related to permaculture systems (Fink, 2014:96; Tracy, 2020:84). Convenience sampling, grounded in the availability and accessibility of information, was utilised to select cases based on aerial information and the responsiveness of key stakeholders, contributing to the spatial data needed for the study (Fink, 2014:96). A combination of convenience sampling and theoretical sampling methods was used to gather particular types of cases because they met certain characteristics relevant to the larger intent of the study to ultimately consider how the data and findings can develop, critique, or be used in existing theory (Fink, 2014:96; Tracy, 2020:84).

Sampling for qualitative research was primarily purposeful, ensuring the inclusion of information-rich cases conducive to an in-depth study (Mills *et al.*, 2009:837). The sampling process involved a planned combination of convenience, theoretical, and snowball sampling, aligning with the study's broader objectives (Fink, 2014:96; Tracy, 2020:84). Researchers adopt a snowball sampling method for interviews, a technique widely employed to engage self-identified

participants who meet the study's criteria. This method relies on participants suggesting other potential interviewees who share similar interests and criteria, gradually expanding the sample (Seidman, 2006:55; Neuman, 2013:273; Tracy, 2020:84; Dosek, 2021:651). Snowball sampling was deemed appropriate for identifying influential and key informants within the specific context of permaculture in South Africa (Mills *et al.*, 2009:95).

To initiate the snowball sampling process, individuals directly involved in the case studies were sought through a web search focused on permaculture projects in South Africa. Initial contacts were established via email, providing a concise study summary and an invitation to participate. Follow-up requests were sent to unresponsive individuals, while respondents who replied were asked for additional recommendations, forming the basis of the snowball contacts (Naderifar *et al.*, 2017:2). This iterative process of reaching out to initial contacts and expanding the sample through recommendations constituted a crucial aspect of the search strategy for cases and interview participants (Figure H).

In summary, the search strategy encompassed a purposeful combination of convenience, theoretical, and snowball sampling for case selection, with a specific focus on spatial data and information-rich cases in South Africa. The iterative nature of the snowball sampling process, involving continuous engagement with contacts, played a pivotal role in shaping the research effort throughout its duration.

3.5.2.1.4 Selecting the cases study sites

To conduct a multiple-case study, it is essential to identify and select suitable cases for the study. This approach aligns with the recommendations of Stake (2005:22) and Yin (2018:97), who suggest that a multiple-case study should ideally include between 4 and 10 cases. They also emphasise the importance of carefully selecting cases that are linked by a specific concept, in this case, permaculture. This selection should aim to yield similar or contrasting results at the start of the investigation. During the search for permaculture case studies in South Africa, case study sites directly oriented towards permaculture and deemed significant for the study's purpose were identified. The localities of the case study sample can be found in Figure 3-4.

Over a span of 18 months, from January 2021 to June 2022, extensive online searches and inquiries culminated in the identification of twelve (12) permaculture sites in South Africa. These sites, showcasing varying degrees of permaculture practice, were associated with key stakeholders who were approached via email. Following an initial request and subsequent follow-up, three stakeholders responded and agreed to participate in the interviews and supplemented

the study with crucial information for spatial surveying. Several more stakeholders were subsequently contacted as snowball contacts and two agreed to also participate in the interviews. The results were thoroughly scrutinised and compared to identify the most relevant and eligible case study sites. Consequently, four cases were chosen for data collection through spatial surveying, while interviews were conducted with five participants.

The selection of each case study site primarily depended on its significance to the research focus on permaculture. Additionally, it depended on the availability of information, as some cases had limited information available. The four (4) selected cases were identified as having the most significance for the concept of permaculture as defined and perceived in this study. They also had the most comprehensive information available, including discussions on applications, maps, and response rates. The eight (8) study case study sites that were not selected were either misclassified as permaculture systems or had limited stakeholder engagement and information availability. As a result, these cases were excluded from the multiple-case study.

3.5.2.1.5 Locality and profile of selected case studies in South Africa

Four (4) case study sites were selected were based partly on the cases' level of connection to permaculture (selected criteria) and, consequentially, on the response rate from stakeholders and information availability. The four selected case studies are Case 1: Tlhlolego Ecovillage (*https://rucore.org.za/tlholego-village/*) and Learning Centre, Case 2: Numbi Valley Permaculture Farm (*https://numbivalley.webs.com/*), Case 3: Kuruma Farm Cottages (*https://www.kurumafarm.com/)*; and Case 4: Pachamama Forest Retreat (https://www.facebook.com/Pachamamaforestza/). A profile of each case was developed to communicate characteristics of the cases inter alia size, main activities, and distance to nearest urban node. The spatial profiles of the cases can be seen as Annexure A. The locality of the eligible and selected cases can be seen in Figure 3-4. Locational discussions of each case can be found in the second manuscript (Cultivating cities for tomorrow: Lessons for urban planners from permaculture case studies in South Africa).

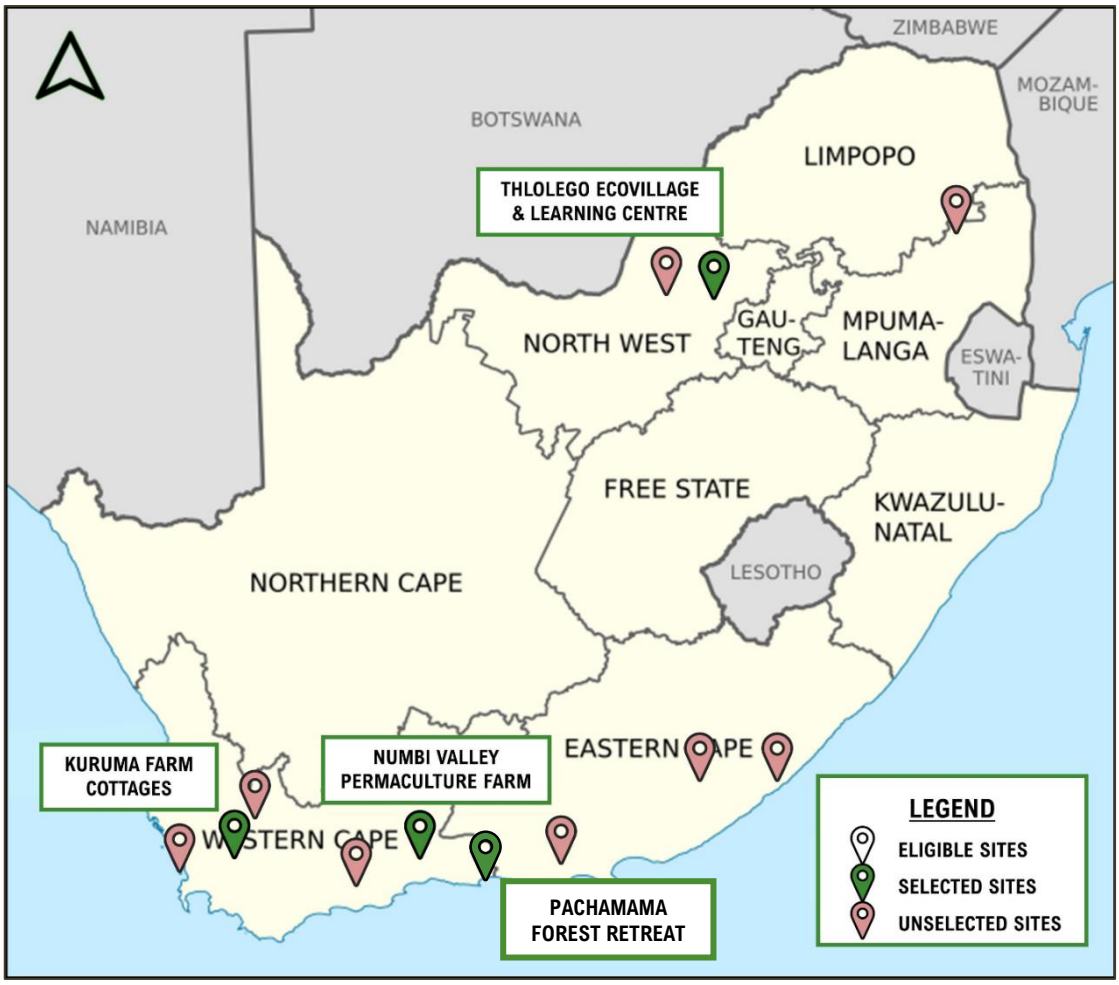


Figure 3-4: Locality of the cases study sample (red) and the selected case study sites (green) in South Africa.

Source: Author's own compilation

The selected cases were individually investigated, and a profile for each was created that included the cadastral boundaries and diagrams of each property, their locality and size, elevation, topography, climate zones, and landscape characteristics. These profiles are discussed more comprehensively in the empirical section of the study, Chapter 4 (Manuscript 2: Cultivating cities for tomorrow: Lessons for urban planners from permaculture case studies in South Africa).

3.5.2.2 Data generation method 2: Spatial surveying

Spatial surveying is a form of visual data generation using visual research and usually comes in the form of surveying. Maps, images, and videos are often used to identify and examine spatial patterns, scales, trends, and integration within the surroundings of the study area (Kindon, 2007:3; Klein, 2012:81; Ahidana & Bierbaum, 2015:14). Visual data is used to virtually represent data that

was collected during surveying a terrain, culture, or social network (Kindon, 2007:3; Klein, 2012:82).

The surveying included identifying and presenting certain spatial patterns, landmarks, demographic data, features, challenges, and assets of the various study areas (Kindon, 2007:3; Schensul, 2008:525; Ahidana & Bierbaum, 2015:14). In the light of complex systems, the spatial surveys provide extra depth into the status quo of permaculture in South Africa by allowing the researcher the opportunity to observe certain spatial factors and opportunities more easily (Schensul, 2008:525; Ahidana & Bierbaum, 2015:14). For this study, spatial surveying was used as a tool for exploring the spatial patterns, features, and characteristics between case studies and to identify potential intervention zones and guidelines that form part of the recommendations from this research. To strengthen the study, a second data generation method was used. Semi-structured interviews with key informants and permaculture enthusiasts were conducted to inform the multiple case studies from a grassroots level.

3.5.2.3 Data generation method 3: Interviewing

Case study research may include one or more “individuals” who are studied over time. The umbrella concept of purposeful (opportunistic) sampling necessitates qualitative sampling methods that purposefully choose cases or subjects that fit the characteristics of the study and the research questions, aims, and objectives (Tracy, 2020:31). The information for this type of research is collected through interviews, observations, and accessing other sources such as written records or film and is often sampled opportunistically (Green & Thorogood, 2004:102).

Interviews are an effective qualitative data generation method whereby relevant experts' and stakeholder’s opinions, knowledge, and perspectives regarding a field or topic are explored and understood (Greeff, 2005:287; Kindon *et al.,* 2007:2). Interviews most commonly consist of open-ended questions where the participants are free to express their own opinions on the question (Greeff, 2005:288). Interviewing is one of the most commonly used qualitative data generation methods (Greeff, 2005:287; Kumar, 2011:137). An interview requires a researcher to interact with the participant, either face-to-face or electronically, to ask questions related to the research at hand (Kothari, 2004:17; Kumar, 2011:137). There are various types of interviews (see Table 3-7*)*.

Table 3-7: Interview types.

Interviews		
Formal	**Informal**	
Closed-ended	**Open-ended**	
Structured	**Semi-structured**	**Unstructured**
This interviewing approach follows a democratic style, encouraging participants to provide concise, closed-ended responses. It prioritises the collection of factual and nominal data over personal opinions.	Semi-structured interviews adopt an approach akin to casual conversations, where the interviewer employs a predefined set of questions to guide the interaction. This format offers the participant increased flexibility in expressing their opinions and thoughts on each topic. Notably, the trajectory of the interview and the significance attributed to different discussion points are influenced by the responses provided by the participant, adding a dynamic and adaptive dimension to the conversational flow.	Unstructured interviews, also known as in-depth interviews, involve randomly selected samples. These interviews extend and formalise conversations, emphasising participants' perspectives. Unstructured interviews encourage storytelling, focusing on participants' perspectives and depth of knowledge about social and historical events. In oral histories, they often spotlight marginalised group experiences, providing insights overlooked in formal accounts.
Structured interviews are usually shorter and swifter than informal type interviews.	The duration of the interviews is determined by the time available, and the level of data saturation[1] produced.	

Sources: Green and Thorogood (2004:80, 103, 110), Greeff (2005:288); Seidman (2006:15); Brinkman (2013:20); Tracy (2020:160).

Following the global COVID-19 pandemic and the digital surge that came with it, it was thought well to conduct the interviews through an online meeting platform, Google Meet. This not only reduced travel costs but also allowed a much more flexible and attenuated schedule for both the interviewer and the interviewees (Kara, 2021:144). The interviews shed light on the practical aspects of permaculture practices and highlighted important considerations for permaculture application in urban areas (Brinkmann, 2013:90).

[1] *Data saturation is achieved once a substantial volume of data has been produced, and no additional insights or information emerge.*

3.5.2.3.1 Selection of participants

For the interview section of the study, the snowball sampling method was used to identify participants who had the necessary criteria to participate in the online interviews. The sample of participants for the interviews were all contacted either telephonically or by e-mail. It was recorded who responded, who did not respond, who agreed to the interviews, and who didn't. Of the eight (8) participants that were sampled for the interviews, five (5) agreed to participate, three (3) declined the request due to time constraints, one (1) electronic mail address was incorrect, and the invitation could not be delivered. Three of the selected participants are key stakeholders in the permaculture case study sites. The remaining two selected participants were members of Food and Trees for Africa, which teaches permaculture at over 300 schools in South Africa and does not have a designated permaculture site that could be used for the case study.

Ultimately, the interviews with the five (5) selected participants commenced between 08 February 2023 and 15 March 2023. The participants were each contacted a week before their interview to establish a time and date that suited both them and the researcher. The preceding communication included data gathering for the participant profiles and an invitation sent to them via email whereby they could join the interview on the day of.

3.5.2.3.2 Participant profiles

Participant profiles were developed to share contextual data about each participant, including age, gender, qualifications, years involved in permaculture, and their role in permaculture (Seidmann, 2006:119). The participant profiles can be found in Annexure C. The participant profiles revealed that the participants were mostly male (4/5), all older than 36 years of age, and all had a degree or qualification.

3.5.2.3.3 Structure of the interviews

The goal of the interviews is to obtain rich insight into the understanding of permaculture and the drivers behind permaculture practices in South Africa. The interviewees had the freedom to answer the questions in any way they chose. The questions that guided the interview are captured in the interview schedule (see Annexure D).

3.5.2.3.4 Protocol for the interviews

The protocol for the interviews was simple. Upon agreeing to partake, participants were provided with a consent form (Annexure B) and a participant profile (Annexure C) form to complete and send back before the interviews commenced. Follow-up emails were sent to each agreeing participant to confirm a time and date best suited for the interviewer and the interviewee. A reminder was sent to each participant the day before the scheduled interview, containing the *Zoom* or *Google Meet* link, to acknowledge receipt of their invitation. Also contained in the reminder, the participants were presented with the purpose of the study, the structure of the interview, and the goal of the interview to allow them time to prepare and orient themselves with the study.

On the day of each interview, the participant clicked on a link to the online meeting platform (*Zoom or Google Meet*). Once the interviewer and the participant were both present on the meeting platform, the meeting commenced according to the interview schedule (Annexure D). The interview was started with greetings and an introduction by the interviewer to declare the purpose of the interview and give context to the study. Each interview was recorded by the interviewer, with the participants' consent, and the transcriptions were manually typed from the recorded audio after each interview.

3.6 Data analysis and interpretation

Data analysis is how data generated for a study is interpreted and presented in the research project (Kumar, 2011:210). Data can be analysed manually or by computer (Kumar, 2011:210). In this case, the data was organised and processed manually and by using computer software (Seidman, 2006; Guest, 2012). A scoping review method was used to explore the existing body of literature for the first manuscript.

3.6.1 Analysis of the scoping review

A scoping review was conducted to investigate the existing body of permaculture literature from the past eight years. Two frameworks were employed to structure and carry out the review: the framework proposed by Hanc *et al.* (2019) for scoping reviews and the framework outlined by Arksey and O'Malley (2005) for scoping studies. Arksey and O'Malley's framework guided the selection and analysis of the literature, while Hanc *et al.* (2019) framework facilitated the identification and analysis of the key themes and trends within the permaculture literature. Following the initial selection, the literature underwent a thematic analysis using the framework

proposed by Hanc *et al.* (2019). This involved identifying recurring themes, patterns, and trends within the permaculture literature.

3.6.2 Analysis of the multiple-case study

The data gathered during the spatial surveys and the interviews were comprehensively analysed (Guest *et al.,* 2012; Nowell *et al.,* 2017; Braun & Clarke, 2022). The surveying section of the empirical study was mainly analysed by identifying comparable and contrasting spatial patterns in the study areas and identifying potential planning intervention zones. Thematic analysis of the interviews allowed the extraction of the main themes that emerged from the various interviews and could contribute to enriching related theories and identifying and addressing real-life problems (Kumar, 2011:210; Guest, 2012:9). The main themes were highlighted by colour in each interview transcript (Annexure E). Excerpts from the interview transcripts were thematically coded and collated into a table (see Annexure F) (Guest *et al.,* 2012; Braun & Clarke, 2022). A review of the relevant excerpts was conducted, and a narrative for each theme was generated to form themes and subthemes.

3.7 Trustworthiness of qualitative data

The trustworthiness of this study is firmly established through meticulous attention to data quality and transparency throughout the research process. The data utilised in this dissertation was sourced from reputable channels, including the EBSCO Discovery Service (EDS), which consist of a collection of over 3.7 billion records from esteemed publishers worldwide. Access to EDS is granted to registered researchers at North West University (NWU), ensuring the credibility of the literature reviewed. Spatial data, crucial for this study, was collected directly from key participants involved in the permaculture projects under examination, guaranteeing firsthand accuracy. Moreover, interview data was also obtained directly from these participants, enhancing the authenticity of the findings. Each step of the research process is meticulously documented and provided as annexures within the dissertation, ensuring transparency. Furthermore, the inclusion of a peer-reviewed academic article adds an additional layer of credibility to the study (Section B: Chapter 4, Paper 2). While limitations such as travel challenges and financial constraints were present, alternative methods like virtual interviews and direct spatial data collection were employed, maintaining the integrity of the research. Adhering to established criteria for trustworthiness, this study ensures validity, reliability, objectivity, and relevance in its findings, with claims supported by credible evidence and a commitment to factual accuracy over personal bias (Marshall and Rossman, 2016:122).

3.8 Ethical considerations

This study implied minimal risk for human participants as it had semi-structured interviews that were conducted digitally online (Kara, 2021). These interviews consisted of open-ended questions regarding permaculture and contained no personal or invasive dialogue. As for the remaining data generation methods (case studies and spatial surveying), no human participants were involved, and therefore there was no risk factor for human participants. Thus, this study has minimal unexpected negative consequences, discomfort, or inconvenience. This study does not require any interaction with children or incapacitated adults. This study was approved by the Faculty of Natural and Agricultural Sciences Ethics Committee (ethics number: NWU-01203-21-A9) and thus adheres to the necessary ethical standards of the North-West University. See the Ethics Approval Letter of Study as Annexure G.

3.9 Conclusion

The empirical study consisted of a multiple-case study design where four (4) cases were analysed spatially and supplemented by semi-structured interviews with permaculture experts that highlighted grassroots-level findings. The literature review findings and the findings from the empirical study were ultimately compared to inform spatial findings of existing permaculture systems in South Africa and recommendations for the way forward.

CHAPTER 4 : MANUSCRIPTS

4.1 Structure of this chapter

Figure 4-1 shows the structure of the two manuscripts included in Chapter 4.

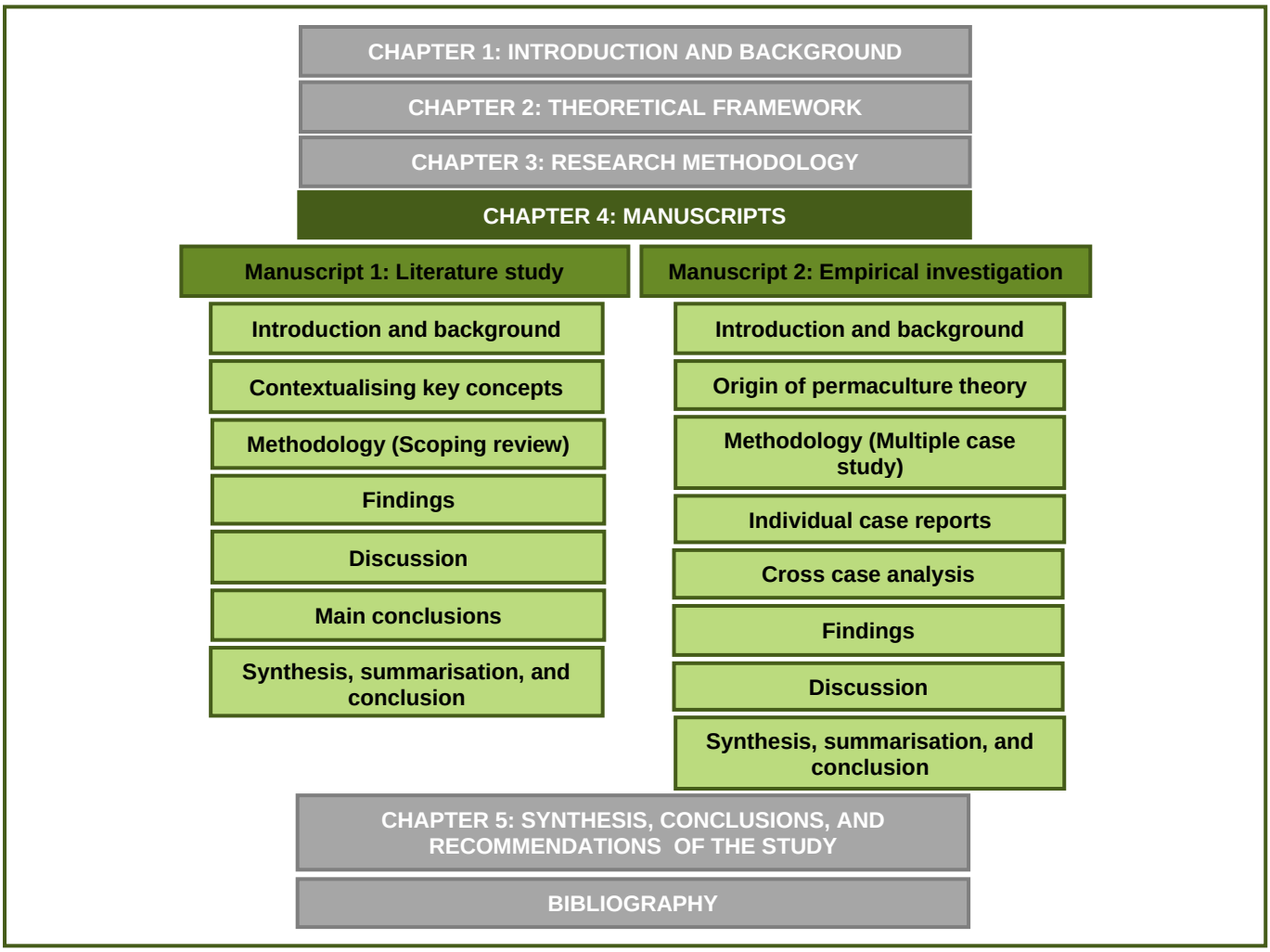


Figure 4-1: Structure of this chapter.

Source: Author's compilation.

PAPER 1 : FIGHTING THE HUNGER GAMES THROUGH PERMACULTURE: A LITERATURE SCOPING TO INFORM SPATIAL PLANNING

4.2 Introduction and background

"… We say, let us give the child an education modelled on permaculture; something that needs and returns nurture. It is time to turn the ebbing tide of energy towards useful ends and develop a permaculture for the society of man and nature."
-Bill Mollison and David Holmgren (1990)

The United Nations has set a universal goal (SDG 2) to eliminate global hunger by 2030 (United Nations, 2015), However, since 2015, the number of people suffering from hunger has increased. Over 800 million people globally are undernourished and over eight million people have died from starvation (The World Counts, 2023). Currently, Africa is one of the continent's most severely affected by hunger (Statista, 2022). The alarming levels of hunger are exacerbated by significantly high rural-to-urban migrations (Haysom, 2021; Steenkamp *et al.,* 2021; Davies *et al.,* 2021). Although Africa is the least urbanised continent in the world with only 44% of its population residing in urban areas, the continent is currently experiencing some of the highest urban population growth rates in the world due to urbanisation (Ali, 2021; Vasyviela and James, 2021; Gambe *et al.,* 2023). This situation calls for a critical intervention in urban areas on the African continent to address food insecurity (Haysom, 2021; Vasylieva and James, 2021). The sub-Saharan Africa context in particular faces the most serious problem with food insecurity. This is verified by the Food and Agriculture Organisation (FAO) (FAO, 2020), which reports that sub-Saharan Africa has the highest rate of undernourishment in the world, with over 23.2% of its population suffering from chronic hunger. Together with the high demand for food production as a side effect of urbanisation in the area, poor urban planning can exacerbate food insecurity. For instance, in many sub-Saharan African cities, ineffective transportation systems, a lack of infrastructure for food delivery, and restricted access to affordable, nutrient-rich food are prevalent problems (HLPE, 2017). Urban planners need to address sustainable urban food programmes, enhance food supply chains, and support equal access to food resources within urban regions to address these issues. According to the UN-Habitat (United Nations, 2017), cities in sub-Saharan Africa can seek to reduce hunger and improve the general well-being of their citizens by including food security considerations in urban planning and design initiatives. Several solutions have been offered across different disciplines to address food insecurity in urban environments, e.g., through urban agriculture (Slade *et al.,* 2016; Siebert, 2019; Steenkamp *et al.,* 2021), food-sensitive planning (Haysom, 2021) and infrastructure gardening (rooftops and vertical gardens)

(Choudhary & Rawat, 2021). In addition, permaculture (derived from the words "permanent" and "agriculture" and introduced in the 1970s) has been proposed in the literature as a potential tool for addressing food insecurity. However, despite a significant rise in food-related research across disciplines, permaculture's emphasis on food production in cities has garnered little attention. Furthermore, while topics, e.g., urban agriculture and green infrastructure have been incorporated into the planning of urban environments (Slade *et al.,* 2016; Mui *et al.,* 2021; Steenkamp *et al.,* 2021), reference to the integration of permaculture in urban planning is almost non-existent.

While permaculture has been promoted primarily as a design approach, its potential application in the context of urban planning and design remains an area of limited research. A further concern is that much less permaculture research has been directed to the African continent than in other countries, especially in sub-Saharan Africa where the need for food is critical. This gap is addressed in this paper by investigating the extent of permaculture as a possible tool for addressing food insecurity with specific reference to possible links with urban planning. The main purpose of the literature study presented here was to investigate the range of aptitudes permaculture offers as a food system and to identify potential prospects to inform urban planning initiatives to combat food insecurity. The main research question that has guided the investigation is: "To what extent has permaculture been addressed in the literature and what are its prospects to inform urban planning in addressing food insecurity? Fighting hunger in highly urbanised cities by considering permaculture may well provide fertile ground to seek an answer to this question.

4.3 Contextualising permaculture, urban systems, regenerative systems, and urban planning

The purpose of this section is to provide the theoretical framework that underpins the research. The framework comprises the concepts of permaculture, urban systems, regenerative urban systems, and urban planning.

4.3.1 Permaculture

Permaculture, initially introduced by Bill Mollison and David Holmgren in the late 1970s, was offered in relation to alternative and small-scale farming initiatives as a design framework for creating sustainable systems that function in harmony with nature (Leahy, 2021). In permaculture systems, people and the environment are integrated in a harmonious whole to provide food while addressing basic needs such as shelter, water, and other materials (Mollison & Holmgren, 1990; Moughtin & Shirley, 2005; Mang & Reed, 2012; Philips, 2013). The approach is based on observing and replicating the patterns and processes found in natural ecosystems, with the goal

of developing systems that are self-sustaining and require minimal human intervention (Holmgren, 2002; Salleh *et al.,* 2018; Leahy, 2021). Furthermore, permaculture aims to establish agricultural ecosystems that replicate natural ecosystems to provide food, preserve biodiversity, deliver ecosystem services, and require minimal maintenance. The principles and ethics of permaculture are based on complex-system thinking and rooted in 12 design principles and three ethical principles (Holmgren, 2002; Philips, 2013). The initial idea of permaculture as a food system design evolved towards permaculture as a holistic system design approach, as presented in Figure 4-2.

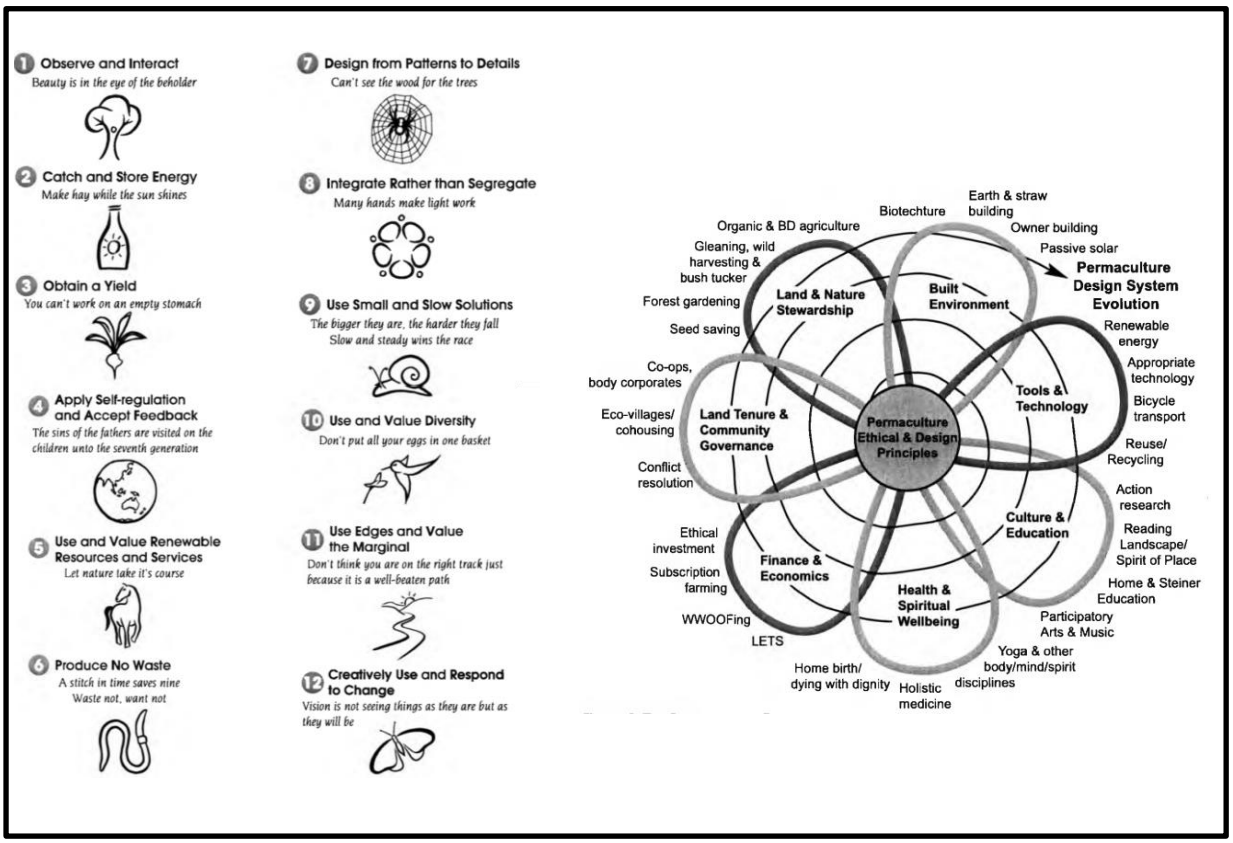


Figure 4-2: Permaculture principles and ethical values.

Source: Holmgren (2002).

This tool has been applied in developing countries globally over a period of 50 years, e.g., in Malawi (Rivett *et al.,* 2018), South Africa (Kruger, 2015), the Philippines (Flores & Buot, 2021), Zimbabwe (Didarali & Gambiza, 2019), and India (Fadae, 2019), albeit to a limited extent, but has not remained stagnant. Across the world, permaculture evolved from being used as an intimate small-scale food-growing practice for private application into a practice that is recognised for its wide-reaching pertinence within systems of various sizes, types, and scales. Although permaculture was originally developed as a holistic way of integrating food-growing systems into human systems, its potential integration in urban systems is still underexplored (Howe, 2002; Viljoen *et al.,* 2005; Ulbrich & Wostl, 2019; Lapoutte, 2020). Existing permaculture literature is mainly focused on rural contexts in response to food provision, system regeneration, and/or addressing social issues. Limited recent examples in which permaculture has been researched in urban contexts include a study by Babac and Belic (2018) in the Balkan region, which focused on how agroecological practices, biodiversity conservation, soil health and supporting communities can contribute to more efficient systems, and a study by Salleh *et al.* (2018), which reviewed the literature on permaculture and its principles to analyse how these principles align with the United Nation's SDGs. In the latter, the authors argued for a holistic framework to achieve sustainable development by integrating ecological, social, and economic considerations. A study by Shaojie *et al.* (2019) followed that explored the significance of outdoor landscapes to inform the design of contemporary primary schools in Hefei city in China. Although originated from agriculture, these studies echo the flexibility of a permaculture system as propagated by Mollison and Holmgren in the 1970s. Despite the variety of studies that are mentioned here, the potential application of permaculture in urban environments has yet to be fully explored, and further research is needed to understand how it can be applied in urban areas, especially concerning food systems. It is especially concerning that while permaculture has been considered through the lenses of various disciplines, the contribution from an urban planning and design perspective is almost non-existent in scholarship. In view of SDG 11: Sustainable cities and communities, which calls for the planning of inclusive, safe, resilient, and sustainable cities and human settlements (United Nations, 2015), an investigation of permaculture as a possible urban food system tool seems to be a fruitful topic for further exploration – especially in contexts such as that of sub-Saharan cities where food insecurity is a pressing reality in the future of growing cities.

4.3.2 Urban systems

A sustainable urban system refers to the interconnected network of physical, social, economic, and ecological components that make up a city or metropolitan area (Taylor, 1998). This system includes the built environment, e.g., buildings, roads, infrastructure, the natural environment – such as open spaces, rivers, wetlands – and the social and economic networks that facilitate the

movement of people, goods, and capital within the urban area (Maruyama, 2016:9). Urban systems are characterised by higher population densities and greater concentrations of economic activity compared to rural areas. Consequently, these systems often face unique challenges related to sustainability, specifically with respect to resource depletion, pollution, climate change, and food insecurity (Wilson & Piper, 2010; Pickett *et al.,* 2013; Battersby & Watson, 2019). These challenges call for a reconsideration of how urban systems can be transformed into regenerative systems.

4.3.3 Regenerative systems

In essence, regeneration is the ability of a system to sustain itself in the face of external disturbances, as described by Rhodes (2015). Regeneration stems from resilience thinking where a system has the potential to transform itself in response to shocks and disturbances (Holden *et al.,* 2016; Legaspi *et al.,* 2016; Masnavi *et al.,* 2018). The concept of resilience concentrates on the importance of the system subjected to shock in returning to its original state. Regenerative thinking takes resilience a step further by enabling systems that can self-adapt to disturbances and adjust their threshold for future disturbances (Cole, 2012; Caniglia *et al.,* 2020). In that respect, regeneration involves designing a system that can withstand and reconcile the damages caused by external shocks while continuing to provide for its consumers, whether they are people, organisms, animals, or others. Hence, permaculture as a food system is a design method that goes beyond the traditional notions of sustainability and resilience to create regenerative systems (Rhodes, 2015; Caniglia *et al.,* 2020). Permaculture specifically focuses on creating regenerative food systems that provide for the interactive components of an integrated system. Unlike other urban food systems (e.g., urban agriculture and aquaponics), the primary advantages of permaculture, also embedded in its principles (Principle 9: small and slow solutions), are flexibility and adaptability to different scales (Mollison & Holmgren, 1990; Holmgren, 2002). By incorporating regenerative design principles such as minimising waste, maximising diversity, and creating closed-loop systems, permaculture aims to create regenerative food systems that not only meet the needs of the present consumer but also continually regenerate the system to provide for future consumers (long-term dependability). The incorporation of permaculture into urban areas as a measure to regenerate urban food systems may well become a much-needed urban planning tool for alleviating food insecurity in growing urban contexts.

4.3.4 Urban planning and food security

Urban planning is the arrangement of components (roads, public spaces, residential areas, social hubs, business districts, etc.) within urban systems to create thriving communities to live in (Metternicht, 2018). Furthermore, urban planning is directly responsible for structuring urban systems in a way that ensure prosperous communities and more recently consolidative people-nature systems (Taylor, 1998; Shen & Shen & Kawakami, 2013). Also, urban planning facilitates infrastructure planning, determines viable land use arrangements, ensures the equitable use of resources, and is orientated around sustainably resolving conflicts of space (Metternicht, 2018). From an urban planning perspective, innovative and flexible planning tools and approaches must be pursued and developed for fighting the advancing challenges of ongoing urbanisation, society, and subsequential issues such as hunger which is currently one of the most important urban challenges to address in Africa (Davies *et al.,* 2021).

The idea of incorporating food production in the planning of urban environments is not new. Countless academic endeavours have explored the integration of food into urban systems in one way or another. The most common topics researched in this regard include inter alia urban agriculture, rooftop gardens, vertical gardens, and aquaponic systems (Badami & Ramakutty, 2015; Choudhary & Rawat, 2021; Goddek *et al.,* 2015). These initiatives all show promising prospects for addressing urban food concerns but often lack flexibility and adaptability for dynamic contexts.

One urban and planning approach that focuses on addressing food security is urban agriculture. It is one of the most popular approaches for integrating food into urban systems and is the practice of integrating large- and medium-scale agriculture into urban systems mainly to provide food and ecosystem services to the surrounding urban communities (Badami & Ramakutty, 2015). However, urban agriculture is criticised for its application in large open spaces with healthy soil available in urban areas while, similarly to traditional agriculture, land availability and tenure constraints are prominent shortcomings (Horst & Hoey, 2017; Audate *et al.,* 2019; Davies *et al.,* 2021). Urban agriculture is also a costly process that requires traditional sowing, ploughing, and reaping techniques and often produces monocrops that fail to support biodiversity (Badami & Ramakutty, 2015).

Another approach that has received attention in the past decades is the use of rooftop and vertical gardens, recognised for its efficient utilisation of urban infrastructure to grow food (Choudhary & Rawat, 2021). Rooftop gardening is the practice of utilising building rooftops for gardening and crop cultivation. Vertical gardening is the practice of employing vertical stacking to grow crops

and is often used for hydroponic and aeroponic systems (Horst & Hoey, 2017). Rooftop gardens and vertical gardens are both revered for reducing the environmental footprint of food production operations while providing ecosystem services in cities and for their efficient use of space in densely populated urban areas (Ekren, 2017). However, rooftop and vertical gardening have been criticised due to the incapacity of existing infrastructure to support these practices and cost ineffectiveness for maintaining these systems in terms of leakage prevention, preparatory construction, and soil and water management (Ekren, 2017; Wang, 2018).

Aquaponics is another food-generating practice where aquaculture (fish farming) is combined with hydroponics (soilless plant cultivation) to create a symbiotic relationship where fish waste provides nutrients for plants in a closed system (Goddek *et al.,* 2015). Although a relatively novel practice, aquaponics has been researched quite extensively in urban contexts due to its unique nature and its efficiency in water use (Yep & Zheng, 2019). Although popular, the significant amount of financial and resource input for aquaponics to function efficiently together with high disease risks associated with using fish and plants are main points of criticism (Yep & Zheng, 2019; Turnsek *et al.,* 2020).

Relative to other approaches, it is argued that permaculture offers a promising, more flexible, adaptable, and affordable approach to producing food in cities. By designing integrated urban food systems that mimic natural ecosystems, permaculture can help foster resilient and regenerative urban environments on the environmental, social, economic, and physical (planning and design) dimensions. Permaculture principles can guide the planning and design of urban spaces to enhance biodiversity, conserve resources, reduce waste, provide food, and foster community resilience (Leahy, 2021). Sustainability in urban systems is increasingly questioned in academic scholarship due to the popular interdisciplinary use of the terminology to promote business-as-usual under the pretence of adapted ecological awareness within organisations and procedures (Ang & Van Passel, 2012; Rhodes, 2015; Holden *et al.,* 2016). Resilient and regenerative systems, on the other hand, have been endorsed to be the latest aspirations for the future preservation of systems, especially urban systems (Cole, 2012; Rhodes, 2015; Caniglia *et al.,* 2019). It is in this sense that the potential of integrating permaculture in urban systems as a regenerative food system looks promising. The question remains to what extent permaculture has been researched as a potential tool to create sustainable and regenerative urban food systems and how it can be integrated into urban planning to address food insecurity.

4.4 Methodology

4.4.1 A scoping review

To answer the question “To what extent has permaculture been addressed in the literature, and what are its prospects for urban planning?”, a scoping literature review was conducted. Various authors (e.g., Arksey & O’Malley, 2005; Colquhoun *et al.,* 2014; Levac *et al.,* 2010; Peters *et al.,* 2015) agree that scoping reviews involve synthesising existing knowledge to explore a research question and map key concepts, types of evidence, and research gaps in a defined field or area. While similar to traditional systematic reviews, scoping reviews differ in their methodology and are better suited to the objectives of this study . Systematic reviews are typically focused on answering well-defined questions through a rigid protocol, whereas scoping reviews allow for a broader exploration of the literature to map key concepts and can be less specific (Levac *et al.* 2010; Peters *et al.* 2015). A scoping review is considered here as a first step prior to conducting an exhaustive literature study to provide some initial insights about a topic (i.e., permaculture) that has received little consideration in urban contexts or urban planning. In this case, the scoping literature review is used to provide a brief overview of existing permaculture research to create a better, more nuanced understanding of the current state of this topic in research. It is also used to identify potential areas for further investigation and inform perspectives that have previously not been accounted for (in this case an urban planning perspective). Additionally, a scoping review was recommended to identify potential barriers and facilitators to the implementation of permaculture practices in different contexts, and thus to contribute to the development of policies and programmes that promote sustainable food systems (Van Huizen *et al.,* 2021; Hanc *et al.,* 2019). It is argued here that a scoping review is a necessary first step to address complex research questions where knowledge gaps are present in an existing body of literature (permaculture) and where research from the urban planning discourse is limited.

4.4.2 Search strategy, literature selection, and exclusions

The solid foundation and specified nomenclature of permaculture made locating relevant papers relatively easy. To ensure a comprehensive search, the terms "permanent agriculture" and "permanent culture" were included with the same limiting factors as "permaculture." These limiting factors included full-text papers available in English only and published in peer-reviewed academic journals. The decision to use peer-reviewed papers was because their literature holds the most significance and accuracy in scientific publications. Only research papers that were published in academic journals were considered in the search to ensure authenticity and validity. The time span of the research was limited to 2015-2021 to ensure a scoping review that is informed by recent findings. Other exclusion criteria included research that was not conducted

from perspectives relevant to this study (social, environmental, business, or spatial perspectives) or studies that fell within saturated discussions of permaculture e.g., many studies have explored permaculture as a land regeneration tool. Thus, a certain number of articles were selected to represent a saturated phenomenon in this review. A comprehensive search was conducted across several academic databases, including Science Direct, Scopus, Sage, Directory of Open Access Journals, Web of Science, and Google Scholar.

To ensure that earlier trends in permaculture literature were not overlooked, a search (with the same limiting factors) was conducted for the years 1985 to 2014. This period (29 years) yielded a meagre 16 papers which were not available in full text. The papers were scrutinised for trustworthiness and thoroughness based on the purpose of this review. This review intends to address a research phenomenon combination that has not trended in studies since 1985-2014. The search for eligible literature yielded 113 papers, but after removing duplicates and ineligible sources, 46 peer-reviewed journal articles between January 2015 and December 2022 remained that were eligible for further analysis. Eligible studies included those with the search terms in their title, expanders, and limiters, and those that focused on permaculture research across all dimensions over the past eight years (to represent recent trends in permaculture). To identify the extent of permaculture research, the urban planning discipline's contribution and the status quo of permaculture literature, the eligible papers were systematically scanned using a database system. Titles, abstracts, and disciplines were screened to categorise key perspectives, disciplines, and research methodologies, and ultimately to establish a representative body of literature to be reviewed that signifies the extent of permaculture literature to date.

In search of studies that attempted to exceed standard thematic boundaries, it was detected that permaculture is mostly researched from three specific perspectives, namely permaculture intervention from social, economic, and environmental perspectives. With the aforementioned also being the fundamental dimensions of sustainable urban systems, a body of literature was selected that represents the main researched approaches within permaculture research to obtain possible lessons that can inform urban planning. Regrettably, nearly all the permaculture literature has been conducted in rural contexts and with only limited reference to urban contexts (see Babac & Belic, 2018; Shaojie *et al.,* 2019; Salleh, 2020; and Fiebrig *et al., 2020*). As urban systems are made up of social, environmental, and economic dimensions, it is deemed appropriate to review the permaculture literature accordingly. Thus, after assessing the titles, abstracts, and field of disciplines of the 46 eligible papers, 31 were selected for the scoping review. The selected literature represents novel research as well as saturated research on the positions of permaculture from social, economic, and environmental perspectives, in the hope that these

permaculture perspectives may shed useful knowledge to inform urban planning initiatives when it comes to urban food systems.

Firstly, as this study has an overarching urban planning perspective, papers conducted from a built environment/spatial focus were immediately selected (3). These included papers from urban planning, architecture, and design fields. Papers that were considered especially significant from the initial selection were those conducted from social and/or environmental perspectives. These included agriculture, biology, ecology, sustainability, sociology, philosophy, anthropology, and cultural study fields (23). Finally, due to their regularity and popularity, the selection could not overlook a third area of focus, namely the business and economic area. This area included the fields of marketing, business management, economics, and education (7). See Figure 4-3 for the search strategy and selection as well as the research methods and foci distribution of the selected literature. Two frameworks were used to structure and conduct the scoping review: Hanc *et al.* (2019) framework for scoping reviews and Arksey and O'Malley's (2005) framework for scoping studies. Arksey and O'Malley's framework was used to guide the selection and analysis of the literature, while Hanc *et al.* (2019) framework was used to identify and analyse the key themes and trends in permaculture literature.

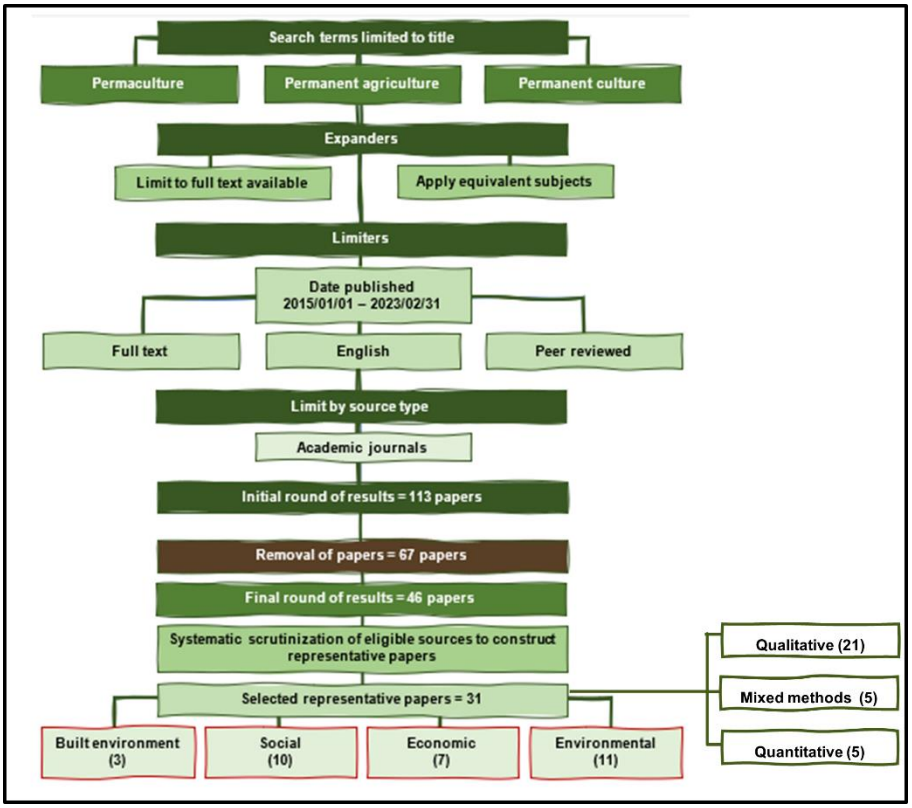
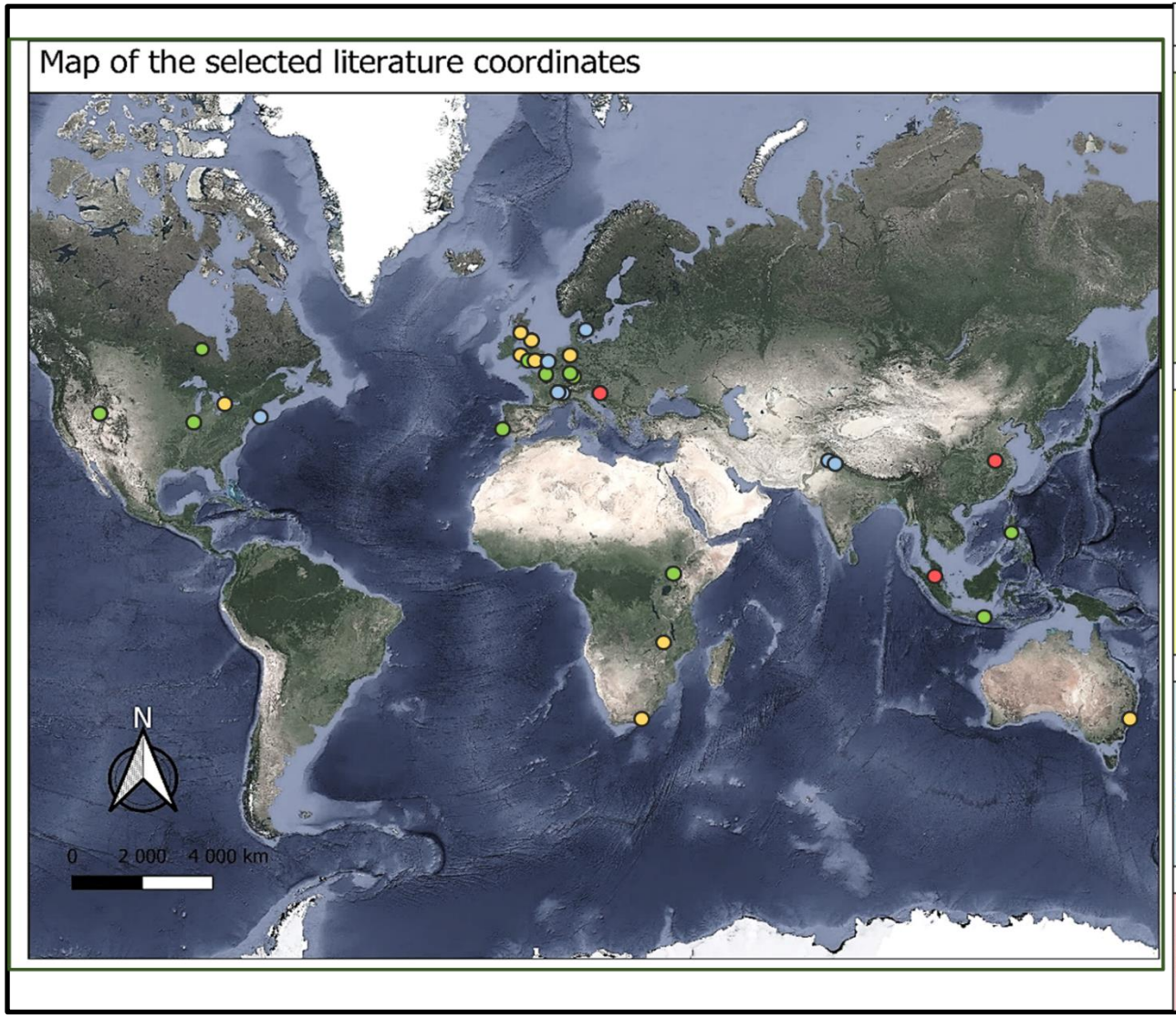


Figure 4-3: Data search and selection process for papers for scoping review and research methods and foci distribution of the selected literature.

Source: Author's own compilation.

4.5 Findings

Figures 2 and 3 illustrate the structural findings of this study, including the locality, perspectives, and research methods used in the selected literature. In Figure 4-3, it is illustrated that 67% of the studies presented in the literature used a qualitative research approach, 16% a quantitative approach, and the remaining 17% a mixed-methods approach. The geographical distribution of the studies conducted is presented in Figure 4-4, with green indicating studies that focus on environmental perspectives, yellow on social perspectives, blue on business and economic perspectives, and red on built-environment perspectives. Figure 4-4 provides a visual overview of the diverse perspectives and approaches used in permaculture scholarship. When examining the perspectives and the distribution of the selected literature, as depicted in Figure 4-4, we can already see how permaculture's multifaceted nature demonstrates its ability to be applied in the wide array of environmental, social, and economic context. Three primary focuses in permaculture emerged from the scoping review: (i) an environmental focus, (ii) a social focus, and (iii) an economic focus. These focuses revolve around key concepts of permaculture that have been investigated in various contexts. The relation between the themes that are identified in the literature and urban planning is considered to address the purpose and research question as provided in the introductory section of this paper.



LEGEND			
	AUTHOR/S	DATE	LOCATION
ENVIRONMENTAL	DE TOMBEUR, F. ET AL	2018	NORMANDY, FRANCE
	FERGUSON, R.S. & LOVELL, S.T.	2017	ILLINOIS, UNITED STATES
	FIEBRIG, I. ET AL	2020	STUTTGART, GERMANY
	FLORES, J.J.M. & BUOT, I.E.	2021	LAGUNA, PHILIPPINES
	GRANT, K.J.H. & YASUE, M.	2017	BUTULA, KENYA
	HIRSCHFELD, S. & VAN ACKER, R.	2019	ONTARIO, CANADA
	KREBS, J. & BACH, S.	2018	LANDAU, GERMANY
	MAYE, D.	2018	GLOUCESTERSHIRE, ENGLAND
	OLIVEIRA, H. & LOPES, G.P.	2020	LISBOA, PORTUGAL
	PUTRO, R.H. & MIYAURA, R.	2020	BALI, INDONESIA
	VON COSSEL, M. ET AL	2020	STUTTGART, GERMANY
SOCIAL	AIKEN, G.T.	2017	DURHAM, UNITED KINGDOM
	DIDARALI, Z. & GAMBIZA, J.	2019	GRAHAMSTOWN, SOUTH AFRICA
	FADAEE, S.	2019	MANCHESTER, UNITED KINGDOM
	FERGUSON, R.S. & LOVELL, S.T.	2015	ILLINOIS, UNITED STATES
	HENFREY, T.W.	2018	BRISTOL, UNITED KINGDOM
	HINTON, R.G.K. ET AL	2021	LILONGWE, MALAWI
	KARIM, M.E.	2018	SOUTH WALES, AUSTRALIA
	MILLNER, N.	2016	BRISTOL, UNITED KINGDOM
	SPANGLER, K. ET AL	2021	LOGAN, UNITED STATES
	ULBRICH, R. & WOSTL, C.P.	2019	OSNABRUCK, GERMANY
BUSINESS & ECONOMICS	AKHTAR, F. ET AL	2015	LAHOE, PAKISTAN
	AKHTAR, F. ET AL	2016	LAHOE, PAKISTAN
	GENUS, A. ET AL	2021	KINGSTON, UNITED KINGDOM
	JELINEK, R.	2017	RHODE ISLAND, UNITED STATES
	LAPOUTTE, A.	2020	LYON, FRANCE
	ROCHA, S.S.R.	2022	AARHUS, DENMARK
	VITARI, C. & DAVID, C.	2016	LYON, FRANCE
BUILT ENVIRONMENT	BABAC, S. & BELIC, D.	2018	ZAGREB, CROATIA
	SALLEH, A.M. ET AL	2018	PERAK, MALAYSIA
	SHAOJIE, Z.	2019	HEFEI ANHUI, CHINA

Figure 4-4: Locality of selected literature.

Source: Author's own compilation.

4.5.1 Main theme 1: An environmental focus

In this paper, an environmental focus refers to the study of ecosystems and their interconnected elements, with permaculture as a key component. Research on permaculture in environmental studies focuses primarily on preserving ecosystems with sustainable food production for future generations. A variety of sustainable food production methods have been explored in the literature, with a focus on papers published between 2015 and 2022. This review has identified four sub-themes within this research area: (i) permaculture as an agroecological system (sub-theme 3.1.1), (ii) permaculture as a tool for land regeneration (sub-theme 3.1.2), (iii) permaculture for commercial agriculture (sub-theme 3.1.3), and (iv) permaculture in landscape design (sub-theme 3.1.4). These sub-themes highlight the various ways in which permaculture can contribute to the preservation and restoration of ecosystems while simultaneously promoting sustainable food production.

4.5.1.1 Sub-theme 1: Permaculture as an agroecological system

Agroecological systems as farming systems aim to integrate ecological principles and biodiversity into agricultural practices (Krebs & Bach, 2018; Oliveira *et al.,* 2022). These systems are focused on creating sustainable, resilient, and productive farms by working with natural processes rather than relying on synthetic inputs e.g., pesticides and fertilisers (Grant & Yasue, 2017). Agroecological systems evolved from the concerns regarding traditional or conventional agricultural practices that can trigger inter alia the loss of biodiversity , monocropping , and/or soil degradation (Grant & Yasue, 2017; Flores & Buot, 2021). According to Grant and Yasue (2017) and Ferguson and Lovell (2017), permaculture can be used to create diversified, resilient agroecosystems that have the potential to enhance rural livelihoods and increase rural people's competence and independence. However, Krebs and Bach (2018) and Hirschfeld and Van Acker (2019) illuminate that permaculture design along with its unique principles has not received the necessary in-depth investigation to guide the design, implementation, and maintenance of agroecological systems, thus leaving a gap for further investigation. Further scientific evidence for permaculture from an environmental perspective is provided by Krebs and Bach (2018), who point to the effectiveness of permaculture as a design approach in strengthening agroecosystems by weighing the implementation of the 12 principles against the intentions of agroecology. One of the most important findings from these studies relates to the fact that permaculture may well contribute to higher crop and species diversity, land heterogeneity, and perennialisation towards agroecological practices (Hirschfeld & Van Acker, 2019; Putro & Miyaura, 2020). Furthermore, permaculture may add to the maintenance and strengthening of ecosystems as found by De Tombeur (2018), emphasising its reutilising characteristics in terms of the soil from permaculture

practices that deliver overall higher physiochemical properties and nutrient bioavailability (organic carbon, nitrogen, calcium, magnesium, potassium, and phosphorus) than that of traditional agriculture (De Tombeur, 2018). This highlights the indispensable ability of permaculture systems to not only maintain existing ecosystems but also regenerate them.

A close link exists in the literature between agroecological systems and food security, as it increases the availability, accessibility, and affordability of nutritious food. This approach can lead to higher yields and lower input costs, making it a more sustainable and cost-effective way to produce food, particularly in resource-constrained areas. Additionally, agroecological systems often prioritise the production of diverse crops and livestock, which can help increase dietary diversity and provide a wider range of essential nutrients. This is particularly important for food security, as malnutrition and hunger are often linked to a lack of dietary diversity (Krebs & Bach, 2018; Hirschfeld & Van Acker, 2021). However, a lack of integration of agroecological systems and permaculture in urban environments is one of the research gaps that emerged from the literature review.

4.5.1.2 Sub-theme 2: Permaculture as an instrument for land regeneration

Due to high quantities of abandoned rural landscapes and agricultural land and soil degradation, Oliviera and Lopes (2020) explored permaculture as a way to revitalise land, as food production is directly dependent on the quality of the soil in which the crops are cultivated. These authors used a socio-ecological inventory to characterise social movements and discovered that young male adults primarily practise grassroots movements like permaculture to revitalise degraded land. They concluded by recognising that permaculture can bring young land stewards to the forefront to recreate livelihoods (Oliviera & Lopes, 2020). Likewise, Von Cossel *et al.*'s (2020) study focused on the application of permaculture as an improved approach for the renaturation of quarries in the temperate zone (regions with moderate annual rainfall, infrequent droughts, moderately warm summers, and moderately cold winters) that are commonly renatured by the planting of indigenous flora that have no further use. In this study, permaculture is considered in quarry renaturation for its ability to improve the soil by producing food, giving the former quarries more valuable ecosystem services following their renaturation (Von Cossel *et al.,* 2020).

Permaculture as a land regeneration instrument is closely linked to food sovereignty, as it can be applied to create sustainable food systems that are resilient to environmental and economic challenges. Furthermore, permaculture principles prioritise the use of natural processes and ecosystem services to produce food, while also regenerating the soil, conserving water, and enhancing biodiversity. The recent studies mentioned here indicate how permaculture can be a

powerful instrument for both land regeneration and food sovereignty, as it prioritises sustainable food production, regenerates the soil and ecosystem, and thus builds resilient and diverse food systems that can adapt to changing conditions.

4.5.1.3 Sub-theme 3: Permaculture as commercial agriculture practice

Commercial agriculture refers to large agricultural enterprises, also known as conventional farming, that produce food on a large scale with the sole purpose of retailing the produce to the industrialised food market. In contrast, permaculture is traditionally a non-commercial rural farming practice (Fiebrig *et al.,* 2020). Fiebrig *et al.* (2020) recognise that permaculture is in dire need of engagement by a wider group of professionals and suggest it to be incorporated into commercial farming to deliver produce for profit whilst earning from its beneficial characteristics. The integration of permaculture into commercial farming practices presents a shift from traditional agriculture to more sustainable and environmentally friendly ways to grow crops and raise livestock. Permaculture can be recognised as a holistic approach to agriculture that emphasises the creation of self-sustaining ecosystems that mimic natural patterns and processes. The outcome of such an approach is an improved health of agricultural land through the reduced need for chemical inputs. Specific benefits of such approaches include creating higher yields, better quality produce, and reduced costs over time. In terms of addressing food insecurity, an integrated approach entails a shift towards more sustainable and regenerative forms of agriculture that prioritise long-term health and productivity over short-term gains.

4.5.1.4 Sub-theme 4: Permaculture for landscape design

Flores and Buot (2021) have explored the structural characteristics and components of permaculture landscapes in the Philippines. They identified six zones (in line with Babac & Belic's study in 2018 which is discussed in section 3.4) that are common across 12 permaculture case study sites. These zones provide a framework for designing more productive and diverse agricultural landscapes in terms of permaculture. Flores and Buot's (2021) permaculture study emphasises the potential of permaculture principles and practices in promoting sustainable agriculture, improving food security, and enhancing ecological resilience, particularly in small-scale farming communities in developing countries. Further to the environmental focus, the study also highlights the importance of incorporating local knowledge and practices into permaculture design to ensure cultural appropriateness and social sustainability.

Despite existing research illustrating the numerous benefits of permaculture from an environmental perspective as discussed in the sub-themes under section 3.1, surprisingly, this approach is not often applied. According to interviews with 150 permaculture enthusiasts in Portugal, not a single permaculturist has been identified as an urban planner (Oliviera & Lopes, 2020) in their regions, even though urban planning is an influential intervention tool for integrating food planning approaches into urban systems. According to Maye (2018), one of the main reasons why permaculture is not fully integrated into a wider variety of disciplines (including urban planning) is that permaculture knowledge struggles to find a footing in agriculture, and this limits the crossing of disciplinary boundaries. Maye (2018) further argues that the limited interaction and intentional separation of the permaculture community from other agricultural philosophies partly explains the isolation of permaculture-agricultural integration, despite both focusing on food production.

4.5.2 Main theme 2: A social focus in permaculture research

A second main theme that has emerged from the literature scoping is the social perspective within permaculture. A social perspective for the purpose of this paper entails institutions, the general functioning of society, and the interactive relationships of different components within society. Several intervention notions have been researched and investigated as means to address social challenges, for example, hunger, poverty, unemployment, and inequality. The permaculture research conducted from a social focus, from 2015-2022, includes sub-themes regarding: (i) permaculture as a social movement (3.2.1), and (ii) permaculture as a social regeneration instrument (3.2.2).

4.5.2.1 Sub-theme 1: Permaculture as a social movement

Permaculture is in its essence a grassroots initiative (a social movement) that is practised from the bottom up by communities and NGOs (Ferguson & Lovell, 2015; Millner, 2016; Henfrey, 2018; Fadaee, 2019). However, unlike most studies, Fadaee's (2019) study illuminates that permaculture as a social movement forms a part of the political society – on that premise, political intervention could directly equip marginalised communities to become more independent and self-sufficient. In most other studies on this stance, authors emphasise that there is a lack of intervention by scientific, political, and professional forces to support permaculture application in social systems and address contemporary global challenges, especially food insecurity (Ferguson & Lovell, 2015; Millner, 2016).

Aiken (2017) suggests that permaculture goes beyond adopting solutions for agricultural and ecological systems – they perceive permaculture as a facilitator of resilient communities and one that balances the interests of social and ecological systems. Ulbrich and Wostl (2019) present a more alternative interpretation of permaculture for social systems by introducing communities of practice (CoP) as an important social learning process. A CoP refers to a network of people who share similar interests, visions, ethics, and knowledge. These networks collaborate by participating in events and distributing expertise and experience to improve, grow, and develop social, cultural, and educational practices (Ulbrich & Wostl, 2019). Furthermore, Ulbrich and Wostl (2009) also noticed that NGOs are more inclined to adopt CoPs in their frameworks in the hope of enticing municipalities and decision-makers to endorse social development strategies. Consequently, these authors consider the permaculture community as a CoP for social innovation through learning opportunities.

4.5.2.2 Sub-theme 2: Permaculture as a social regeneration instrument

Another aspect of permaculture that emerged from literature is its capability to regenerate social systems by addressing social issues such as food insecurity, poverty, violence, and health (Millner, 2016; Karim, 2018; Didarali & Gambiza, 2019). For example, a local study by Didarali and Gambiza (2019) reveals that seasonal droughts posed an ongoing risk to many local farmers and their food production, which was partly the reason for permaculture adoption in Southern Africa. In the same study, permaculture is considered to have benefits for rural livelihoods, including improved nutrition from direct access to fruits and vegetables and the creation of additional work opportunities (Didarali & Gambiza, 2019). According to Millner (2016), political systems that focus solely on the "right to food" may overlook the social and environmental implications of mass food production. On the other hand, Didarali and Gambiza (2019) support the idea that designing agricultural systems with the ecological and social considerations of permaculture can offer solutions to a wide range of social challenges beyond just food insecurity, such as malnutrition. They argue that permaculture's emphasis on sustainability can lead to more equitable and resilient communities while still achieving the same benefits as larger-scale, comparatively costlier food production approaches.

Another example from literature is Karim's (2017) study, which highlights the extreme violence in the Middle East and North Africa region caused by low living standards and underlying social and environmental frustrations among citizens. Hunger, water scarcity, and climate change conflicts often lead to violent outbursts. Karim (2017) proposes that permaculture can be a viable alternative to address these underlying issues that cause violence and unrest in underprivileged societies. By offering long-term food security, social inclusivity, and surplus sales income,

permaculture can help alleviate the root causes of violence and provide sustainable solutions to communities facing these challenges. In this sense, Karim's (2017) study supports the theme of permaculture as a regenerative social tool in literature.

Most of the literature highlights the low adoption of permaculture by small-scale farmers since there is a lack of permaculture training, education, knowledge, and awareness (Didarali & Gambiza, 2019). Awareness and understanding are especially lacking, not only in communities but also NGOs, professional disciplines, and government organisations that are emphasised in the literature. A few studies focused on raising permaculture awareness and improving the understanding of permaculture to improve community resilience through permaculture (Henfrey, 2018; Hinton *et al.,* 2021; Spangler *et al.,* 2021). Spangler *et al.* (2021) observe that the understanding and application of permaculture is extremely broad, and confusing, which often leads to its neglect within scientific communities. Interviews conducted in Spangler's study revealed the participants have varying understandings of permaculture and permaculture design and often confuse the two concepts/use them interchangeably. Permaculture design is considered to be concerned with the physical application of the design principles and recognised as more of a lifestyle approach and a way of thinking (Spangler *et al.,* 2021). They also recognise that permaculture is frequently misunderstood and emphasise the importance of practitioners anchoring permaculture principles to promote its deeper integration into the design of healthy and equitable food systems.

In recent literature, Hinton *et al.* (2021) attest to the lack of permaculture awareness that also restricts its implementation in communities for example to borehole-garden permaculture (BGP), a method of permaculture implementation around public borehole waterpoints with the intent of utilising and filtering stagnant infectious water that accumulates around these points (Rivett *et al.,* 2018). Thus, their study envisions permaculture as a tool to address the health risk posed by these points, by utilising the water to irrigate community food gardens (Hinton *et al.,* 2021). However, only 43% of borehole communities were aware of BGP, and essentially only 2.4% implemented BGP. The study concluded that the reason for low awareness and application rate was social segregation, extreme poverty, limited financing, and lack of permaculture knowledge (Hinton *et al.,* 2021). Hinton *et al.* (2021) suggest that NGOs and government organisations should take greater responsibility in promoting awareness and supporting the application and implementation of permaculture practices in communities in the future. Henfrey (2018) agrees by recommending that permaculture can be a useful transdisciplinary research tool to raise up resilient communities that can thrive independently from industrial food systems. Nevertheless, permaculture and its social benefits are often overlooked or oversimplified as a socioecological

process because of its isolation, limited attention from scientific societies, and low awareness rate (Ulbrich & Wostl, 2019).

Finally, there is a visible need for intervention by professional disciplines, NGOs, and government organisations concerning permaculture. Ferguson and Lovell (2015) notably add that the responsibility of permaculture application and growth also lies with established permaculturists, who should help build institutional capacities and facilitate efficient efforts to raise awareness and promote democracy within social systems. While some attempts have been made to incorporate permaculture into professional and political knowledge, for example, permaculture application as a tool to regenerate social systems (Lapoutte, 2020), various other studies point out the importance of incorporating local knowledge and practices into permaculture design to ensure cultural appropriateness and social sustainability.

4.5.3 Main theme 3: An economic focus in permaculture research

In this study, business and economics have been combined in their approach to permaculture and entail the managing, coordination, and organisation of business strategies as described by Akhtar (2015) and Genus *et al.* (2021). This typically includes business management models, financial management, marketing, and trading strategies, among others. A body of literature has emerged from business and economic perspectives to address economic and management challenges through permaculture approaches as reviewed in the following paragraphs. The sub-themes that have emerged include (i) permaculture in business and market management systems (sub-theme 3.3.1), and (ii) permaculture in economic systems (sub-theme 3.3.2).

4.5.3.1 Sub-theme 1: Permaculture in a business and market management system

Lapoutte (2020) studied the application of the permaculture management model as a tool to regenerate socio-economic enterprises that are under pressure from traditional management models, capitalism, professionalisation, and isomorphism. Lapoutte (2020) concludes that implementing a permaculture perspective to regenerate social economy enterprises seem promising. Akhtar *et al.* (2015) and Akhtar *et al.* (2016) studied permaculture as a tool to design management models to be sustainable from the onset, which they also found promising.

Akhtar *et al.* (2015) and Akhtar *et al.* (2016) explore the integration of ecological sustainability into the business community through applying permaculture thinking. In their first paper, they explored the compatibility between permaculture and strategic management to achieve sustainability (Akhtar *et al.,* 2015). In their research, Akhtar *et al.* (2015) integrated the 12 permaculture

principles with the process of strategic management using a spiral integration tool. They found accordingly that for a management system that looks to integrate social and environmental factors, permaculture indeed supports suitable business management strategies. In their second paper, they explored how permaculture's ethics could assist strategic management agendas in the sustainable management of ecological resources (Akhtar *et al.,* 2016). Recognising that people's lives depend on the productivity of their lands, the researchers developed a management tool that monitors the social, economic, environmental, consumption, success factors, and sustainability of policy implementation to ensure that natural resources are not exploited and to decrease workload (Akhtar *et al.,* 2016).

Vitari and David (2016) also researched the integration of permaculture principles in management models to achieve sustainability and more integrated economic, social, and environmental enterprises. They discovered a lack of in-depth research on the performance and results of permaculture-infused management models and suggested that permaculture as an alternative management model might be ideal for organisations in search of more forward-thinking and sustainable management models (Vitari & David, 2016).

4.5.3.2 Sub-theme 2: Permaculture in an economic system

Genus *et al.* (2021) explores the integration of permaculture with institutional entrepreneurship and its effect on rising permaculture organisations. In the study, 20 interviews were conducted with permaculturists who started their own organisations and had created institutional biographies and portfolios (Genus *et al.,* 2021). In line with the goals of King IV Report on Corporate Governance for South Africa (Institute of Directors in Southern Africa, 2016), their findings indicate the great potential of permaculture thinking to inform sustainable entrepreneurship and restructure business models into models that see beyond only "profit" entrepreneurship (Genus *et al.,* 2021).

Interestingly, Jelinek (2017) states that sales management systems, nowadays, fail to identify and respond to substantial changes and shocks in the economic world and makes the connection that a permaculture perspective within these systems can empower sales organisations to be better able to withstand disturbances and shocks. Rocha (2022) contributes further by revealing that a permaculture approach to economic systems can indeed reveal innovative ways to pursue the consumption of natural resources and food production for capital growth more sustainably. He also states that this sustainable pursuit of natural resources would stimulate sustainable economic degrowth by which communities could rely less on industrialised food systems and

transform food systems to be more sustainable and resilient and not depend on consumer-provider ploys (Rocha, 2022).

4.5.4 Main theme 4: Permaculture from an urban planning and design perspective

To account for the lack of permaculture literature that incorporates urban planning perspectives, this study expanded its scope to include disciplines from the built/spatial environment. The built environment, as defined by Wilson and Piper (2010) and Pickett *et al.* (2013), encompasses all man-made communities, cities, and buildings, including residential areas, shopping centres, office buildings, and people. Relevant disciplines in this field include development management, urban planning, environmental management, architecture, and landscape architecture. Despite this, there remains a dearth of permaculture literature that specifically addresses urban planning, design, or other urban qualities, and as such, relevant papers were analysed and reviewed to determine the extent of permaculture research from a built environment perspective. The only sub-themes that emerged from this theme include (i) permaculture to improve the efficiency of food systems (3.4.1); and (ii) permaculture knowledge to inform urban systems (3.4.2.).

4.5.5 Permaculture to improve the efficiency of food systems

Although permaculture is agricultural by nature, it is not as simple as applying its 12 principles. It should be a tool for designing food systems and dealing with the challenges within these systems that is based on ethical values and principles (Fiebrig *et al.,* 2020). For instance, Babac and Belic's (2018) research was conducted from an agricultural and mechanical engineering perspective, although their research itself directly regards zone planning. Specifically, they designed a layout for a permaculture system to minimise transport distance between the elements of a permaculture system and maximise efficiency. This system was informed by the mathematical formula, the triangular method. With this method, they generated a triangular layout in which, they recommend, all four zones are connected to Zone 0 (living quarters of humans) (Babac & Belic, 2018). This is different from Mollison's concentric circle zoning model (MCZM) of the 1900's (Mollison, 1990). In MCZM, zone 0 has no connection with zones 2, 3, or 4, while in Babac and Belic's method (2018), zone 0 is directly connected to zones 1, 2, 3, and 4. Figure 4-5 illustrates the two zoning models alongside each other.

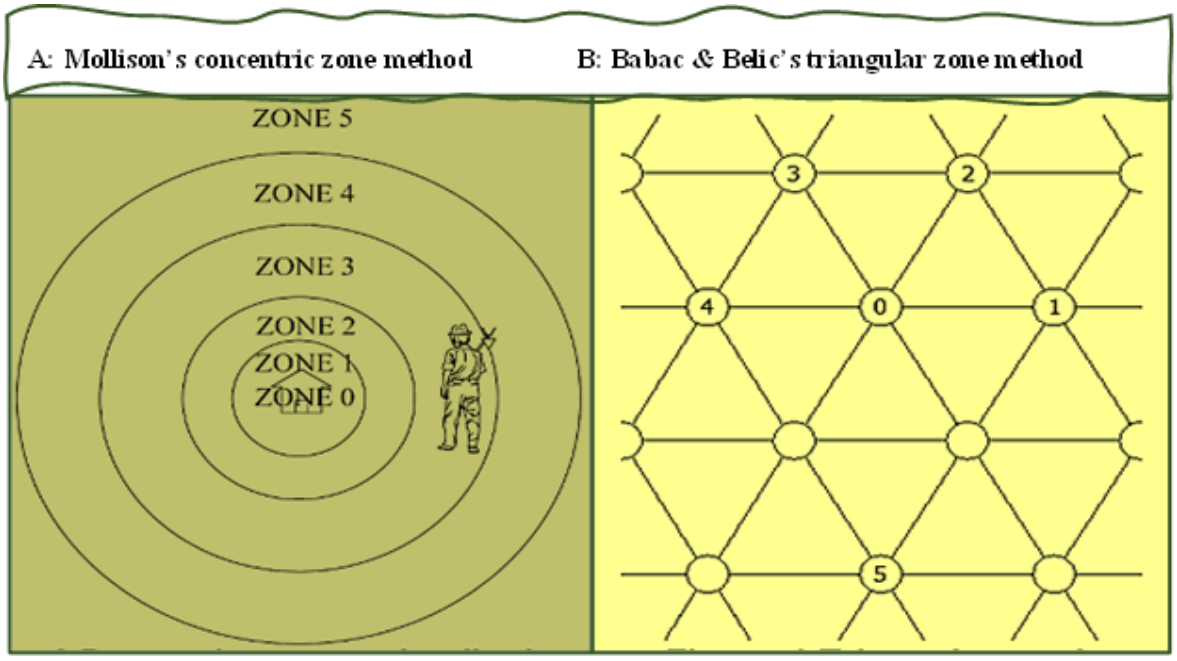


Figure 4-5: (A) Mollisons' concentric zoning model for a PC system.
(B) Babac & Belic's triangular zoning method for a permaculture system.

Source: Mollison (1990); Babac & Belic (2018).

In illustration A of Figure 4-5; Zone 0 represents the living quarters of the humans, Zone 1 represents crops that need frequent attention (a few times a day), Zone 2 includes crops that require often visitation (once a day), Zone 3 represents the main crops that are grown for household use and trade and require fewer visitations by humans (once a week), Zone 4 represents a semi-wild area that requires little human visitations (once a month), and Zone 5 represents wilderness or natural areas that require no human interaction. Ultimately, the triangular method proposed by Babac and Belic (2018) presents a design that minimises the transport distance between the living quarters of people and each of the zones that require visitations. Although their study is still conducted within a rural setting, it could serve as a useful stepping stone for systems-thinking of permaculture within the built environment. At the very least it provides a good example of how the planning of permaculture systems can be explored more deeply. The issue of access as suggested here is highly relevant in the African context and South Africa .

4.5.6 Permaculture knowledge to inform urban systems

Salleh *et al.* (2018) established the importance of local knowledge for designing permaculture systems and explored the impact of local knowledge (livelihoods, culture, and ecology) on permaculture planning and design. Akin to Babac and Belic's (2018) study, Salleh *et al.* (2018) also highlights the permaculture zoning method based on the required interaction between nature

and people. They state further that the success of a permaculture system largely depends on the local knowledge of a person to utilise the system positively or negatively and to apply the principles of permaculture. They establish that a permaculture system should be planned and designed with close consideration and observation of local knowledge and the local ecosystem to find the most suitable pattern and design for the system (Salleh *et al.,* 2018).

Conducted from the built environment, architecture, and planning fields, Shaojie *et al.* (2019) study explored permaculture design on primary school campuses to educate youngsters about the natural environment by engaging them directly in such an environment. Through this engagement, children have been encouraged to participate in various activities while learning the importance and functioning of natural systems. Another driver behind this research theme could be translated to the need for an interconnected system in teaching. Here, they highlight that outdoor campus space has the potential to be integrated with indoor classroom teaching to broaden the teaching experience and learning abilities of children, all while providing the school with food (Shaojie *et al.,* 2019). In contrast to Babac and Belic's (2018) study, the study by Shaojie *et al.* (2019) takes another step closer to viewing permaculture as a food-growing practice within an urban setting and highlights the important potential of permaculture in an urban setting (food provisioning, learning landscapes, livelihoods, culture, and ecology).

Although the existing body of literature on permaculture from physical design and built environment perspectives is quite valuable, it has not been researched extensively enough to be duly considered and applied in the built environment as a tool to address urban food insecurity. With its brief presence in the built environment and spatial fields, permaculture research lacks the foundation needed for it to be utilised to its full extent in urban systems. Currently, the potential of permaculture research has been acknowledged marginally in spatial fields; however, it is too lacking in deep-rooted research and practical exploration of its position in urban systems for it to effectively address challenges regarding urban food insecurity and access to food. However, despite the limited presence in academic scholarship, practical examples (specifically on the African continent) where permaculture has been implemented successfully to address hunger do exist. Two primary examples are the food forests in Malawi (Moorsom, 2015) and the Food and Trees for Africa educational programme in South Africa (Food & Trees for Africa, 2023). A third example is the Chikukwa Project in Zimbabwe (Leahy, 2013).

4.6 Discussion

This scoping literature suggests that permaculture has significant potential in the key components of sustainability namely the social, environmental, and economic dimensions. However limited reference is made to the integration of permaculture in planning and design interventions, especially in urban contexts and how food systems can be included. The next section will synthesise the data and findings generated from this study to make recommendations for using permaculture to inform urban planning and design initiatives with special reference to urban food systems. A reflection is done on the themes, benefits, and limitations in the literature in relation to the integration of permaculture into urban systems.

Across all three dimensions – namely, the social, environmental, and economic realms – permaculture is examined as interacting elements of a design methodology aimed at rejuvenating deteriorated systems, whether they are environmentally compromised, socially impaired, or economically unproductive. (Grant & Yasue, 2017; Ferguson & Lovell, 2017). This is done in contrast with other research on permaculture, where these three components are mainly treated in isolation from one another and thus lack the holistic integration that is necessary to function as an integrated sustainable permaculture system. In the planning for urban systems, it is essential to consider the social, environmental, and economic dimensions of urban systems as functional and whole environments for people to live in, while the purpose of a permaculture system is to provide food and ecosystem services to its components. This scoping review found that the primary themes (environmental, social, and economic perspectives) have featured strongly in permaculture scholarship in the past eight years. The evidence suggests that the benefits of permaculture reach far beyond mere food provisioning (see Table 4-1 for a summary of these benefits). Two main aspects are noteworthy regarding permaculture literature across the main themes. First, the potential of permaculture to become an instrument for regeneration in various systems, including food systems; second, the flexibility of permaculture to be applied in different systems across various geographical contexts and on different scales while providing abundantly within the three components (environmental, social, and economic). These two characteristics will be elaborated upon in the next section with specific reference to the potential to inform urban planning of food systems, especially for contexts where high urbanisation prevails, where urban land is available, and where food insecurity remains a primary challenge.

Table 4-1: Value added by permaculture in all the dimensions.

	Value added through permaculture	Limitations of permaculture
Environmental	Ability to renature degraded land	Lack of engagement by professionals (urban planning)
	Broaden competence and autonomy	
	Regenerate soil health	
	Higher biodiversity	Lack of awareness in mainstream agricultural knowledge systems
	Provides ecosystem services	
	Produce food	
Socio-ecological	Recreate rural livelihoods	Lack of implementation in urban communities
	Improve rural livelihoods	
	Soil health - Composting - Recycling	Lack of intervention by professional forces
Social	Infuses transition for resilient community design	Lack of training and education
	Social learning process	
	Addressing social issues (poverty, violence, food insecurity, health, malnutrition, water scarcity)	
Socio-economic	Provide work opportunities	Lack of awareness and understanding in communities
	Generates income through surplus sales	
	Regeneration of socio-economic enterprises	
Business and economic	Tool for designing sustainable management models	
	Monitoring social, economic, environmental consumption (resource)	Lack of scientific research for integration
	Forward-thinking management models	
	Regenerate business models to see beyond profit entrepreneurship	
	More resilient and sustainable sales organisations	

Source: Author's compilation from findings.

4.7 Main conclusions

4.7.1 Permaculture as an instrument for regenerative urban systems

As a tool for regenerative food systems, permaculture represents a comprehensive and regenerative method of food production that is in line with the ideas of system regeneration and resilience. The idea of permaculture is to build self-sustaining and regenerative ecosystems by modelling food-growing systems after natural patterns and processes. Permaculture promotes soil health, biodiversity, and ecosystem services, all of which are essential for the renewal of food systems (see section 3.1.2). Furthermore, permaculture methods endorse minimal soil disturbance, integrated cropping, agroforestry, and the utilisation of organic matter, all being key factors in food production. Also, permaculture principles encourage waste reduction, effective resource use, and a thorough grasp of ecological relationships, which help produce food that is more resilient and sustainable (see section 3.1.2).

In the context of urban environments, permaculture principles may well inform the design of productive and resilient urban food systems. Permaculture is emerging as a powerful tool to not only solve these concerns but also to actively regenerate food systems and promote long-term food security as the global food system faces increasing difficulties connected with urban growth. It is argued that due to the provision of fresh, locally sourced food, permaculture may potentially restore urban ecosystems and improve urban resilience by incorporating it as a regenerative and adaptable food-producing system. Permaculture design places a strong emphasis on resource management through techniques such as composting and rainwater harvesting, making it a useful tool for closing urban resource cycles (see section 3.2.2). Permaculture promotes social cohesiveness and equips urban dwellers to take an active role in the development and regeneration of their local food systems through its emphasis on community participation and education (see section 3.4.2).

Although mostly studied in rural contexts, the characteristics of a permaculture system may potentially offer creative and sustainable approaches to developing regenerative urban food systems that are ecologically sound, socially inclusive, and economically viable in a time when urbanisation and food insecurity are serious issues.

4.7.2 Permaculture as urban planning instrument in regenerative urban systems – potential connections

A few characteristics of permaculture provide potential connections between urban planning and permaculture food systems:

(i) Permaculture as an integrated design philosophy:

Permaculture encourages the use of an integrated design approach in the development of food systems. It emphasises the peaceful cohabitation of people and nature and promotes the deliberate planning of space (although mostly referred to in rural contexts) that takes food production, green space, water management, and waste minimisation into account (Oliviera & Lopes, 2020; Von Cossel *et al.,* 2020; Flores & Buot, 2021). To design more sustainable and regenerative urban landscapes, urban planners might use permaculture concepts.

(ii) Local food production:

Permaculture promotes the practice of local farming on various scales (Fiebrig *et al.,* 2020; Flores & Buot, 2021). This may include food production in larger community gardens, smaller domestic gardens, school gardens, and even regenerating degraded urban spaces with the benefit of food production (Von Cossel *et al.,* 2020; Hinton *et al.,* 2021). These smaller-scale food systems can be incorporated by urban designers to boost regional food production, cut down on food miles, and improve urban dwellers' access to wholesome food.

(iii) Biodiversity and ecosystem services:

Permaculture places a high priority on biodiversity and the development of ecosystems that offer a variety of functions and services (Oliviera & Lopes, 2020; Von Cossel *et al.,* 2020). If permaculture can be incorporated into urban planning (e.g., parks, green roofs, underutilised space between buildings, and urban forests), it can provide food, promote biodiversity, deliver ecosystem services, enhance the quality of the air and water, and lessen the impact of the urban heat island.

(iv) Resource efficiency:

Resource efficiency and waste minimisation are stressed in permaculture concepts. Cities can be planned by urban planners to decrease resource usage and encourage techniques such as composting, recycling greywater, and rainwater gathering (Rivett *et al.,* 2018). These techniques not only lessen the environmental impact of cities but also support resilient urban food systems.

(v) Community engagement:

Permaculture fosters community engagement, community empowerment, and participatory decision-making, which can be valuable in urban planning processes (Fadaee, 2019; Henfrey; 2018). Engaging residents in the design and management of urban food systems and green spaces enhances social cohesion and empowers communities to take ownership of their urban environments.

(vi) Resilience:

Improving urban resilience is a goal shared by permaculture and urban planning and design. Cities can become more resistant to the problems posed by climate change, resource scarcity, and food insecurity by incorporating permaculture concepts into urban development. In summary, although permaculture is not necessarily propagated here as a panacea to address food insecurity in highly and complex urbanised contexts (e.g., sub-Saharan cities), it does seem to offer a valuable point of departure where resource efficiency, community involvement, and sustainable food production may well be incorporated into urban food systems. Urban planners may help create regenerative urban food systems that improve the quality of life for city dwellers while tackling urgent environmental and social issues by taking permaculture concepts into account.

4.7.3 Challenges for permaculture in urban contexts

Firstly, permaculture is often misunderstood in communities and professions mainly due to unfamiliarity and misinterpretation. One of the main reasons for the absence of permaculture in urban communities, scientific research, and professional disciplines is its connotation with rural practices and the lack of awareness regarding its capabilities to provide food and address other social issues within urban systems. South African towns are less densely populated in comparison to many other towns and cities in developing countries and offer ample underutilised open spaces (Smith, 2005). In some townships , for example, The Masicendane Community Allotment Garden in Gugulethu and The Siyazama Community Garden in Khayelitsha, both in the Western Cape, open spaces have been transformed into community vegetable gardens, and although these spaces do not conform to permaculture principles, they have the potential to do so (see van der Walt, 2020 & The Farm and Garden National Trust, 2009).

Secondly, a common misconception that hinders the adoption of permaculture in urban environments is the belief that a significant amount of land is necessary for its implementation. Contrary to this notion, the earlier reference to Holmgren's original permaculture design principles, especially principle 9, emphasises "small and slow solutions," indicating that permaculture can be applied effectively regardless of land size. Permaculture is adaptable in terms of its scale and extent, making it suitable for a range of urban settings, from high-rise apartments and residential gardens to open spaces between buildings and community gardens. Its application is diverse, involving private individuals, local authorities, and communities. Holmgren (2002) also clarifies that while the productivity and yield of a permaculture system may depend on its size, it is not restricted by it, as long as it is proportionate to the needs of its consumers. A third challenge relates to the view of permaculture as a labour-intensive practice that requires constant human

intervention, especially during its early stages (Babac & Belic, 2018). This reveals a possible restriction to its application by urban planning as it would require a great deal of time from the involved persons or immediate community to actively maintain, care for, and manage the permaculture system for it to essentially 'bear fruit'. Finally, a challenge that specifically relates to the application of permaculture within urban planning initiatives is the extent to which planning policies, frameworks, and legislation endorse land use types that support permaculture practices or earmark specific areas in cities for urban food systems.

4.8 Synthesis, summarisation, and conclusion

The research in this paper stems from the call by the United Nations to end world hunger by 2030 (SDG 2) and the need to address food insecurity, which is a prevailing issue globally, especially in highly complex and urbanised sub-Saharan African countries. Permaculture, an integrative design system that mimics the patterns and processes found in natural ecosystems and requires minimal intervention by people, has the potential to establish food-producing ecosystems that, among other benefits, provide food sustainably. However, while permaculture has been researched from different disciplinary perspectives across a variety of global contexts, the focus is mostly on rural areas and limited research focuses on the African continent, where urbanisation rates are extremely high. Subsequently, urban planning perspectives and the prospects for integrating permaculture in the sustainable planning of cities and communities (SDG 11) remain a gap in permaculture research, especially relating to the potential of permaculture as an integrated food system to address food insecurity in urban communities. In this paper, a scoping literature review of permaculture was presented with the aim of considering the extent to which permaculture has been addressed in scholarship, taking cognisance of food insecurity and how permaculture can inform urban planning initiatives focused on food production in urban systems. It has been clear through the COVID-19 pandemic that generally our current food systems are too far from the point of consumption to be reliable in a crisis (Battersby & Watson, 2019; Fuseini & Sichone, 2019; Onyeaka *et al.,* 2022). This begs the question: to what extent can cities and their hinterlands produce more of the food for urban consumption, and how can these be incorporated in the planning/design of cities? The scoping review presented here is argued to be a small step in the right direction of reconsidering how we plan for food sovereignty in sub-Saharan African cities and how planners may contribute to the ongoing global discussions on hunger.

Evidence from the scoping review strongly suggests that permaculture is a flexible system that promises excellent prospects to be utilised as a sustainable regenerative food system. It is argued here that these prospects may well be useful to consider for urban environments. The three

dimensions of sustainability, namely, the environmental focus, social focus, and economic focus, have emerged as main themes from the scoping review with links to food systems and possibilities to utilise it as an integrated food production tool (see Table 4-1). It is recommended here that the prospects of permaculture to act as a regenerative and sustainable food system should be considered in areas (i) that need less sophisticated food systems (e.g., vertical gardens, aquaponics etc.) (ii) that require little maintenance (iii) with high population growth, and (iv) where a flexible, adaptable system (in terms of size and scale) may respond well to rapid changing urban environments such as cities of sub-Saharan Africa where food is not readily accessible and where resources (knowledge, skills, finances etc.) are low. Despite these prospects to create integrated sustainable regenerative urban food systems in the hope of achieving more sustainable inclusive cities and communities in African/sub-Saharan African cities, it is not offered as a panacea for food insecurity on the African continent. The success and contribution of permaculture in sub-Saharan Africa to address food insecurity are still questionable, and the extent of integration in the planning/design of cities has not yet featured strongly in academic scholarship. For these prospects to be realised, research should consider how urban environments are planned/designed and integrated on policy and legislative levels with respect to permaculture.

Better awareness and understanding of permaculture and its role in urban food systems to address food insecurity is necessary if planners want to tap into the potential benefits of permaculture to create sustainable cities and communities. This requires planners to move beyond the consideration of traditional and sophisticated food systems in the planning of cities in sub-Saharan Africa and look for ways to incorporate permaculture in existing urban spaces.

The authors acknowledge that the selection criterion used in a scoping review may inadvertently skew the scope of the review towards Western-centric perspectives and academic publishing norms, potentially omitting important knowledge and experiences from diverse cultural and linguistic contexts in the global permaculture community. To mitigate this bias, future literature studies such as integrative or systematic literature reviews of permaculture scholarship should consider incorporating a more comprehensive and inclusive approach where diverse sources and languages are considered.

According to the scoping review discussed in this paper, permaculture is significant from an environmental, social, and economic standpoint. It can also be modified to be a beneficial tool for supplying a sustainable, regenerative urban food system. The many benefits of permaculture have been underlined in promoting sustainable food production, enhancing community resilience, and assisting in a more comprehensive approach that might influence attitudes on urban development.

Given the complexity of the urban food landscape, the findings indicate the need for additional study from an urban planning viewpoint to combat the Hunger Games that urban populations face in sub-Saharan countries/cities.

PAPER 2: CULTIVATING EDIBLE CITIES: LESSONS FOR URBAN PLANNERS FROM PERMACULTURE CASE STUDIES IN SOUTH AFRICA.

4.9 Introduction and background

The future of African cities is facing a pressing challenge in addressing hunger and food insecurity (Cabannes & Marocchino, 2018:3; Vasyviela & James, 2021:77). The impact of the COVID-19 pandemic has intensified this challenge, with the number of Africans affected by food insecurity surging by over 60% (UN ECA, 2022:30; Gambe *et al.*, 2023:2). Vulnerable communities, especially in the African context, are the most affected by these issues of poverty and hunger globally (Ashley, 2016:32–34; Crush *et al.*, 2020; Cilliers *et al.*, 2020:4). Further to this, it is widely recognised that hunger often stems from poverty, peri-urban living, drought, poor governance, and food system planning issues (Crush and Battersby, 2006:9; Ashley, 2016:39; Gambe *et al.*, 2023:2). South Africa is no exception when it comes to challenges related to poverty, hunger, and high urbanisation rates (Smith, 1992:18; Haysom, 2020:7; van der Berg *et al.*, 2022:2). The General Household Survey of 2021 revealed that nearly 12% of the South African population experiences hunger, and 21% lacks adequate access to food, with urban areas being disproportionately affected as 66% of people living in urban areas do not have proper access to food (StatsSA, 2023). This alarming situation necessitates a continuous effort to combat hunger and food insecurity across the African continent, including South African cities (Wesselouw & Mashele, 2019; Siebert, 2020; Steenkamp *et al.*, 2021). As one of the 193 member states of the United Nations, South Africa is bound by the responsibility to work towards achieving the 17 SDGs by 2030 (see Figure 4-6). The United Nations, through the Sustainable Development Agenda established in 2015, outlines these goals, with a specific focus on SDGs 2 (ending hunger) and 11 (creating sustainable cities and communities). This study aligns with the objectives of SDGs 2 and 11, emphasising the urgent need to address hunger and create sustainable urban environments in South Africa and beyond. The research question that guides this study is: How can best practices of permaculture in South Africa inform future food-sensitive planning in South African cities? It is believed that an increase in agricultural food production in South Africa may well improve food availability in this context and consequently reduce the level of food insecurity (StatsSA, 2022:17). Agricultural food production practices manifest in various forms and may include, inter alia, vegetable gardens (Joubert, 2009), urban agriculture (van Wijkvliet, 2022), and green infrastructure (Living Green Walls). However, these initiatives are mostly applied to private land for personal use and by private companies and do not necessarily aim to address urban food insecurity on a broader scale (Rogerson, 2010:378).



Figure 4-6: The 17 SDGs as outlined in the sustainable development agenda.

Source: UN Nations, 2015

In seeking answers to address the challenge of food insecurity, a wide variety of research studies from different contexts and disciplines using different research approaches (Noll and Murdock, 2020:2; Janse van Rensburg and Puren, 2023:4) have been conducted in different spatial contexts. Recent examples include Yuan *et al.*'s (2022) study on NBS[2] in urban areas, Choudhary and Rawat's (2021) study on rooftop gardening, and Goddek *et al.*'s (2015) study on commercial aquaponics in urban contexts. While progress has been made in researching food systems from a planning perspective, e.g., urban agriculture (Steenkamp *et al.*, 2021), urban gardening networks (Wesselouw & Mashele, 2019), and transforming local food systems through transforming vacant land in townships (Mkhize *et al.*, 2023), authors agree that planning has not effectively integrated people and nature into city planning (Cilliers & Cilliers, 2016:23; Haysom *et al.*, 2020:5; Mui *et al.*, 2021). While the planning of cities plays a significant role in addressing socio-economic challenges including, inter alia, poverty, spatial disparities, and homelessness, this study is particularly focused on integrating sustainable food systems to address food insecurity, an area that has not yet received much attention from urban planning (Cabannes & Marocchino, 2018:6; Haysom *et al.*, 2020:10). This paper examines permaculture as a tool for sustainable food systems, aiming to transform urban areas fighting hunger into the thriving edible cities of tomorrow.

[2] *Nature-based solutions (NBS) are widely regarded as an overarching concept where systems are planned for people and nature to exist in mutual synchronisation and with a symbiotic relationship (Russo and Cirella, 2017:53; Yuan et al., 2022:1). NBS implies the incorporation of green infrastructure into urban systems to reap the benefits and services of natural systems, for example temperature regulation, water treatment, flood prevention, renewable energy, etc., (Kabish, 2017:2). Nature-based solutions serves as a canopy notion for initiatives like green roofs, green walls, constructed wetlands, urban agriculture, and permaculture.*

Permaculture is a practice that is widely recognised as a realistic and potentially successful approach to tackling the urban food challenge. However, permaculture is not well recognised in scholarship (Kruger, 2015:545; Salleh *et al.*, 2018:4; Fiebrig *et al.*, 2020:381; Janse van Rensburg and Puren, 2023:15), and even less so from a planning perspective. This study calls for a shift towards a focus on food-sensitive planning (FSP) in urban contexts in Africa, with special reference to South African cities. FSP is an approach to planning that links issues of food insecurity with infrastructure, urban systems, and governance to create sustainable, resilient, and regenerative systems (Haysom, 2021:290). The purpose of this paper is to reflect on existing successful permaculture practices in South Africa and draw lessons from best practices in food-sensitive urban planning for cultivating future South African cities. The question that guided this paper include: (i) "How can best practices of permaculture in South Africa inform future food-sensitive planning for South African cities?"

The paper is structured as follows: Firstly, a brief introduction to permaculture is provided, followed by how the theory of permaculture has developed over the past four decades, and concluded by a brief overview of permaculture research in Africa. Secondly, the methodology is explained, including the design and how the data was generated and analysed. Thirdly, the individual cases are analysed individually, followed by a cross-case analysis. Finally, the findings and discussion highlight the challenges of permaculture and lessons for urban planners on how permaculture can be utilised as a sustainable urban food system in order to address hunger.

4.10 The origin of permaculture theory

Permaculture is derived from the term “permanent agriculture” (Mollison & Holmgren, 1990). It was developed as a universally applicable, low-energy, high-yielding agricultural, self-regulating model to grow food (Holmgren, 2002:7, 73). The initial vision of permaculture was to provide a solution for urban and rural populations in poor countries to achieve greater self-reliance (Holmgren, 2002:7). Bill Mollison and David Holmgren developed permaculture in 1978 as an integrated and dynamic agricultural system that draws inspiration from existing ecosystems. Their goal was to present a holistic agricultural approach aimed at improving agricultural practices by addressing the shortcomings of energy-intensive and mechanistic agricultural practices that led to rapid land degradation, deforestation, and the exploitation of people (Mollison & Holmgren, 1990:1). The permaculture model is guided by three ethical considerations and based on 12 principles that mimic activities and relationships that occur in natural ecosystems, derived from complex systems thinking (Mollison, 1979; Philips, 2013:68). The 12 principles and 3 ethics are portrayed in Figure 4-7. While the principles and ethics provide a framework to develop a thriving

permaculture system, permaculture is not achieved simply by growing fruit and vegetables but rather through a time-consuming and demanding process that requires individuals to acquire knowledge and experience of multiple aspects of permaculture design.

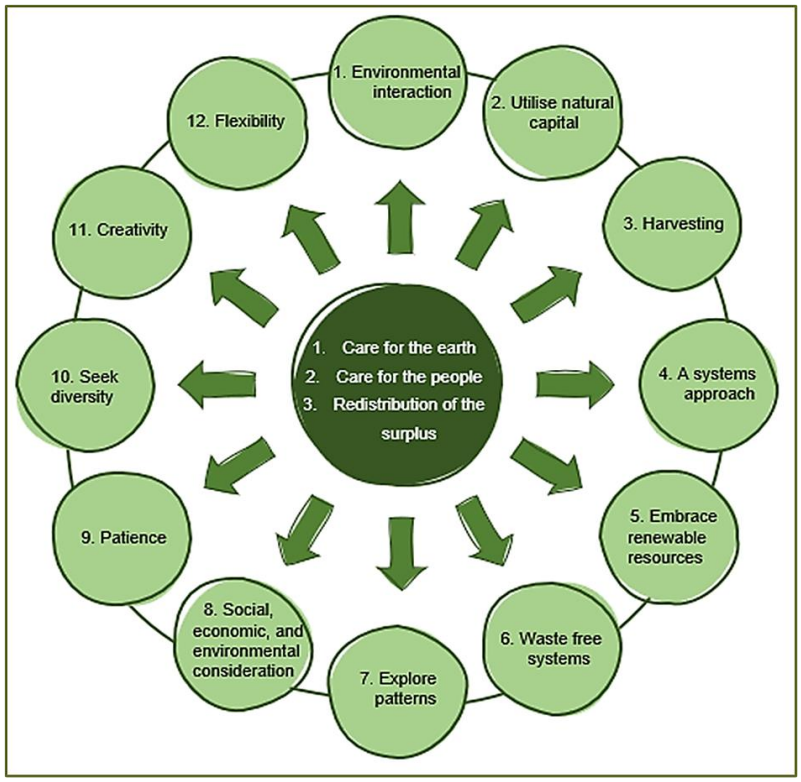


Figure 4-7: Permaculture ethics and principles.

Source: Author's compilation from (Mollison & Holmgren, 1990).

Permaculture is a system design approach that mimics natural ecosystems to create liveable environments for people. Mollison's concentric zoning model (MCZM) provides a framework for designing permaculture systems where the zones are classified according to the level of human interaction they require. In Mollison's model, the zones are consecutively distributed outward from Zone 0 to Zone 5. Zone 0 represents the living quarters, kitchen, and main pantry. Zone 1 includes non-perennial herbs and edible plants that require frequent daily visitations and regular interaction. Zone 2 includes edible plants that require visitation at least once a day. Zone 3 is where larger crops that require less (weekly) visitation and that are often used where commercial production occurs occur. Zone 4 represents semi-wilderness that barely requires any human interaction and is often where grazing takes place, and Zone 5 represents wilderness that does not require any human intervention.

In Mollison's (1998) zoning model, each zone represents a further layer of a permaculture system as depicted in Figure 4-8.

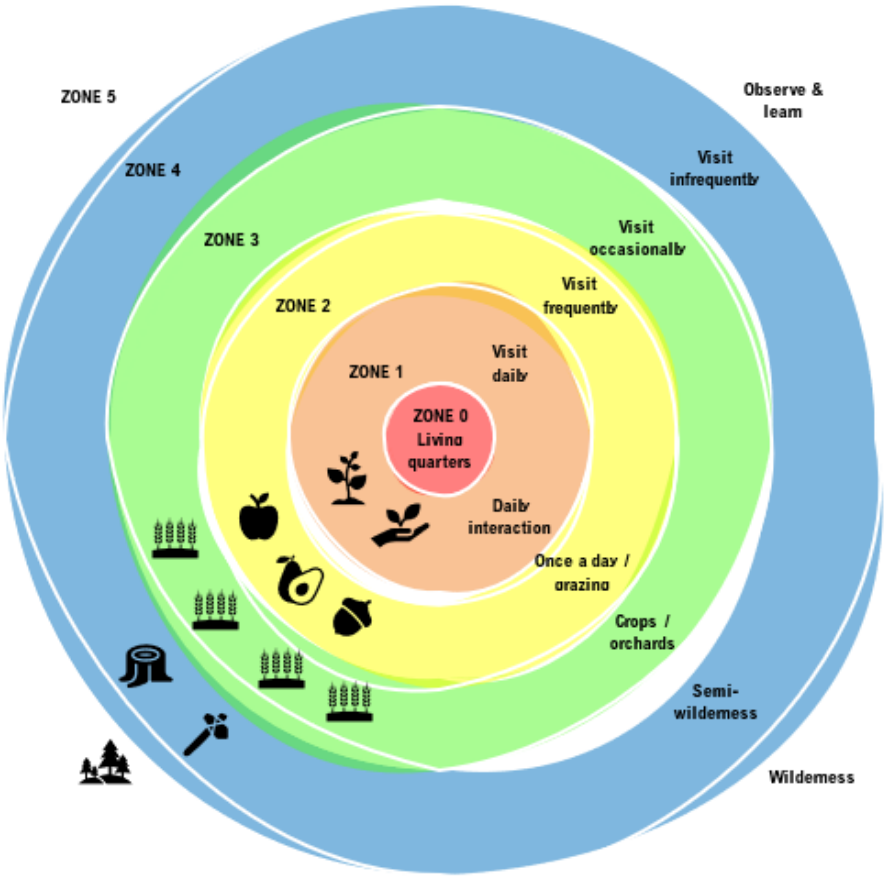


Figure 4-8: Mollison's concentric zoning model (MCZM) for permaculture.

Source: Author's own compilation from Mollison (1990).

The evolution of permaculture into a complex, multifaceted system is discussed in the subsequent section.

4.10.1 Evolution of permaculture over four decades

Permaculture theory has evolved over four decades from an alternative agricultural ecosystem to a social design system and an ongoing ecological and cultural process.

4.10.1.1 First phase: Permaculture as agricultural ecosystem (1978-1990's)

Mollison defined permaculture in 1978 as an integrated agricultural ecosystem centred around perennial or self-sustaining plant and animal species. Permaculture was characterised by labour-intensive practices, with an emphasis on observation and control rather than conventional agricultural activities such as ploughing (Mollison and Holmgren, 1990:9). Its definition was based on the principles of sustainability, resilience, and regeneration and emphasised a broader

movement aimed at promoting independence and social empowerment (Mollison and Holmgren, 1990:8, 94). Building on this foundation, Kennedy (1991:210) elaborated on it in the 1990s by describing permaculture as a way of thinking about the future as one of abundance — a planning system for cultivating productive, diverse agriculture, sustainable cities, and architecture that is critical to maintaining a stable life on the planet.

4.10.1.2 Second phase: Permaculture as a design system (2000-2010)

Holmgren expanded the original definition of permaculture in 2002 by emphasising permaculture as a design system that goes beyond regenerative land use types to include a more overall sustainable way of life. A system, as defined by systems theory, involves intricate relationships and interactions among components, emphasising their interdependence and integral role in overall functionality (Teater, 2014:16). Rooted in General Systems Theory (GST), this framework categorises systems into open and closed systems. Closed systems function in isolation, maintaining consistent operation regardless of external events (Von Bertalanffy, 1968:39). In contrast, open systems exhibit continuous interaction with their surroundings, contributing to self-maintenance (Carmichael, 2019:244; Batty *et al.*, 2019:25). Systems can be further classified as simple or complex (Bak, 1996), with simple systems characterised by minimal variation and high uniformity (Bak, 1996:80), and complex systems featuring dynamic components with strong interactions (Bak, 1996:19). In the planning and built environment disciplines, urban systems are recognised as complex adaptive systems (Ilmola, 2016:209). Systems thinking enables the identification of valuable components, facilitating problem recognition and intervention opportunities across disciplines (Mang & Reed, 2012:5; Lai & Line, 2017:2). Scholars like Hu (2002:39) and Batty *et al.* (2019:25) highlight the co-dependent nature of man-made and natural systems, supporting arguments for permaculture—a seamless integration of people and the environment.

A design system in permaculture entails purposefully creating ecosystems, landscapes, and human landscapes with the resilience and diversity of natural ecosystems in mind. The objective is to establish a peaceful and fruitful environment that satisfies the requirements of the local ecosystem and people. In this context, a permaculture system falls within the realm of complex systems, intricately designed to account for all components and their interactions, as well as their responses to external disturbances (Teater, 2014:16). This stands in contrast to a simple system, which is isolated from external components and characterised by fewer integrated internal interactions (Bak, 1996; Ilmola, 2016:209; Mang & Reed, 2012:5; Lai & Line, 2017:2). Moreover, the permaculture system aligns more closely with an open system, considering external effects, as opposed to a closed system that operates in isolation from external influences (Von Bertalanffy,

1968:39; Carmichael, 2019:244; Batty *et al.*, 2019:25). This shift in permaculture emphasised values, vision, a holistic understanding, and the management of natural resource systems for the well-being of present and future generations. Permaculture has been presented as a creative response to a world faced with diminishing energy and resource availability, forming a global network working on design solutions for future challenges (Holmgren, 2002:2, 69, 203).

In the following years, scholars, e.g., Whitefield (2009), continued to define permaculture as a design system that focuses on looking at the whole, understanding connections between different parts, and making useful connections within a system. The emphasis has remained on working with what is existing, preserving the best, improving existing systems, and introducing new elements. Permaculture continued to be emphasised as a sustainable practice that involves working with the land and careful observation to meet the needs of both the land and people.

4.10.1.3 Third phase: Towards a focus on collective and social design (2010 – 2019)

About a decade later, permaculture has evolved into an integrated vision that underscores collectives, the integration of nature, and connections, with a focus on social design modelled after nature's patterns. In this refined understanding, permaculture emerges not solely as an agricultural practice but also as a versatile design tool for navigating complex systems and shaping a sustainable society guided by ethical values (Aiken, 2017:178, 182). Social design within permaculture advocates for ecologically responsive design and the utilisation of renewable resources to fulfil basic human needs (Kruger, 2015:552). Rejecting top-down imposition, this phase of permaculture encourages active individual contributions to communities, fostering self-awareness and self-sufficiency. Rooted in the recognition of patterns in nature, this understanding of permaculture originates from a vision of individuality within a system of interactions and individual development in service to humanity, embodying resilience (Akhtar *et al.*, 2015:797). This evolved perspective collectively positions permaculture as a holistic and adaptive approach to societal development (Akhtar *et al.*, 2015:797).

4.10.1.4 Fourth phase: Permaculture as an ongoing ecological and cultural process (2020 onwards)

Permaculture, as described in a study by Spangler *et al.* (2021), is characterised as a "systems-level thinking," emphasising a comprehensive approach that extends beyond food growing practices. It entails an ongoing ecological and cultural process, involving dynamic decision-making and problem-solving protocols rather than rigid rules. Permaculture serves as a world view that advocates for and constructs synergistic effects on human well-being and ecosystem

health, incorporating moral and ethical elements (Rocha, 2022:17). It thrives in self-organised networks and bottom-up movements across various boundaries, emphasising a transformative shift in values and worldview (Rocha, 2022:9, 17; Fiebrig *et al.*, 2020:391). Inspired by the innate human desire for an environment reminiscent of paradisiacal ideals, permaculture reflects a holistic approach rooted in our inherited inclination towards a biodiverse and natural setting (Fiebrig *et al.*, 2020; Spangler *et al.,* 2021; Rocha, 2022). It is argued here that this way of thinking about permaculture holds significant value for addressing the SDGs 2 and 11.

4.10.1.5 Synthesis of four decades of permaculture theory

Permaculture theory evolved through various stages of development since its inception in the 1970's. This evolution is captured in Figure 4-9.

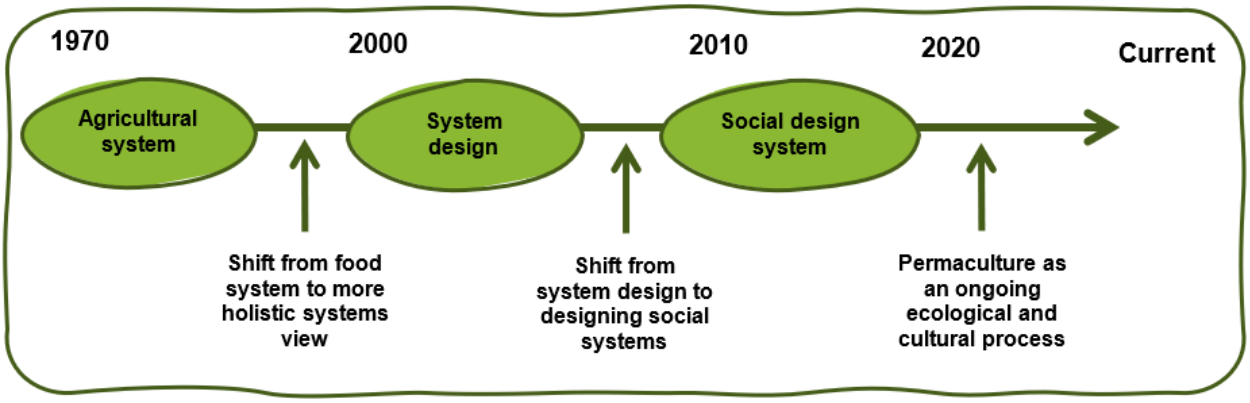


Figure 4-9: The evolution of permaculture theory.

Source: Author's own compilation.

In summary, a few shifts in thinking are notable. First, the inclusion of people as part of a permaculture system is evident in scholarship development. While people have always played an important role in permaculture thinking, the focus on their importance has increased. Second, but complementary to the focus on people, permaculture has transitioned from a farming method to a broader, adaptable approach where ecological and cultural practices merge with the spatial design of the system. Third, although permaculture was meant to be a flexible system from the onset, the emphasis on its adaptability to be considered in a variety of different socio-cultural and geographical contexts is important when planning for a more sustainable, resilient, and regenerative urban future. It is exactly this advantage that may well be important for food sovereignty in an increasingly urban Africa.

4.10.2 Permaculture research in Africa

Permaculture research in Africa has remained limited up until now, with notable contributions from Kruger (2015), Karim (2018), and Didarali and Gambiza (2019) being the primary explorations of permaculture within the African context. Kruger's study explores the sustainability debate surrounding globalised societies since the 1970s. It highlights a case study from a rural permaculture project in the Western Cape, South Africa, revealing opportunities and challenges for sustainability in energy and building. Her research underscores the gap between South African policies acknowledging sustainability and the practical implementation of sustainability goals in housing and energy (Kruger, 2015). Karim's study investigates the causes of ongoing violence in the Middle East and North Africa (MENA), focusing on Syria and Iraq. Their study discusses climate-related concerns and explores how addressing the environmental crisis in MENA could lead to sustainable development. In their study, permaculture is introduced as a potential adaptation to climate change, illustrating its capabilities in addressing underlying causes of violence in the MENA region (Karim, 2018). Didarali and Gambiza (2019) conducted a study examining permaculture as an alternative, sustainable agricultural approach to address environmental impacts caused by conventional agricultural practices, focusing specifically on rural livelihoods in Zimbabwe and South Africa. Their research finds that permaculture contributes over 40% to participants' income, offering benefits like improved health and reduced input costs. Despite challenges such as labour intensity and pest issues, integrating permaculture with other sustainable practices shows potential for enhancing rural livelihoods. All these studies focus on rural landscapes, not acknowledging the importance of urban-rural links in combating food insecurity or giving cognisance to the reality of high levels of urbanisation and increasing population growth in urban contexts and subsequent challenges regarding food insecurity.

Despite the limited research on permaculture in Africa and even less in South Africa (especially from the perspective of urban planning), relevant benefits of permaculture are acknowledged by the key authors. Firstly, permaculture has been renowned for its adaptability to large and small scales (Kruger, 2015:545; Salleh *et al.*, 2018:4; Fiebrig *et al.*, 2020:381; Janse van Rensburg and Puren, 2023:15); secondly, permaculture is known for fostering public health and community engagement through local food production (Hinton *et al.*, 2021:14; Janse van Rensburg, 2023:15); and thirdly, permaculture is renowned for sustainable resource consumption and creating self-reliant and sustainable food systems (Millner, 2017:781; Lapoutte, 2020:486). However, although recognised as an integrated theoretical concept that has the potential to provide food in a sustainable and regenerative manner, permaculture has not received much recognition in urban contexts and less in the planning for cities to address food insecurity in urban African and South African cities. Janse van Rensburg and Puren (2023) conducted a scoping

review to explore theoretical themes related to permaculture (PC) in the literature and propose further research in African and South African contexts, especially regarding practical guidelines for implementing permaculture in rapid-growing cities in the South.

In conclusion, while permaculture research in Africa, particularly in South Africa, has seen limited exploration, significant contributions from Kruger (2015), Karim (2018), and Didarali and Gambiza (2019) have highlighted its potential in rural settings. However, the discourse underscores a critical need to extend this research to urban contexts, exploring the potential for urban food systems, and addressing the pressing issue of food insecurity in rapidly growing African cities (Janse van Rensburg and Puren, 2023).

4.11 Methodology

4.11.1 A qualitative approach as point of departure

The approach that was selected for this study is qualitative. MacCallum *et al.* (2019:37) explain that a qualitative approach to planning research is likely to be linked to an open research question that leads to a more discursive answer and an exploratory type of investigation, as in the case of this research. Furthermore, a qualitative investigation is appropriate because it enables the researcher to access community settings and focus on small cues to understand behaviour, context, and broader societal issues (Tracy, 2020:3). The focus here is more on understanding selected cases in their contexts than quantifying variables and being representative. Also, qualitative research contributes to understanding the world, culture, and institutions and addressing societal problems. It is characterised by richness, holistic exploration, and interpretation of lived experiences and acknowledges multiple interpretations through the exploration of theoretical, moral, and practical significance, making it appropriate for investigating practical cases of permaculture (Tracy, 2020:7).

4.11.2 A multiple-case study design

The framework that was used as the research design is presented in Figure 4-10. A multiple-case study design was selected to apprehend permaculture application throughout SA and to reveal the existing structure of permaculture in South Africa (Tobin, 2010:289). Multiple case studies were selected to illustrate how permaculture is applied in South African context and to explore how the existing structure of permaculture systems in South Africa can inform its consideration in urban systems (Stake, 2005:23).

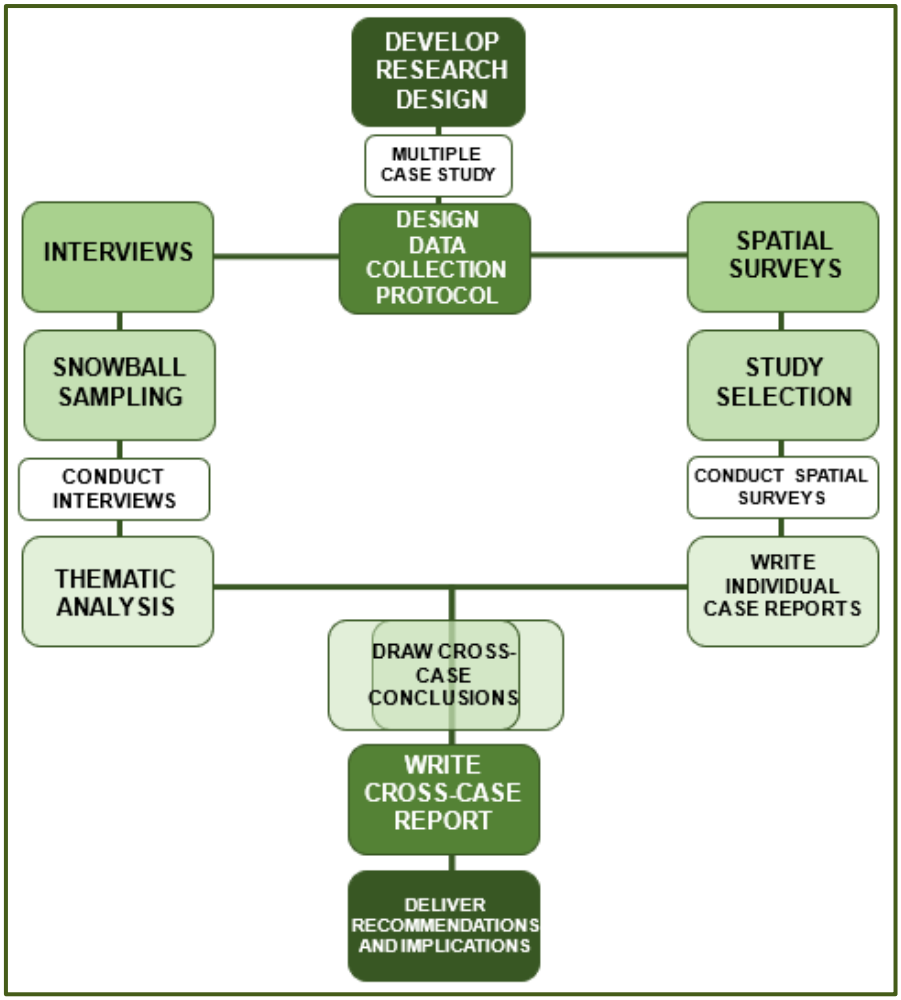


Figure 4-10: Methodological framework.

Source: Author's own compilation.

In employing the multiple-case study design, the question of selecting a suitable number of cases was considered. According to Yin (2018:94), traditional criteria involving the use of power analysis for determining the preferred sample size are not applicable in a multiple-case study design due to the absence of sampling logic. Rather than focusing on the desired number of cases, the literal and theoretical aspects that align with the study's objectives are key considerations. (Yin, 2018:94). On the other hand, Stake (2005) advises that between 4 and 10 cases are ideal for a reliable multiple-case study. In selecting the cases for the study, each case might have a different relationship with permaculture. Some might be textbook cases, while others might only have an accompanying relationship to permaculture (Stake, 2005:23). Nine (9) eligible sites were identified and recognised as valuable for the purpose of this study due to their relation to permaculture.

The original nine (9) cases were narrowed down to four (4) by using Stake's (2005:23) three criteria for selecting suitable cases: (i) Is the case relevant to permaculture? (ii) Does the case offer a variety of contexts? and (iii) Does the case offer good opportunities to learn about the complexity and context of permaculture in South Africa? (iv) A fourth criterion was the acceptance of the participants that were approached to participate, which was thus used to narrow down the number of cases. The following cases of permaculture were included in the research: (i) Case 1: Tlholego Ecovillage; (ii) Case 2: Numbi Valley Permaculture Farm; (iii) Case 3: Kuruma Farm Cottages; and (iv) Case 4: Pachamama Forest Retreat.

4.11.3 Data generation

The multiple-case study (collective case study) was informed by two qualitative data generation methods. The primary data collection method included spatial surveys and analysis supplemented by semi-structured digital interviews.

4.11.3.1 Spatial surveys/analysis

Spatial data was obtained through stakeholder engagement, public GIS software, and online websites to establish important spatial features that characterise permaculture landscapes in South Africa. Spatial analysis is a widely adopted data methodology in the realm of urban planning research as it can provide significant spatial context for comprehending social phenomena and spatial patterns (Ahidana & Bierbaum, 2015:14). MacCallum *et al.* (2019:87) describe this type of generation method as a site analysis (commonly used by planners), where a detailed examination is conducted about specific features of a site and where the observational and visualisation skills of the planner-researcher are of paramount importance. In this case, observing and obtaining spatial data on selected features that relate to permaculture (including land uses and zoning structure) were incorporated.

In qualitative research studies, spatial data usually serve two roles that are applicable in this case. Firstly, demographic data offers a comprehensive understanding of the context in which social processes unfold. Ahidana and Biermaun (2015) assert that integrating spatial analyses into examinations of social phenomena heightens the depth and rigour of qualitative research. These statistics are typically employed descriptively and presented in the form of tables or maps. Secondly, spatial data is commonly used with maps to analyse patterns and trends, comparing the study area with its surroundings. This involves combining spatial and qualitative data to describe spatial relationships or similarities between cases (Haining, 2003:4; Ahidana &

Bierbaum, 2015:14). Spatial profiles of the selected cases were developed to portray the property details, locality, and cadastral boundaries of each case (see Annexure A).

4.11.3.2 Interviews

Although various types of interviews, namely structured, semi-structured, and unstructured (Beebe, 2008:727; Brinkmann, 2013:18), are suitable for interviews, semi-structured interviews were chosen for this study because they offered the interviewer enough liberty to generate unrefined and in-depth responses from the participant. Semi-structured interviews are conversation-like in character, guided by, but not limited to, a set of predetermined questions (Beebe, 2008:727; Brinkmann, 2013:18). Following the global COVID-19 pandemic and the digital surge that came with it, it was decided to conduct the interviews through an online meeting platform, Google Meet. This not only reduced travel costs but also allowed for a much more flexible and attainable schedule for both the interviewer and the participants. Online interviews are an alternative to face-to-face interviews, where the interview still has a designated structure and the interviewers and participants still see each other "face-to-face," virtually only via a camera (Saumure and Given, 2008:926; Kara, 2021:144).

The main advantage of semi-structured questions in this study was that they provided the necessary flexibility to pose open and follow-up questions from discussions that provided rich data. Semi-structured interviews were conducted with five (5) permaculturists across the case studies in South Africa. Semi-structured interviews were chosen to inform the study by offering a more profound understanding of the grassroots involvement, application, and comprehension of permaculture. The interviews also sought to gather valuable ideas and insights into the application of permaculture, its potential in urban communities, and the challenges experienced with its implementation.

4.11.3.3 Participants

(i) Selection of participants:

Participants were sampled through purposive and snowball sampling, both nonprobability sampling methods where the sampling frame was unknown (Dosek, 2021:651). Initial contact persons were identified during the search for permaculture sites in South Africa. Thereafter, all the persons were contacted and either agreed to participate, referred the researcher to other interested contacts, or both. Following the snowball sampling, five (5) participants agreed to participate and be interviewed.

(ii) Participant profile:

Participants included individuals between the ages of 36 and 65 years old. All the participants are South Africans, and all have more than 6 years' experience in permaculture practice, while three had more than 10 years' experience by the time of the interviews. The profiles highlight that the participants were all knowledgeable and informed about permaculture. The participant profile outlines the age group, experience, and locality of the selected participants and is illustrated in Annexure C.

4.11.3.4 Interview protocol and questions

(i) Protocol:

The four (4) participants who were invited and agreed to participate were contacted by email to provide background information and the purpose of the study. They were also requested to sign an informed consent form. Interviews were scheduled and conducted during February and March 2023 and lasted for approximately one hour each (ranging between 40 minutes and an hour and 55 minutes).

(ii) Questions:

The questions that guided the interviews were determined beforehand and served as a foundation to ensure the discussions stayed pertinent and focused. However, despite their broad nature, the interview questions permitted nonconformity and spontaneity in the conversation. The initial questions aimed to investigate participants' connections to and motivation for permaculture in their daily lives, while the subsequent set of questions delved into their experiences and knowledge of permaculture practice. The interview schedule and the template for informed consent are provided in Annexure D.

4.11.3.5 Data analysis

(i) Spatial data analysis:

The case studies were analysed using spatial analysis that included topographical, geographical, land use, and permaculture zone structure considerations. The zoning structure of each of the permaculture cases was classified according to Mollison's (1998) concentric zoning model[3] for permaculture as a reference to analyse the layout of each case's permaculture system.

[3] *Zone 0 is mostly where the caretaker/human inhabitant of a system dwells; zone 1 represents crops that need frequent attention (a few times a day); zone 2 includes crops that require frequent visitation (once a day); zone 3 represents the main crops that are grown for household use and trade and require fewer visitations by humans (once a week); zone 4 represents a semi-wild area that requires little human visitation (once a month); and zone 5 represents wilderness or natural areas that require no human interaction.*

Maps of each case were constructed that indicated the different land uses, permaculture zones, and important features like water sources on the sites. Each case map was overlayed with MCZM to determine the structure of each of the permaculture systems and how they relate to the original model.

(ii) Analysis of interviews:

The interviews were translated into English where necessary and transcribed verbatim for the purpose of data analysis. The interviews were further processed by conducting a thematic analysis (Guest *et al.*, 2012:49; Braun and Clarke, 2022). Thematic analysis entails recognising and explaining both implicit and explicit themes embedded in interview data and was chosen for this study due to its usefulness in capturing the complex meanings within the textual data generated from interviews (Guest *et al.*, 2012:9–10). The steps that have been followed to identify themes include the following: (i) the interview transcripts were studied manually, and codes were allocated to topics throughout each interview, (ii) codes were then collated into categories from where main themes were formulated that capture the core messages from the interviews (see Annexure F for the theme coding), and (iii) the themes were considered in depth, and sub-themes were generated for each main theme. The fully coded transcripts can be seen in Annexure E.

4.11.4 The research context

The broader context of all 4 cases is South Africa. The locality of the cases in South Africa context are indicated in Figure 4-11. Three of the selected case studies are located in the Western Cape province and another in the North West province. Figure 4-11 is followed by relevant indicators to further motivate permaculture as a suitable choice to address food insecurity in the case of South Africa: (i) poverty and hunger; (ii) household agricultural involvement; (iii) urbanisation; (iv) population growth.

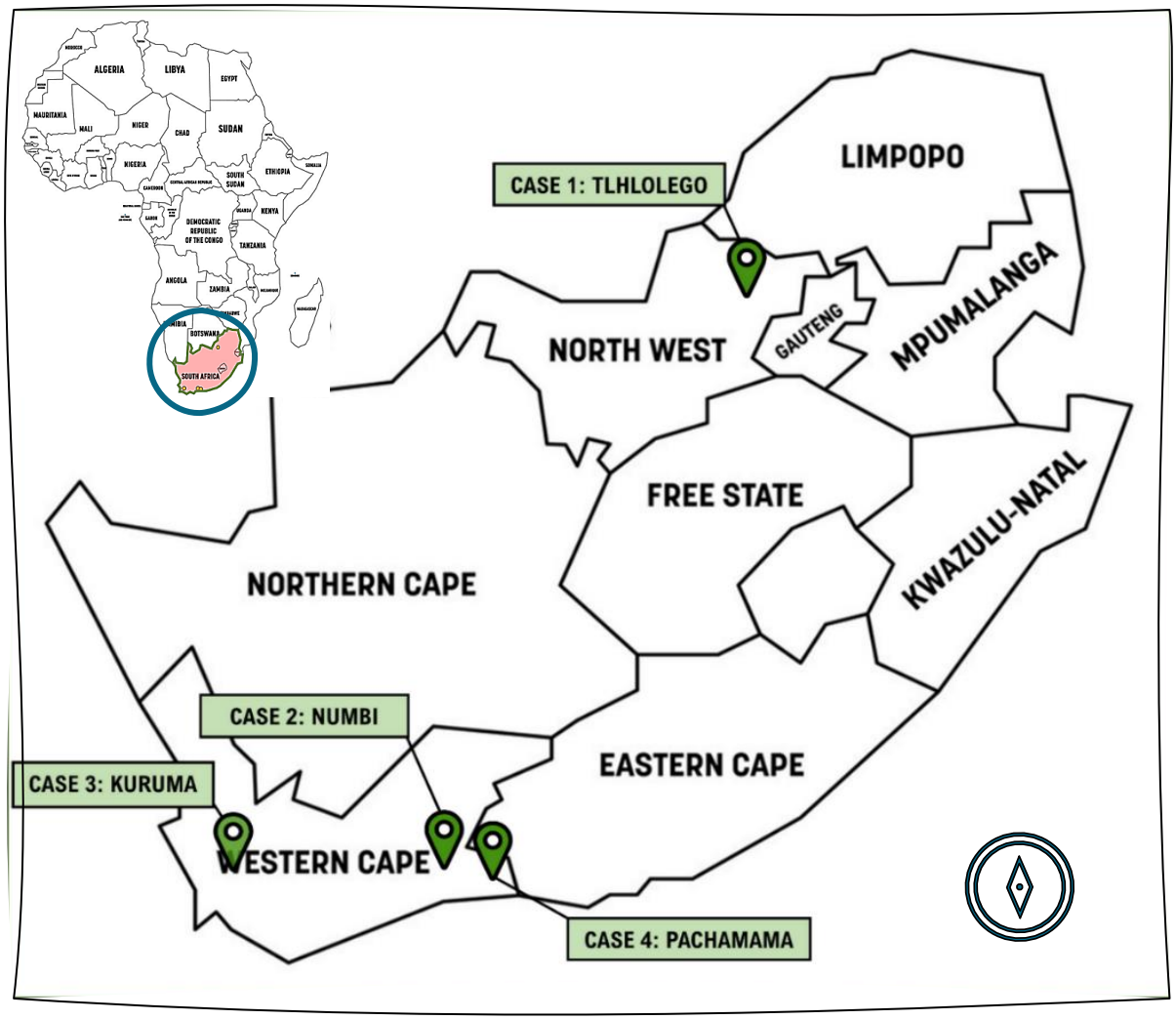


Figure 4-11: Distribution of the selected cases in South Africa.

Source: Author's own compilation

4.11.4.1 Poverty and hunger in South Africa

The population of South Africa comprises 62 million people. Among this total, 20% (3.7 million) of households reported facing insufficient or severely inadequate access to food, and in 2021, about two-thirds of these households resided in urban areas, with nearly half a million residing in major cities such as Cape Town (240,970) and Johannesburg (238,610) (StatsSA, 2021). The Western Cape is the South African province with the lowest poverty headcount and intensity, with a poverty intensity of 40.1% in 2016. In contrast, the North West province experiences one of the most intensive poverties in South Africa, recording a rate of 42.5%, following Gauteng (44.1%), the Eastern Cape (43.3%), and Mpumalanga (42.7%) (Alexander, 2022; StatsSA, 2023).

Figure 4-12 provides a visual representation of the poverty headcount in South African provinces as of 2016. This headcount reflects the proportion of households experiencing multidimensional

poverty, encompassing health, education, living standards, and economic well-being. The provincial poverty headcount of South Africa is relevant for this study as it illuminates that the majority of the selected permaculture cases are located in the least poverty-affected province (Western Cape) in South Africa.

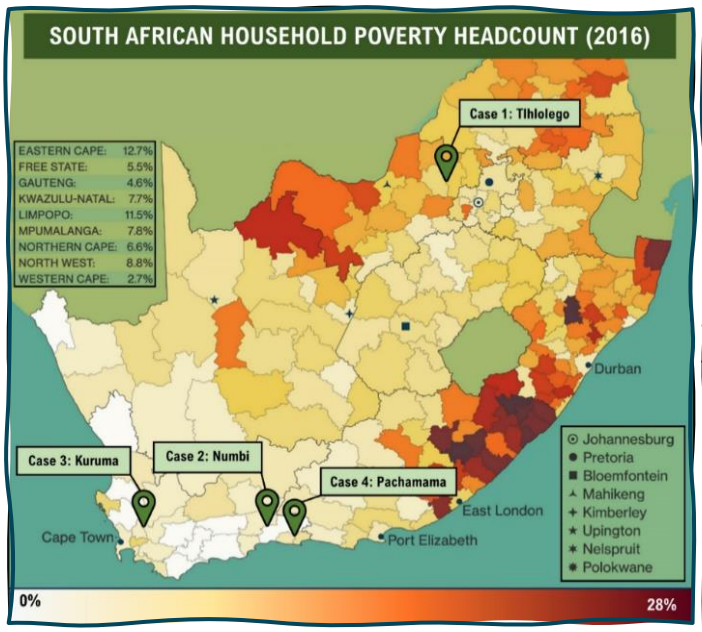
4.11.4.2 Agricultural involvement of South Africa's population

It is also noteworthy that, between 2017 and 2020, when the statistics were collected, a mere 20% of South African households participated in agricultural activities (StasSA, 2022). Figure 4-12 indicates the engagement of South African households in agricultural production activities across provinces: 2017–2020. Figure 4-12 also shows that the Western Cape and Northwest, along with Gauteng, have the lowest household involvement in agricultural activities in South Africa. It can be assumed that household involvement in agricultural activities in South Africa has not shifted significantly since and is therefore considered noteworthy, as permaculture is an agricultural activity that can provide a more flexible and adaptable agricultural practice than traditional agriculture and paves the way for its consideration in South African towns and cities.

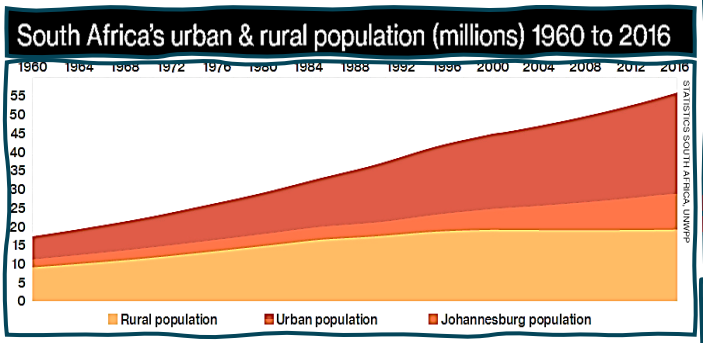
4.11.4.3 Urban and rural population trends in South Africa

All the cases of permaculture practice are in rural areas with a combination of strong and weak links to urban areas. The distance between the cases and their nearest Central Business Districts ranges between 3km and 40km. A detailed overview of each of the cases is presented in Section 5.6. Individual case reports of the selected cases were compiled, followed by a cross-case report where the cases are compared regarding best practices to draw lessons for permaculture implementation in urban systems (Yin, 2018:90).

Figure 5.7 shows the shift between urban and rural populations in South Africa over the last six decades. South Africa's rural population has gradually decreased in the last 30 years, while the urban population has increased by about 35% in the last 60 years. This urban-rural population shift is relevant for this study as it emphasises the importance of considering the urban challenges in a country with a growing urban population.



	Number of households with people that experienced hunger	Percentage (%)
South Africa	**2 078 496**	**11,6**
Sex of the household head		
Male	1 077 702	51,9
Female	1 000 794	48,1
Population group of the household head		
African/Black	1 925 294	92,6
Coloured	133 929	6,5
Indian/Asian	10 511	0,5
White	8 763	0,4
Province		
Gauteng	525 813	25,3
KwaZulu-Natal	362 863	17,5
Western Cape	290 356	14,0
North West	224 596	10,8
Mpumalanga	220 107	10,5
Eastern Cape	186 134	9,0
Free State	125 721	6,0
Northern Cape	77 342	3,7
Limpopo	65 564	3,2
Settlement type		
Urban	1 279 282	61,5
Rural	799 214	38,5



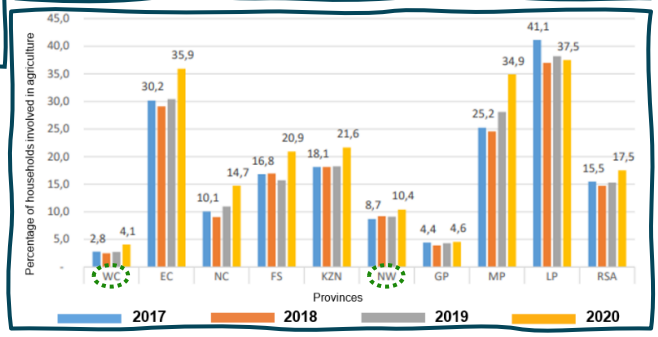


Figure 4-12: Top left and right: South African household poverty (left) and hunger (right) count. Bottom right: Engagement of South African households in agricultural production activities across provinces from 2017–2020.: Bottom left: The urban-rural population shift in South Africa from 1960 – 2016.

Source: Alexander (2022); StatsSA (2022); StasSA (2023).

4.12 Presenting the four permaculture case studies (case reports)

To conduct the quintain study, Stake (2005:vi) suggests that the data gathering of the individual cases first must be organised and then compared with each other. Thus, the cases are first presented individually, followed by a cross-case analysis (Chmiliar *et al.*, 2010:583).

4.12.1 Case study 1: Tlholego Ecovillage

(i) Demographic profile:

Tlholego Farm [4] (Case 1) is located in the Bojanala Platinum District Municipality and the Rustenburg Local Municipality of the North-West Province (see Figure 4-13). The North-West Province has the third highest household poverty headcount in South Africa, with 8.8% of households in the province experiencing poverty, and about 11% of South Africa's household hunger population resides in the North-West Province. The percentage of people experiencing poverty in the Rustenburg Municipality has increased steadily over the last decade, and in 2020, 44% of the Rustenburg Municipality's population experienced poverty (Rustenburg Local Municipality Draft IDP, 2022:69).

(ii) Locality:

Case 1 is positioned approximately 10km south of Phokeng town in the North West province of South Africa and is about 57 hectares in size. The farm is about 22km south-west of the nearest CBD in Rustenburg. Figure 4-14 shows the locality of Case 1 to its nearest urban centre. Case 1 is located in a rural landscape and was established in 1990.

(iii) Character of the case study area:

The farm provides residential living quarters, guest accommodations, and a learning center that conducts permaculture design courses. Access to the farm is from the R52 provincial road, intersecting the eastern corner and connecting to the N4 national road to the north. The farm exhibits a humid subtropical climate with dry winters and is dominated by non-endemic Zeerust Thornveld vegetation. It has a relatively flat topography and is traversed by the Selons River to the west and the R52 regional road to the east. There are three water wells and a tiered swale system on the farm where water is sourced. Figure 4-15 shows the land uses in Case 1.

(iv) The permaculture activity zone:

The permaculture activity zone is in the mid-section, and the fringes are dominated by indigenous vegetation. The permaculture activity zone consists of Zones 0–5. Figure 4-16 shows the permaculture zones in Case 1.

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[4] *"In South Africa today, some of our most pressing problems include those of material poverty, social and economic inequalities, environmental degradation, and volatile markets. Since 1994 Tlholego has been pioneering local solutions to these challenges and is now helping to address these concerns in a greater context. Through its partnerships, Tlholego aims to further its technological advancement and capacity building programs in practical working real life examples of local community sustainability." - Tlholego Ecovillage.*

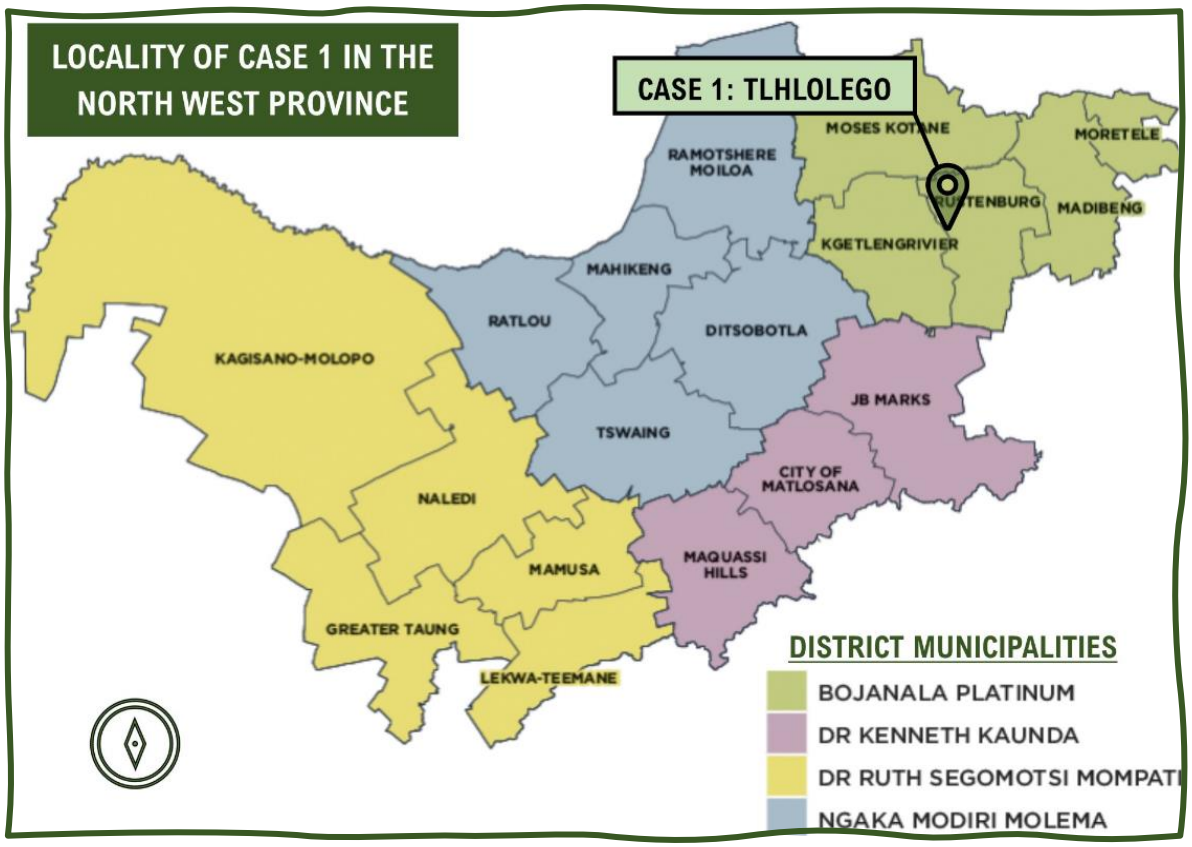


Figure 4-13: Locality of Case 1 in the North West province.

Source: Author's own compilation.

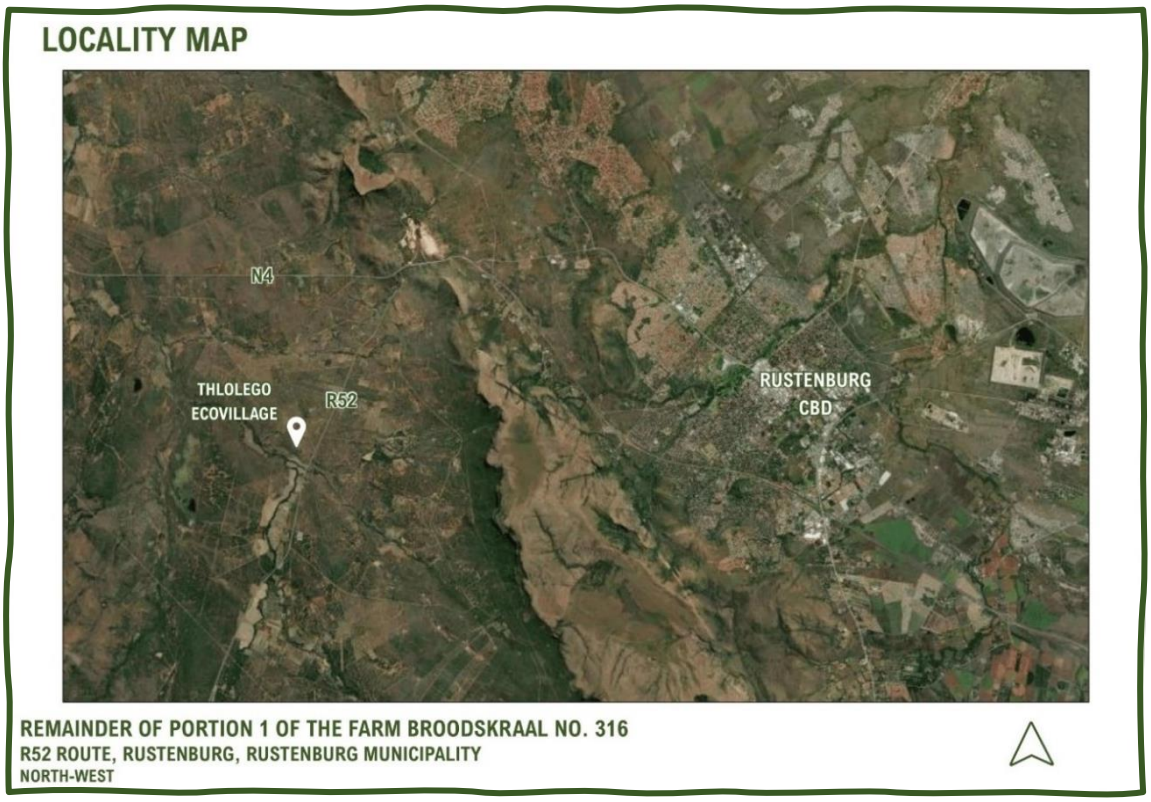


Figure 4-14: Locality of Case 1 with its nearest town and CBD.

Source: Author's own compilation.

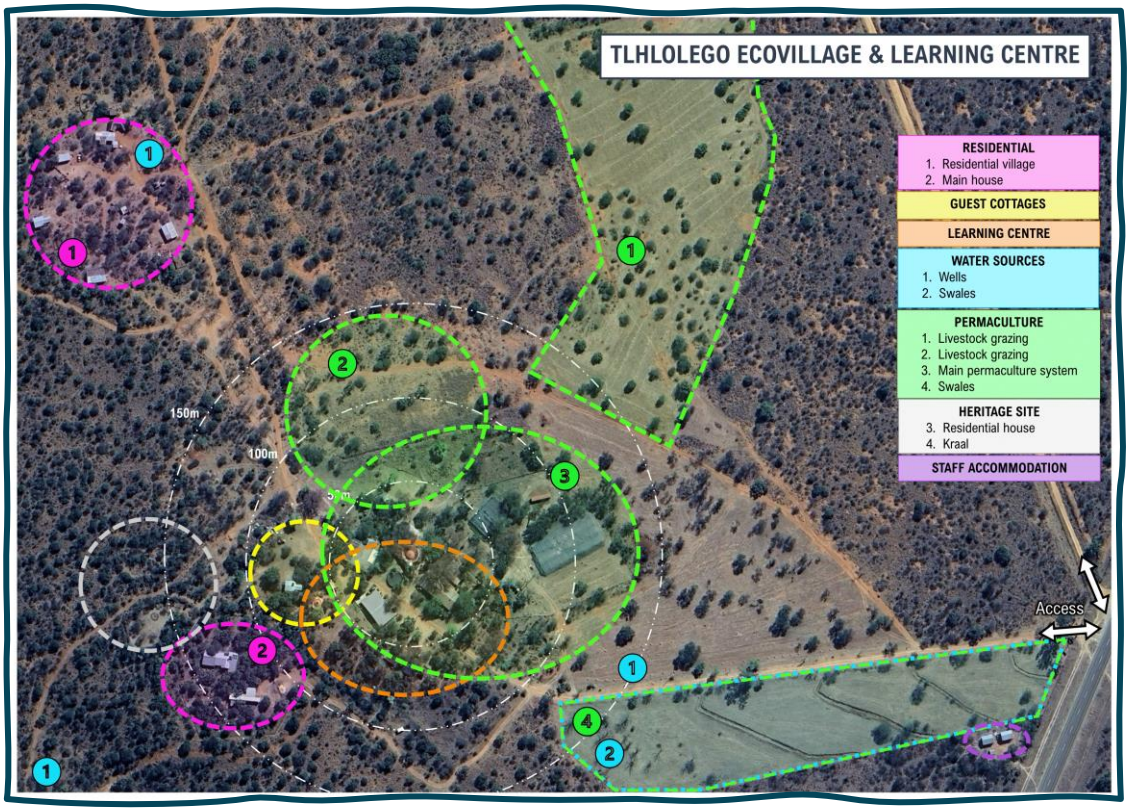


Figure 4-15: Land use distribution on Case 1.

Source: Author's own compilation

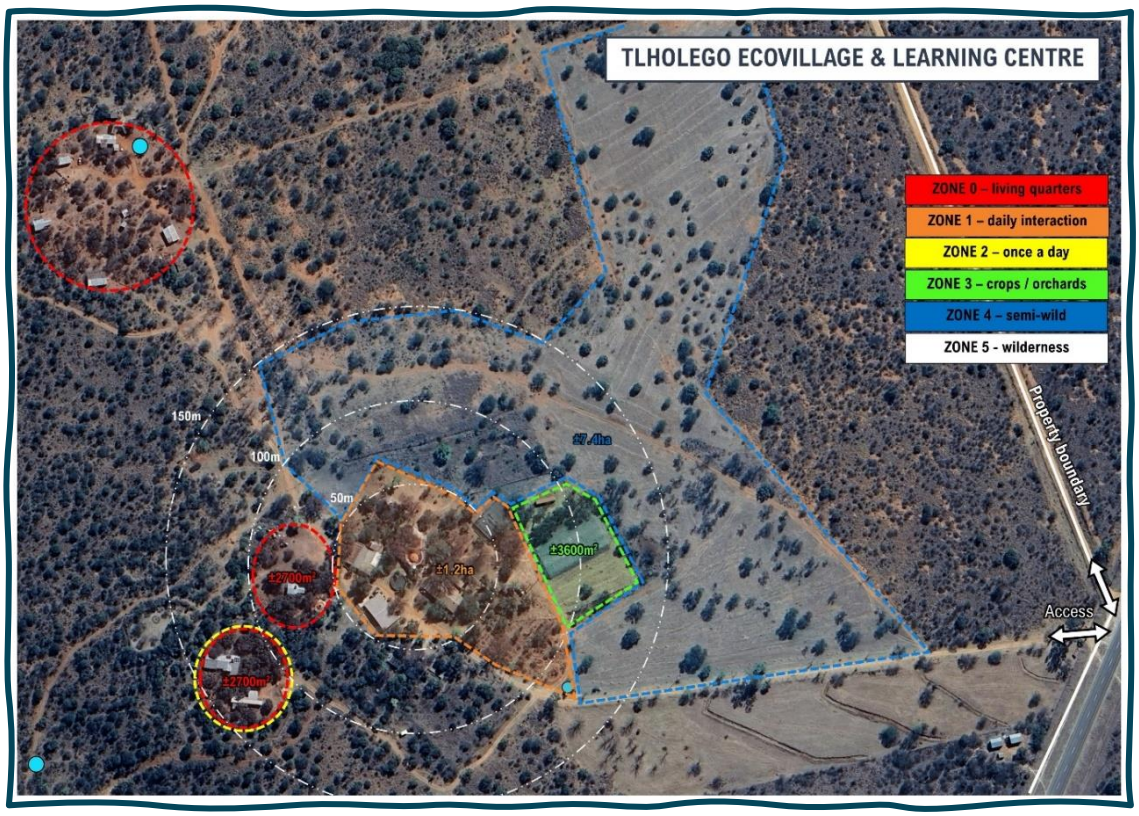


Figure 4-16: Permaculture zone distribution on Case 1.

Source: Author's own compilation.

(v) Zoning structure of permaculture system:

The permaculture zoning structure of Case 1 shares similarities with MCZM in terms of the core structure based on the distance to each zone. In Case 1, Zones 0 to 5 are present, aligning with MCZM. Zone 0 constitutes the primary residences on the farm, mirroring the central zone in Mollison's model. However, a notable deviation exists in the northern residential village (zone 0) of Case 1, which lacks connections to zones other than Zone 5, unlike the interconnected nature expected in Mollison's model. Furthermore, in Case 1, Zones 1 and 2 are positioned in proximity to specific residences, akin to MCZM, which represent different levels of human activity. However, Zone 2 in Case 1 is directly connected to Zone 0 but disconnected from the other, diverging from the typical pattern seen in Mollison's model. Zones 3 and 4 in Case 1 are situated sequentially beyond Zone 1, similar to MCZM. Both Zones 3 and 4 are not connected with Zones 0 in Case 1 and align with the expected connectivity seen in Mollison's design. Although the layout of the permaculture in Case 1 is not concentric, it reflects many of the core dynamics of MCZM and has a relatively structured layout. As a large, compact system, the cumulative area of the permaculture site on Case 1 is about 10 hectares, of which about 8 hectares consist of Zone 4, and the remaining 2 hectares consist of Zones 0 to 3. Figure 4-17 shows the permaculture zones of Case 1 in relation to MCZM.

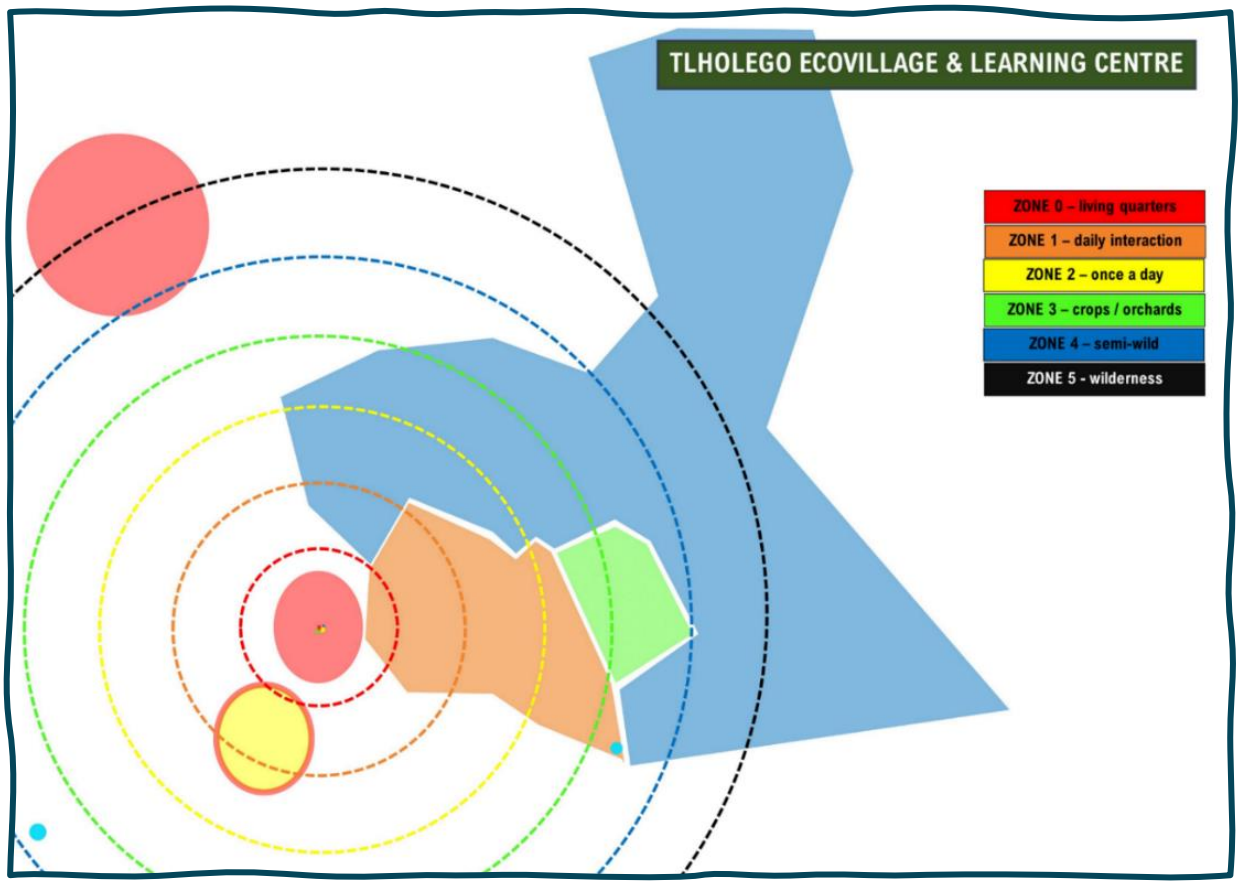


Figure 4-17: The permaculture zones on Case 1 in relation to MCZM.

Source: Author's own compilation.

4.12.2 Case study 2: Numbi Valley

(i) Demographic profile:

Numbi Valley Farm[5] (Case 2) is located in the Garden Route District Municipality and the Oudtshoorn Local Municipality of the Western Cape province (see Figure 4-18). The Western Cape province has the lowest household poverty headcount in South Africa, with only 2.7% of households in the province experiencing poverty; however, about 14% of South Africa's household hunger population resides in the Western Cape province. The percentage of people experiencing poverty in the Oudtshoorn Municipality has increased over the last decade, and in 2016, 11.3% of the Oudtshoorn Municipality's population experienced poverty (Oudtshoorn Municipality Amended IDP, 2020:48).

(ii) Locality:

Case 2 is situated approximately 8km north of the nearest town, De Rust, and about 40km from the nearest CBD in Oudtshoorn. The farm is situated in the eastern section of the Western Cape province and is about 72 hectares. Figure 4-19 shows the locality of Case 2 to its nearest urban centre. Case 2 is located in a rural landscape and was established in 2004.

(iii) Characteristics of the case study area:

The farm features residential living quarters, guest accommodations, and diverse agricultural activities, including a one-hectare olive orchard. The farm is traversed by an unnamed, unpaved road linking to minor, divisional, and regional roads leading to De Rust and Oudtshoorn. Its climate is characterised by a cold semi-arid steppe, falling within the thicket biome with remnants of various endemic vegetation. The Olifants River traverses the farm in the north-west, and an artesian well is located on the northern boundary, where water is sourced. Figure 4-20 shows the land uses in Case 2.

(iv) The permaculture activity zone:

The permaculture activity zone is in the northern section of the farm, and indigenous forest in the entire eastern section. The farm also has a significant olive orchard to the north of the primary permaculture site. The permaculture activity zone consists of Zones 0–3 and 5 and does not have a Zone 4. Figure 4-21 shows the permaculture zones in Case 2.

[5] *Numbi Valley farm is a wonderful example of off-grid, sustainable living. We practice permaculture on the farm and have lived entirely off-grid since 2004. We are passionate about regenerative agriculture, sustainable living and creating abundant eco systems for all to thrive. - Numbi Valley Permaculture Farm.*

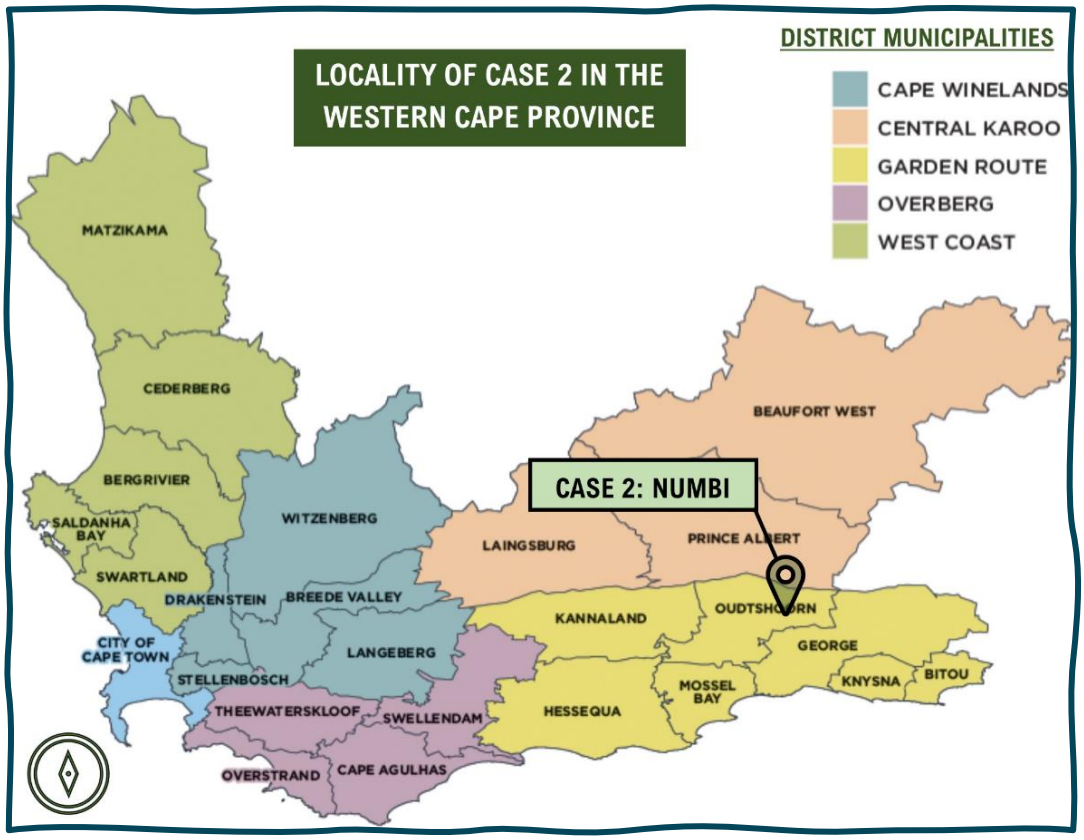


Figure 4-18: Locality of Case 2 in the Western Cape province.

Source: Author's own compilation.

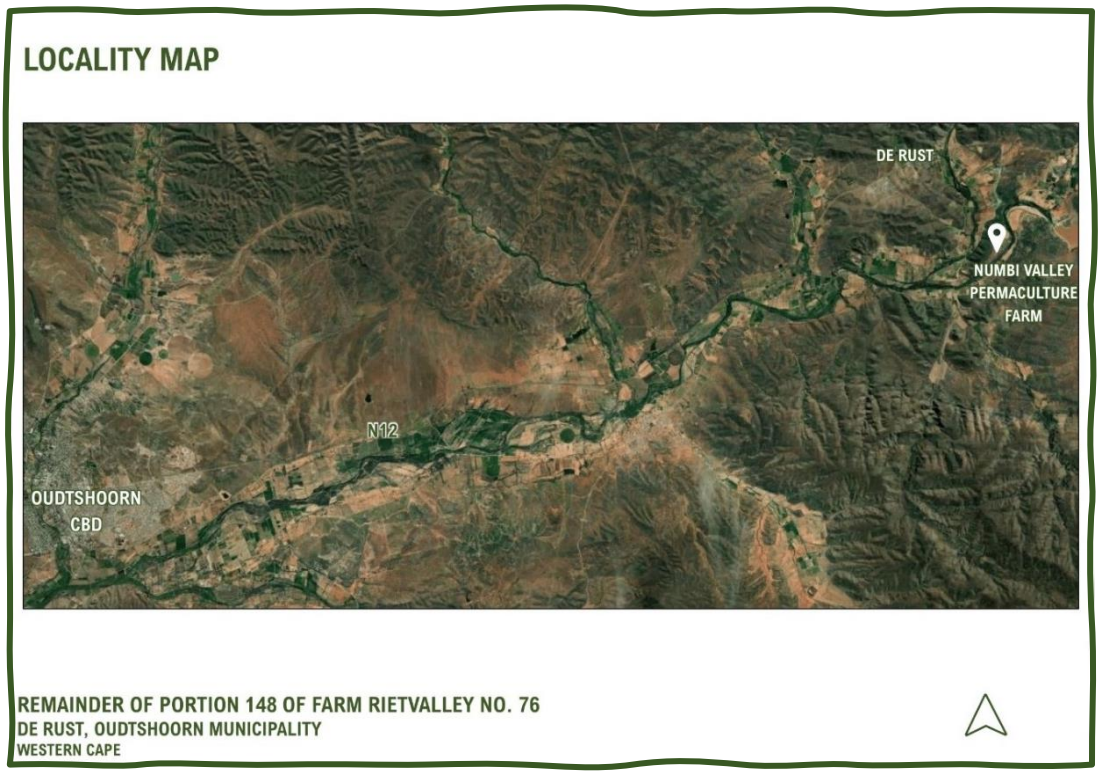


Figure 4-19: Locality of Case 2 with its nearest town and CBD.

Source: Author's own compilation.

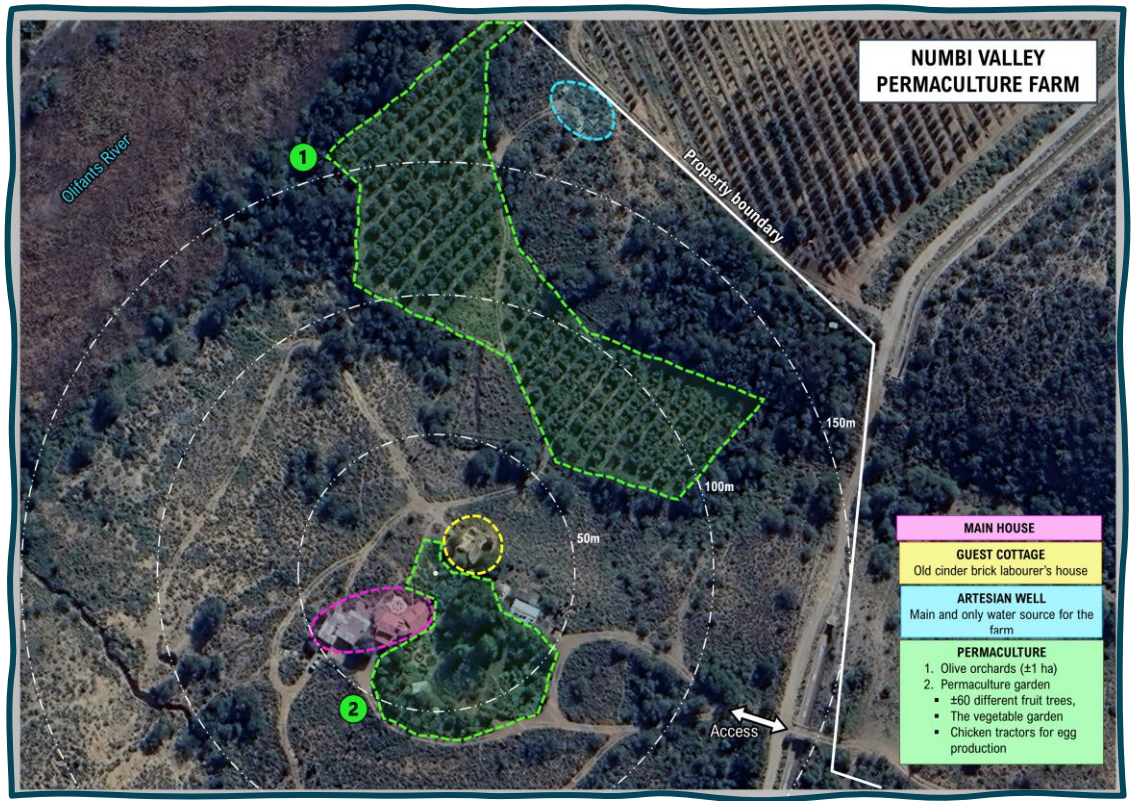


Figure 4-20: Land use distribution on Case 2.

Source: Author's own compilation

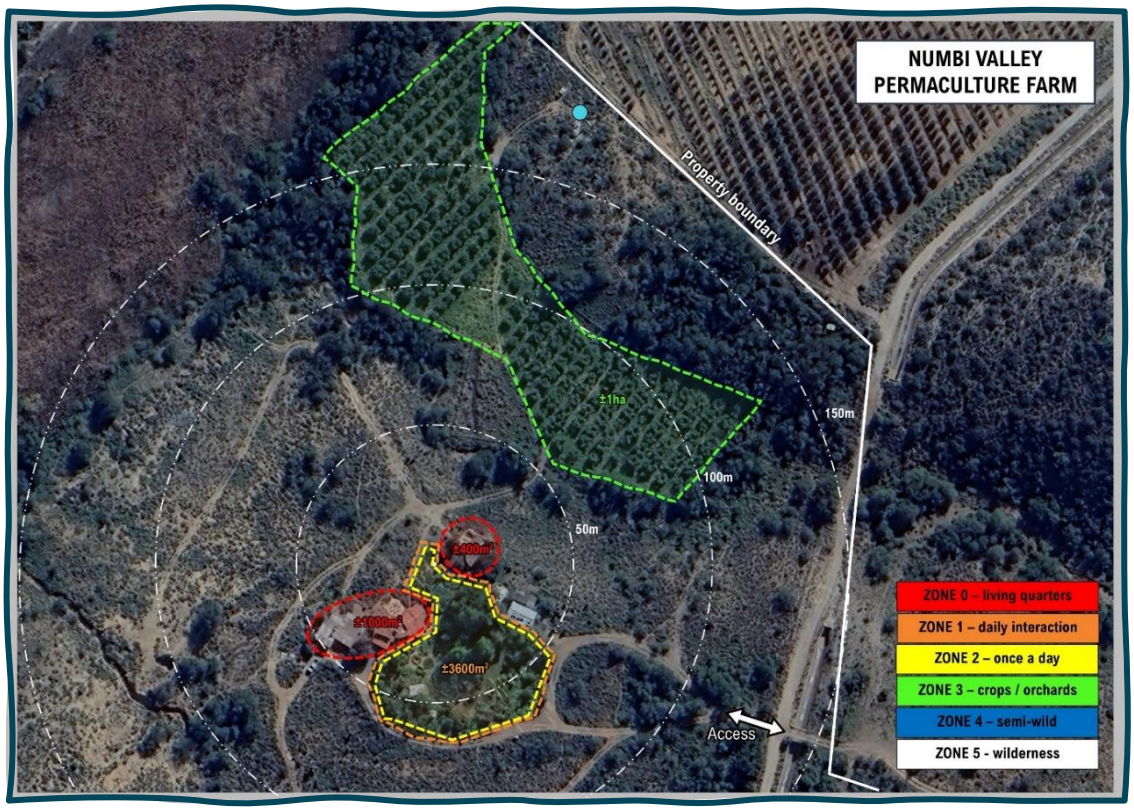


Figure 4-21: Permaculture zone distribution on Case 2.

Source: Author's own compilation.

(v) Zoning structure of permaculture system:

The zoning structure of Case 2 exhibits both similarities and differences when compared to MCZM, particularly in terms of the core structure based on distance to each zone. In Case 2, a notable difference is the absence of Zone 4, which deviates from Mollison's model where Zones 0 to 5 are typically present. Zones 0 in Case 2 are the two residential sites on the farm, aligning with Mollison's central zone concept. However, a distinct feature in Case 2 is that Zones 1 and 2 are both adjacent and connected to Zones 0, suggesting a different spatial arrangement compared to MCZM, where Zone 2 would typically not be connected to Zone 0. In Case 2, Zone 3 is not connected with both Zones 0 and is separated by wilderness (zone 5), which is both in line and in contrast with the typical concentric connectivity in Mollison's design. Case 2's zoning structure shares similarities with MCMZ in terms of the central core structure but differs in the absence of Zone 4. The connectivity patterns of Zone 3 also differ from the traditional concentric model and have a relatively simple and perhaps unstructured layout. As a fragmented system, the cumulative area of the permaculture site in Case 2 is about 1.4 hectares, consisting of about 0.4 hectares around Zones 0 and an additional hectare in the north, consisting of Zone 3. Figure 4-22 shows the permaculture zones in Case 2 in relation to the conceptual concentric circles of MCZM.

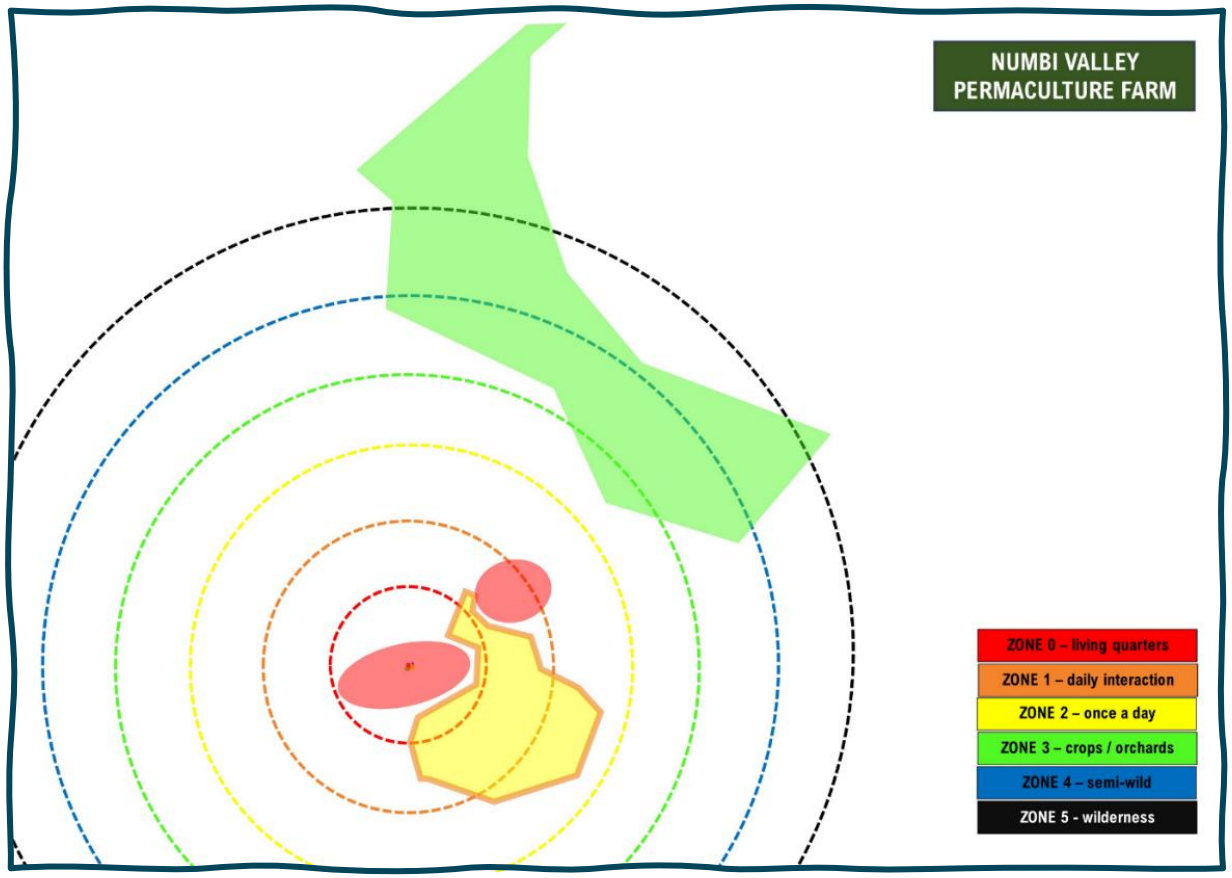


Figure 4-22: The permaculture zones on Case 2 in relation to MCZM.

Source: Author's own compilation.

4.12.3 Case study 3: Kuruma Farm Cottages

(i) Demographic profile:

Kuruma Farm [6] (Case 3) is located in the Cape Winelands District Municipality and the Breede Valley Local Municipality of the Western Cape province (see Figure 4-23). The Western Cape province has the lowest household poverty headcount in South Africa, with only 2.7% of households in the province experiencing poverty; however, about 14% of South Africa's household hunger population resides in the Western Cape province. The percentage of people experiencing poverty in Breede Valley Municipality has increased over the last decade, and in 2018, 15% of the Breede Valley Municipality's population experienced poverty (Breede Valley Municipality 5th Generation IDP, 2022:40).

(ii) Locality:

Case 3 is located about 3km outside the Worcester CBD in the Western Cape province and is about 52 hectares. Figure 4-24 shows the locality of Case 3 relative to its nearest urban centre. Case 3 is located in a rural landscape and was established in 2009.

(iii) Character of the case study area:

The farm features residential living quarters, guest accommodations, agriculture, an olive orchard, and an indigenous forest. While not directly traversed by roads, it is adjacent to a paved divisional road connecting to the N1 national highway. Case 3 experiences a hot and dry summer Mediterranean climate and falls within the Fynbos biome, with large remnants of Breede Alluvium Fynbos vegetation. A pipeline servitude runs along the perimeter of the Hartbees River, which traverses the property from north-east to south-west. The farm features an artificial dam in the south-western corner that is connected to a mainframe swale and a harvesting pond. Water is collected in the dam and then transported to the harvesting pond in the permaculture activity zone. Figure 4-25 shows the land uses in Case 3.

(iv) The permaculture activity zone:

The permaculture activity zone is in the mid-to-east section around the guest accommodation, and indigenous forest in the northern section. The permaculture activity zone includes Zones 0–5. Figure 4-26 shows the permaculture zones in Case 3.

[6] *" Around the main house we have gradually implemented permaculture principles and we also offer a few introductory courses. Our dream is to live in a self-sustainable manner and to be conscious of and caring for the environment that we are the custodians of." - Kuruma Farm Cottages.*

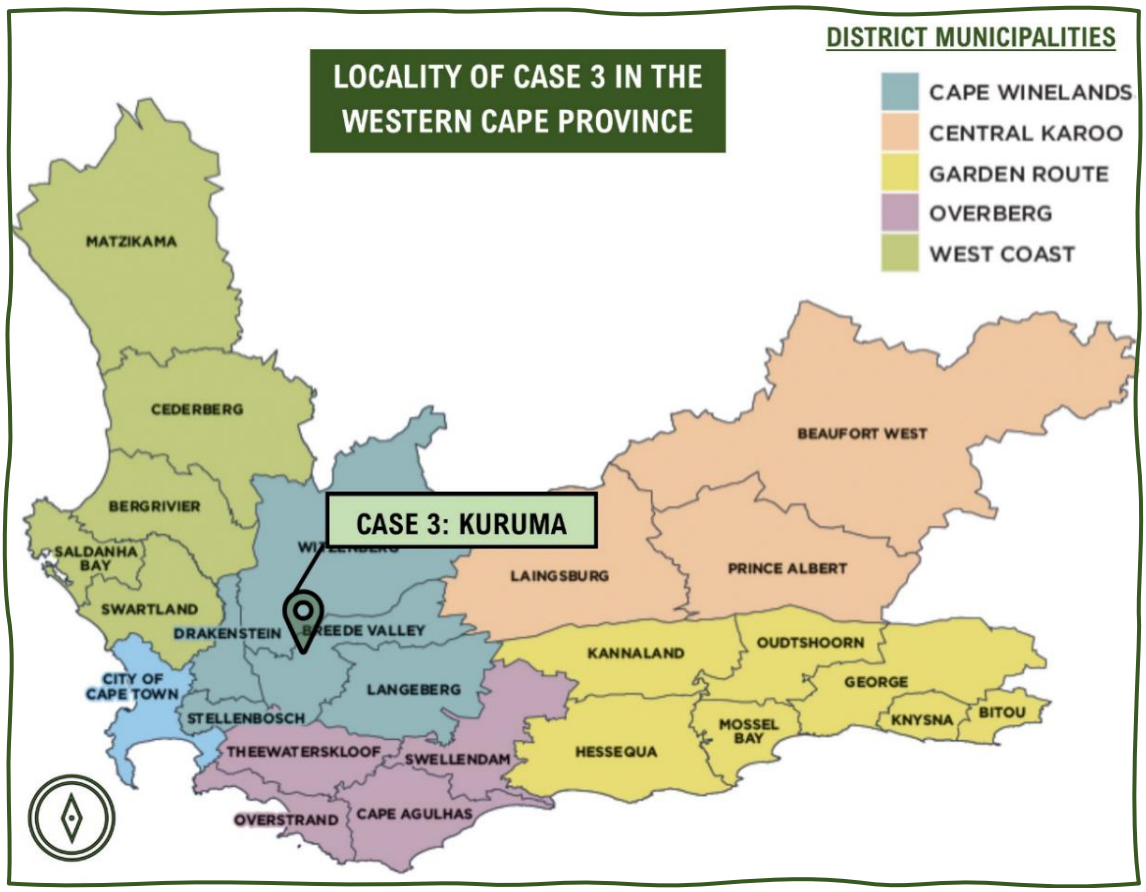


Figure 4-23: Locality of Case 3 in the Western Cape province.

Source: Author's own compilation.



Figure 4-24: Locality of Case 3 with its nearest town and CBD.

Source: Author's own compilation.

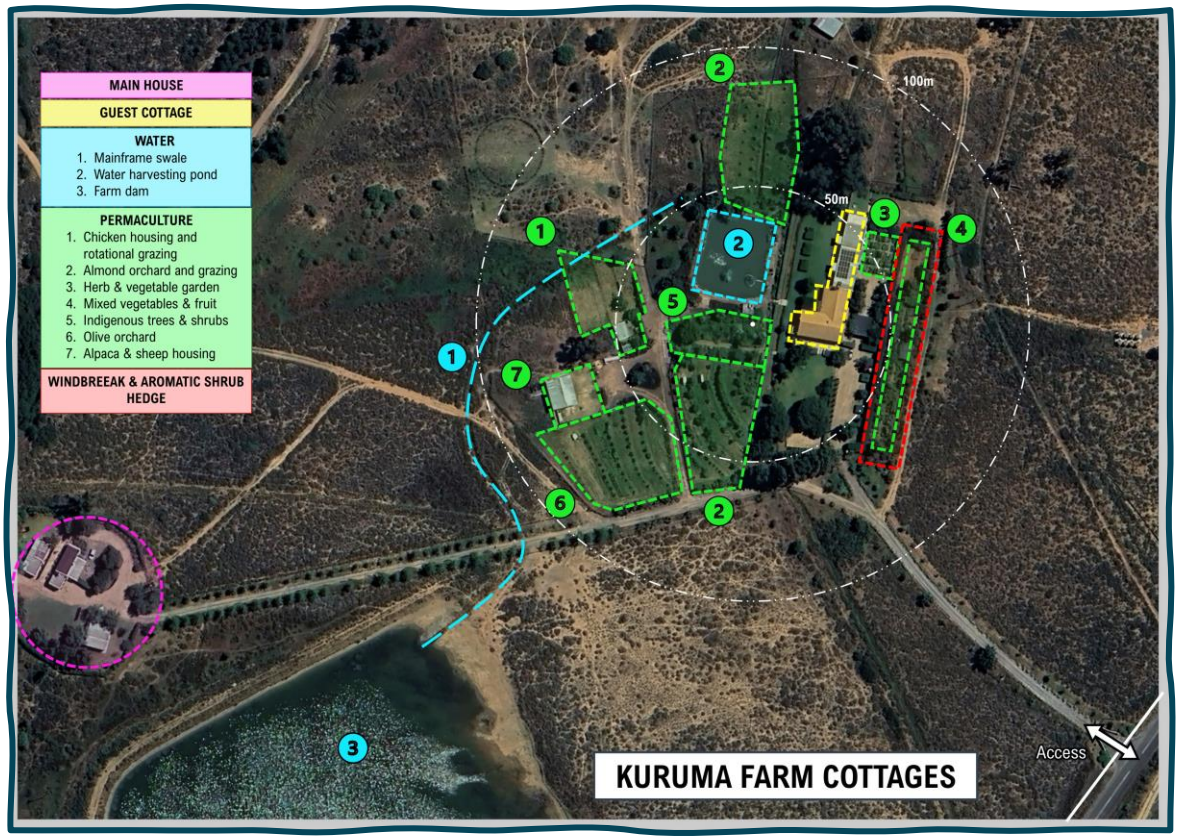


Figure 4-25: Land use distribution on Case 3.

Source: Author's own compilation.

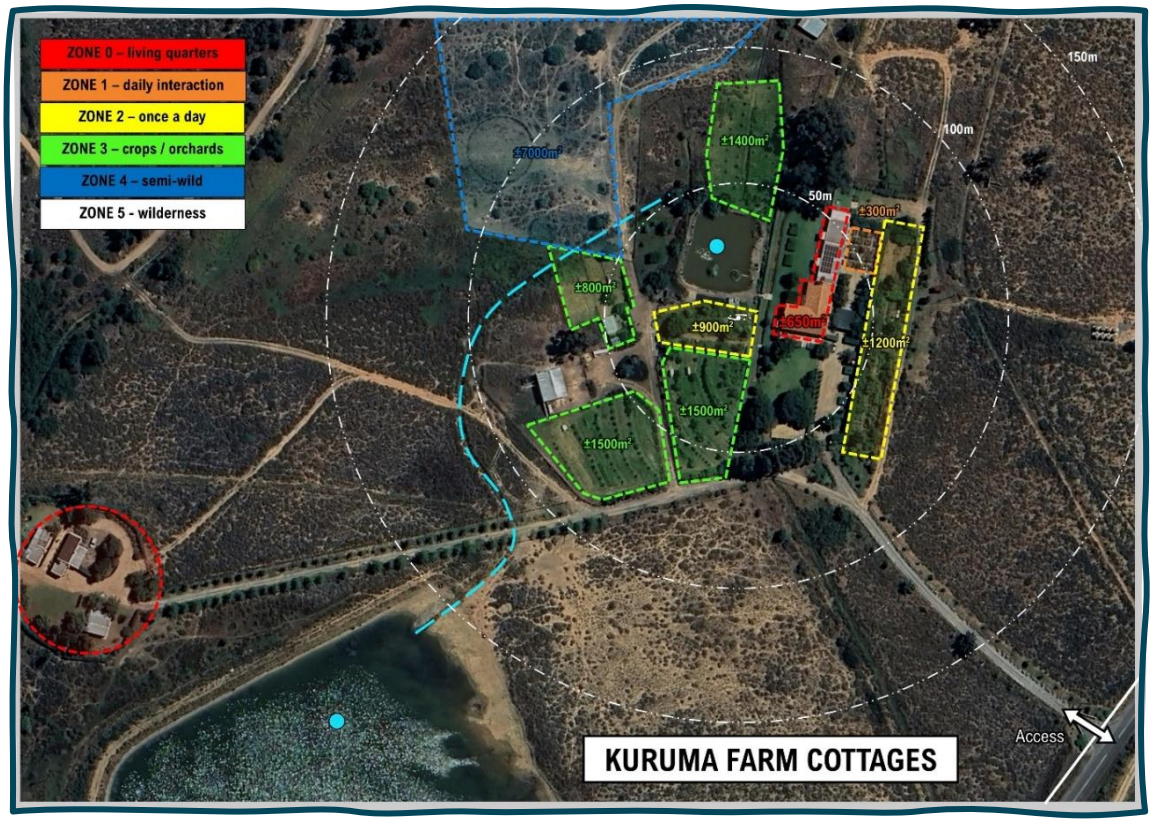


Figure 4-26: Permaculture zone distribution on Case 3.

Source: Author's own compilation.

(v) Zoning structure of permaculture system:

The zoning configuration in Case 3 exhibits a lot of similarities to MCZM, particularly concerning the core structure based on the distance to each zone. In Case 3, the presence of Zones 0 to 5 aligns with the concentric zones in Mollison's model. Zone 0 represents the two residential sites on the farm, partially reflecting MCZM as the northern residential site (zone 0) is exclusively connected to Zone 5, diverging from Mollison's model and rendering it non-integrated into the permaculture system on the farm. However, Zone 1 in Case 3 is compact and directly linked to Zone 0. Notably, there are two Zones 2 on the farm, each positioned slightly farther and disconnected on both sides from Zone 0, consistent with Mollison's model. The farm comprises four Zones 3 beyond Zone 2 to the west, which are also each disconnected from Zone 0, further reflecting the structure of Mollison's model. Zones 4 and 5 are consecutively situated beyond the other zones and are both disconnected from Zone 0, also aligning with Mollison's model. While the layout of permaculture in Case 3 is not entirely concentric, it reflects a concentric-based structure and incorporates many of the core dynamics of MCZM. The overall layout is highly structured and profoundly reflects MCZM. As a compact system, the cumulative area of the permaculture site in Case 3 is about 2.5 hectares. Figure 4-27 shows the permaculture zones in Case 3 in relation to the conceptual concentric circles of MCZM.

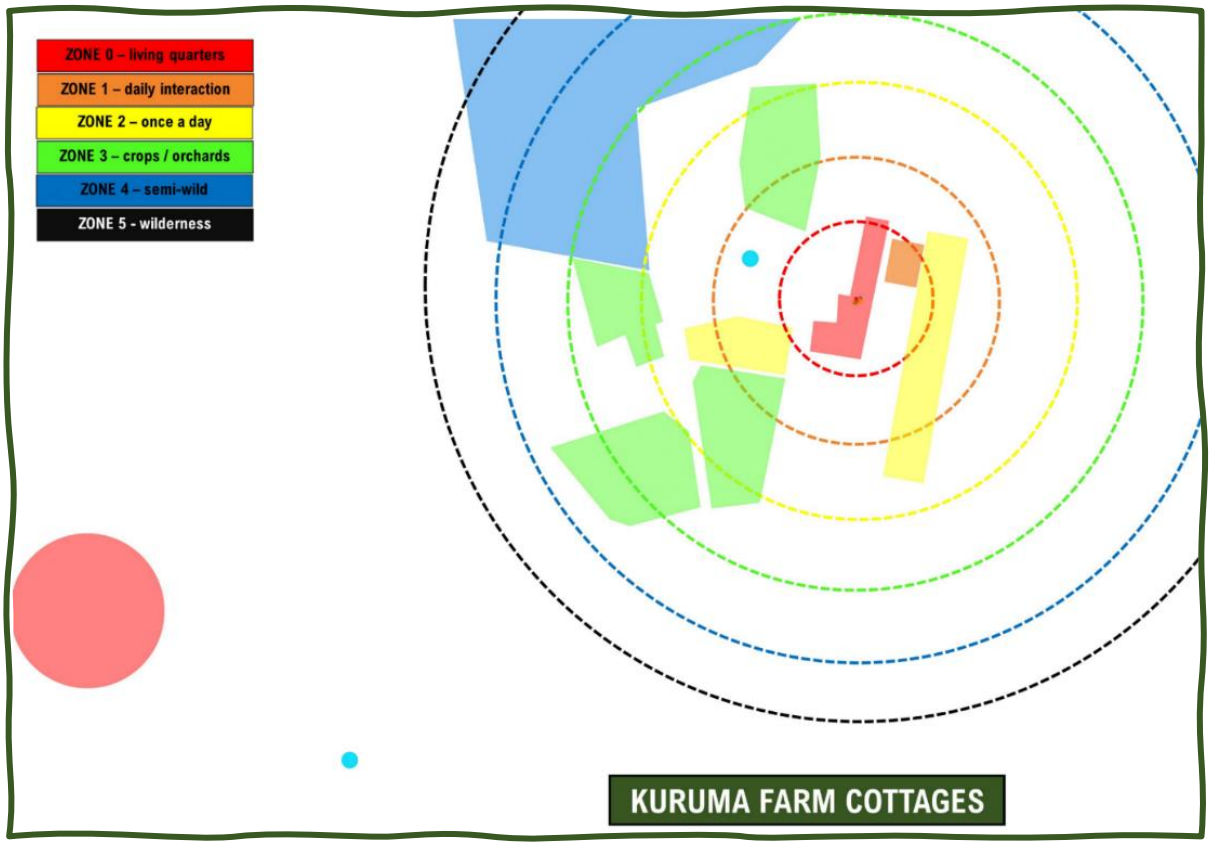


Figure 4-27: The permaculture zones on Case 3 in relation to MCZM.

Source: Author's own compilation.

4.12.4 Case study 4: Pachamama

(i) Demographic profile:

Pachamama Farm[7] (Case 4) is located in the Garden Route District Municipality and the Knysna Local Municipality of the Western Cape province (see Figure 4-28). The Western Cape province has the lowest household poverty headcount in South Africa, with only 2.7% of households in the province experiencing poverty; however, about 14% of South Africa's household hunger population resides in the Western Cape province. The percentage of people experiencing poverty in the Knysna Municipality has marginally decreased over the last decade, and in 2021, 56.83% of the Knysna Municipality's population experienced poverty (Knysna Municipality IDP, 2023:19).

(ii) Locality:

Case 4 is located on the eastern fringe of the Western Cape province and is about 8 hectares. The farm is about 4km west of Rheenendal town and about 33km north-west of the nearest CBD in Knysna. Figure 4-29 shows the locality of Case 4 to its nearest urban centre. Pachamama is located in a rural landscape and was established in 2019.

(iii) Character of the case study area:

The farm features residential living quarters, guest accommodations, agriculture, small integrated orchards, and indigenous forest. The farm is adjacent to an unpaved minor road that connects to a divisional road to the west. Pachamama Farm experiences a temperate oceanic climate without a dry season, falling within the fynbos biome. The non-perennial river traverses the western corner, and all corners of the property are predominantly forested. Noteworthy features include artificial dams in the south-north-eastern, mid-section, and south-western corners. The north-eastern and south-western dams are used for water storage, and the mid-lying dam is used for irrigation of the permaculture activity zone. A water channel flows from north to south over the farm that feeds the mid-lying dam, and a tiered swale system across the property evenly distributes rainwater across the farm and permaculture activity zone. Figure 4-31 shows the land uses in Case 4.

(iv) The permaculture activity zone:

The permaculture activity zone is in the mid-east section of the farm with the zones distributed across the mid-section. The permaculture activity zone consists of Zones 0 - 5. Figure 4-30 shows the permaculture zones in Case 4.

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[7] *Seeding a regenerative culture, through the restoration of inner and outer landscapes. Ecovillage, living learning centre, retreat venue. Pachamama is a space for conscious spiritual, mental and physical self-exploration, and self-healing. Our retreat provides a peaceful environment where you can reconnect with nature, and dive deep into yourself and your personal practices. A forest restoration project, living learning centre, permaculture, and agroforestry project. - Pachamama Forest Retreat.*

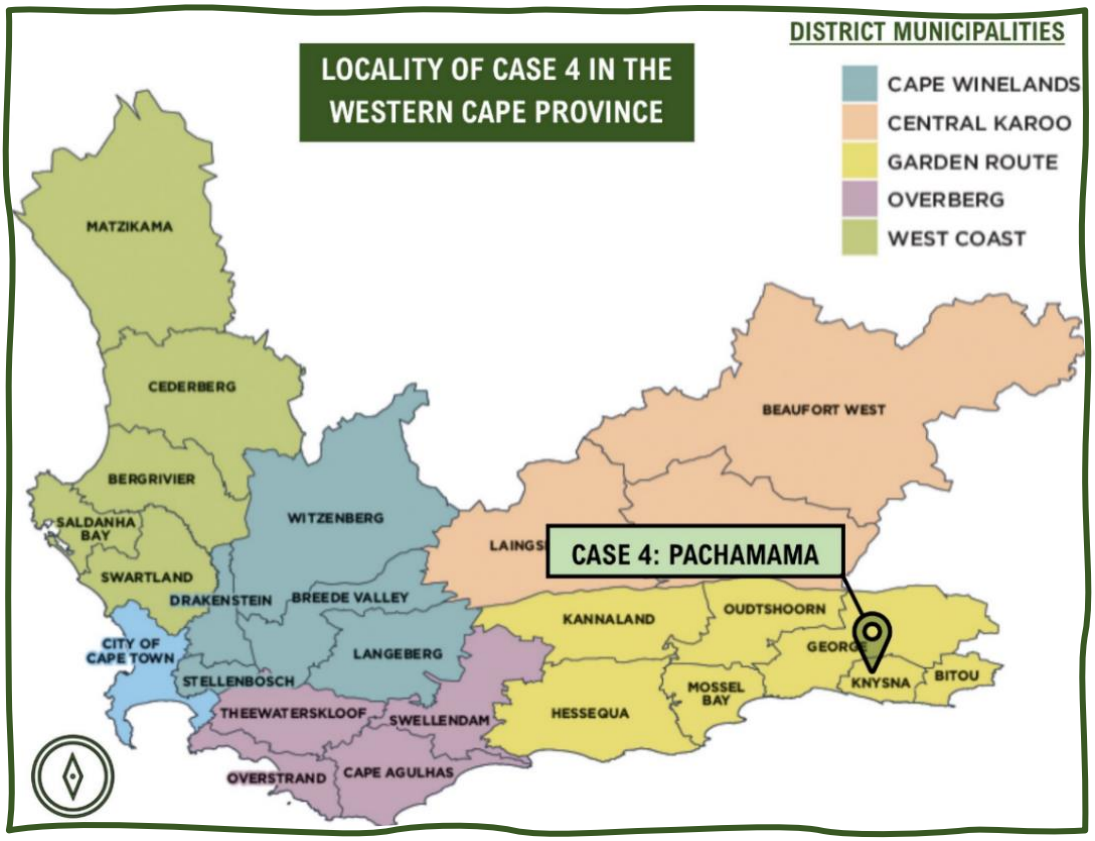


Figure 4-28: Locality of Case 4 in the Western Cape province.

Source: Author's own compilation.



Figure 4-29: Locality of Case 4 with its nearest town and CBD.

Source: Author's own compilation.

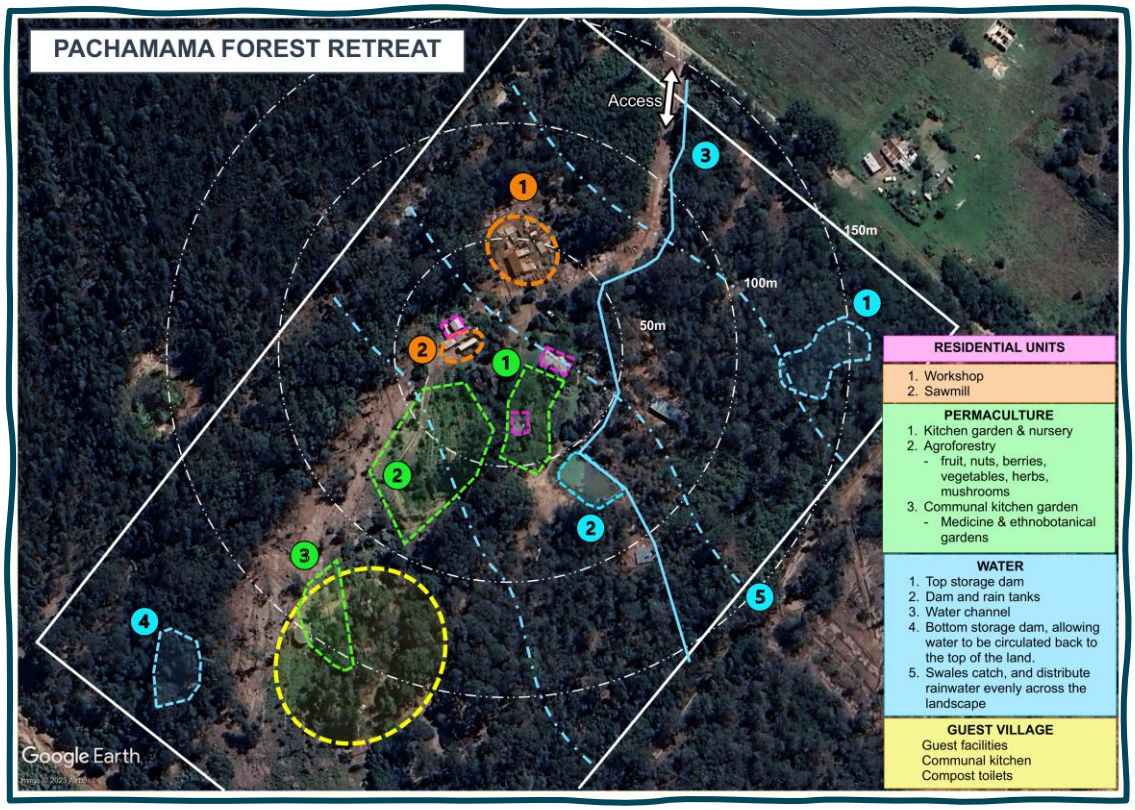


Figure 4-31: Land use distribution on Case 4.

Source: Author's own compilation

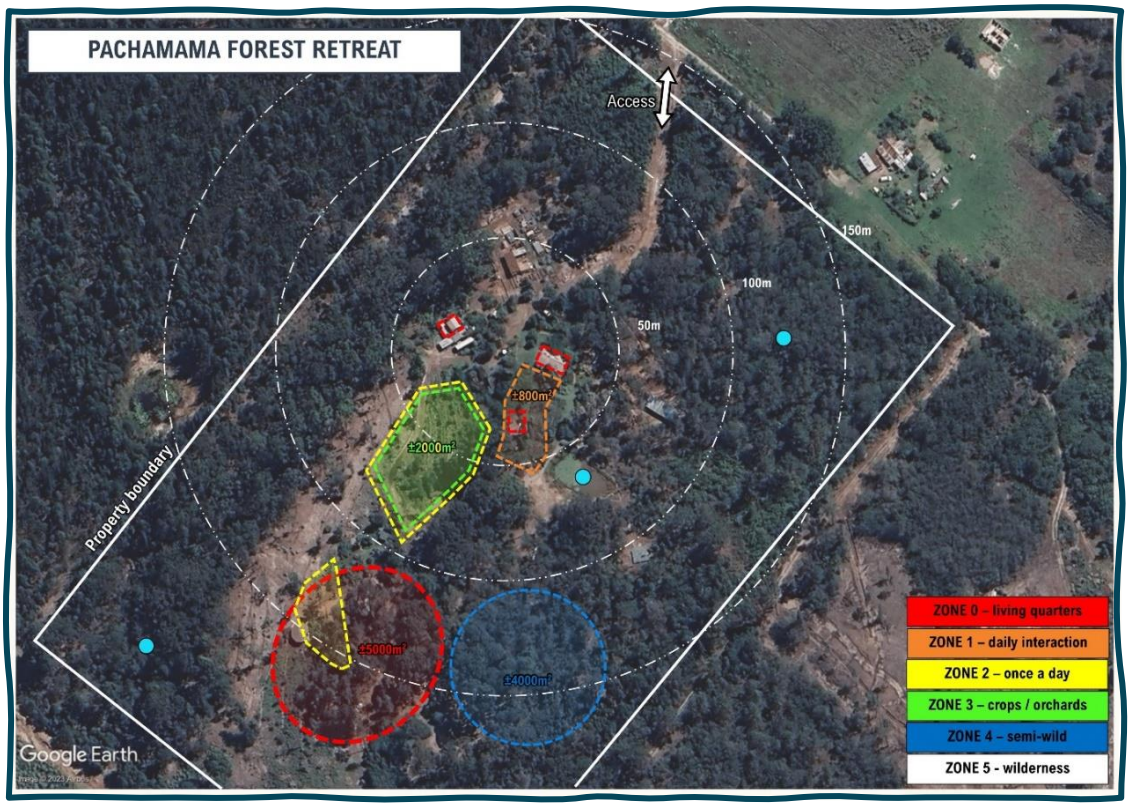


Figure 4-30: Permaculture zone distribution on Case 4.

Source: Author's own compilation.

(v) Zoning structure of permaculture system:

The zoning arrangement in Case 4 displays limited similarities to MCZM, particularly in terms of the core structure based on the distance to each zone. In Case 4, the presence of zones 0 to 5 aligns with the concentric zones in Mollison's model. Zone 0 represents four residential sites on the farm, partially adhering to MCZM. The most northern residential site (Zone 0) is exclusively connected to Zone 5 and is otherwise closest to Zones 2 and 3, deviating from Mollison's model. However, the two Zones 0 in the mid-section of the farm are both connected to Zone 1, aligning with Mollison's model. The residential village (Zone 0) to the south is integrated with a Zone 2 and connected to Zone 4, departing from the structure of Mollison's model. Zones 2 and 3 are combined and are not connected to any of the Zones 0, conforming to Mollison's model. Zone 4 is unconnected to any zone except the southernmost residential village (Zone 0), deviating from Mollison's model. While the permaculture layout in Case 4 is not entirely concentric, the overall arrangement is considered semi-unstructured, not compact, and only partially reflects the core dynamics of MCZM. As a non-compact system, the cumulative area of the permaculture site on Case 4 is about 2 hectares. Figure 4-32 shows the permaculture zones in Case 4 in relation to the conceptual concentric circles of MCZM.

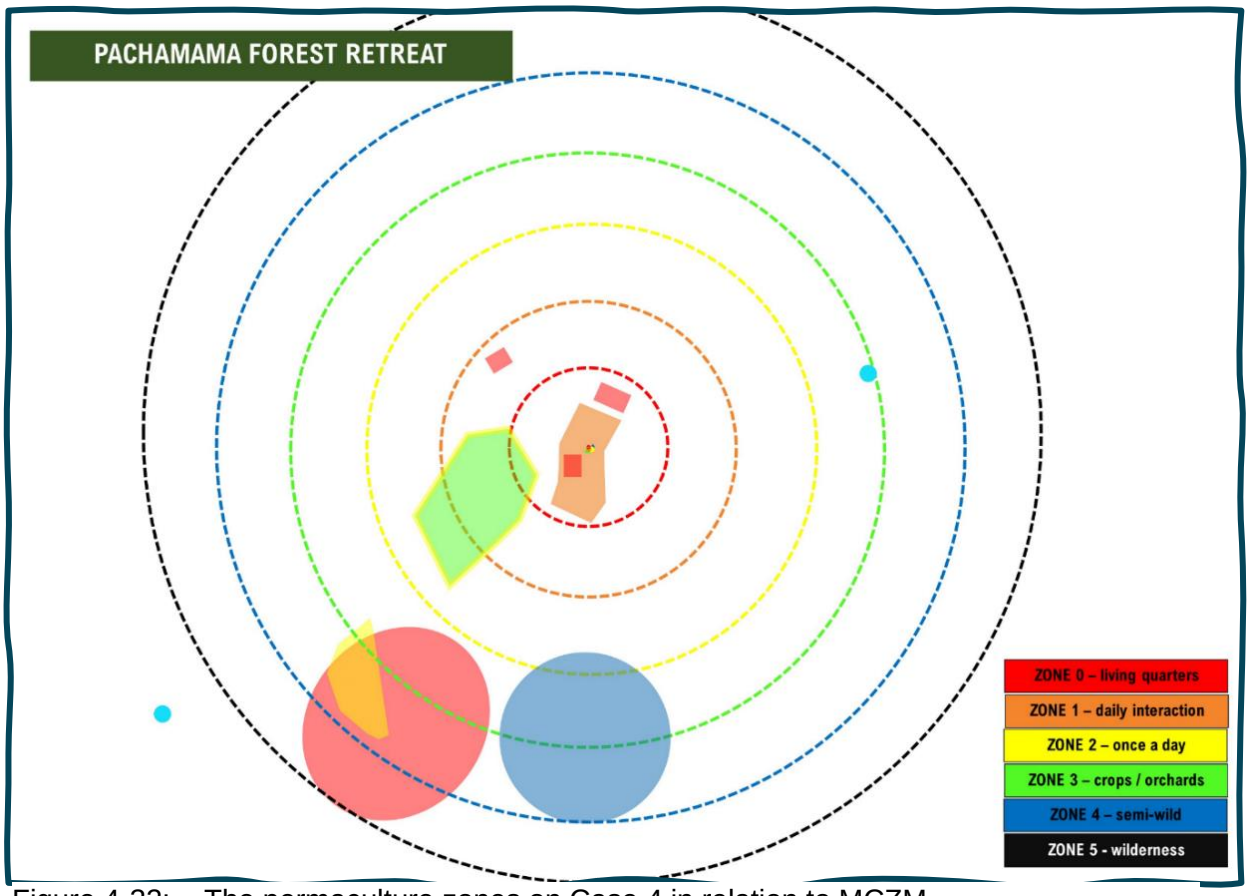


Figure 4-32: The permaculture zones on Case 4 in relation to MCZM.

Source: Author's own compilation.

4.13 Cross case analysis: Findings from the spatial data

The cross-case spatial analysis will report on the following (i) the level of settlement[8] of the cases; (ii) the zoning and structures of the cases; (iii) resource management of the cases; and (iv) the level of land use integration with each permaculture system.

The spatial data of each case was analysed in terms of (ii) their locality and their level of settlement; (ii) their permaculture zoning structure; and (iii) their resource management approaches. Table 4-2 indicates the spatial findings across the cases in terms of cadastral, urban, permaculture, and resource contexts and provide the background to compile the cross-case report.

Table 4-2: Spatial findings across cases in terms of contexts.

		CASE 1	CASE 2	CASE 3	CASE 4
YEARS IN EXISTENCE		34	19	14	4
CADASTRAL		**57ha**	**72ha**	**52ha**	**8ha**
URBAN	RURAL / URBAN	**Rural**	**Rural**	**Rural**	**Rural**
	DISTANCE TO NEAREST URBAN SETTLEMENT (km)	**10km**	**8km**	**3km**	**4km**
	DISTANCE TO NEAREST CBD (km)	**22km**	**40km**	**3km**	**33km**
PERMACULTURE	LAND USES	**Residential Guest accommodation Learning centre Permaculture Agriculture**	**Residential Guest accommodation Permaculture Agriculture**	**Residential Guest accommodation Permaculture Agriculture**	**Residential Guest accommodation Permaculture Agriculture**
	ZONE 0	**3**	**2**	**2**	**4**
	ZONE 1	**1**	**1**	**1**	**1**
	ZONE 2	**1**	**1**	**2**	**2**

[8] *The level of settlement refers to the extent and quality of integration and diversity among land uses within the study area. It is determined by assessing the range of land uses present and how effectively they are harmonised and interconnected with each other.*

	ZONE 3	**1**	**1**	**4**	**1**
	ZONE 4	**1**	**0**	**1**	**1**
RESOURCES	**NATURAL WATER SOURCE**	**Selons River**	**Olifants River**	-	**Non-perennial river**
	ARTIFICIAL WATER SOURCE	**3 Wells Tiered swale system**	**Artesian well**	**Farm dam Harvesting pond Mainframe swale**	**Storage dams Rain tanks Water channel Tiered swale system**
	Climate	**Humid subtropical climate with dry winter**	**Cold semi-arid steppe**	**Hot and dry summer (Mediterranean)**	**Temperate Oceanic without dry season**

Source: Author's own compilation.

Table 4-2 presents a spatial and geographical comparison of the four permaculture case studies, highlighting key aspects such as years in existence, cadastral size, urban/rural classification, distances to urban settlements and CBDs, permaculture land uses, zoning distribution, available resources, including natural and artificial water sources, and climate conditions. Each case study demonstrates varying characteristics, such as land use diversity, zoning distribution, and environmental conditions, providing insights into the different approaches to permaculture design and implementation.

4.13.1 Level of settlement across the cases

All four cases are located within the rural expanse, on the outskirts of their closest urban communities. The regional and climatic characteristics of the cases vary significantly, as they are each located in a different climate. In terms of size, the cases also vary greatly. All four cases have guest cottages that provide overnight accommodation for guests, visitors, or volunteers. In all four cases, the guest accommodation is integrated into the permaculture systems (less than 100m). All but one of the cases have at least one main residential site that is integrated into the permaculture system. In Case 3, only the guest accommodation is integrated into the permaculture system and not the residential area.

Case 1 is considered to have the most sophisticated level of settlement as it has a main dwelling, a residential village, staff accommodation, guest accommodation, and a learning centre integrated into and around the permaculture site. Case 1 also has several water wells across the

property and a multi-tier swale system to the east. In contrast, the level of settlement in Case 2 can be considered more primal as it has less land use diversity, consisting of a single residential house and guest accommodation, and has one artesian well on the northern boundary that is the main and only water source on the farm. However, as Case 2 also has the most intimate permaculture activity zone, it is presumed that a singular water source is sufficient. Case 3 also has only one main residence and guest cottages but has a much more complex permaculture system with specified functionality; for example, the aromatic shrub hedge (Zone 2) also serves as a windbreak and provides visual screening from the road in the east. Case 4 has a residential village, a guest accommodation village, and a tiered water swale system that guides water through the entire permaculture system.

4.13.2 Zoning, layout, and size structure across the cases

To analyse the zoning structure of each permaculture system, Mollison's (1998) zoning model served as a reference. This model categorises zones based on the level of human interactivity required by each zone: Zone 0 for human living quarters, resource storage, and kitchen; Zone 1 for crops needing frequent daily attention; Zone 2 for crops requiring once-a-day visitation; Zone 3 for main crops grown for household use and trade with fewer human visitations; Zone 4 for a semi-wild area needing infrequent human visits; and Zone 5 for wilderness or natural areas that require no human interaction. Each case was analysed according to Mollison's model in the individual case reports. This section compares the zoning and structures of the cases.

Cases 1, 3, and 4 all resemble MCZM in the sense that they consist of all 5 zones. Case 2 does not have a Zone 4. Cases 1, 3, and 4 also resemble Mollison’s model in the sense that Zone 1 is connected to Zone 0 and the other zones are not connected to Zone 0, which is indicative of a consecutive design based on the interaction required by humans. Case 2 has a more integrated design where Zones 1 and 2 are combined in one area and Zone 4 is separated from the permaculture system by Zone 5. Cases 1, 3, and 4 all have a Zone 0 that is not part of the permaculture system, whereas Case 2 is the only case to have all its Zone 0 included in the permaculture system. Case 1 has the most variety of land uses and is considered to have a very structured layout in terms of the consecutiveness and relation of each zone to Zone 0. Case 2 has the least variety of land uses as it does not consist of Zone 4 and is considered unstructured in terms of consecutiveness and the relationship of each zone with Zone 0. Case 3 has more land uses than Case 3 and less than Case 1 and is considered to be the most structured in terms of consecutiveness and the relationship of each zone with Zone 0, and the other zones. Case 4 is considered to have a semi-structured layout as the northern section of the permaculture system is based on consecutiveness from Zone 0 outward, whereas the southern section is not based on

consecutiveness from Zone 0. Table 4-3 shows the estimated land use allocation in square meters (m2) of each zone in each case.

Table 4-3: Average land use allocation of each zone in square meters (m2) of the permaculture activity zone.

	Case 1	Case 2	Case 3	Case 4	Average (m^2)	Percentage (%)
Zone 0	5 000	1 400	650	5 000	±3 000	9.5
Zone 1	2 500	1 800	300	2 300	±1 700	5.4
Zone 2	12 000	1 800	2 100	800	±4 200	13.3
Zone 3	3 600	10 000	1 300	500	±1 600	5.1
Zone 4	74 000	0	7 000	4 000	±21 000	66.7
TOTAL					**31 500**	**100**

Source: Author's own compilation

Case 1 has the largest permaculture system area (10 ha) but is still considered compact when considering the number of permaculture activities included in the area (Zones 0 to 5, water harvesting, and livestock grazing). Despite lacking Zone 4 and having the smallest permaculture system area (1.4 ha), Case 2 is also considered compact and very functional considering that 1 ha is occupied by orchards and the amount of permaculture activities included in the remaining 0.4 ha of the entire permaculture (chicken tractors, vegetable garden, and more than 60 different fruit trees). Case 3 has a permaculture activity area of 2.5 ha and is considered to have a very compact structure as the entire 2.5 ha is occupied by a wide range of permaculture activities (rotational grazing, chicken housing, orchards, mixed vegetables and fruits, indigenous trees and shrubs, and other livestock housing). The permaculture activity area in Case 4 is about 2 ha in size and does not have a compact structure. On the contrary, the zones are distributed spaciously and are separated by strips of wilderness (Zone 5) throughout.

Conclusively, although each case study exhibits a unique permaculture zoning structure with varying degrees of alignment and deviation from MCZM, Cases 1 and 3 are considered the most structured and have the most resemblance to Mollison's zoning model. Cases 2 and 4 are both considered less structured and have fewer similarities with Mollison's model. The zoning structure, compactness, land use diversity, and sizes of the permaculture systems are relevant for informing urban considerations, as urban areas are commonly characterised by smaller land parcels and would require compact and diverse design options. The differences between these aspects of the cases highlight the adaptability of permaculture systems to specific contexts and needs.

4.13.3 Water management across the cases

Each case employs unique strategies to ensure a sustainable water supply for their permaculture systems. In Case 1, the primary source revolves around underground water derived from three on-site wells. Complementing this, a layered swale system strategically placed to the east enhances the system's resilience by capturing and managing rainwater and surface runoff. Case 2, in contrast, relies solely on an old artesian well located more than 150m north of the permaculture site, specifically situated at the olive orchards. The well's positioning at a higher contour relative to the orchards and permaculture garden reflects a consideration of elevation in their water-sourcing strategy. In Case 3, a notably sophisticated water system is in place. Rainwater and runoff are collected in a farm dam situated southeast of the permaculture area. A pumping system then transfers the water from the dam to a harvesting pond within the permaculture site. Unlike Cases 1 and 2, this farm does not rely on a well, showcasing an advanced swale system as the primary means of managing water resources effectively. Case 4 also shows a sophisticated water management system, featuring three dams strategically positioned on different contours from north to south. The northern and southern dams serve as storage reservoirs, retaining water, while the middle dam and rain tanks are interconnected with a passing water channel. This integrated system is specifically designed to irrigate the main permaculture activity zones (Zones 1, 2, and 3) on the farm, presenting a comprehensive approach to water distribution and utilisation.

The diverse water management strategies across the cases highlight the adaptability of permaculture systems, with each case considering its unique geographical and contextual factors to ensure effective and sustainable water utilisation within their permaculture systems.

4.14 Cross-case analysis: Findings from the interview data

Thematic analysis was used to analyse the interview transcriptions (Guest *et al.*, 2012; Braun and Clarke, 2022). Three main themes with sub-themes have emerged from the data. The main themes that have emerged are (i) permaculture as a tool for sustainable, resilient, and regenerative food systems; (ii) permaculture to improve community wellbeing; and (iii) permaculture consideration in urban environments. The main and subthemes are presented in the ensuing section.

4.14.1 Main theme 1: Permaculture as tool for sustainable, resilient, and regenerative food systems

This theme relates to permaculture as a food growing practice that (i) strengthens local food sovereignty (sub-theme 1.1) by (ii) establishing independent and self-reliant food systems (sub-theme 1.2). Permaculture systems also encourage (iii) sustainable use and consumption of resources, and (iv) optimising time, money, and labour.

4.14.1.1 Sub-theme 1.1: Permaculture as a tool to enhance local food sovereignty

All the interviews highlighted how permaculture can play a vital role in enhancing local food sovereignty and fostering a sense of sharing and community support. One participant stated, “These gardens play a massive role in local food security within these communities." For example, in the majority of cases, to some extent, a portion of the produce from the relevant permaculture projects is donated to the local community, either to schools, churches, or even community soup kitchens. One participant highlighted that “the wealthier you are in South Africa, the more you have access to affordable, high-quality food, and the less money you have, the less access you have to affordable food,” while another participant stated, “Permaculture’s goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources." The interviews also highlighted that, even in the face of poverty, some individuals have embraced permaculture practices and thrived. This theme highlights the ability of permaculture to provide food within communities as a means to eliminate these communities’ need to depend on external food systems and to empower them to produce their own food.

4.14.1.2 Sub-theme 1.2: Permaculture to establish self-reliance and independence in food production

The second sub-theme regards the capability of permaculture to foster self-reliance and independence among communities and is described by a participant as “it's more than just producing food; it's social inclusivity and, if you're lucky, income generation. But I also believe the main purpose is not necessarily to grow food to sell but to sustain the people involved in the project." Self-reliance and sufficiency were highlighted as core goals of permaculture. Another participant stated, Permaculture’s goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources." It is evident that permaculture aims to create self-reliant communities and is argued to work effectively at the community level as a means of organising informal systems,

enticing community members to participate, and empowering communities to be self-sufficient. However, a bottom-up, community-level approach is essential because, as one participant states, “Sometimes, if it is a top-down approach, people won’t and don’t buy into it." The potential for permaculture to establish integrated communities and ecovillages through knowledge-sharing and skill development was also recognised.

4.14.1.3 Sub-theme 1.3: Resource efficiency

The interviews highlight that permaculture aims to design systems that consume available resources efficiently, ensuring long-term sustainability. The interviews reveal the participants’ intentions for applying permaculture are partly to minimise their reliance on external resources and to create local, self-sufficient food production systems. As a participant stated, “Permaculture’s goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources.”

Water is also identified as a critical component to consider when designing permaculture systems. The interviews highlight that municipal water's expense and unreliability in South Africa led to them advocating for greywater systems for garden water reuse. One participant stated, “Water is a scarce commodity” and highlighted the importance of careful consideration of water availability and the implementation of technical methods such as rainwater harvesting and greywater systems to support permaculture gardens. One participant explicitly said, “Water is the most important component of designing such a system." For example, reusing and integrating household water like shower, bath, and washing machine water into a permaculture system can effectively conserve and recycle water on-site. In two of the cases, water is sourced from underground wells. In an urban setting, boreholes present a viable method for acquiring water that can be seamlessly integrated into a permaculture system.

Participants advocated for techniques like sheet mulching, composting, and integrated pest management to maintain soil health in permaculture systems. These methods also hold potential for rejuvenating degraded land and restoring ecosystems sustainably. Permaculture was found to promote biodiversity, ecological balance, and the attraction of beneficial pests while reducing reliance on harmful pesticides. One participant stressed the role of permaculture in regenerating degraded land, highlighting human responsibility in ecosystem restoration. Additionally, participants underscored the importance of tailoring permaculture projects to local needs, harnessing available resources, and considering both the ecological system and community requirements.

4.14.1.4 Sub theme 1.4: Optimising labour, time, and money

This theme underscores permaculture's goal of achieving "maximum output with minimum input," as noted by several participants, aiming to reduce labour and resource-intensive practices. Permaculture, though demanding like traditional farming, strives for efficiency and sustainability by designing systems requiring less time, money, and carbon input. While persistent labour is necessary, permaculture avoids intensive farming techniques. Well-designed food forests and permaculture systems can become increasingly self-sustaining, needing less maintenance over time. Although these systems require continuous attention, proper design can result in low-maintenance, more manageable systems. The interviews also highlight permaculture as a means to disengage from the monetary system, promote local markets, and foster stable food exchange within communities. Bartering and exchanging produce foster local self-sufficiency instead of relying on external purchases, enhancing community resilience.

4.14.2 Main theme 2: Permaculture to improve community wellbeing

In this main theme, permaculture emerges as stretching beyond its main and obvious focus of producing food to improve community well-being, e.g., physical wellbeing (sub-theme 2.1) and social wellbeing (sub-theme 2.2).

4.14.2.1 Sub-theme 2.1: Permaculture to improve physical wellbeing

The interviews shed light on the impact of permaculture on health and well-being. One participant said, “And it’s not only about growing food but about healthier food too." Permaculture is not solely about growing food but also about improving well-being and promoting healthier food choices and practices by reconnecting with people with indigenous knowledge systems and providing diverse food sources to its local community. From the interviews, the view also arises that, when successfully implemented, permaculture gardens can reduce dependency on external resources and play a crucial role in improving food sovereignty and living conditions in South African communities. Permaculture also fosters nutritional and healthier food production, which can directly contribute to combating undernourishment and malnutrition in poorer communities.

4.14.2.2 Sub-theme 2.2. Permaculture’s role in social wellbeing

The participants mainly agreed that, in their experiences, permaculture contributes significantly to a sense of belonging and place in communities. Not only do permaculture gardens address

food insecurity, but they also encourage engagement, enhance the overall atmosphere, and feel of the community, provide a safe and inclusive space, and, in some cases, serve as emotional support for community members. An example by one of the participants was, “A lot of the women joining our projects want to have people to talk to and something to do during the day, but also a safe place where they feel in power and safe.” Permaculture is also viewed as a motivational community practice that fosters community well-being and care among community members. As one participant explains, “we've seen it and estimated that only about 10% of produce is actually for their own consumption and then donating the rest to the community.” This directly fosters social relationships and dynamics in communities. However, the opposite is also a reality faced in communities where the downside of such food growing initiatives are also very real and is labelled by another participant as “kwaal[9]”. Ultimately, the participants vouched for permaculture to truly “play a massive role in local food security." As one participant described their experience with permaculture projects at schools, they explained that initially, it’s only the students that attend their permaculture courses, and then later on, their parents and other members of the community also join the courses and start engaging in food growing ventures.

4.14.3 Main theme 3: Permaculture consideration in urban environments

A final main theme that closely relates to the sphere of urban planning is the prospects recognised for permaculture consideration in urban planning practices, specifically in terms of (i) space utilisation, (ii) beautification of urban spaces, and (iii) design elements.

4.14.3.1 Sub-theme 3.1: Improved utilisation of urban spaces

The interviews recognised the significance of underutilised spaces in urban areas as potential food-growing spaces. One participant stated, “There is all that space in urban areas that is not necessarily being utilised,” while another participant stated, “The space doesn’t matter; you use what you have to maximise your yield." The interviews also identified a growing opportunity to integrate systems thinking and holistic approaches into the planning and design of urban spaces as a means to create resilient and regenerative human settlements, and one participant specifically stated that “we could organise our land better to support urban food security, and we don't necessarily have to develop all the multiple layers of it, but at least get the foundation in place." This is considered very valuable in the sense that urban systems consist of so many underutilised or non-functional spaces that provide great opportunities for exploration as food growing spaces.

[9] *Kwaal essentially refers to the jealousy that a successful food growing initiative would cultivate amongst other community members, which would then lead to these community members sabotaging the food gardens.*

4.14.3.2 Sub-theme 3.2: Permaculture for functional beautification of urban spaces

A noteworthy proposal from the interviews included giving functionality to ornamental spaces in urban systems (planes, front yards, sidewalks, curbs, etc.) by growing food in these “futile” spaces. As one participant stated, “If you do good permaculture design in an urban environment, it’s like walking in the Garden of Eden." Another interview supported this by proposing retaining stormwater in parking areas and beside roads instead of draining it out of the city as a practical example of sustainable water management in urban areas that could ultimately be integrated into urban permaculture systems. In one of the interviews, a participant explains a square-foot garden as an ideal proposition for urban permaculture. In essence, a square-foot garden is described as a patch of 1m x 1m ($1m^2$) in size where permaculture can be applied. The patch is essentially divided into several 10 cm2 patches, and within each smaller patch, a different vegetable or herb is cultivated. The participant goes on to say, “For example, if you’ve got more than a square foot, you can start introducing fruit and perennial herbs to your space." In this proposal, permaculture principles are still used to guide the design of the system. This sub-theme highlighted the potential for transforming small urban spaces and existing infrastructure, such as parking areas, old houses, bridges, and abandoned spaces, into functional permaculture sites. It insists that the availability of “space" should not be a restricting component for food-growing initiatives in urban communities. Instead, it should be considered an opportunity to apply innovative designs in urban communities to grow food.

4.14.3.3 Sub-theme 3.3: Permaculture system design elements

The participants unanimously emphasise the important role of permaculture design principles in their daily lives, considering them as guiding directives in designing functional and aesthetic food systems with maximum output and minimal input. The participants stress the importance of permaculture principles for designing permaculture systems, for example, slow and steady solutions and observation. As stated by a participant, an example of using these principles in an urban environment would be, “You start with the back door and build from there.” The participants highlight that despite challenges in urban spaces, permaculture is flexible and adaptable and has the opportunity to create sustainable systems that enhance food security, community well-being, and environmental health. Integration of permaculture principles with urban design is seen as a means to create highly productive and enjoyable spaces contributing to a more sustainable future, again phrasing one participant’s statement, “If you do good permaculture design in an urban environment, it’s like walking in the Garden of Eden." The concept of zones in permaculture, with the house as the origin of resources, is highlighted, emphasising the importance of integration and proximity, and considering the larger context in planning permaculture gardens.

4.14.4 Cross case analysis: Challenges

Several challenges with permaculture practices were highlighted throughout the case study. The challenges are summarised in the following paragraphs and are more socially oriented than physical, although physical constraints are also highlighted. The challenges include (i) negative attitudes, (ii) cultural stigmas of agricultural practices, (iii) knowledge and education, (iv) a lack of environmental preparedness, (v) financial implications, and (vi) educating communities and fostering permaculture skills and knowledge.

4.14.4.1 Challenge 1: Navigating negative attitudes and the struggle for harmony in community food-growing initiatives

A negative perspective on this theme is frequently highlighted throughout the interviews, and in one interview specifically labelled "kwaal," isolating and jealous attitudes are a common issue that hinders the success of community food-growing initiatives. This clearly emphasised the need for healing and fostering good neighbourliness for successful collaboration. However, permaculture is also considered to have the potential to bridge this gap between community conflicts and create connections between community members by promoting a decentralised and inclusive food system.

4.14.4.2 Challenge 2: Cultural stigma of agricultural practices

The current cultural stigma linked to agricultural practices poses a challenge to the successful realisation of urban food-growing practices. Before urban food growing practices can be scaled up in the South African context, there would need to be investment in terms of community training and awareness to ensure that communities engage with the concept of permaculture and especially the benefits related thereto. Culturally sensitive and targeted participatory planning processes would be required to illustrate to these communities that permaculture can enhance the sustainability of modern cities and societies to their benefit.

4.14.4.3 Challenge 3: Overcoming knowledge gaps and lack of interest

The lack of permaculture education and knowledge is highlighted throughout the case study. Certain approaches for fostering permaculture education are discussed, including through school programmes and permaculture design courses; however, the lack of engagement on a community level poses a challenge. The interviews also highlighted that a main challenge with permaculture design courses is that many of the individuals who attend these courses lack even basic

gardening and agricultural knowledge, delaying the nurturing of more valuable skills or advancing existing skills to support permaculture application.

In this regard, the case study emphasised that the lack of technical skills associated with permaculture, including soil conditioning, water harvesting, pest management, seasonal planting, and business development, are essential skills for permaculture that could empower people with practical tools for sustainable and resilient living. It was also emphasised that permaculture education aims to reconnect people with indigenous knowledge systems and self-reliance, acknowledging the value of traditional practices in sustainable living. However, a further challenge revealed was that the lack of resources, skills, and knowledge often leads to deeper challenges of negative attitudes and frustration towards permaculture, which then also leads to a lack of interest in the communities.

The interviews also pointed out that the modern world's focus on industrialised and centralised systems has led to a loss of traditional knowledge on sustaining productive systems in smaller spaces. The interviews argue that permaculture education should strive to help everyone understand and learn, regardless of their background, promoting self-management and self-driven permaculture systems.

4.14.4.4 Challenge 4: Lack of preparedness for environmental challenges in South Africa

A prominent challenge that arose across the interviews was the lack of preparedness for the current environmental issues faced in South Africa. Participants emphasise that existing planning legislation and regulations generally fail to consider modern-day environmental challenges, such as longer droughts, increased floods, and the growing poverty status of South Africa. The participants emphasise that there is a need to update planning and other built environment regulations to better prepare for and mitigate these issues.

4.14.4.5 Challenge 5: Financial constraints, limited funding, and short-term engagement

The interviews revealed that permaculture application is also often hindered by financial challenges like limited funding and long-term engagement from knowledgeable permaculture implementors. There is a need for continuous funding and continued teaching within a community to ensure the long-term success and impact of permaculture initiatives.

4.14.4.6 Challenge 6: Educating communities and fostering permaculture skills and knowledge

The significance of permaculture education is highlighted, particularly for children and learners, and to teach individuals how to apply permaculture principles in the spaces available to them. The technical skills associated with permaculture, including soil conditioning, water harvesting, pest management, seasonal planting, and business development, could empower people with practical tools for sustainable and resilient living. A participant mentioned, “If water is a poor resource, we teach them to harvest water." The interviews argue that permaculture education should strive to help everyone understand and learn, regardless of their background, promoting self-management and self-driven permaculture systems. Permaculture education aims to reconnect people with indigenous knowledge systems and self-reliance, acknowledging the value of traditional practices in sustainable living.

4.14.5 Cross case analysis: Lessons for urban planners from best permaculture practices

Permaculture is clearly an innovative tool to consider for fostering food sovereignty and well-being in urban communities. In order to answer the research question (How can best practices of permaculture in South Africa inform future food-sensitive planning in South African cities?) important lessons were revealed by the cases to consider when implementing permaculture in urban communities. These lessons include (i) optimising resource use in urban permaculture, (ii) fostering grassroots approaches in urban permaculture planning, (iii) space utilisation for urban permaculture, and (iv) transformative approaches to urban permaculture.

4.14.5.1 Lesson 1: Optimising resource use in urban permaculture: Sustainable water sourcing, soil health, and topography integration

The study underscored the significance of utilising existing resources and adopting sustainable methods for resource acquisition rather than solely relying on rainwater storage tanks and municipal water, for example, harvesting and reusing greywater and rainwater. This suggestion clarified that greywater systems, typically positioned near Zone 0, can be employed to gather, purify, and store household water for reinvestment into the permaculture system. Notably, the study emphasised that do-it-yourself (DIY) greywater systems can be implemented without the need for expensive and intricate equipment.

Additionally, the study emphasised the significance of considering the land's topography in permaculture system design. Instead of collecting water at a higher contour, utilising the topography to direct water into the permaculture system was highlighted, thereby reducing the need for water pumps. The study also brought to light valuable methods that can be employed to improve and retain healthy soil within a permaculture system. These methods included sheet mulching, composting, and integrated pest management.

This lesson holds relevance for urban contexts, offering practical approaches to water acquisition for permaculture systems and emphasising their capacity to sustain soil health, thereby mitigating the need for expensive and harmful pesticides and fertilisers.

4.14.5.2 Lesson 2: Grassroots approach for urban permaculture: Fostering community engagement

The case study highlights the importance of grassroots initiatives in fostering community engagement and positive attitudes, as seen in Cases 1 and 4, which are both community driven. The case studies illustrate communities where members actively participate in shaping the land through permaculture practices. However, the interviews revealed challenges in uniting individuals to initiate food-growing gardens, as sustaining interest and effort can be difficult. However, permaculture initiatives also tend to spark enthusiasm among community members and emphasise the importance of bottom-up engagement in planning urban spaces. Involving the public in the planning stages is crucial for sustained success, especially in addressing the challenge of educational engagement. Equipping participants with the necessary skills and knowledge is essential to maintaining initiatives and preventing loss of motivation.

4.14.5.3 Lesson 3: Space utilisation for urban permaculture: Adaptability of permaculture systems to urban scale and size

The study focused on permaculture applications in rural settings, emphasising the belief among participants that permaculture is adaptable to various land sizes, echoing the original theory by Mollison and Holmgren (1990). While the cases lacked specific spatial recommendations for urban contexts, the spatial data from rural permaculture studies was considered valuable for informing urban adaptation. To reconcile the differences in scale between rural and urban settings, the study proposed considering Zones 0–2 as primary informants for urban permaculture, with the option to include Zone 3 in larger urban spaces. Table 4-4 & Table 4-5 illustrate the proportional land use allocations across the cases and establish a 30-20-50 percent split of permaculture activity zones (0-2) for smaller urban spaces and a 30-15-40-15 percent split

of permaculture activity zones (0-3) for larger urban spaces. Table 4-4 & Table 4-5 represent the proportions of each zone relative to the case studies. The tables can also be used to generate conceptual land use allocations on urban land parcels.

Table 4-4: Average land use allocation per zone in square meters (m2) of the permaculture activity zone – only considering Zones 0 - 2.

	Case 1	Case 2	Case 3	Case 4	Average	%	
Zone 0	5 000	1 400	650	5 000	±3 000	33	33
Zone 1	2 500	1 800	300	2 300	±1 700	20	67
Zone 2	12 000	1 800	2 100	800	±4 200	47	
TOTAL					**8 900**	**100**	

Table 4-5: Average land use allocation of each zone in square meters (m2) of the permaculture activity zone – only considering Zones 0 - 3.

	Case 1	Case 2	Case 3	Case 4	Average	%	
Zone 0	5 000	1 400	650	5 000	±3 000	29	30
Zone 1	2 500	1 800	300	2 300	±1 700	16	55
Zone 2	12 000	1 800	2 100	800	±4 200	40	
Zone 3	3 600	10 000	1 300	500	±1 600	15	15
TOTAL					**10 500**	**100**	

Source: Author's own compilation

The suggested splits highlight the flexibility and adaptability of permaculture, irrespective of property size. For instance, on a 500m² property, the split could allocate 30% for residential use (Zone 0) and 70% for Zones 1 and 2 (food growing practices). The same goes for a larger property where Zone 3 can also be introduced, and the 30-15-40-15 split could be suitable.

The study highlighted the adaptability of permaculture in informing the zoning design of urban space, focusing on land use allocation rather than detailed design proposals within each zone. Consideration of MCZM and the incorporation of Holmgren's (2002) principles are deemed crucial for guiding the micro-level design of an urban permaculture system. Additional urban elements, such as topography and infrastructure, in determining zone allocations on a land parcel will also be important to consider when designing a permaculture system.

4.14.5.4 Lesson 4: Transformative approaches to urban permaculture: Fostering sustainable food systems for urban adaptation

In exploring how permaculture principles intersect with urban planning in South Africa, valuable insights emerged. Suggestions advocate for repurposing urban spaces like lawns, sidewalks, and parking lots into productive areas for growing food and retaining stormwater in urban areas and support permaculture's principles of catching and storing energy and creatively using available resources.

Participants unanimously highlighted the pivotal role of permaculture design principles in creating efficient and visually appealing food systems. The concept of "starting with the back door and building from there" reflects the holistic approach of permaculture, designing from patterns to details. Water management, a critical element in each case study, is valued in permaculture for its renewable nature, promoting techniques like groundwater and rainwater harvesting and greywater systems to address water challenges in South African cities. Practical applications of Holmgren's permaculture principles, such as observing and interacting with nature, were evident in the interviews. The "square foot garden" aligns with the principle of small and gradual solutions, promoting sustainable urban permaculture approaches.

The challenge highlighted by the case study regarding inadequate planning legislation underscores the need for a paradigm shift, echoing Holmgren's principle of creatively responding to change. Updating planning regulations to integrate innovative food system planning also aligns with permaculture's principle of integration over segregation.

These insights emphasised permaculture's adaptability and transformative potential in urban spaces. By integrating permaculture principles into urban planning, there is an opportunity to create sustainable, resilient systems that address environmental challenges, enhance food sovereignty, and contribute to community well-being.

4.15 Discussion: Synthesising the multiple-case study in terms of permaculture theory to inform urban food systems

The findings from the cross-case analysis of four permaculture farms reveal how permaculture theory and practice can inform food-sensitive planning in urban contexts. This discussion aims to provide a synthesis of permaculture principles and practices and their relevance for urban food systems.

4.15.1 Permaculture theory and its consideration in urban food systems

The study's exploration of permaculture as an approach to sustainable food systems in urban context reflects the principles of permaculture and advocates for a paradigm shift in planning regulations to promote urban food growing initiatives as a response to evolving urban needs and challenges.

4.15.1.1 Designing for resource efficiency and sustainability

The principles of permaculture greatly involve designing systems to be resource efficient and sustainable. This study underscores the importance of optimising resource use, promoting self-reliance, and minimising inputs in urban permaculture systems (sub-themes 1.3 & 1.4, p. 146 & 147)). However, challenges such as overcoming knowledge gaps, financial constraints, and cultural stigma hinder the full implementation of these principles. However, the themes of resource efficiency, self-reliance, and optimising labour, time, and money emerged as crucial considerations in urban permaculture planning (lesson 1, p. 152).

4.15.1.2 Fostering community engagement and social well-being

Another dimension involved fostering community engagement and social well-being. The study highlights grassroots approaches to community involvement, emphasising the importance of fostering connections and addressing negative attitudes within communities (sub themes 1.2, 2.1, & 2.2, p.145, 147, & 147). However, challenges persist in navigating social conflicts, overcoming lack of interest, and promoting cultural acceptance. Still, the themes of community empowerment, social cohesion, and improving physical and social well-being underscore the transformative potential of permaculture in urban settings.

4.15.1.3 Adaptability and flexibility in urban space utilisation

Lastly, adaptability and flexibility in urban space utilisation are essential aspects of permaculture practices. The study reveals strategies for integrating permaculture into urban spaces, utilising underutilised areas, and promoting functional beautification (sub themes 3.1 & 3.2, p. 148, 149). However, challenges such as lack of preparedness for environmental challenges, limited funding, and short-term engagement pose obstacles to effective implementation. Nonetheless, the findings of utilising urban spaces through functional beautification and permaculture system design elements highlight opportunities for creating resilient and sustainable urban food systems (lesson 3, p.153).

4.15.2 Implications for urban food systems planning

These findings have significant implications urban food systems planning namely (i) promoting urban food sovereignty, (ii) building resilient and inclusive communities, and (iii) integrating permaculture into urban planning and policy.

4.15.2.1 Promoting urban food sovereignty

By leveraging permaculture principles, urban planners can promote food sovereignty within cities through grassroots initiatives to establish sustainable and resilient food systems, address issues of food access and equity, and empower communities to engage in independent and regenerative food systems (sub theme 1.1, p.145 & lesson 2, p.153).

4.15.2.2 Building resilient and inclusive communities

Incorporating permaculture practices into urban planning efforts can contribute to building resilient and inclusive communities. By fostering social cohesion, community empowerment, and well-being, urban planners can address social inequalities and challenges, creating more vibrant and cohesive urban environments (sub theme 1.1, p.145).

4.15.2.3 Integrating permaculture into urban planning and policy

Finally, integrating permaculture into urban design and policy can lead to transformative changes in urban landscapes (sub theme 3.3, p.149). By recognising the potential of permaculture in transforming urban spaces and enhancing environmental resilience, policymakers can develop policies and regulations that support sustainable food systems and promote environmental stewardship (lesson 4, p.155).

4.16 Conclusion

The study not only underscores the relevance of permaculture theory in guiding food-sensitive planning in urban contexts but also reflects its practical application through four case studies in South Africa. Recognising the significance of permaculture in addressing urban challenges, the study advocates for its principles and ethics as solutions that underscore adaptability and transformative potential within complex urban dynamics. Embracing permaculture principles, urban planners can work towards developing sustainable, resilient, and equitable urban food

systems, fostering community engagement, social inclusion, and innovative urban design. Ultimately, by integrating permaculture principles, cities can evolve into hubs of food sovereignty, well-being, and environmental stewardship, benefiting all residents and fostering a more sustainable future.

CHAPTER 5 : SYNTHESIS AND CONCLUSION

5.1 Purpose and structure of this chapter

The primary purpose of this chapter is to provide a synthesis of the study in total, with special attention to the findings from the cases of permaculture that are presented in this dissertation. In this concluding chapter, the outcomes of the literature review and empirical section of the research are merged to reflect on how to adopt regenerative edible landscapes in towns and cities by utilising permaculture. In terms of the structure of the chapter, Figure 5-1 illustrates how the chapter is compiled.

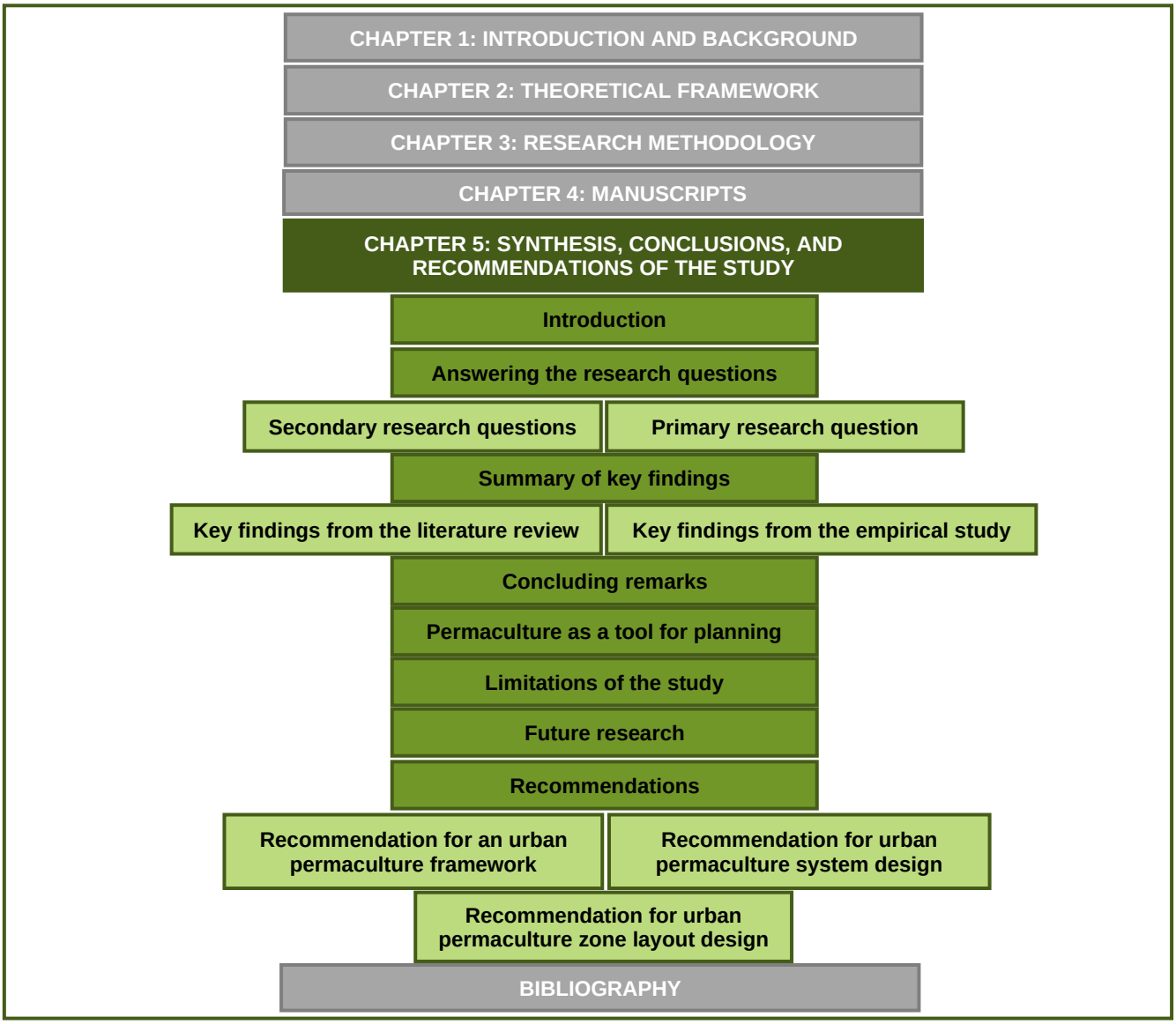


Figure 5-1: Structure of this chapter.
Source: Author's compilation.

In the first part of the chapter, it is illustrated how the research questions of the study as well as the aims and objectives have been met, followed by a summary of the key findings from the two manuscripts to show the amalgamated findings from the two studies (literature and empirical). The chapter ends with concluding remarks that include recognising the significance of the study, the limitations of the study, and recommendations for future research and planning considerations.

5.2 Introduction

The purpose of the research was to investigate permaculture through an urban planning lens by assessing how permaculture could be incorporated into the planning and design of urban systems. Based on this assessment, recommendations for food-sensitive urban planning, particularly for South Africa, were developed using edible landscapes. The study employed multiple data generation methods, combining a scoping review (literature) and a multiple-case study (empirical) (Section A: Chapter 3). The scoping review assessed the extent to which permaculture has been addressed in the literature and its prospects for informing urban planning (Section B: Chapter 4, Paper 1). The multiple-case study examined permaculture practices in South African cities, focusing on their contributions to food sovereignty, community well-being, and sustainable and resilient systems (Section B: Chapter 4, Paper 2). The research encompasses the potential of permaculture to address food insecurity and community well-being in the long run and, in this way, create sustainable and resilient urban food systems by drawing insights from global and local perspectives. Although the research presents a small step in the right direction, it fills a gap in current urban planning scholarship, while reality indicates that hunger is an ever-increasing challenge on the African continent.

5.3 Answering the research questions

The primary research question that guided the study is: How can permaculture be used as a planning tool to produce regenerative food systems (edible landscapes) in South African cities to combat food insecurity? In order to effectively address the primary research question, the secondary questions are answered first. The secondary questions serve as foundational questions to offer important insights and context needed to answer the primary research question (Section A: Chapter 1).

5.3.1 Secondary research question 1: To what extent has permaculture been addressed in the literature and what are its prospects to inform urban planning in addressing food insecurity?

The scoping review that was conducted comprehensively addresses the research question regarding the extent to which permaculture has been explored in the literature and its prospects for informing urban planning to tackle food insecurity. It revealed that while permaculture has been extensively studied globally, the focus has mainly been on rural areas, leaving a critical gap in understanding its applicability in urban systems, especially in sub-Saharan African countries (Section B: Chapter 4, Paper 1). The review emphasised the need for increased attention to integrating permaculture into urban planning, highlighting its potential to create sustainable and regenerative urban food systems.

One aspect that emerged from the scoping review is that permaculture is predominantly examined through social, environmental, or economic lenses individually, predominantly in rural settings. A second aspect highlighted by the review is permaculture as an integrated design approach for regenerating degraded systems, emphasising its advantages beyond food provision (Section B: Chapter 4, Paper 1). A third aspect noted in the review is its significance for urban planners, urging them to recognise the comprehensive nature of permaculture for urban systems. This acknowledgement is crucial for harnessing its regenerative benefits across all dimensions within urban systems, with a primary focus on food provision in urban areas.

Although acknowledging the potential urban benefits, the review also emphasised the challenges and uncertainties regarding the success and contribution of permaculture to addressing food insecurity in sub-Saharan Africa. It stressed the importance of additional research, particularly through a systematic review, to consider how permaculture could be effectively integrated into urban planning on policy and legislative levels.

The scoping review emphasised the importance of raising awareness and understanding about permaculture in urban planning. It calls for more research from an urban planning perspective to tackle the complexity of the urban food landscape in sub-Saharan African cities (Section B: Chapter 4, Paper 1). Conclusively, the scoping review effectively answered the research question, offering a nuanced perspective on permaculture's potential in addressing food insecurity in urbanised systems, particularly in sub-Saharan Africa.

5.3.2 Secondary research question 2: How can best practices of permaculture in South Africa inform future food-sensitive planning in South African cities?

Despite the case studies being in rural areas, the multiple case studies that were utilised in the empirical section of the research focused on lessons (best practices) about permaculture that can possibly be applied in urban systems. There are at least four best practices that have emerged from the spatial surveys and interviews that can be used to inform urban food systems. These include adaptable size, community empowerment, resource and environmental management, and functional urban design.

The first best practice identified in the empirical study concerns permaculture's adaptability across different land sizes. This aligns with the original concept proposed by Mollison and Holmgren (Section B: Chapter 4, Paper 2), suggesting that urban environments may derive as much benefit from permaculture as rural areas. While the data did not yield specific spatial recommendations for urban settings, the case studies offered valuable insights into scaling based on spatial data. Additionally, they proposed potential layout patterns and macro designs for future urban spaces suitable for permaculture implementation.

The next best practice from the empirical study highlights how permaculture systems inherently facilitate community empowerment. In South Africa, the adoption of permaculture techniques significantly enhances local food security, community well-being, and environmental health. The study underscores permaculture's ability to strengthen the sense of place, foster self-reliance, and promote community engagement, ultimately empowering communities towards self-sufficiency and food sovereignty. Importantly, the research advocates for a grassroots approach to urban space planning and stresses the necessity for South African planning legislation to undergo a paradigm shift to align with permaculture principles.

A third best practice revealed the ecocentric nature of permaculture by emphasising its intentions to foster sustainable waste and resource management. This encompasses efficient resource utilisation and water management, especially pertinent for urban settings (refer to Section B: Chapter 4, Paper 2). These practices underscore permaculture's sustainable and regenerative potential, making it a compelling option for long-term food system viability due to its core ethics and principles that prioritise both the environment and people.

A final best practice that emerged shed light on urban planning in South Africa. It proposes that through permaculture, the repurposing of ornamental spaces (sidewalks, parks, and parking lots) into practical food systems could be a viable way of integrating food into urban communities

through urban planning (Section B: Chapter 4, Paper 2). The crucial role of permaculture in establishing sustainable and adaptable urban environments was emphasised, underscoring its capacity for fostering transformation and the necessity for legislative harmonisation with permaculture principles. The research contributes to the integration of permaculture into urban planning frameworks, offering valuable insights for future considerations. In answering the secondary questions, as discussed in the previous section, it was possible to structure an answer for the primary question.

5.3.3 Primary research question: How can Permaculture be utilised as a planning tool to produce regenerative food systems (edible landscapes) in South Africa cities to combat food insecurity?

A main aspect that emerged from the study is the possibility of using permaculture as a planning and design tool to cultivate regenerative food systems in towns and cities. This planning tool can be utilised in at least four ways: fostering community engagement, planning for regenerative urban systems, planning for food sovereignty, and utilising permaculture's adaptability and flexibility in urban contexts.

Firstly, as a tool to **foster community engagement and create social impact:** The study emphasises the impact of permaculture, including food sovereignty, a sense of belonging, self-reliance, and community empowerment (Section B: Chapter 4, Papers 1 and 2). These aspects contribute to the resilience of urban communities. The research findings offer a pathway for urban planning to actively engage communities in revitalising underutilised public urban spaces for food growing practices. This engagement aims to transform spaces in densely populated communities where space may be scarce into edible urban areas. Through joint efforts, urban planners and community leaders can pinpoint optimal locations for implementing permaculture systems, considering factors such as accessibility, soil conditions, and community preferences. In this context, the planner could serve as the facilitator connecting urban communities with local authorities responsible for land allocation and utilisation decisions.

Second, as an example of how to **plan for regenerative urban systems:** The study underscores permaculture's capacity to revolutionise food systems. It emphasises permaculture's ability to empower systems to sustain themselves, thereby fostering self-sufficiency (Section B: Chapter 4, Paper 2). This paradigm shift raises awareness about permaculture's capability to establish urban food systems that operate independently, catering to communities in a sustainable manner. Such systems possess regenerative qualities, forming interconnected people-nature networks that can

perpetuate themselves without relying on external inputs, ensuring continuous provision for both the system's components and the community at large.

Thirdly, permaculture's potential to offer an **integrated approach to planning for food sovereignty**: The research underscores permaculture's pivotal role as a valuable tool for urban planners seeking to enhance urban systems across social, environmental, and economic dimensions (Section B: Chapter 4, Paper 1). Permaculture addresses social considerations such as community well-being and sense of place while simultaneously fulfilling environmental imperatives by establishing and maintaining long-term sustainable and resilient food systems through environmentally sensitive ‘farming’ methods. Economically, permaculture systems empower communities to disengage from industrialised food systems, fostering local economic development and participation.

Urban planners can foster complex urban systems by implementing initiatives like edible public spaces within townships, leveraging the benefits of urban permaculture. Such spaces could encourage community engagement and foster a sense of community empowerment (social), stimulate economic activity by providing platforms for local producers to vend fresh produce (economic), and contribute to the creation of environmentally sustainable urban environments by optimising resources, minimising waste, and supporting natural ecosystems (environmental). By combining these aspects through urban permaculture, edible public spaces could play a crucial role in promoting food sovereignty in urban areas.

Fourthly, **adaptability and flexibility:** The adaptability of permaculture systems to different urban contexts, sizes, and challenges is a recurring theme throughout the study. Permaculture offers customisable solutions suited to specific requirements and local circumstances (Section B: Chapter 4, Paper 2). In South African cities, where informal arrangements are common, urban permaculture could serve as a bridge between formal and informal systems. Its flexibility could enable food growing systems to flourish in almost any space, whether temporary or permanent, and allow for management and growth based on the resources and needs of involved members. It can be tailored to both large and small communities.

5.4 Summary of Key Findings

Permaculture, rooted in the principles of observing and emulating natural ecosystems, offers a holistic approach to sustainable living and design (Section A: Chapter 2). While traditionally applied in rural settings, its potential in urban environments remains underexplored (Section B: Chapter 4, Papers 1 and 2). This study is intended to bridge the gap between permaculture and urban planning practices, particularly focusing on South African cities where food insecurity and socio-economic challenges persist.

5.4.1 Key findings from the literature

There are three main findings to present as key findings from the scoping review that was conducted for the period of 2021 – 2023 (Section B: Chapter 4, Paper 1).

5.4.1.1 Key finding 1: Transformative Potential and Integration of Human Needs and Environmental Contexts

Permaculture is acknowledged for its capacity to support resilience and regeneration within systems by harmonising human needs with environmental contexts. It advocates for local farming across various scales, enhancing food production across systems. Permaculture prioritises biodiversity and the creation of ecosystems with diverse functions and services, which can be seamlessly integrated into urban planning. It promotes the development of self-sustaining agricultural ecosystems with minimal human intervention, irrespective of scale.

5.4.1.2. Key finding 2: Exploration through social, environmental, or economic lenses

The scoping review found that permaculture has been predominantly examined through social, environmental, or economic perspectives, often with a rural emphasis. Despite this comprehensive exploration, there's a noticeable absence of permaculture research within the spatial planning profession, indicating a gap in understanding and integration. Permaculture endorses techniques like composting, greywater recycling, and rainwater harvesting, aiming to reduce cities' environmental impact and support resilient food systems. By empowering urban communities to produce their own food, permaculture could foster social inclusivity. The scoping review emphasises the necessity of integrating permaculture into urban systems, particularly in sub-Saharan African cities, to enhance their social, environmental, and economic resilience.

5.4.1.3. Key finding 3: Limited Application in Urban Settings and Challenges and Uncertainties in Integration

Despite extensive global examination from various perspectives, permaculture's adoption in urban settings remains limited. Recognised as an integrated design philosophy, permaculture offers valuable concepts and principles for urban planners to consider in crafting urban food systems. The review also underscores the challenges and uncertainties impeding the seamless integration of permaculture into urban planning. It advocates for further research and thoughtful consideration from both planning and policy angles to effectively address these challenges.

5.4.2 Key findings from the multiple-case study

There are three main findings to present as key findings from the multiple-case study that was conducted for the period of 2022 – 2023 (Section B: Chapter 4, Paper 2).

5.4.2.1 Key finding 1: Contributions of Permaculture Practices in South Africa

The multiple-case study revealed that permaculture enhances local food security, improves community well-being, and fosters sustainable and resilient systems. It achieves this by empowering communities to create their own independent food systems, thereby positively impacting the sense of place, self-reliance, and community engagement within communities.

5.4.2.2. Key finding 2: Challenges Hindering Permaculture Adoption in Urban Systems

The multiple-case study also highlighted common challenges hindering permaculture adoption. Mainly, cultural stigmas and negative attitudes often result in disinterest from communities due to a lack of knowledge and understanding of permaculture. Secondly, financial constraints for initiating permaculture projects tend to hinder implementation and discourage involvement from communities in need.

5.4.2.3. Key finding 3: Action Needed from the Planning Profession to Foster Urban Food Production

Despite the challenges outlined in the multiple-case study, there is a strong recommendation for a fundamental change in planning legislation. This transformation should prioritise bottom-up approaches, fostering connections with communities at the grassroots level. This approach should also aim to enable communities to actively engage in and implement concepts like

permaculture for urban food production. Additionally, intervention is necessary to educate and equip urban communities with the knowledge and skills required to initiate and sustain food growing initiatives.

5.4.3 Integrated findings from the research

Permaculture is based on the observation and imitation of natural ecosystems and presents a holistic approach to sustainable living and design (Section A: Chapter 2). Its evolution can be traced through several developmental phases, from its roots as an agricultural ecosystem (1979–1990s) to permaculture as a design system (2000–2010), towards a focus on collective and social design (2010–2019), and finally to permaculture as an ongoing ecological and cultural process (2020 onwards). While traditionally applied in rural areas, its potential in urban settings remains largely unexplored.

A comprehensive review conducted from 2021 to 2023 highlighted permaculture's transformative capacity, emphasising its ability to align human needs (social and economic) with environmental contexts. Despite its acknowledged role in enhancing resilience and regeneration within systems, permaculture research in the spatial planning profession is lacking, indicating a critical gap in understanding and integration. Case studies in South Africa conducted from 2022 to 2023 showcased permaculture's contributions to local food security and community well-being. They demonstrated how permaculture practices empower communities to establish independent food systems, positively impacting their sense of place, self-reliance, and community engagement. However, challenges such as cultural stigmas, negative attitudes, a lack of knowledge, and financial constraints persist in hindering permaculture adoption in urban systems.

The findings emphasise the need for a paradigm shift in urban planning practices to embrace permaculture principles and incorporate them into urban food system planning. Despite its potential to address food insecurity challenges and promote sustainable urban development, permaculture's full potential remains unrealised due to limited integration into planning scholarship and practical application. Efforts from academics, planners, policymakers, and communities are required to bridge this gap and create enabling environments for the widespread adoption of permaculture practices in urban contexts, fostering more resilient, inclusive, and regenerative food systems that benefit both people and the planet.

Despite its rich history and potential to address food insecurity, especially in regions like Africa, permaculture has not fully permeated planning scholarship. Although empirical evidence demonstrates its efficacy in addressing communities' food and nutritional needs while

empowering them, these successes are rarely mentioned and referred to for guidance, highlighting a significant gap between theory, practice, and potential in addressing pressing food insecurity challenges through urban permaculture.

5.5 Concluding remarks

5.5.1 Significance of the study

The scoping review discussed in Section B: Chapter 4, Paper 1 ('Fighting the Hunger Games through Permaculture: A Literature Scoping to Inform Spatial Planning') highlighted a gap in current research. It emphasised the necessity for a thorough understanding and systematic assessment of the challenges and benefits of integrating permaculture into urban planning for sustainable and resilient urban food systems. The significance of this research is underscored by its exploration of the potential of permaculture to combat food insecurity, foster sustainable urban development, and highlight the barriers hindering its integration into mainstream urban planning practices.

The empirical investigation in the form of a multiple-case study design as presented in Section B: Chapter 4, Paper 2 (Cultivating Edible Cities: Lessons for Urban Planners from Permaculture Case Studies in South Africa) addressed a gap in research that relates to the need for localised perspectives and practical assessments regarding the integration of permaculture into urban planning, particularly within the context of sub-Saharan African cities. The significance of this part of the research lies in its emphasis on the necessity for additional research to better understand the complexities of urban food landscapes and to strengthen urban planning contributions to promote food sovereignty in urban environments.

Overall, the significance of the study lies in its comprehensive exploration of permaculture's potential as a NBS to address urban challenges through food production, its emphasis on the need for tailored approaches based on local contexts, and its call for increased awareness and understanding of permaculture within urban planning discourse. This study advocates that permaculture can be used as a useful tool in urban food systems planning. The three core ways found in this research to enable the integration of permaculture into urban planning are (i) by engaging communities in the planning of urban food systems, (ii) by intervening at the physical design level when planning urban food systems, and (iii) by referring to the principles and ethics of permaculture design to guide urban food system design.

5.5.2 Permaculture as a tool for planning urban food systems

The three core ways found in this research to enable the integration of permaculture into urban planning are (i) by engaging communities in the planning of community spaces to become integrated urban food systems e.g. by transforming open spaces not being utilised into regenerative edible landscapes, (ii) by intervening at the physical design level when planning urban food systems e.g. by incorporating multiple stakeholders to plan/design together, and (iii) by referring to the principles and ethics of permaculture design to guide urban food system design e.g. by mobilising community members to obtain knowledge and training about permaculture as a way to plan public spaces (open spaces, sidewalks) in local communities.

5.5.2.1 Grassroots level engagement as point of departure for urban permaculture

Grassroots engagement as a point of departure is considered one of the most crucial steps for initiating permaculture for food production in urban systems. It emphasises that involving the community from the outset is vital for ensuring a sense of ownership and enthusiasm among community members to embrace self-reliance. By actively involving community members and stakeholders in the planning and implementation phases of urban permaculture projects, communities can develop a deeper connection to the initiatives. This early engagement will foster a sense of ownership and empowerment, as community members will feel personally invested in the success of the projects. Grassroots engagement would also promote transparency and inclusivity in decision-making processes related to urban permaculture and could create opportunities for knowledge sharing and skill development within the community.

5.5.2.2 Physical design intervention from the planning profession

The adoption of permaculture in urban systems necessitates proactive involvement from the planning profession to promote urban food production, particularly within the public realm. This intervention could demand the development of practical design guidelines that urban planners can use as references for structuring and arranging urban food systems in a functional manner. In essence, the planning profession must actively engage in facilitating the integration of permaculture principles into urban landscapes. This could ensure that urban food production initiatives are not only conceptualised but also supported by tangible frameworks and guidelines to aid urban planners in the physical design and organisation of these systems within urban environments. By establishing clear and actionable design guidelines, urban planners can effectively incorporate permaculture practices into the built environment, optimising available space and resources for sustainable food production.

5.6 Recommendations

In this study, "edible urban landscapes" denote systems of food cultivation within urban areas that aim to reduce dependency on industrialised food systems, empowering communities to develop independent food-growing systems. Permaculture is proposed as a distinctive concept to achieve this objective. However, the urban planning profession has yet to fully embrace and promote permaculture within urban communities, leaving ample room for further exploration and investigation into its potential. This study lays a solid foundation for such investigations by providing a comprehensive overview of both current and future possibilities inherent in urban permaculture. Beyond its capacity to address food insecurity in urban settings, urban permaculture offers numerous benefits for the natural environment and local economy.

5.6.1 Strategic recommendations

5.6.1.1 Role of the local planning government (public sector)

The adoption of permaculture in urban systems necessitates proactive involvement from the local planning sector to promote urban food production, particularly within the public realm. This intervention could demand the development of practical design guidelines that urban planners can use as references for structuring and arranging urban food systems in a functional manner. In essence, the planning profession must actively engage in facilitating the integration of permaculture principles into urban landscapes. This could ensure that urban food production initiatives are not only conceptualised but also supported by tangible frameworks and guidelines to aid urban planners in the physical design and organisation of these systems within urban environments. By establishing clear and actionable design guidelines, urban planners can effectively incorporate permaculture practices into the built environment, optimising available space and resources for sustainable food production.

This study offers both strategic and spatial recommendations for urban planners aiming to integrate urban permaculture practices. Firstly, it outlines strategic considerations for the initiation phase, providing a conceptual framework to guide implementation and the permaculture principles to guide its design. Secondly, it presents spatial recommendations derived from the study's spatial analysis. The spatial recommendation involves transforming a public open space into an edible urban landscape. This initiative not only facilitates direct food provision but also fosters economic, social, and environmental advantages for the surrounding community.

5.6.1.2 Recommendation for an Urban Permaculture Framework (UPF)

The proposal here is to develop an Urban Permaculture Framework (UPF) alongside a Spatial Development Framework[10] (SDF) to be formally incorporated as a spatial vision to address food insecurity. The development of such a proposed UPF should be guided by the following:

(i) Learning from best permaculture practises:

As this study has proved, urban permaculture initiatives can draw valuable insights and guidance from existing permaculture practices. Although few urban permaculture practises exist, rural practises have been very valuable in informing the dynamics of a permaculture food systems and can in many cases directly inform its consideration in urban systems. Urban planning sectors should observe existing permaculture practices and draw valuable solutions therefrom to create edible urban landscapes that can grow to be self-sustaining and support communities in need.

***(ii) Including community stakeholders*:**

The study highlights the critical role of grassroots engagement in urban permaculture initiatives. It emphasises that involving the community from the outset is vital for ensuring a sense of ownership and enthusiasm among community members to embrace self-reliance. By actively involving community members and stakeholders in the planning and implementation phases of urban permaculture projects, communities can develop a deeper connection to the initiatives. This early engagement will foster a sense of ownership and empowerment, as community members will feel personally invested in the success of the projects. Grassroots engagement would also promote transparency and inclusivity in decision-making processes related to urban permaculture and could create opportunities for knowledge sharing and skill development within the community. Permaculture workshops could be an impactful tool during the planning phases to prepare and equip communities for the way forward.

(iii) ***Embracing flexibility and adaptability*:**

This study highlights the flexibility and adaptability of permaculture, demonstrating its ability to be tailored to various environments. An UPF should incorporate space for change and adaptability throughout the project's duration to strengthen the system's resilience to changes, for example shifts in stakeholder engagement or unforeseen natural shocks and prevent disturbances from disrupting the functionality of the system. By doing so, the right framework could ensure the longevity of urban food systems and foster continuous regenerative development.

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[10] *A spatial development framework (SDF) is a strategic planning tool used by urban planners, policymakers, and stakeholders to guide the physical development and planning of an area. It analyses the current spatial context, sets a vision for future development, and provides strategies for sustainable growth, including land use allocation, infrastructure planning, and environmental protection. An SDF aims to promote spatial efficiency, economic prosperity, social equity, and environmental sustainability through informed decision-making and investment.*

5.6.1.2.1 Elements to be contained in a UPF

Guided by the aforementioned guidelines, such a proposed UPF should contain the following elements to support its implementation:

(i) ***Identifying suitable areas for permaculture in urban settings*****:**

Efforts to identify optimal areas for permaculture within towns or cities necessitate the integration of relevant expertise. This will include assessing the broader context of the urban environment, either at a holistic level or within specific neighbourhoods, to pinpoint ideal locations for dedicated urban permaculture precincts. These areas should be easily accessible to the local community, thereby fostering widespread participation. Moreover, leveraging the existing open space network within a town or city can facilitate the establishment of a network of potential permaculture gardens, thereby strengthening local food sovereignty and enhancing green networks. Such edible gardens can be seamlessly integrated into the built environment through various means, including existing parks, community gardens, schools, sidewalks, underutilised municipal land, vertical gardens, and rooftop gardens, (each of which will require individual scrutiny).

(ii) ***Establishment of dedicated permaculture precincts*****:**

The concept of dedicated permaculture precincts entails areas where residents are keen to convert private land into permaculture gardens. It is imperative to differentiate between areas that are most favourable and those less suitable for implementing permaculture systems. Ideal locations may encompass central areas with access to the open space network, manageable topography for efficient water management, existing infrastructure and services, and seamless integration into the surrounding society and economy without necessitating extensive travel. Less suitable areas may be characterised by considerable distance from the community, limited access to essential services such as public transport and local economic centres, and existing established social, economic, and environmental functionalities.

(iii) ***Incorporating design guidelines rooted in permaculture principles*****:**

Guided by permaculture principles, the framework should incorporate design guidelines aimed at providing a fundamental understanding and highlighting the objectives of establishing urban permaculture initiatives.

(iv) ***Integration of regulations and parameters*****:**

The framework should encompass regulations and parameters governing the operations of individuals, organisations, or systems involved in urban permaculture endeavours. These measures should serve to manage risks, mitigate conflicts, and facilitate informed decision-

making. Additionally, regulatory frameworks can enhance accountability and transparency by defining standards and expectations for compliance and enforcement, ultimately fostering an efficient and equitable urban permaculture network.

(v) ***Municipally supported initiatives for active participation and sustainable endeavours*****:**

When community members engage in permaculture initiatives within the allocated precinct, they are eligible to receive subsidies or support to boost their endeavours. This support mechanism could reflect the municipality's commitment to incentivising community involvement in urban permaculture initiatives that are aligned with its goals and priorities. By providing financial assistance or other forms of support, the municipality could empower residents to actively contribute to the betterment of their community while ensuring that sustainable practices and initiatives thrive. Such support will not only encourage participation but also strengthen the partnership between local government and residents in advancing shared objectives for a resilient and self-sustaining communities.

(vi) ***Spatial maps*****:**

In addition to conceptualising proposed precincts, it is essential to visually represent them through spatial maps to how these precincts integrate into the greater urban permaculture network (macro) and into the immediate community (micro). These maps should encompass wide-ranging information, including essential services, land uses, interconnected networks, economic hubs, social amenities, and proximities to key locales. By incorporating such detailed insights, the spatial maps will not only offer clear visualisation of permaculture precincts but also serve as strategic tools for identifying future expansion of the networks. A conceptual example of such a map in Figure 5-2 offers a visual insight into how a permaculture precinct map within a UPF might appear. This map utilises a zoning basemap, delineating various zones across both public and private properties. The permaculture precinct itself is outlined by a distinct dark green dotted line, encompassing the broader area it comprises. Under this precinct, every property, regardless of ownership or land use, is eligible for potential subsidies and support from the local Municipality based on merits and requirements. Within the precinct, certain properties are designated explicitly for urban permaculture initiatives and are actively encouraged to adopt permaculture practices. These designated properties, strategically positioned throughout the community, include public open spaces (green), sidewalks along public streets (orange dotted line), community churches (purple), schools (light purple), and a non-profit organisation (dirty purple) offering social work services. These designated properties are chosen based on their seamless integration with the community, aligning with the principles outlined in the UPF. Figure 5-3 and 5-4 illustrates street view images with proposed permaculture initiatives as also indicated in the spatial map.



Figure 5-2: Conceptual Permaculture Precinct map

Source: Author's own compilation.



Figure 5-3: Conceptual zones (1-4) for permaculture initiatives within the permaculture precincts of the UPF.

Source: Author's own compilation from Google Maps (2024)



Figure 5-4: Conceptual zones (5-8) for permaculture initiatives within the permaculture precincts of the UPF.

Source: Author's own compilation from Google Maps (2024)

5.6.1.3 Utilising permaculture principles and ethics to guide urban food system design

The permaculture principles and ethics arose as key drivers throughout the study and offer valuable guidance for designing sustainable urban food systems. **Error! Reference source not found.** presents a brief description of how permaculture principles and ethics could inform the design of holistic and integrated urban food systems.

Table 5-1: Permaculture principles and ethics for urban food system design.

Permaculture Ethics	
Earth care	Ensure that urban food systems respect and enhance the health of the earth's ecosystems.
People care	Design urban food systems that prioritise the well-being, health, and dignity of the people involved
Fair share (or fair distribution)	Ensure that surplus produce and resources are shared within the system (feeding and recycling) and the surrounding community (local markets and donations).
Permaculture Principles	
Observe and interact	Study the urban space, the community, resources, and existing patterns before designing the food system.
Catch and store energy	Utilise renewable energy sources such as rainwater harvesting and composting to create regenerative urban food systems.
Obtain a yield	Design a food system that provide definite benefits such as food and community cohesion.
Apply self-regulation and accept feedback	Continuously monitor and adapt urban food systems based on feedback from the system itself and stakeholders.
Use and value renewable resources and services	Prioritise renewable resources and services like composting, perennial crops, and natural pest control methods.
Produce no waste	Implement strategies such as composting, recycling, and reusing materials to minimise waste from urban food systems.
Design from patterns to details	Identify and work with existing patterns and processes in the urban environment to inform the design of a food system.
Integrate rather than segregate	Create interconnected and mutually beneficial relationships between different elements of the urban food system, such as plants, animals, and humans.

Use small and slow solutions	Implement small-scale, incremental changes in urban food systems that are easier to manage and less disruptive to the environment and communities.
Use and value diversity	Promote biodiversity in urban food systems by cultivating a variety of crops, animals, and microorganisms.
Use edges and value the marginal	Capitalise on the limits and marginal spaces in urban environments to maximise productivity and diversity.
Creatively use and respond to change	Embrace change as an opportunity for innovation and adaptation in urban food systems.

Source: Author's own compilation.

5.6.2 Spatial recommendations

5.6.2.1 Recommendation for urban permaculture zones in urban contexts

The following derivatives are recommendations for the spatial layout and design of an urban permaculture system that can be integrated into public spaces or private land.

The spatial adaptation of permaculture to an urban system is primarily informed by the spatial assessment of best permaculture practices in this study (Section B: Chapter 4, Paper 2). The case studies considered in this study are rural and each comprises three/four/five of the permaculture zones. However, to compare the case studies to urban systems in terms of size and scale, the number of zones incorporated into an urban permaculture design would be directly dependent on the size of space available. What is important to state is that due to the flexibility of a permaculture system, it is suitable for various sizes of land and thus implementable in diverse urban contexts. In most urban cases Zones 1 & 2 are the most significant for self-sufficient food production and should always be present. As the sizes of the subject spaces differ, the number of zones can be adjusted accordingly. For example, in a small urban space, Zone 3 would not necessarily be considered for an urban permaculture system, as orchards usually require larger spaces and are not necessarily a necessity for self-sufficient provisioning. In a larger urban space, Zone 3 could be introduced accordingly and might offer the means to start selling produce for profit or distributing produce into the community. Zones 4 and 5 would not be typically applicable in urban areas, as semi-wild and wilderness areas are not common elements of urbanised areas.

Table **4**-**5** (Section B: Chapter 4, Paper 2) is used to determine land use allocations for a permaculture system in an urban context where space might be limited. When looking at Zones 0–2 across the cases, the food-growing areas (Zones 1 and 2) within these spaces constitute between 70% and 90%, while the living quarters account for 10% to 30% of the permaculture

application space. The cases collectively exhibited an average 30-70 split in the utilisation of permaculture activity zones for living and food growing respectively. This split offers a valuable scale reference for land use allocation in urban permaculture systems, illustrating the flexibility of permaculture in terms of size and scale. For instance, applying the 30-70 split to a 500m^2 property would designate 150m^2 for Zone 0 (typically residential) and the remaining 350m^2 for food-growing practices (Zones 1 and 2). See Figure 5-5.

Similarly, this split can be applied to larger or smaller properties, such as a 1500m^2 urban property in which case, Zone 3 may also be considered due to increased space availability. Referring to Table 4-4 & Table 4-5 (Section B: Chapter 4, Paper 2), the split for a permaculture system with Zones 0–3 would be 30-55–15, allowing 30% for residential purposes in Zone 0, 55% for Zones 1 and 2, and 15% for a small orchard. Thus, a 1500m^2 property could allocate 450m^2 for residential use, 825m^2 for Zones 1 and 2, and 225 m^2 for an orchard.

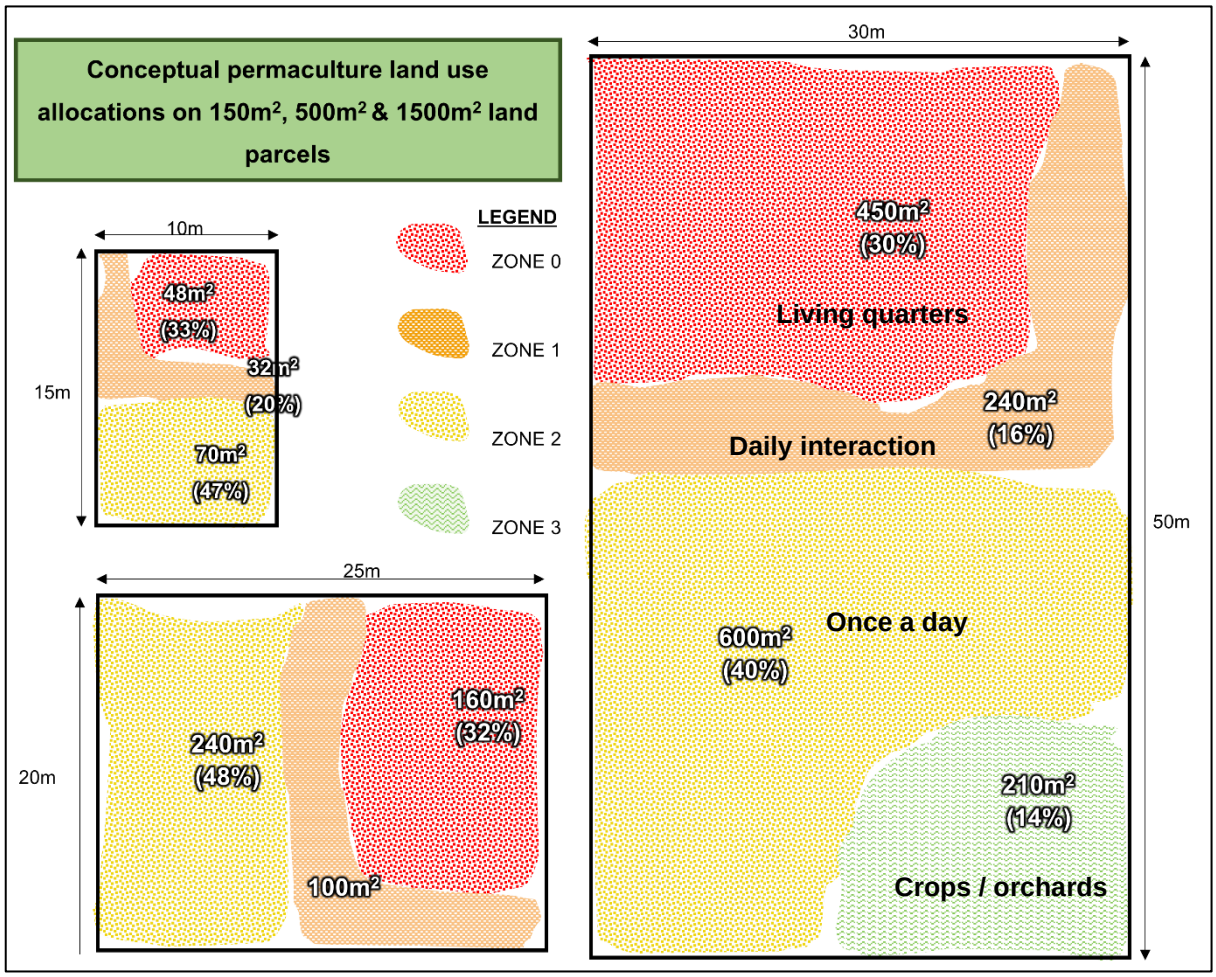


Figure 5-5: Conceptual permaculture zone allocations on 3 land parcels (150m2, 500m2 and 1500m2) based on the studies.

Source: Authors own compilation.

The conceptual illustrations in Figure 5-5 demonstrate how the adaptable proportions of permaculture can inform the zoning design of urban spaces, considering land allocation rather than detailed zone design. These illustrations adhere to Mollison's zoning model, emphasising a sequential order with only Zone 1 directly connected to Zone 0. It's crucial to note that additional urban elements like topography and driveways may significantly influence zone allocations, necessitating the integration of Holmgren's 12 principles to guide micro-level permaculture system design.

5.6.2.2 Recommendation for an Urban Permaculture System Design (UPSD)

The final recommendation proposes the transformation of a public open space within an existing are (suitable for low-income communities) into an edible landscape, serving as a prototype for similar projects. This conceptual design process unfolded in seven distinct steps. To start with, a site central within a low-income urban community, spanning 4950m^2 with a gentle slope from north to south, was selected. The site's zoning as Open Space Zone I permits urban agriculture and similar land uses. It is abutted by residential properties on its north-eastern and western boundaries and public streets on the north-western and southern boundaries.

(i) ***Step 1: Site analysis***

The first step involved a thorough site analysis, identifying existing features such as public roads, footpaths, a swing set, and an informal dumping site. The layout of internal paths reflects pedestrian traffic patterns within the neighbourhood. Notably, the swing set emerged as the sole socially engaging feature on the property, prompting its inclusion in the proposed design. There is also an overhead powerline traversing the property from northeast to southwest. Figure illustrates this step.

(ii) ***Step 2: Zone layout design***

Step two focused on designing the zone structure layout, drawing from the multiple case studies and MCZM. Zones 0 to 3 were delineated according to the scale measure (see 5.8.1.2), allocating specific functions and areas to each zone on the property. Zone 0 will serve as the main living quarters, while Zone 1 will contain plants that will require daily interaction with food-growing activities. Zone 2, the largest area, will accommodate food-growing activities requiring less regular interaction, along with water ponds and a playground. Zone 3 is designated for commercial crops or orchards. The plan also integrates edible or indigenous hedges for windbreaks. Figure illustrates this step.

(iii) Step 3: Infrastructure planning and Zone 0

In step three, the planning centred on Zone 0 and essential infrastructure. This encompassed water collection through channels and storage ponds, with provisions for rainwater harvesting and greywater systems for households. Moreover, communal facilities including a kitchen, hall, and pantry were envisaged to process and store fresh produce. The integration of large indigenous trees across the property aims to foster a central social activity area. Figure illustrates this step.

(iv) Step 4: Planning Zone 1

The fourth step entailed the planning of Zone 1, featuring garden beds for medicinal plants, herbs, and vegetables requiring daily attention. Notably, a circular polyculture bed serves as the primary vegetable growing area, complemented by a firepit for outdoor gatherings and a storage shed with a composting station.

(v) Step 5: Planning Zone 2

Step five entailed the planning of Zone 2, which will function as the food-growing area for plants necessitating less frequent interaction. This zone integrates fruit tree clusters, raised garden beds, a greenhouse, composting stations, storage sheds, beehives, and a movable chicken tractor. Benches scattered throughout encourage community engagement. Figure illustrates this step.

(vi) Step 6: Planning Zone 3

This step regarded the planning of Zone 3. In this case, this step only consisted of adding an orchard in the area demarcated for Zone 3. The orchard would typically consist of a cash crop that the members cultivate and retail into the community.

(vii) Step 7: Refining the design

The seventh and final step entailed the refinement of the proposed design by tending to safety, security, and functionality. Gated access points are placed at each pedestrian entrance to ensure daytime accessibility for community members while enhancing safety for residents during the night. Figure illustrates this step.

The final conceptual design is demonstrated in Figure 5-13. This design is merely a comprehensive representation of each step of the design. All the figures to follow is sourced by the owner’s own compilation.



Figure 5-6: Step 1 - Site analysis.

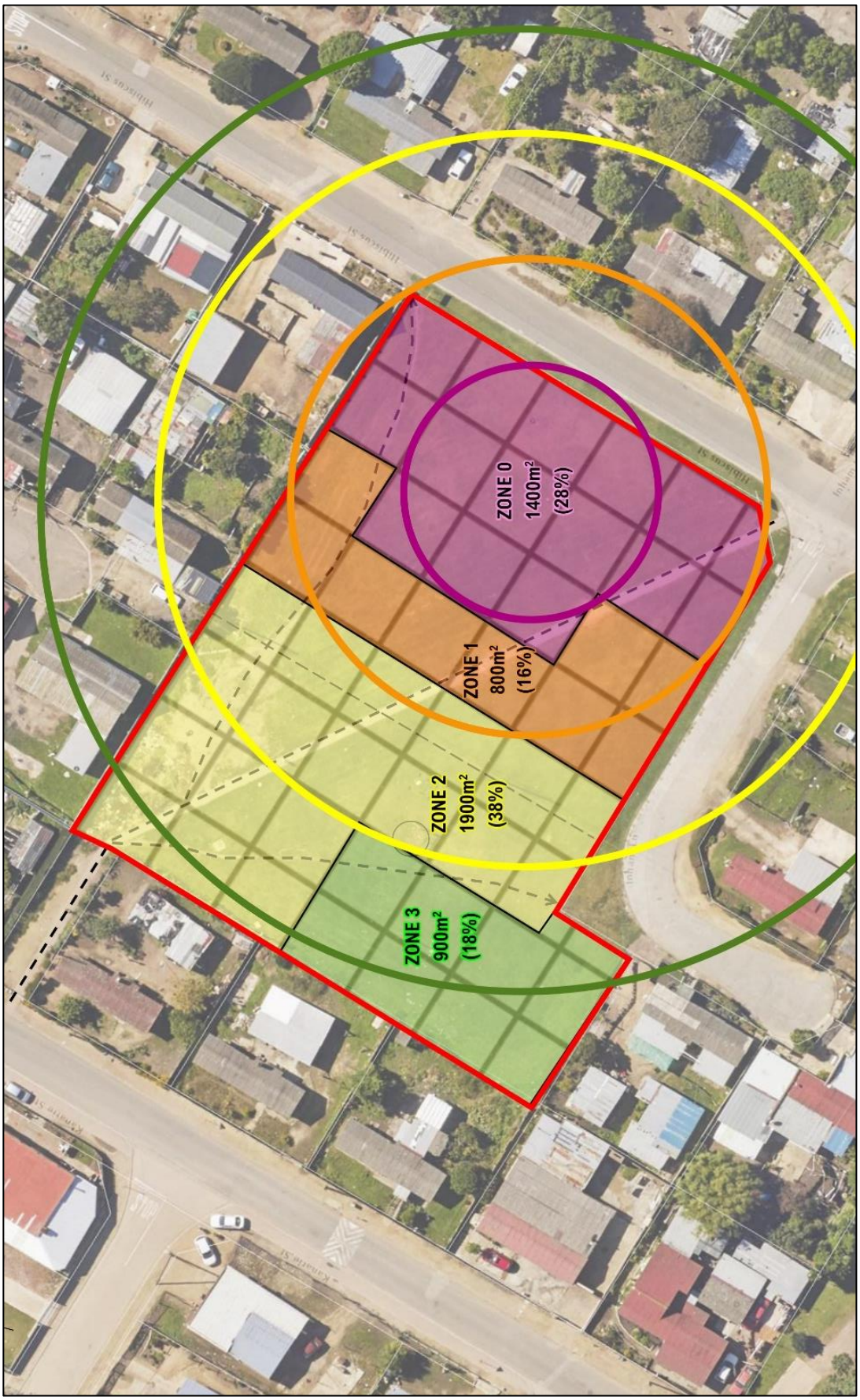


Figure 5-7: Step 2: Zoning layout determination.



Figure 5-8: Step 3: Planning Zone 0 and essential infrastructure.



Figure 5-9: Step 4: Planning Zone 1.



Figure 5-10: Step 5: Planning Zone 2.



Figure 5-11: Step 6: Planning Zone 3.



Figure 5-12: Step 7: Final touches to the design.

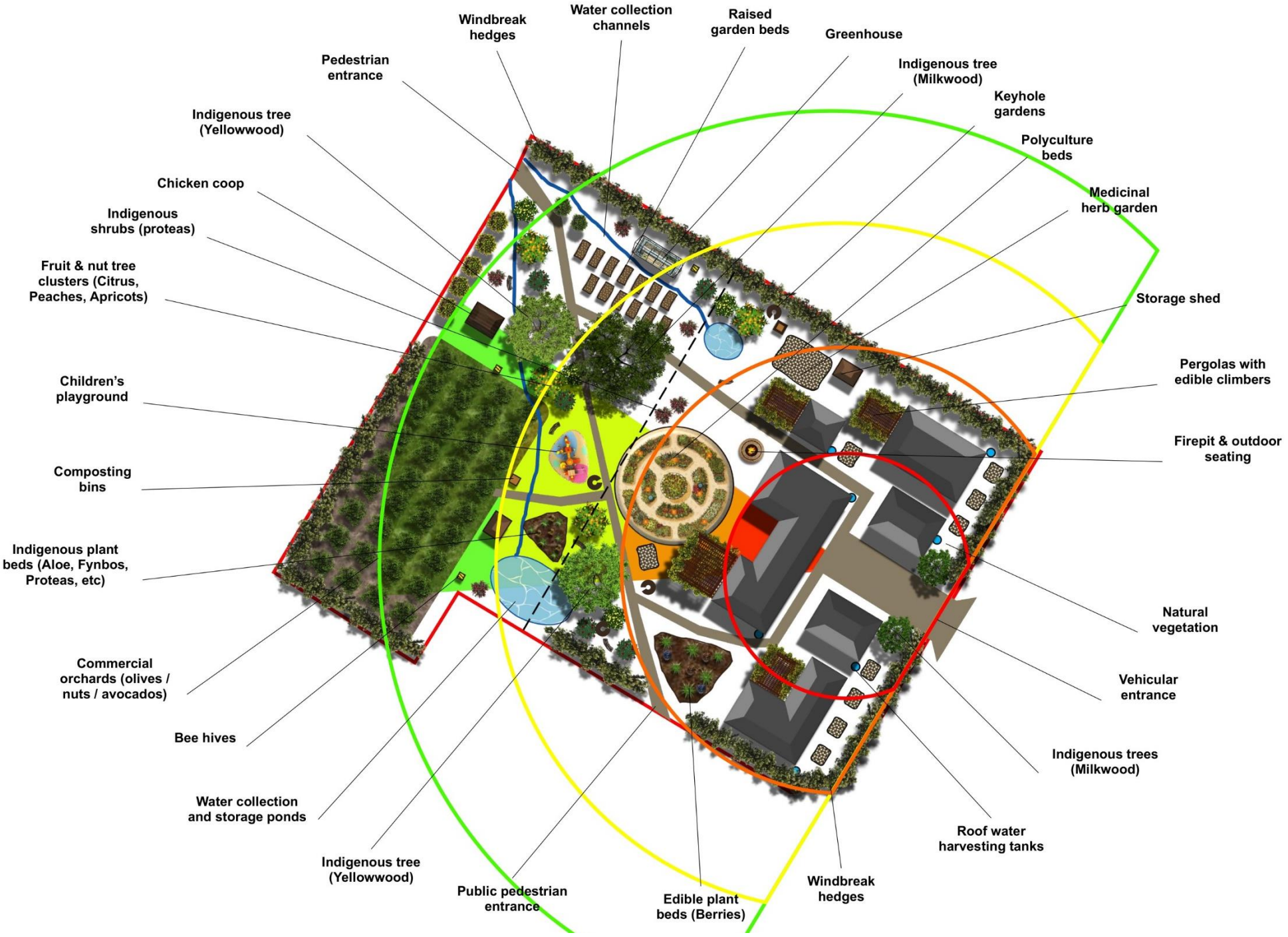


Figure 5-13: Final conceptual design.

5.7 Future research

This study discovered that, despite permaculture having design and settlement characteristics since its origin, there is a noteworthy absence of its consideration from urban planning globally and in South Africa to inform settlement planning, design, food-sensitive planning, etc. It is in this regard that this study urges an in-depth examination of permaculture for urban systems, specifically how valuable permaculture practices can inform physical planning on a macro level and how its principles can be channelled for enriching urban planning and especially food-related planning on a micro level in urban systems to provide a structured guideline for urban permaculture as a regenerative food system approach.

Future research should focus on longitudinal studies to assess the long-term impacts of permaculture integration in urban environments. Additionally, comparative analyses across different urban contexts can provide further valuable insights into the scalability and adaptability of permaculture principles.

In terms of the prospects of urban permaculture, the study highlighted that a lack of knowledge and understanding about permaculture systems is a challenge for urban permaculture. To advance urban permaculture in the future, interventions will be needed to improve knowledge among both urban planning professionals and local community members. Permaculture design courses offer one avenue for imparting this knowledge. Another approach could involve integrating permaculture principles into planning and design guidelines and frameworks, pushing professionals to become familiar with permaculture systems. The study emphasised that improved knowledge and understanding of permaculture and the benefits it could offer positively influence community engagement and sustained enthusiasm to participate.

5.8 Conclusion

The study commenced with an introduction providing the context of the research as well as a structure for the layout of the dissertation (Section A: Chapter 1). Following this orientation chapter, the theoretical framework (containing relevant theories, worldviews, and concepts) was provided as the foundation for the study (Section A: Chapter 2) followed by the methodology that underpinned the scientific process that was followed to execute the study (Section A: Chapter 3). Chapter 4 (Section B) consists of two academic papers (a literature study and an empirical study) followed by the final chapter (Section C: Chapter 5) that presents the synthesis, key findings, returns to the research questions, and recommendations.

This study has undertaken a significant gap in existing scholarship by examining the integration of permaculture into urban food system planning. Specifically, it has identified the absence of both theoretical considerations and practical applications of permaculture in this context, as evidenced in Section B: Chapter 4, Paper 1 and Paper 2. While this study does not offer a definitive solution to urban food insecurity, it illuminates the potential of urban permaculture in shaping multifunctional urban systems and fostering food sovereign communities. Moreover, it emphasizes the need for further research, particularly within the South African context, to deepen our understanding of permaculture's implications and efficacy within urban systems. By addressing this lingering research gap, we can contribute to the advancement of sustainable and regenerative urban food practices, offering hope for addressing the alarming food insecurity challenges faced by African cities. Specifically, this research underscores the novelties and potential benefits of incorporating permaculture into spatial planning efforts, thereby taking a critical step towards combating food insecurity in South African towns and cities.

The recommendations presented in this study intend to stimulate fellow urban planning peers to explore the potential of permaculture as a phenomenon for enhancing urban food systems and the resilience and functionality of urban spaces.

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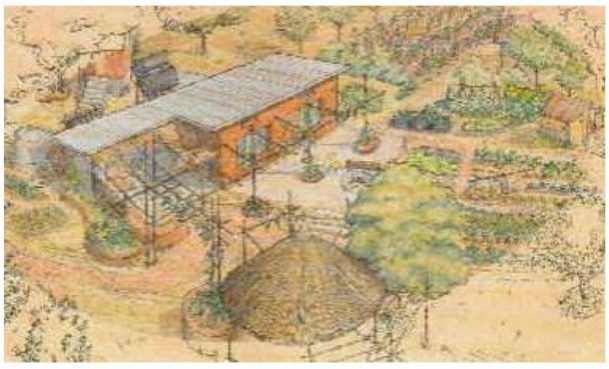
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ANNEXURE A: SPATIAL PROFILES

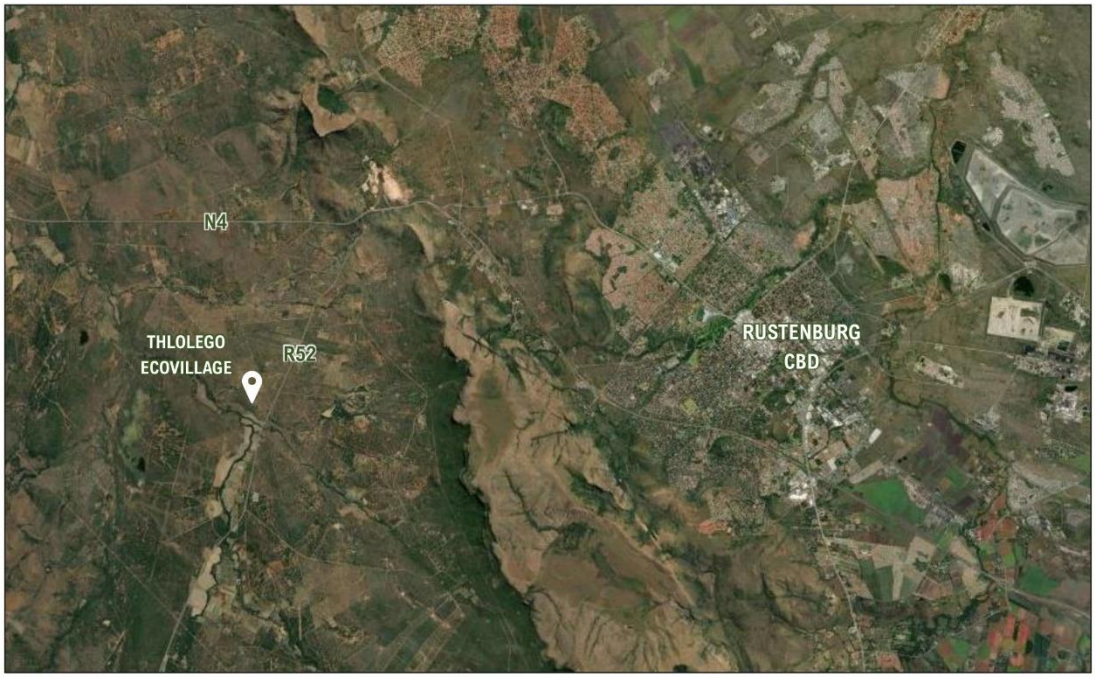
CASE 1 PROFILE:

TLHOLEGO ECOVILLAGE

FARM DESCRIPTION:	REMAINDER OF PORTION 1 OF THE FARM BROODSKRAAL NO. 316
FARM SIZE:	±58 hectares
PROVINCE:	NORTHWEST
MUNICIPALITY:	RUSTENBURG



LOCALITY MAP



REMAINDER OF PORTION 1 OF THE FARM BROODSKRAAL NO. 316
R52 ROUTE, RUSTENBURG, RUSTENBURG MUNICIPALITY
NORTH-WEST

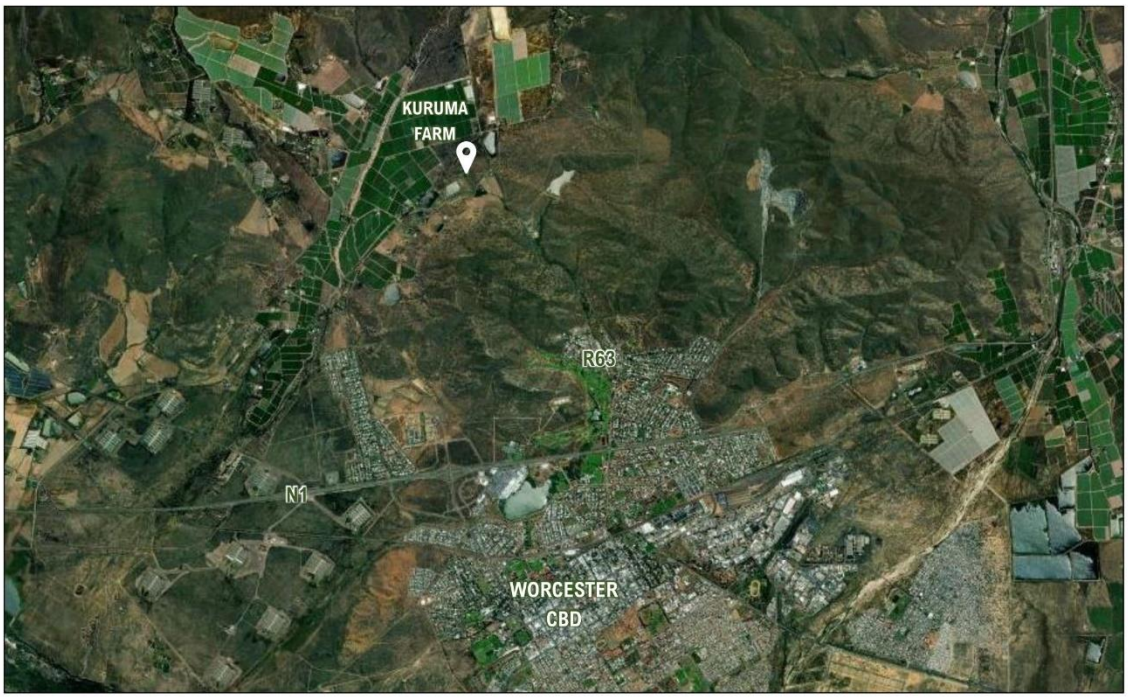
CASE 2 PROFILE:

NUMBI VALLEY PERMACULTURE FARM

FARM DESCRIPTION:	REMAINDER OF PORTION 148 OF THE FARM RIETVALLEY NO. 76
FARM SIZE:	±72 hectares
PROVINCE:	WESTERN CAPE
MUNICIPALITY:	OUDTSHOORN



LOCALITY MAP



PORTION 150 OF HARTEBEESTERIVIER FARM NO. 306
WORCESTER, BREEDE VALLEY MUNICIPALITY
WESTERN CAPE

CASE 3 PROFILE:

KURUMA FARM COTTAGES

FARM DESCRIPTION:	PORTION 150 OF THE FARM HARTEBEESTERIVIER NO. 306
FARM SIZE:	±53 hectares
PROVINCE:	WESTERN CAPE
MUNICIPALITY:	BREEDE VALLEY



LOCALITY MAP



REMAINDER OF PORTION 148 OF FARM RIETVALLEY NO. 76
DE RUST, OUDTSHOORN MUNICIPALITY
WESTERN CAPE

CASE 4 PROFILE:

PACHAMAMA FOREST RETREAT

FARM DESCRIPTION:	STATE LAND MILLWOOD FOREST RESERVE NO. 150
FARM SIZE:	±8 hectares
PROVINCE:	WESTERN CAPE
MUNICIPALITY:	KNYSNA



LOCALITY MAP



STATE LAND MILLWOOD FOREST RESERVE NO. 150
RHEENENDAL, KNYSNA MUNICIPALITY
WESTERN CAPE

ANNEXURE B: PARTICIPANT CONSENTS

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Private Bag X6001, Potchefstroom
South Africa, 2520

Tel: (018) 299 -1111/2222
Web: http://www.nwu.ac.za

Urban and Regional Planning
Tel: (082 719 8816)
Fax: (082 719 8816)
E-mail: denisejvr01@gmail.com

January 2023

INFORMED CONSENT: PERMACULTURE (SOUTH AFRICA)

I have accepted an invitation to participate in a postgraduate (MSc Urban and Regional Planning) research project at the North-West University entitled "Towards regenerative edible urban landscapes through permaculture: A spatial planning perspective" under supervision of Dr. Karen Puren.

I have been informed that the purpose of the research is to share my experience and knowledge about Permaculture. My participation will involve:

- the completion of a participant profile with my age, gender, and details about my involvement in permaculture in the South African context;
- taking part in an individual interview of approximately 20-30 minutes via an online paltform;

I understand that there are no foreseeable risks or discomforts if I agree to participate in the study. I understand that the possible benefits of my participation in the research are to share my experience with permaculture and knowledge of the subject.

I understand that the results of the study may be published but that my name or identity will not be revealed. I also understand that the results of the study may be used for secondary studies connected to this project, but that my name or identity will not be revealed. The North-West University will maintain confidentiality of all records, materials and voice recorders.

I hereby also acknowledge that I will not be compensated for my participation and that any questions I have concerning this research study or my participation in it before or after my consent, will be answered by the investigators of this study. I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. In signing this consent form, I am not waiving any legal claims, rights, or remedies.

I, the undersigned, [redacted] (full names), have read the above information and by signing this form indicate that I will participate in the research voluntarily.

Participant's signature — 7/2/2023 Date

Researcher's signature — 26 January 2023 Date

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Private Bag X6001, Potchefstroom
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[redacted]
Participant's signature

3 February 2023
Date

Researcher's signature

26 January 2023
Date

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
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[redacted]
Participant's signature

2 February 2023
Date

Researcher's signature

26 January 2023
Date

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
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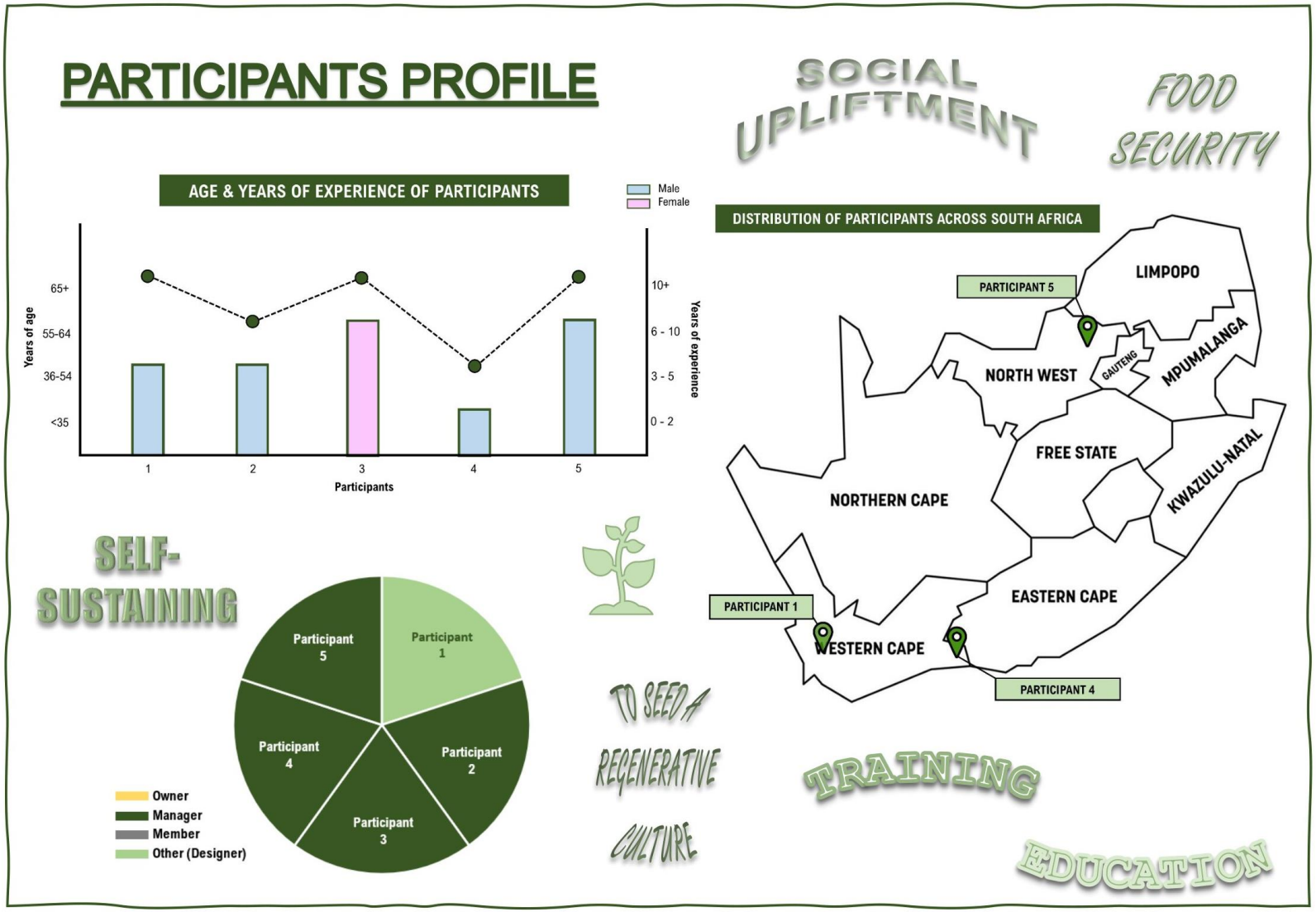
[redacted]
Participant's signature

24th Feb 2023
Date

Researcher's signature

26 January 2023
Date

ANNEXURE C: PARTICIPANT PROFILES



PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PROJECT

1. Official name of permaculture project

KuRUMA

2. Address of permaculture project

BRANDWACHT, WORCESTER

3. Start date of permaculture project

Mid 2014

4. Number of years in existence

9

5. Purpose of project (personal, business, training, etc)

PERSONAL ; TRAINING

6. Primary role-players in permaculture project (private, public, joint initiative, etc.)

PRIVATE

7. Size of land occupied by Permaculture practice.

± 2,5 ha

PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PARTICIPANT

1. Capacity of involvement

☐ Owner ☐ Manager ☐ Member ☒ Other (please specify) Designer

2. Gender

☒ Male ☐ Female ☐ Non-binary

3. Age group

☐ Under 35 ☒ 36 – 54 ☐ 55-64 ☐ 65+

4. Years of experience in permaculture

☐ Less than 2 years ☐ 3-5 years ☐ 6-10 years ☒ 10+ years

5. Full time or part time involvement

☐ Full time ☒ Part time

6. Education

☐ Matric ☐ Diploma ☒ Degree ☐ Post-graduate degree ☐ Other



PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PROJECT

1. Official name of permaculture project

Food and Trees For Africa (NPO)

2. Address of permaculture project

We opperate throughout South Africa

3. Start date of permaculture project

1992

4. Number of years in existence

31 Years

5. Purpose of project (personal, business, training, etc)

Social Upliftment, education and food security

6. Primary role-players in permaculture project (private, public, joint initiative, etc.)

Local comunity members

7. Size of land occupied by Permaculture practice.

Our programs cover over 2000 hectares





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PARTICIPANT

1. ***Capacity of involvement***

☐ Owner ☒ Manager ☐ Member ☐ Other (please specify) _____

2. ***Gender***

☒ Male ☐ Female ☐ Non-binary

3. ***Age group***

☐ Under 35 ☒ 36 – 54 ☐ 55-64 ☐ 65+

4. ***Years of experience in permaculture***

☐ Less than 2 years ☐ 3-5 years ☒ 6-10 years ☐ 10+ years

5. ***Full time or part time involvement***

☒ Full time ☐ Part time

6. ***Education***

☐ Matric ☐ Diploma ☐ Degree ☒ Post-graduate degree ☐ Other





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PROJECT

1. Official name of permaculture project

EduPlant Program

2. Address of permaculture project

Projects are based at 300 schools nationally

3. Start date of permaculture project

New 2 year cycle commenced in January 2022

4. Number of years in existence

EduPlant has been implemented since1995 - 28 years

5. Purpose of project (personal, business, training, etc)

Training

6. Primary role-players in permaculture project (private, public, joint initiative, etc.)

Teachers . Learners and Community Members

7. Size of land occupied by Permaculture practice.

Ranging from 100 metre square to 0.25 heactares





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PARTICIPANT

1. Capacity of involvement

☐ Owner ☑ Manager ☐ Member ☐ Other (please specify) _____

2. Gender

☐ Male ☑ Female ☐ Non-binary

3. Age group

☐ Under 35 ☐ 36 – 54 ☑ 55-64 ☐ 65+

4. Years of experience in permaculture

☐ Less than 2 years ☐ 3-5 years ☐ 6-10 years ☑ 10+ years

5. Full time or part time involvement

☑ Full time ☐ Part time

6. Education

☐ Matric ☐ Diploma ☐ Degree ☑ Post-graduate degree ☐ Other





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PROJECT

1. Official name of permaculture project

Pachamama Projects NPC

2. Address of permaculture project

Farm 150, Kraaibosch, Knysna Rural, W.C, SA

3. Start date of permaculture project

2019

4. Number of years in existence

8

5. Purpose of project (personal, business, training, etc)

To seed a regenerative Culture

6. Primary role-players in permaculture project (private, public, joint initiative, etc.)

Joint initiative

7. Size of land occupied by Permaculture practice.

8.6 Ha



PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PARTICIPANT

1. Capacity of involvement

☐ Owner ☑ Manager ☐ Member ☐ Other (please specify) _____

2. Gender

☑ Male ☐ Female ☐ Non-binary

3. Age group

☑ Under 35 ☐ 36 – 54 ☐ 55-64 ☐ 65+

4. Years of experience in permaculture

☐ Less than 2 years ☐ 3-5 years ☑ 6-10 years ☐ 10+ years

5. Full time or part time involvement

☑ Full time ☐ Part time

6. Education

☑ Matric ☐ Diploma ☐ Degree ☐ Post-graduate degree ☑ Other





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PROJECT

1. Official name of permaculture project
   Tlholego Ecovillage & Learning Centre

2. Address of permaculture project
   Farm JQ316, Broodskraal Kgetlengrivier 0348

3. Start date of permaculture project
   1989

4. Number of years in existence
   34 years

5. Purpose of project (personal, business, training, etc)
   Centre of Learning

6. Primary role-players in permaculture project (private, public, joint initiative, etc.)
   Joint Initiative

7. Size of land occupied by Permaculture practice.
   140Ha





PARTICIPANT PROFILE & PERMACULTURE INFORMATION:

PARTICIPANT

1. Capacity of involvement

[ ] Owner [x] Manager [x] Member [x] Other (please specify) Custodian

2. Gender

[x] Male [ ] Female [ ] Non-binary

3. Age group

[ ] Under 35 [ ] 36 – 54 [x] 55-64 [ ] 65+

4. Years of experience in permaculture

[ ] Less than 2 years [ ] 3-5 years [ ] 6-10 years [x] 10+ years

5. Full time or part time involvement

[x] Full time [ ] Part time

6. Education

[ ] Matric [ ] Diploma [ ] Degree [x] Post-graduate degree [ ] Other



ANNEXURE D: INTERVIEW SCHEDULE

QUALITATIVE INTERVIEW SCHEDULE

PERMACULTURE

OPENING

I am **Denise Janse van Rensburg**, and I am conducting this interview as part of the data collection for my master study at the North-West University, supervised by **Dr Karen Puren**. Before we begin the interview, I want to take the opportunity to introduce myself and my research topic. I am researching the potential of permaculture as a spatial planning instrument to combat food insecurity, within urban areas. As more people migrate to cities, especially those in poor conditions on the peripheries of cities, the challenge of food insecurity grows. The aim of my study is to explore the incorporation of permaculture into urban planning to empower communities to grow their own food. Through this interview, I seek practical insights into permaculture and to obtain firsthand experience into the realities of permaculture. My focus is on understanding how permaculture systems operate and if they can be applied to combat urban food systems and contribute to more sustainable and secure urban environments. So, I'm here today to hear and learn from you and understand it better.

INTERVIEW QUESTIONS

Question / Answer	Description
Question 1	This forms part of establishing knowledge about decolonisation as the opening of the interview schedule. ***NB:*** *This question is not based on the planning education curricula or planning theories but on South Africa as a country.* How did you become involved with permaculture and how did your involvement with this particular project start?
Question 2	What were the reasons for engaging with permaculture and what were the goals with this particular project? *Follow up question: What resources are essential for this project and how do you acquire these resources?*
Question 3	To what extent have you implemented and applied permaculture principles in your system, and what was your approach to designing the system?
Question 4	How much time do you spend interacting with/in your permaculture system and how labour intensive is it to maintain such a system?

1

Question / Answer	Description
Question 5	What are the main lessons you have learned about permaculture during your engagement therewith?
Question 6	What are your perspectives on incorporating permaculture into urban systems, such as towns and cities, and what guidance would you offer for urban initiatives?

CLOSING STATEMENT

We have come to the end of the interview.

Do you have any further questions for me?

Thank you for taking the time to be part of this interview.

Note: The interviews followed a semi-structured format, with the provided interview schedule serving as a flexible guide rather than a strict script. This approach allowed the inclusion of open-ended questions and unfiltered responses, creating an interview dynamic that mirrors that of a more casual conversation. In this setting, participants' responses play a pivotal role in shaping the tone and direction of the discussion.

ANNEXURE E: INTERVIEW TRANSCRIPTS

PARTICIPANT 1: Transcript

PARTICIPANT
Hi, Denise.

INTERVIEWER
Can you hear me clearly?

PARTICIPANT
I hear you clearly. Can you hear me?

INTERVIEWER
Thank you. So yes, I can hear you. Thank you so much for joining.

PARTICIPANT
Yeah, no problem.

INTERVIEWER
Are you English or Afrikaans or what do you prefer?

PARTICIPANT
I'm very English, I'm afraid.

INTERVIEWER
OK well my English is not great, but I do speak English, I do understand it, so I'm going to try my best.

PARTICIPANT
I can't even offer to try I'm afraid.

INTERVIEWER
No, it's fine. OK, PARTICIPANT, can I introduce myself quickly and tell you what my study is about and then we can continue. OK, So, I'm a post graduate student in urban and regional planning. And for I have started my Masters' degree in 2021 and the problem statement for my study is the intense urbanization and people moving to urban areas and with the more people moving to urban areas, the more people live in poor conditions within these urban areas, for example townships and people who don't have homes it's too costly. So, and with the massive migration to urban areas there is also growing challenges like especially food insecurity, people that can't afford food, or don't have access to food and water. So, I started looking into permaculture, read up about it, what it's about and I thought it might be good to explore if permaculture can be used by the urban and regional planning profession to see if we can somehow incorporate it into our into planning cities and settlements and communities to provide food to communities, and to people who can't afford to buy food or don't have access to food. And so, the purpose of this interview is only for a section of my study, and it's mostly to get a better understanding of practical permaculture because I've only researched about it, read about it, but I've never had any experience there with, so I'm here to learn from you and understand it better.

PARTICIPANT
Sounds like a very interesting study. Definitely something quite close to me, so prior to working at FTFA, I was a partner in a company called Urban Fresh.

And our idea was to go into those poor areas and the informal settlements and establish fresh produce gardens within the communities and then develop and look between those communities and the more sort of high-end retail and restaurant outlets so that they could sell their produce for top dollar and. Our first pilot was in Alex, and it was just very interesting because you're working in Alexandria with depths of poverty and you have the same guideline as your view, so you've got literally the richest people on the continent and some of the poorest people of the continent and they're living right next to each other. And that juxtaposition was very, very interesting. And we often said, like, well, we should like actually get a postgraduate student to come in here and do a study on it from a social economic perspective, it's just crazy. And obviously the issue of food insecurity is very close to me, it's something I've been personally working on since I finished my postgraduate degree all the way back in 2010.

INTERVIEWER
May I ask what in what field?

PARTICIPANT
I actually did fisheries and interestingly, etheology and science.

And following my degree I worked for the social development of Rhodes university, where we had outreach programs, and we were partnered with the Department of Agriculture. And I basically worked around the country trying to establish rural fisheries projects, so letting fish to then consume and sell in the local communities. But our fish projects and events inevitably had a spin-off of including vegetable garden and vegetable production. And one of the things that really struck me and saddened me, when I went and lived in the village for three years, was that when you went to a spaza shop in the community, because now bear in mind we're in the rural areas, you have to travel at least sort of 60-70 Km's and if you're taking a taxi, that's like R50 each way, so it's 100 bucks just for your transport to go to town in order to get a lot of fresh produce. And then within the community, obviously things like fresh milk just doesn't even exist, so it's small, long life box milk. The quality of the fresh produce is poor, so you're dealing with, like, really old stuff and things that are starting to rot. But you're paying a premium for it. So, whereas you can go to even Woolworths and walk around in a sort of luxurious setting and air conditioning and top-quality products you can pick tomatoes up for, say R15, R16 round a kilo.

Go into the community where people are poor and you're going to be buying half rotten Tomatoes, which are all soft and then pay R25 and a kilo, so it's more expensive, less accessible, and poorer quality, and the wealthier you are in South Africa, the more you have access to affordable, high-quality food.

INTERVIEWER
Yeah, that's actually very true.

PARTICIPANT
The less money you have the less access you have to affordable food, and it's crazy. So, I mean, even simple things like a loaf of bread are about R15 at Pick-n-Pay and R18 at the spaza shop.

INTERVIEWER
Wow. Yeah, because they need the money as much as possible.

PARTICIPANT
Yes, and then instead of retaining money in the community, they export all of that finance essentially to the nearby town. So, there's never any economic growth within these villages because it's always going to the nearest city or to taxis. So sorry, it's a bit of a long story, but I think it's quite relevant because I think it brings us to like the next big challenge and one of the things that really upset me was that, they had land there with water that's being provided by a government, there's electricity that's largely being provided by a government, and there's an incredibly strong demand or need for this kind of basic infrastructure and basic production, and it doesn't exist. And it's just like, made me question. How is it that every community, every household here probably has 1 or 2 cows, yet there's not one person producing or selling milk or butter or cheese or cream.

There's no one baking bread, there's no bakery. They wait for the Blue Ribbon or the Sasco van to arrive on a Tuesday.

INTERVIEWER
They still rely on outside sources.

PARTICIPANT
Yeah, there's no local production and that's, in a sense, I think speaks to people's mindsets, speaks to the history of disadvantage, and it almost speaks to kind of broken souls.

And that's actually the biggest challenge. So, bringing it then back to sort of vegetable production and I prefer to call it vegetable production because we've moved away from the term permaculture.

Not that we don't practice permaculture anymore, we still we still train permaculture, and all our projects are based on permaculture principles, but for marketing purposes we've changed it from permaculture to either biointensive agriculture or agroecology purely because permaculture kind of has a bit of a negative stigma attached to it. You see, permaculture and people think it’s some dirty hippie growing vegetables in

their backyard. And that's the association with permaculture. I'm sure through your studies you've discovered permaculture is more about a philosophy in terms of power and...

INTERVIEWER
Yeah. And actually, a lot of a lot of the research I've done, it's actually not even people growing anything. It's more like a guide to managing any systems, like some people even applied it to economic systems and business management. So, it's a very broad concept.

PARTICIPANT
Yes. No, it's extremely broad and I think it's that's a lot of people sort of shy away from it, when you say permaculture, then now you just talking and playing. But then you say, oh, we do agroecology and biointensive agriculture and that sounds very interesting and sophisticated to them even though it's the same thing or basically the same thing. It's also about moving away from irresponsible agriculture, so moving away from the Petro chemicals moving away from really toxic pesticides, and then trying to maximize production in small areas because for commercial farmers, it's easy because it's all mechanized. So, you've got a big fancy tractor that connects to the satellites and drives itself by Wi-Fi and its extremely precise and they're able to, you know, just cut down on the intensive labour cost that's associated with agriculture, which is ironic because obviously in South Africa, where we have a real need for employment and we have serious job shortages, agriculture offers a real solution in that it's extremely labour intensive if you don't mechanise.

INTERVIEWER
Yeah. And it's always been one of our country's largest work sectors was in the agricultural sector.

PARTICIPANT
So, I hope I'm not deviating too far from the topic but I'd just like to give you some sort of background and feedback from my opinions, cause I think I got quite a lot of good sort of 20 years of experience in social development through food security, so not necessarily permaculture, but I think it's the bigger issue that you're trying to address of food insecurity and these socially and economically marginalized areas and I imagine that's more the sort of the real issue that you're trying to say, like how do we help design cities to assist with food production and even while we were with Urban fresh, we wanted to start a movement called guerrilla farming where we go in the middle of the night when no one's looking and you plough 100 meters of island between two roads and plant spinach.

INTERVIEWER
You should have done it. Nobody was going to remove it.

PARTICIPANT
You know. You know, there's all that space and land that is not necessarily being utilized, but there is a slightly historic, again, sort of negative attitude towards agriculture, especially amongst the men who would have had a white boss and as a black farm worker, there's this negative association. You're just being the black farm worker and most of the sort of the communities haven't grown in confidence and spirits enough to see that no, they can be the boss, that agriculture does in fact offer financial opportunities. That said, farming, whether you're doing it commercially with all the pesticides and the chemicals, or if you're doing it full on permaculture, it's really hard and I think that's another misconception people have because farming is incredibly difficult.

And if you look through the history of time, and especially within the poorer communities, there's this history of famine and starvation and it's because growing food is not easy. If it was easy, we wouldn't have seen this historic problem of people not being able to do it. The reality is it's actually very hard so to come to your point of that person not necessarily having the enthusiasm or the passion for their project, without that passion it's almost impossible because it's so hard because it requires an incredible amount effort. So that that again is a big challenge. So there there's these sorts of inherent, almost systemic challenges before you even get down to the real, what does it actually mean to try and grow a vegetable in concrete and rubble and all that polluted shit. So, we started with the negatives, so you can move towards the more positive sides.

And so, bringing it back to FTFA is obviously quite an old organization, we've been around for 30 years, and I was a facilitator for about five years running projects on the ground, so I've had a lot of experience with fruit trees as well in terms of project facilitation and management, and I now sit on the procurement team and essentially do all the buying and all the technical background for each project. Right now, we've got 248 food garden projects around the country, 380 plant gardens with schools, about 6 enterprise

orchards, and then three or four bigger more sort of commercial scale farms. So, it's not one project in particular, it's a lot of projects. And we have a fairly good success rate in terms of getting our projects to a point where they're producing a decent amount of food that's able to generate a little bit of income. Idealistically, we imagine being able to get these farmers to a point where they're producing between R5 000 and R10 000 each per month.

In reality, we are probably lucky to get R2000 a month, and we're probably averaging out at about R800 to R1000.

And then there's a lot of gardens where income generation is not the point and I think that's another thing that might be interesting for you to look at, is the importance of these gardens from a point of obviously greening in the community, some sort of giving life within these poor communities and greenery goes a long way to improving just the whole feel of the community.

INTERVIEWER
You're absolutely.

PARTICIPANT
But it also has a refuge and a point of safety. So, a lot of the women joining these projects want to have people to talk to and something to do during the day, but also as a safe place where they feel superior and safe. So, it plays quite a big role, bigger than you would otherwise imagine.

INTERVIEWER
Yes, and that's the thing. I've also realised, it's more than just producing food, it's social inclusivity and if you're lucky, income generation. But I also believe the main purpose is not necessarily to grow food to sell but to sustain the people involved in the project.

PARTICIPANT
Yes, absolutely. And so typically on our gardens we, I mean we're trying really hard to get production data in, there's a reluctance for farmers to share production data and I think there's a feeling of, if they show themselves to be doing really well, they might lose their funding.

So, they intentionally make it look like they're doing worse so if the penny hasn't dropped it. The better you do, like there's feeling of if I show myself to be really needy, the more likely I am to get help.

INTERVIEWER
Yeah. So.

PARTICIPANT
Sorry, we're really sort of running through the negative stuff here, but there's another really serious problem that that impacts our projects tremendously and not just our projects, all projects across the country suffer from it. A phenomenon known as Kwaal, and I don't know if you've come across that.

INTERVIEWER
OK, I recall it is an Afrikaans word and it refers to like a pest or an illness. But please explain.

PARTICIPANT
Yes so, within the Community, Kwaal is a sense of jealousy but it's kind of worse than just jealousy, because it often comes with malicious intent. So, if you're working in a community garden, let's say there's 10 people working on that garden, generally what happens is they'll divide it up into 10 plots and each person will be responsible for their own little plots, so they don't collaborate in the sense of working together to produce it. Instead, they segregate themselves and isolate each person onto a single plot, and everyone looks after their own piece of land. So, if it happens that there's, someone who's really passionate and good and produces a lot, they'll start to have people come and buy vegetables. And then the other members, rather than being inspired by that person and trying to learn from them, will become jealous and start sabotaging. So, if that person doesn't rock up, they'll go and harvest their spinach and salads out of their garden and not give them money but will steal.

They'll start isolating and alienating that individual and pushing them away so that the individuals become unpopular in the community because of their success. I remember with one of the project members I used to work with, she comes to me in tears sometimes and she was like, how do we heal the hearts? How do we fix the mindset? Like there's these broken hearts and these broken minds, and how do you fix that?

How do you change that? So, I mean the more you work in the communities, the more you experience it, then it's hard not to become very cynical and a little bit disillusioned.

And very often, it's the very people you're trying to help, that's working against each other, and these conflicts arise that you could never have imagined would happen. And successful projects come with their own challenges and conflicts and the more successful the project is, the more likely it is that there will be these conflicts because now that person's earning more money, so you end up having Kwaal.

INTERVIEWER
Yeah, I like the word that they're calling it. Can I ask you; how did you initially hear about permaculture?

PARTICIPANT
So, it's difficult for me bringing it directly into permaculture because permaculture has never really been a huge thing for me. I was a student at Rhodes and had lots of friends that were hippies and lots of us, including myself, grew vegetables in our yards. So, I've always kind of been interested in producing my own food and even with chickens, I would rather grow my own chicken and slaughter it than support a corrupt and sort of evil chicken. I would rather know what my chicken ate, and I would rather know what my vegetables were made with than just receiving and even the Woolies stuff, I know for a fact that it goes through all the radiation processes to prevent their produce from browning and going off. So, I guess there's kind of been a bit of a history there.

So, for me, it's always been more about the social development side. I was initially trying to address food security at registered fisheries and somehow or another, I got involved with FTFA where I became a project facilitator and learned quite a bit about permaculture and its application, but immediately said look, I think even permaculture is too rigid in a way because we have a bigger issue so. Also, I suppose I don't want to get confused as well because there's permaculture but then there's also organic farming and very often permaculturalists are just very strict organic farmers.

Like you know, you've got vegans, and then you've got vegetarians

And veganism is just a stricter, more rigid form of vegetarianism, metaphorically speaking. I'm trying to think of a kind of analogy where you get these fanatical organic farmers sometimes, and there's all this certification and what, what, what? Just for a way of marketing. I'm more practical you know, if you've got a square piece of land ……., it's more space efficient. I agree with intercropping, there's huge benefits to using intercropping as a as a technique, but scaling is important. It depends on what sort of a garden you're talking about being about, 100 square meters in someone's backyard because then you just have to planted everything in one space, or if you're talking about 2000 square meters, which is still small in a community and what kind of production are you trying to get into? Because if you want to have regular food production, if you think about certain crops like cabbage, you're going to grow a cabbage to a head and you're going to harvest that whole cabbage. If you've got rockets, radishes and spring onions and stuff around it, it's very hard then to harvest that cabbage because there's stuff in the way and it's also very hard then to cultivate that land and prepare it for your next sowing if you've got all the other plants in the way.

Most of the benefits you have from intercropping are to do with attracting useful pests or useful insects for example, so marigolds attract carnivorous beetle. Carnivorous beetles will eat the aphids and the pests on the plants, but as long as they within the vicinity of the crop, it's fine. So, I would kind of say, if you're going to be intercropping, that's fine, use beneficial plants and make sure their companions and do it in a sensible way, but you might look at intercropping it in terms of between rows not within rows and so do a roll of broccoli and then you can plant a row of okra next to it and then plant a row of spinach next to that. It doesn't necessarily mean you have to put all the stuff together, so I'm a little bit more practical when it actually comes to physical production.

INTERVIEWER
But all of these concepts in some way or another, they get confused a lot, in the stuff I read as well like people refer to permaculture. But then in reality it's just like you mentioned now, it's maybe just intercropping and like I haven't yet discovered where the line between permaculture and intercropping and agroecology and all those different terms lie, you know.

PARTICIPANT
It's funny, I actually also majored in philosophy as well, flipping between the philosophical science and the science science. And I guess that's more of a philosophical debate, and I think is where that line is.

And I think, when we're talking about food insecurity and addressing the real needs of hunger and unemployment and so on, in South Africa, we need to be careful not to get too caught up in the line and where it is and what it's called. And so, I've always like, forget about agroecology, forget about permaculture, forget about emerging farmer (I mean, emerging farmer? You're human and you want to be a farmer, there's nothing emerging about you). Like even that term or how emerging farmer is used in this endearing way, but I feel like it's actually quite derogatory and insulting. Why? Because I'm poor and black. Am I now emerging? Do I not qualify as a farmer. Why do I want to have this title of emerging puts on top me?

Even in our own branding, we've decided like we want to change the image that the picture of a woman with a bucket on her head, like, no, get rid of that. It's not the image of people we want to portray. I want to see rather, a young girl using a smartphone with an app that's helping her calculate the application rate of the fertilizer, you know. And just because you're in that poor bracket doesn't mean you now should be excluded from the technology doesn't mean you should be excluded from the product….. available and we've actually begun quite a big move in the last year and a half to supply organic fertilizers, organic pest control, and we now supplying a suite of like 15 pest and fertilizer products, as a program, so each project gets a big bucket full of stuff and a knapsack sprayer, application manuals. When we're supplying seedlings, we're talking about estimating production yields rather than the number of seedlings. Like what's your potential yield from these plants? What's the potential value from that? Like some people say, oh, but, you know, these guys don't understand Rand per kilo? Then I'm like, well then if you don't understand it, then you mustn't farm or learn it, and if you can't learn it then then don't farm. But I think we need to stop being so undermining and derogatory. Just because people have less money than us and possibly went to a lower quality of school, doesn't mean they don't have the ability to learn or understand, and we need to stop treating people like they don't have that ability or this is a bit complicated, don't you think? No, I don't think so. It's like. I don't think it's a bit complicated, but I think it's really important that you learn it, and again, that is the big challenge that we face, and even when we start going into areas to work, we immediately go with this assumption of people don't understand, they're not very intelligent, they're battle to learn this, and I disagree. I think you need to keep those standards really high and push people to learn and understand. If you don't know how to work out grams per kilogram, then you better well learn if you want to sell vegetables?

INTERVIEWER
Yes, and it reminds me of a project we did in 2020 with a guy from a nearby township. He had a community garden, or was starting one, and I think due to a lack of knowledge, his farm failed. And he also had issues with his fellow township dwellers, coming at night and sabotaging his crops.

So, my questions are all very permaculture orientated because for this study I need to focus on the goal, which is permaculture for food insecurity in urban areas. So, how would you introduce permaculture to someone who doesn't know anything about it? Like, what's the first step to giving someone knowledge about permaculture?

PARTICIPANT
We actually have our own book which covers pretty much everything. So, Section 1, Permaculture, and sustainable food gardens, Planning of permaculture garden, dividing into sectors and zones, preparing the Garden, Section 2 deals with soil, soil preparation and making food for your soil. Section 3. Companion plants, general planting lists digging and innovative ideas, Section 5. Growing the plants future self. Permaculture kitchen, health trees and bamboo indigenous trees and a section for ideas for educators, resources and the sectional record keeping and more beautifully illustrated.

So, all of our facilitators attend a PDC to qualify in permaculture design before they become facilitators. We're also in the process of developing a facilitation guide and manual where we've divided projects up depending on the sort of intervention that we do. So, we do anything from a 3-workshop intervention which we call the Permaculture Starter Pack PSP 1.

So obviously, as a non-profit, our interventions are very much governed by the funds that we receive and essentially the way it works is, we've got an online application form where people apply to receive a project from us.

We then look at their application and rate the project based on the application. And you can kind of see are people just trying to get some money or is this person really interested in farming? We then identify potential projects based on the number of project members, the demographics of those that membership, the land, where they are, how much land they have, what sort of access to resources they have. It's not to say that a project that's small in the middle of nowhere has one project member, and they don't have water or

electricity will exclude you by any means, it just means we we're trying to categorize projects based on what their main needs are and where they would get their resources, because that's a big challenge.

INTERVIEWER
Yes, yes, absolutely.

PARTICIPANT
We then do a telephonic assessment where we chat to them and get some more information. Based on that telephonic assessment's projects have been sort of prioritized according to where we see them fitting in terms of their needs. And then we'll send someone out to do a physical assessment. The physical assessment will then come back and form the basis of a proposal which then gets sent out to funders. And then if a funder chooses a particular project, they decide to fund it, we can then say, OK, based on the funding we receive, what kind of intervention.

It happens in other ways as well, so we'll have sponsors that come to us and they'll say hey, we really want to do a project where we do an outreach program here in or around this area. Can you identify potential beneficiaries within this area? We want to put in this much money, what sort of a program can we do? And then we go through our project pipeline and identify specific beneficiaries in specific areas. Other times, funders will come and say we've been working with this garden and so it works out in a variety of ways in terms of actually getting projects off the ground. Once we've matched the budget, we'd set them up with either PSP one, which is a 3-workshop kind of introduction to permaculture usually.

So, workshop one would be an introduction, workshop two would be a little bit of practical work and the materials and then workshop 3 would be an exit plan which might come with some seedlings and some seed to get you started. We kind of use it to assess programs, then we go into phase two, which would be an additional 15 workshops. That's our kind of baseline. So, our normal intervention would be 8.

INTERVIEWER
I'm sorry. I see we have less than one minute on this meeting. Should we go to your Google meet? Platform. Or should I create another zoom?

Switched platforms…

Do you have a good success rate with people asking to start a project and then actually making it work in the long term or does do people easily pull out? And what's the success rate regarding these projects?

PARTICIPANT
So, this is now my third year and then I was five years as a facilitator before that. And it's an interesting question. So, I think our success rate is relatively high, especially as compared to other organizations trying to do the same thing. Which is definitely to do with the long-term intervention. In terms of a short-term project where there's three workshops. I mean, there's no hope of any success in that and we don't go into it too much, its usually just a token gesture from a donor wanting to get some points, which is fine because were still kind of dependent on those funds too.

We do push sponsors quite hard to say this and if you just want to go and donate a garden in the back, it's that's fine, we do gardens in the buckets we and we do a lot of that as well. It's a bucket with a lid that has the Growing Green book, some hand tools, a pack of 50 odd seedlings, and little bits and bobs and those sort of go out as distributions every now and again. So, you'll have a funder and very often what will happen is you'll have a project that comes online, and then the sponsor will say, OK, I want to sponsor an 18 month intervention, a long term project, but I would like to do an enterprise orchard, which is then the type of food forest that we do which is 50 fruit trees and some vegetables. So, they might say, OK, we want an enterprise orchard, and we want this PSP 3, which is the 18-month program and then we also want to do a business box on top of that, which is then a five day more intensive economic and finance training we've also got. The business box takes you through, you know, what's a business plan? How do you do a profile? Finding out about your local statistics, markets, research, and analysing soil. So, it's a little bit more detailed and more business orientated. For EduPlant, we've also got the cluster manual and the activity books, so EduPlant's a 2-year program that we run with schools. We do that every two-year cycle and it's actually a competition. So, we get 300 schools and then at the end of two years the top 20 schools will get taken on a trip and we do a prize giving and there's a whole event and a ceremony at the end of the two years, and then each of those three 300 schools during their two-year workshop, train four other satellite schools, so we're effectively supporting 1500 schools every two years.

INTERVIEWER
Okay, so, I have another question in regard to it because you have a lot of projects going on and it's not a singular thing, but how the people involved in this project, how time consuming are these projects? I mean it's probably very work intensive and these people need to focus on the project.

PARTICIPANT
Yeah, we really do expect project members to be there 5 days a week minimum. So, the sort of gardens that we work with typically that's the sole income, it's the sole activity in those. Sometimes, there may be an owner who's then got six people who work part time on their land with them and it's still classified as a project, but generally, generally speaking, five to seven days a week interaction on these projects yes.

INTERVIEWER
Yes, because you need to keep your hand on it.

PARTICIPANT
Yes, I mean that's quite important, I think it's worth possibly even mentioning, so, we've been looking very carefully at establishing a ranking matrix so we're not only looking at the land and the requisite skills, but we also look at behavioural aspects. Does this person come late? Do they dress appropriately for the task, is someone rude or disliked on the project? And these things all sort of feed into your project score, because we also want we want our projects to work partly because we obviously believe that by having food production happening in these areas and we've seen it and estimated that only about 10% of produce is actually for their own consumption and then donating the rest to the community and that's such a weird double because on the one side you've got Kwaal and on the other side, the community will harvest 80% of their crops and donate it to a church or school.

INTERVIEWER
Oh wow.

PARTICIPANT
So, there's that real sense of giving and generally speaking, you'll find on the gardens that a huge proportion of the vegetables are kept and eaten by the members themselves and donated freely to local community members that are struggling. Somebody comes around and they're hungry, they'll get a bag of spinach. There'll be no charge for it. They donate to weddings and to funerals all the time. So, these gardens do buy a lot into weddings and funerals, and often as a donation. So, they play a massive role in local food security. They really, really do. And it's hard to measure because there's no statistics on it, there's no records of it so. So, anecdotally, we're getting a better idea. Our record sheets now even say how many kilos were sold, how many kilos were taken home and how many were donated. And we have those separate categories if we want.

INTERVIEWER
Yeah, with influencing factors.

PARTICIPANT
Obviously, the more successful our projects are, the more successful we'll be as well. We want successful projects, but you also don't want to support people who are lazy and don't do anything.

INTERVIEWER
Yeah. No, absolutely.

PARTICIPANT
So essentially, leaving the people behind that don't want the help, and focusing on the people with passion and willingness. And that's right back to point #1, it's the motivation that's the main thing. That is the key.

INTERVIEWER
Yeah, yeah, definitely. It's a big part of it. And it's interesting you saying that most of the produce is either consumed by the involved the participants or shared because, for my study that actually resonates a lot with the permaculture ethics of caring for the people and then anything abundant is shared, because they could have sold the surplus products, but they choose to share it with other people and that's how you create a system where the people not involved in the project. Right, and hopefully then, they won't become Kwaal because they are actually also dependent in some sense to those people who are growing the food.

PARTICIPANT
No, absolutely and hopefully they would also be inspired to do similar because that's the irony as well. I mean there's there is sufficient space where we could potentially grow most of our fresh produce within most of our local communities. It's not an issue of space and it's not an issue of resources. It's an issue of motivation and passion, yes.

INTERVIEWER
Yeah. So, one of the things in my study that I tried to put out there is like and that is specifically why I chose Permaculture as well is because you can do it in a very small space and although it can be done on any scale you know permaculture can be a large system as well. But the idea is to essentially create a place or community or settlement, or even a luxury estate if it has to be, you know, like higher income people. But whatever you plan and design it so every person has the necessary means to create their own food system.

PARTICIPANT
Have you looked at? The European version, especially in the UK, they do it a lot. They call it allotments.

Where they have sections of the town, which have been planned by town planners and city planners, for vegetable gardens where the local communities come and grow their vegetables, because especially in the UK, you know everyone's living in these very sorts of cramped houses where nobody has personal gardens. So, there's designated public spaces specifically for vegetable gardening. And each person will get this sort of 10 meters by 1 meter and the can go and grow their food there. I think throughout Europe, they do it quite a lot.

INTERVIEWER
But Europe is actually inspiration for a lot of things I do because they kind of have several food growing practices to it, down to a tee.

So, I would like to know, are any of your projects based in urban areas or are your projects mostly rural, or is it a mixture?

PARTICIPANT
It's a mixture, but probably, 80% of them are in urban areas. And I mean, technically our projects are all permaculture in in principle. It's just that we don't call it permaculture so much anymore for reasons. So, permaculture is the principle that we teach with.

But I think that (person name) is probably a better person to speak to than me as well, because she's been with food and trees for 25 or 26 years and she's one of the forefathers of the organization. And she has a history in education, and she also played a huge role in developing our training materials. It's very likely that she's got some very nice pictures and ideas about special zoning and, and so I think (person name) is going to be the right person to chat to for that.

INTERVIEWER
OK thank you. So, do you have people on your team or at your organization that are specifically allocated to do the designing or structuring of these projects, or when you start a project, is it just trail and error and feeling it out?

PARTICIPANT
Yes, so the facilitators are responsible for that and in their first assessment workshop with the beneficiaries they'll have a look at the garden and suggest what they want to do and what goes where and they'll do a garden design.

So generally, workshops one and two are mapping and designing, depending on the length of your intervention. But we would start with the mapping and design phase and then move into preparing soil and then move into planting.

INTERVIEWER
Yeah, I would love to see some of these men and designs.

PARTICIPANT
There is that process. I see I've. Actually, got another meeting that's starting in 2 minutes at 11:00 o'clock.

INTERVIWER
Sure, okay well, you've got quite the setup and food entrees for Africa. I'm really impressed by the work that you do. Thank you so much for your time, PARTICIPANT.

PARTICIPANT
That's an absolute pleasure. Good luck.

INTERVIEWER
Thank you. Good luck to you too.

PARTICIPANT
All the best. Thanks, Denise.

INTERVIEWER
Thank you. Enjoy your day.

PARTICIPANT 2: Transcript

PARTICIPANT
Hi Denise, I have to leave the meeting early to pick up men on site so if we don't finish, we will just reschedule to organize a second session.

INTERVIEWER
Okay, right, I understand. I've just seen what you look like, can we turn off our cameras and then I'd like to quickly introduce myself and then we can start because I'd like to hear mostly from you and your experience with permaculture to gain more practical knowledge.

INTRODUCTION

PARTICIPANT
I just want to ask you first. Are there other similar philosophies that you are looking at or is the solution you're studying solely permaculture?

INTERVIEWER
Yes, I looked at urban agriculture with my honours degree and examined a slightly wider spectrum of philosophies practiced in urban areas for the same problem. That's where I realized that permaculture is one of the most structured philosophies, especially with its established principles and ethics. I have also noticed that permaculture is also possibly the most integrable with city planning because of the holistic systems that it has, and which are also present in urban systems.

PARTICIPANT
I hear what you say. I just for example, I was away with a friend at the weekend, and she is a plant manager for Geocrisp, I don't know if you know who they are, they do big salads and they buy a lot from farmers in the area and they distribute all the tomatoes and salads to McDonalds, Burger King, KFC, and places like that. But they have a warehouse in Franschoek of which she is the manager, and then they have their own hydroponic farm somewhere where they grow their own salads and then they buy from Philipe. But the whole idea is, it's great that it's grown in Philipe, but it's an open piece of land in the Cape where vegetables have been farmed for decades, but now they ship all the stuff from there to Franschoek to pack and then it is driven back to the city to supply the clients. So, then I asked her, why don't you put a packaging plant right there, then she said they have already done an impact study to investigate its feasibility and they noticed that there is not enough electricity on the grid to start a packaging plant there because it would require refrigeration fridges and freezers and so on. So, we are currently facing a massive problem and our country is facing a high possibility of a grid collapse, and if there is no power for 2 days, the products cannot be kept fresh and after 2 weeks without power and a town of about 7 million people it is an absolutely unsustainable system, we have going on now.

And that's half one of the big moving reasons for Permaculture. And the whole philosophy of permaculture can be half summed up for me as; food production that is not dependent on fossil fuels.

INTERVIEWER
Yes definitely, because at the stage everything is so dependent on power, even to get water to all the people we need power and therefore fossil fuels.

PARTICIPANT
Yes, and we couldn't even drink our village water for a period of time because the sanitation plants don't run as they should, so the water goes through, but it can't be cleaned because the loadshedding and no power broke the sanitation system.

And they even warned at that time that if we went up another phase then our town would be flooded, and we would have no water at all for 4 hours parts of a day.

INTERVIEWER
It's terrible, so you must be quite tense over there about the power and water situation.

PARTICIPANT
Yes, well, on a personal level we can take some precautions for ourselves and keep ourselves going and about, but the problem is if there is a mistake on that scale then we are all in trouble, so many good things will happen to which we can't even necessarily think, so we really hope it doesn't happen.

INTERVIEWER
Yes, hopefully we won't have to face such a crisis because it will be devastating.

PARTICIPANT
Yes, because we have already had many promises in South Africa for which we are still waiting. But okay, let's not get negative about it now, we are instead looking for a solution like you say.

INTERVIEWER
Okay so I'm going to start asking questions for now just so we stick to the structure of the interview. How did you get involved with permaculture and with Kuruma?

CO-PARTICIPANT
So, PARTICIPANT started giving classes at Kuruma and started helping me, but PARTICIPANT is actually on his own. He is involved here, but he is also very widely involved in other places and projects.

PARTICIPANT
So yes, I am a designer. Co-participant was at the very beginning at one of my first courses, which was just an introduction to permaculture. It's basically a meet and greet on the Friday evening and a bit of theory, then Saturday and Sunday are more practical stuff where we talk all the time about what the permaculture solution will be for each problem. Because the whole idea is that people go back on a Sunday, and they know what to read about and watch videos. So, you equip them a bit with the terminology, and we also give them at the end of a course a bunch of plants and a cup of seeds so that they can go back home and start doing something right away.

But for the guys in the cities, water is always the big challenge.

But Kuruma is on a larger farm where parts are rented out, of which a large share is for table grapes and then we have half a small holding here around the complex which she has started to complement with permaculture such as vegetable gardens, fruit, livestock, etc., but little of everything but a little of everything.

INTERVIEWER
OK. And what was the motive behind your interest in permaculture and the motive for Kuruma?

CO-PARTICIPANT
Well, I just wanted to grow my own vegetables and do it as natural and healthy as possible, and when I met PARTICIPANT, I didn't know what permaculture was. When PARTICIPANT got involved, the wheel slowly turned, and all our systems fell into place. What is always a big wow for me is that there was a pipe that came in and the overflow that went out, and just through the time together to manage and redirect that water our "green" (yield) exponentially enlarge. So, PARTICIPANT had always been consultative, and he came to offer courses here with us and we used them as a basis.

So, to my advantage I now regularly got further input and application. So, PARTICIPANT is actually the one who came to ring the bell with us.

INTERVIEWER
Okay thanks Co-participant, and PARTICIPANT how did your interest and involvement in permaculture begin?

PARTICIPANT
We have little time for that, but I will just tell you in broad strokes. So, I was shown in education, and we started a vegetable garden in Hermanus with a retired lady (Avis Hindmarsh) and she was 72 at that stage and she said she would come and help us to mentor the children a bit about the garden, as long as it is a permaculture garden. Then I told her that's all-right aunty, whatever aunty wants to call it, as long as aunty knows it's not a little flower garden, it's a food garden. Then she said no, that's right, I should visit her for a while so that she can show me what permaculture is. She was also on Bill Mollison's original courses, and she also helped start the organic movement in South Africa and then she started the Bryanston market, so she is very deeply established in the organic movement in South Africa.

So, she then became a great mentor for me and introduced me to the permaculture literature which I then started reading and studying and it just felt to me like an incredible knowledge and assurance at that stage.

I really enjoyed the education, but I just realized that I have to dedicate the rest of my life to this thing because here comes big trouble and we have to start planning. It was in 2010/2011 that I finished teaching and started the permaculture journey. So, then I went for a lot of training and did my very first PDC and after that I worked with Hazel Mark for almost two years, unfortunately she has passed away, but she was also a great mentor. We did many projects and courses across the country and so I later started to present PDC's.

I told friends I would come and design your gardens for you without any other costs than the materials, they just need to be able to help with a little labour and help with the materials. So, I made about 4/5 of the garden this way and learned a lot by making mistakes and correcting them. So yes, then I landed at Co-participant and it's one of the places where I've presented the most courses and we focus very specifically on the climate here because we have long dry summers.

INTERVIEWER
So, you say you are a permaculture designer, how strictly do you apply the design principles of permaculture and how design dependent are the gardens and projects you design or is it more of a trial-and-error approach that you follow?

PARTICIPANT
So, people like beautiful things, so I always try to make the things look beautiful as part of the design process, but it has to work first. So, there are an awful lot of principles involved in the design. Mollison and Holmgren actually said later that we should start calling the principles directives instead because that is really what we, or at least I, design according to.

And to make it applicable to the country, for example to check what resources you have at your disposal, and there is the nice example of a slow & small solution where the guys stayed in the Sahara Desert and they dug a well and built canopies with booths over it so that the pigeons that fly past it daily can come and sleep there and get water. Of course, the pigeons all pooped there on that spot, and they collected that poop and used it to start making compost/fertilizer.

And if so, we always come back to the principles with each design and when the design is almost done, I go back to see if I have taken all the principles into account and if they are applicable to each design.

So, the principles are an excellent guideline for the design of systems.

INTERVIEWER
I'm happy to hear the principles feature and is involved in the design of systems.

PARTICIPANT
I think we may have to organize another session sometime to talk about the theory. And also, each person's interpretation is obscured and each PDC has different content and is approached differently. And the whole idea of a PDC as Mollison originally wrote it was that you use that big manual of theirs that was written for every kind of climate and for all regions, and you use it as a syllabus, and it's a minimum of 72 hours can work through. And what PDC's have become unfortunate, and not unfortunate, but the way it is now is people who come on these courses usually have vastly deficient skills and garden dignity and knowledge. They do not have the very basic knowledge of gardening, composting, working with earthworms, how animals work, etc. so the PDC's become a basic gardening course. So, what many people have started to do is they offer a very basic garden make course with a few permaculture aspects in it and then they let the people do a few practical exercises so that the guys can at least go home and the basic garden making can go and do.

But the idea is actually that someone comes to a PDC, and they already have the knowledge of how to garden and the basic system related to it and then attend the design course to become physically more advanced than it is in the design of the system comes from which all the basic knowledge and skills are only a few components in the system. Such a design course is supposed to equip a guy to be able to physically go and hear someone's needs over a piece of land and what resources he has available then design an integrated working realistic system.

And also, many of our clients are not necessarily dependent on the income from the land so it is more of a luxury thing and so then the system does not necessarily have to work so the basic course is sufficient for such people.

And the actual correct approach is to first do a permaculture introduction course and then if there is further interest attend a PDC to build up your knowledge and skills.

Because what happens a lot at the PDC's is there are lay people who don't have the faintest idea what's going on and he asks questions and if you don't answer the questions for him now then he feels he's not getting value for his money but meanwhile he should have attended an introduction course or two first so that you can get the basic knowledge and skills needed to attend a PDC.

But the point of permaculture systems is really that it is minimum input for maximum output. So, if you really don't have output that day, it shouldn't be a blow to your ass because you put in so much. It should take minimum of your time relative to how much you get out.

The idea is that it requires a minimum of your time, money, and carbon input and once you have a system up and running then it is easy to exponentially expand your system. And this connects to small and slow solutions and then the rest of the principles, you have to use the principles to get your system settled and establish a solid foundation and then start expanding.

And one of Mollison's rules is, how big should I go? You start at the back door and build from there and if you go too big for what you can tolerate, you lose the ability to manage and regulate it because you may not have enough resources or time to keep it going and not to support.

INTERVIEWER
Yes, but it was interesting for me to hear that you design permaculture systems for people because it is in a way very much connected to city planning in the sense that just as you explained with permaculture systems, a planner must also consider the feasibility and consider maintainability of a town or community or area and determine what will work and what will not and on what scale. For example if a planner goes and plans a business node with an enormous shopping center in a small town like Middelburg and the node has 1000 parking spaces and a whole new turn lane is built from the main road to the center, it doesn't necessarily go not be profitable because throughout the year the town does not get feet and the population of the town is not necessarily in a financial class to maintain and support such a node.

But the real question I want to get to is, do you take into account stormwater and greywater and topography and such aspects when you design a system or does it depend on the client, such as if the client has sufficient municipal water to maintain the system. How does it fall under your area of knowledge when you design a system?

PARTICIPANT
Yes for sure, water is the most important component of designing such a system and that is one of the misconceptions that people come to the courses with; no man, they will only put up another rainwater tank if one is not enough then they have 20000 litre rainwater tanks, but okay, did you quickly work out how much water you will need if you water a garden 2 times a week for an hour going to have to water in the non-rainy season? And if you make that little sum, you see that your 20,000 litres of water will give you water for 2 weeks in the summer, then in the end that water is minimal when it rains, and your tanks don't fill up again.

And municipal water isn't really an option because it's expensive, it's unreliable, and it's been cleaned with carbon filters so we shouldn't really be drinking that water at all.

And the municipal drinking water is treated so badly, but the other water like your shower, toilet, and garden water is not treated nearly as badly because our country cannot afford to treat it like that which I then recommend to people in the city is that they look into grey water systems as soon as possible so that you reuse the water you use in the house in the garden. Because all your large volumes of water are in any case not that badly polluted, for example, no sinks because the number of bacteria in sinks is far too high and built up from chemical products from hair washing products and so on.

But your shower water, your bath water, and your washing machines' water are very large volumes of water that can be reused by building in a grey water system. And again, if you can't afford it, there are many ways you can build greywater systems yourself with flow bins and so on.

And what is bad is that in many places in the country the bylaws do not allow grey water systems to be installed and in other places that have recently experienced droughts it was almost half encouraged, and the legislation around it is not as strictly enforced as it shouldn't.

And now with load shedding many people have to pump water a second time from their grey water system so that's something we are looking at now is how can we store grey water at the client's house in such a way that he does not need that water a second time not to pump.

So, in order to design such a system that the person only needs to pump water once and further uses gravity, then also know in the system, or integrate the system with certain plant systems that then remove bacteria from the water and put other nutrients back in the water so that the water that is then used in the garden is usable.

INTERVIEWER
Okay, yes, and something that stood out to me, a permaculture system actually extends into a person's home and is integrated with your indoor systems and therefore contributes to the holistic nature of permaculture as it was initially intended to operate.

PARTICIPANT
Yes absolutely, and integration is very important to me. Because it is very difficult for me when I come to a client, and he tells me he has identified that piece of land and he now wants to have a permaculture garden in that piece and then the piece of land there is far away from the house.

So yes, it is absolutely a holistic approach and doing zones is very important because most of the time your house or a house with an inhabitant is your first zone (zone 0) and the permaculture system spreads from there in order which Mollison and Holmgren have so beautifully set out and explained.

Because zone 0 is also often the origin of your system's resources, apart from water, your chickens may also be fed in zone 0 and your food scraps that you don't eat come from zone 0 and so it's definitely important to surround your home with the system integration.

And as soon as you become dependent on rainwater, the need for storage capacity becomes bigger and bigger until you need dams afterwards, and that's why we have so many dams in the Western Cape because we have long dry summers and there is still not sufficient and enough domestic water systems in the country to make households less dependent on municipal water and rainwater.

And I have a friend in the Middle East who builds these systems. He built such a water recycling system at the zoo in Dubai to supply water to the animals and such. And these wetland systems recover water from the oil mines around there and his largest wetland system that he built is 400 hectares.

So, there are people who specialize in such systems.

PARTICIPANT
And I always tell people on the courses because some of the questions that always come up are, can you make a 2000-hectare farm permaculture? Then I say no, you can't because that's not the whole point of permaculture, permaculture's goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to as little as far as possible not to be dependent on external resources (water, fertiliser, pesticide, etc).

And I also always for the people, the biggest level at which permaculture works is at the community level, so you have to look at how you can organize a community, and many times it starts informally, and it also stays informal.

But if you look at our grandmothers and grandfathers' time, it was common to take the eggs from your chickens and the figs from your garden and exchange them with the guy down the street for some of his butter or cheese or honey that he makes

And so, one can become a bit independent of the monetary system as well, because one kilogram of honey is always equal to X amount of eggs, and it is the fixed exchange value that these types of trade items have with each other. So, the "price" of your food does not vary as randomly as in the shops and then you always have eggs and honey, and he always has eggs and honey for example.

INTERVIEWER
Yes, that makes sense.

PARTICIPANT
And that's something we often see at PDC's which is positive, is a group of guys who have called to buy a piece of land together, we're all going to move there with our little animal and families, and we're going to start from scratch. an integrated permaculture community, almost half an ecovillage, starts, and then they come to these PDC's to get the knowledge and skills.

But I have seen such endeavours fail so many times, because one husband's dog bites the other guy's chickens to death or they have differences of opinion and then one by one the partners take their money and leave.

So that's why I say community level, because where you live, in your community, you create a system and try to incite your neighbours and invite them and often it spreads out in that way.

INTERVIEWER
And I noticed, there is a lot of interest, people just need a driver.

PARTICIPANT
Yes absolutely, here where we live in Rawsonville there are so many members of the community who want to buy in and become part of such a community but there is not necessarily someone to direct it, but the people are eager to learn and get involved and it's actually an ideal opportunity for such an intentional community.

CO-PARTICIPANT
And many people in the cities cannot rely on gravitation because the landscape has been flattened and now with load shedding people have to start looking at alternative pumping systems (solar) and then it becomes prohibitively expensive and almost no longer worth the effort.

PARTICIPANT
And if only there was more input from building regulations and so on to, for example, put in a regulation that all houses must be built 500mm above ground level so that the house can allow a natural slope and is equipped for a greywater system with gravity.

CO-PARTICIPANT
But urban planning, where you come in, can also probably say, it should be brought into the planning?

PARTICIPANT
And it is in any case advantageous to build houses 500mm or so from the ground in other aspects as well because it also has many advantages for flood risk prevention.

INTERVIEWER
Yes, and that's something I've also noticed, the legislation in planning but also in other relevant sections (building control, environments, etc) is still very old-school and half-evolved to not consider modern day issues and concerns take or address.

Like, at its core, most of the legislation from 20 years ago is still the same as the legislation of today, but the problems that people faced at that time are different from the problems that we face today.

PARTICIPANT
Yes, and it's not just that tons of countries have longer droughts but also more floods, and other increasing issues for which we are not prepared.

INTERVIEWER
Nooo…. *Meeting ended unexpectedly. Further communication commenced on WhatsApp and a second meeting was proposed.*

PARTICIPANT 3: Transcript

INTERVIEWER
Hi, Chris. Can you hear me?

PARTICIPANT
Yes. Hi, Denise. How are you?

INTERVIEWER
I'm good. Thanks. Are you English or Afrikaans?

PARTICIPANT
I am English.

INTERVIEWER
OK, so I'll speak English. Thank you for joining.

PARTICIPANT
It's a pleasure.

INTERVIEWER
OK, so I'm going to do a quick introduction and then just from there it's going to be a few questions to get your insight and knowledge because I have never practically been involved in permaculture and I need to know more for my research. So, I'm a postgraduate student in urban and regional planning. The problem statement for my study is with many people moving to urban areas and the high urbanisation rates, the more cities grow, the bigger the problem becomes of people in these areas who are hungry because they don't have access to food, or they can't afford food within these urban areas, especially in the peripheral areas. And so, the aim of my study is to figure out if there's a way we can combine urban planning, which is solely about urban areas with food growing practices to create more food secure systems. So, this part of the study that I'm doing the interviews for is specifically to gain more insight about permaculture in practice. Because what research and practicality are not always in sync and so that's why I'm having this interview with you today.

PARTICIPANT
Fantastic. I think our first thought and comment is that I feel like the application goes beyond just food in the urban context, but actually, the flow of resources and energy. So, for example, water and water management, the flow of organic matter, and how organic matter is managed in the urban landscape and then how that will be invested towards kind of resilient food systems. It really goes beyond just the conservation of food but really looks at a systems lens on the flow of energy in ecosystems as a model and then how that can be applied in our design of human landscape.

INTERVIEWER
Yes. And also, cause on the theory part, permaculture is very much based on the systems thinking and it's not just about the act of growing food, but there's a lot of social and economic and other aspects to it as well. What I've learned now, so you're in Knysna now.

PARTICIPANT
I'm actually in Gordon's Bay at the moment, I've moved back closer to The Cape.

INTERVIEWER
Oh okay, and are you still involved with Pachamama?

PARTICIPANT
Yeah, I mean, the non-profits and we'll just be alternating back and forth, taking on a teaching role this year at the school. My son will join in, so he'll be back and forth to Pachamama in our school holidays.

INTERVIEWER
OK. Yeah. So can we start with more about how your systems work at Pachamama. I would like to know firstly; how did you get involved in Permaculture? How did you initially hear of permaculture and how do you apply it in your project?

PARTICIPANT
So, I first heard about permaculture through a friend when I was living in Johannesburg about 10 years ago. At that time, I was working at a cottage school and thought well, that would be fantastic to implement in the school space to and as a learning tool in the environment of the school. And then my partner at the time and I had a child and that really catalysed things, because then my thinking shifted beyond just my own desires to really reflecting on what I really value in life, what I think is important for future generations, what lifestyle I would like to raise my family in, and so that kind of really catalysed my journey with permaculture and resulted in me and my partner at the time moving down to the Cape and we booked a place in a permaculture course and also visited different projects on our on a drive down.

Yeah, and that was really inspiring, especially learning more in the first permaculture design course we did. I was quite fortunate that, I had the opportunity to design and make a proposal for a boutique wine farm that was on her side of the family, and they were looking for a farm manager at the time. And so that allowed me to, design and basically propose a pathway forward to kind of management practices and on that wine farm. And so, I was really fortunate and privileged to have an opportunity like that and that for me, establishing a tree nursery and our first food gardens and continuing my educational journey, doing a facilitators course, and started hosting workshops and courses, and then also organising with other permaculture facilitators.

INTERVIEWER
And do you still do courses?

PARTICIPANT
I do kind of intermittently, since 2020 we've been doing an annual permaculture design course at Pachamama, so you know, there's a regular schedule, and it’s something I'm quite passionate about and so there's quite a lot of work to coordinate.

And so, I was at that wine farm for about 5 years where I really got to put it into practice and do a lot of research and observation and develop my tree nursery and then that created the foundation and opportunity for when I needed to leave that farm to look for other projects up in the garden route, post the big fires in 2017 and 2020, because I saw an opportunity to look at landscape restoration post wildfire.

INTERVIEWER
Right.

PARTICIPANT
So, I thought it would be better to try and get funding to plant the trees that are in my nursery stock than to have to borrow money for compost so I can bag them up or plug them on the retail market. So, that gave me the opportunity, and I found Pachamama and it was really aligned their vision, what I wanted to do and I was able to propose, design and project management services to the land owners of the company that owned the land and I then spent the last four years since 2019 through to the beginning of 2023 working on implementation of both the Forest Restoration and agroforestry projects. I was also running the space as a living Learning Center, hosting workshops and quarters, and quite a regular volunteer program and so that's been a really fascinating. Basically, I used it as a research project to pilot a model that I developed called the holistic organic matter management model, which is looking at the development of organic matter that can become available through the restoration process, for example through clearing invasive vegetation or partially burnt material, looking at what processes and products can be developed through that process, to try and develop models that can subsidize or self-fund the holistic restoration and revegetate them. Yeah. So that's been my work over the last four years.

INTERVIEWER
Okay, so at Pachamama, how does the system operate? How many people are involved, and how do how do you go about the produce, and you know, what are the goals of the project.

PARTICIPANT
So, our vision is to see the regenerative culture through the restoration of both inner and outer landscapes.

So, it's quite broad and works through various projects and programs. So, basically, the land is owned collectively by a group of 11 people at the moment. It was a small old meditation retreat centre on the edge of the Knysna forest. And of those, only 3 live on the land permanently, but there's also accommodation on the land built around the communal kitchen and yoga studios, so the space was really well equipped to host people and then the landscape offered an interesting opportunity because it was vegetated with

invasive vegetation and the fire then burned through the property and there was an alignment of kind of a long term vision to establish an eco-village and be more self-sustainable. And permaculture offered a really good tool set to work towards that vision.

So, I initiated the agroforestry and the forest restoration and established my nursery infrastructure there, and managed project, managed the landscape restoration of clearing the invasive vegetation, processing everything, chipping it down, milling something that's suitable for somebody.

Burning the debris down to biochar, building composts, looking at infrastructure developments and so it's quite a complex project in terms of the stakeholders, but in essence, 10 people that own the land, three of those live on the land full time. And the produce has been mostly for our own consumption, so that would then feed into feeding our volunteer program or when we're hosting people for courses, some surplus is going to local community with the staff that work with us. But we never produced for markets, it was mostly for our own use. And, also looking at agroforestry, the intention was to establish diverse mother stock, both for research to see what works well in that type of system in that bioregion. So, it's kind of small scale, but very diverse, we planted I think 200 trees of 42 varieties.

And but that gives us interesting data and mother stock that we can use to propagate to either scale selectively or propagate to support other restoration or forestry projects.

INTERVIEWER
So, it sounds like it's very work intensive. How often and work intensive are your projects at Pachamama, does it require full-time interaction?

PARTICIPANT
Yeah, there has been over the last four years, but that's shifting a bit at the moment. There's just one labourer and since we're not running our volunteer program this year, it has been quite intensive. For example, we run a three-week volunteer program once a month for probably 10 months of the year and would have anywhere from 2 to 10 volunteers at a time.

INTERVIEWER
Oh wow.

PARTICIPANT
We're also working with local communities, so we've varied from kind of 1 full time employee to up to three full time employees and sometimes working with part time teams of up to 10. Yeah, labour is one of the more intensive parts of the process so, yes, it's all quite intensive.

INTERVIEWER
Okay, and so the I'm not sure obviously how the setup is at Pachamama and the layout and what to do with, but to what extent did you consider the permaculture principles when you designed the layout, say of a certain project?

PARTICIPANT
Permaculture design principles was fundamental in the process and methodology to our landscape design. The design and placement of our systems and infrastructure. So yeah, it's really, really fundamental in the design process. And that design process is really trying to look at natural systems and processes and the flow of resources and of people in the landscape and to try and determine placements of those elements within the system to optimize efficiency. We follow for example a framework called the "Jomans" scale of permanence where we start with the really permanent aspects of the landscape which would normally be your roads, your access, and your water, which can be integrated and once established, that's like your mainframe pattern in the landscape.

And that's informed by the landscape itself like the layout of the land, the slope, the flow of water through the landscape, and then we start looking at next layers of permanence, for example buildings and infrastructure, productive systems and so on.

INTERVIEWER
Wow. OK and so what would you say are the main lessons that you've learned from permaculture, but also like food growing systems overall.

PARTICIPANT
I would say one of the main lessons I could phrase is fertility is a function of diversity. And with some interesting soil research, that's kind of been pointing to that. Integrated diverse systems and then the opportunity for humans to play their role as keystone species within the ecosystem, so, particularly in landscapes that are quite far from the natural state of the ecology, which would often have large herds of grazing animals, for example, in Knysna they would have the Knysna elephants.

So those large animals in the landscape would often play a key function in creating disturbance and cycling organic matter and without especially moving more and more urban and without, those that ecological function being filled by ecology itself, there's an opportunity for humans to really play their role in managing the ecosystems and facilitating the cycling of organic matter and of the flow of energy through the landscape. And then the other important lessons have been really informed by another fantastic design framework called the ecovillage design education framework that looks at design along 4 dimensions of the ecological the social, economic, and then the cultural or worldview dimension and really highlights the importance of the integration of all four those dimensions. So, we really learned the importance of cultivating, if you look at the social dimension of cultivating healthy, sustainable relationships between people that are all stakeholders that are involved and for example, economically, the importance of generating viable economic models to sustain kind of those initiatives and the work that's needs to be done and also to create opportunities for livelihood in those spaces. And then, you know the cultural dimension of really trying to understand the role of, for example, the arts and music in culture and within those relationships or the role of ritual and ceremony in culture or the nature of our narratives and stories and mythologies, that we participate in or use to perceive the world around us, and how that might differ in context of mainstream ideologies and for example, when we look at nature as a model and as our teacher in natural systems, different narratives emerge, or different ways of knowing and being emerge.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
Ways of relating to our landscapes in the non-human elements in within our ecosystems, and even the way that we view ourselves as part of nature as part of the landscape as opposed to the separation between the human and nature, you know, seeing the human is somewhat somehow unnatural. So, there's been really deep learning in. so I guess how to use those principles to establish something that can sustain and grow into a community that is able to live and work together with the landscape, with the ecology. So, the well-being of the landscape and the ecosystem, but also in that how that feedback feeds back into human health and well-being.

INTERVIEWER
Yeah, OK. So how dependent is Pachamama project on municipal water and because obviously you have water management systems in place, as you've said before. And so how you know how dependent on you on municipal water and electricity to keep your food growing systems going?

PARTICIPANT
We have no municipal water or sewage. We do have an Eskom connection that we still depend on for power, but we would love to transition away from it.

INTERVIEWER
Yes, I believe you. And so, Chris, just uh to conclude, what are your thoughts on integrating permaculture I would say more formally into urban planning or town planning practices because I'm going to try and explain I'm working as well now as a town planner and like there's a lot of laws and policies and frameworks. That's it. OK, if you're going to do 10 houses, you have to have this amount of open space or green space. But it's not necessarily monitored to be functional open spaces and so it kind of adds to my problem statement that maybe there's a gap where we can actually implement permaculture and other food growing systems into our urban systems from the get go so that more people can live almost independent from the industrial food systems as it is now, and I would like to know your opinion about permaculture in urban areas.

PARTICIPANT
I think there's a huge opportunity. I think to integrate systems view and to integrate holistic thinking into how we design our urban spaces. I think there's a bit of a tension between policy and politics and the need for resilience and regenerative human settlements. There's a kind of tension between centralized supply and in essence decentralizing. For example, water security, decentralizing energy supply, decentralizing food

supply. So, it's quite a disruptive line of thought, because obviously there's a lot to gain from maintaining power and control from supply chains and maintaining centralised supply systems. So, I think that's reinforced by policy, for example, just like zoning laws of what you're allowed to do on land and it being so restrictive and controlled. So, I think that that would be really beneficial to th commons, to the communities, to the people living in those spaces. However, bridging that, tension in agenda is what really comes to the forefront in that dialogue.

INTERVIEWER
Because that decision would have to come from top down and they would have to give in to giving people more freedom because now they can, as you said, they can control every move, they can control what you do on your portion of land and it's very limiting.

PARTICIPANT
It is a conflict of interest, but I also think that there is a growing need and urgency that's also being recognized on the policy level, and so I think there are opportunities just in terms of how that bridging is trained and approached. So, for example when one looks at, the National Development Plan or the provincial economic development plans or the municipal Spatial development plans, and really looks at the objectives that that kind of plans and strategies are trying to achieve, I think there's a lot of opportunity to propose things in ways and use the language that helps politicians tick their tick boxes in a sense. So, for example, if there's a focus on education, skills development, and capacity building, like there's a focus on food security, or environmental management. And so, I think it's not an unbridgeable divide, I think it just takes a good understanding of how to integrate permaculture and systems thinking and how that can be packaged and framed so that it aligns with that kind of top-down objectives. Because the need is only going to grow, cause there's more stress and pressure for sustainable systems so I think more and more it will be recognized and called upon to.

For example. You're facing something like now with the energy shortages and energy crisis, acknowledgement of that benefits of decentralizing power supply, and likewise with food, there's many angles one can take, you know, like in terms of security and climate justice and climate adaptation and mitigation and like for example, there are a lot of environmental laws that aren't very well monitored or enforced that could be key opportunities for programs or projects that help come into line help companies or land owners or use capabilities come into alignment with those regulations. However, the management is normally where there's a capacity gap, I mean for example, the municipal ability to maintain the law around invasive vegetation along riparian zones and water courses or the risk of wildfires, for example. That can cause companies and municipalities loads of money, so there's an incentive to mitigate fire risk, and that can be done in a way that's designed holistically and integrating from permaculture principles and methods into those projects and programs. So yeah, bridging that policy level, the practice and implementation and then the funding mechanisms. And that's also an area that's really shifting quite rapidly with the decade of ecosystem restoration and UN sustainable development goals and so that triangle between governments, private, either private or NGO's that are able to value in terms of increasing the capacity to achieve those goals and management practices. But then there's the need to draw on from those NGO's and from those kinds of private parties funding mechanisms and resources to be able to do the work.

INTERVIEWER
Yes, I've also realised that especially the spatial development framework of George for example, like it has a lot of the objectives are very good and actually going in the right direction, but the there’s a serious gap between the objectives and the actual implementation thereof. Because you know, developers usually want to go for the most profitable and the lowest cost developments and that rarely includes sophisticated food systems. But anyhow, that you so much for your time, Chris.

PARTICIPANT
It's a pleasure.

INTERVIEWER
I appreciate it and I will definitely try and make work to get to Pachamama this year. I would love to see how everything works and how your systems are up and running and everything. Thank you and enjoy your day.

PARTICIPANT
All the best Denise and thank you.

PARTICIPANT 4: Transcript

INTERVIEWER
Oh, can you hear me? I no, I can't hear you. No, can't hear you. Yes, settings. I don't know if it's sitting on my side or on your side. Oh wait. It says you're unmuted. Ohh no. I'll create a new link because I think this is sitting, I'll I'll e-mail it to you. Ohh, I can't hear, can't hear. OK, we can try Google meet. Do you have Google meet? OK. Will you send me the link please? Thank you.

PARTICIPANT
Hi. Hi. OK, now the camera. It'll come on. Don't worry. May take some time.

INTERVIEWER
Yeah. Can you see me?

PARTICIPANT
I can see you. I can hear you.

INTERVIEWER
OK, sorry for that. Zoom has been giving a lot of problems lately.

PARTICIPANT
Even with us, we've been having problem like I'm having a problem. My camera is on and I don't know what? That's.

INTERVIEWER
You know, there's always something. Yeah, but at least I saw you on zoom.

PARTICIPANT
Yes. How are you doing Denise?

INTERVIEWER
I'm doing very good and you PARTICIPANT.

PARTICIPANT
I'm good, just very busy. Were busy launching a new curriculum to schools. Yeah, with secondary schools. So, I'm leaving to the Western Cape to do our inaugural unpacking of the curriculum.

INTERVIEWER
Oh, we're in the Western Cape are you going? I'm in. George, actually.

PARTICIPANT
Kuils river.

INTERVIEWER
Yeah, it's not far from where I am.

PARTICIPANT
Oh, maybe I can network with you too.

INTERVIEWER Yeah, I'm always open. I work on most weekdays, but I can make time. So I'm going to can I continue just to introduce myself quickly and then I'm going to ask you questions. I want to hear mostly from you because you've got the experience and the knowledge. OK, so I'm a post graduate student at the Northwest University in Urban and Regional Planning. And the problem statement for my thesis is especially urbanization with a lot of people in the last two decades moving to urban areas closer to work, food, everything. And so, with the more people moving to urban areas, the larger the problem of urban food insecurity. It's because all these people are living in urban areas, and they don't have access to food, or they can't buy food because they don't have money. So, it's become a real problem, especially in the larger cities. And so, the overall aim of my study,

Oh yes, and then so with all the people living in urban areas and not they don't have access necessarily to food or they don't have the means to buy food. So especially in the larger urban areas where there's a lot of. Poor communities in the peripheries of these cities. And so, the overall aim of my study is to explore if

permaculture can be implemented through urban planning as a means to equip these people. When does when planning this, their towns, or their settlements to equip them with the means to grow their own food instead of having to depend on buying food? Or getting access to food. And so, the purpose of this interview, however, is only to understand what permaculture is about from a practical perspective, because I've researched it now for three years, so I have the theoretical background, but I don't have the knowledge because I've never 1st hand and been actively involved in permaculture, so that's where you come in. I'd like to know more about permaculture and your experience there with.

PARTICIPANT
OK, my focus area has been with schools. Predominantly schools, so it is a very structured curriculum. Able to adapt permaculture and the implementation in spaces that are available. Be it deep rural, be it urban and very urban. So, what we do. Is we take the principles and apply. It all tailor make it to suit the environment.

INTERVIEWER
OK, wow. So, a lot of thought goes into the design of each project.

PARTICIPANT
So, what happens is the school is given the tools of the operation of permaculture. For example, the soil is most important. What do we do in a situation where there is minimal access to arable land? So if you have space available between 2 classrooms with you, So what you do is you can do what we call sheet mulching. So, I won't go. Into the technical detail, but I'll give you the options that we allow schools.

INTERVIEWER
OK.

PARTICIPANT
So, what you do is you do a process called seat mounting where you build up soil above the ground, that's one process. Then you get an option of doing container gardening. So, you use the plant selection is based on the types of containers you have available remember because it is communities that lack resources or financial resources. So, we use on site resources.

INTERVIEWER
Yeah, what they have available.

PARTICIPANT
So essentially, if you have an old dustbin that has gone, it doesn't hold your dirt anymore because it's got holes in it or it doesn't have the lid or whatever it is. You modify that, whether you create holes for drainage. And you build up an ecology for growing food in that structure or in that resource available.

INTERVIEWER
Yes. Wow.

PARTICIPANT
Then what we do is we do vertical garden. So, you create, with the fences that are available. Sometimes the soil is so compacted around the fence, so you're growing the container. For example, you go grow climbing bean. You don't have to grow it in the ground, you grow it in the container. And then you trellis it along the fencing, or you trellis it along the poles of the corridors, you know the support structures, provided it has adequate sunlight.

INTERVIEWER
OK.

PARTICIPANT
Then, if water is a resource poor resource, then we teach them to harvest water. Then the other thing is sometimes water is scarce commodity, so, we teach them the principle of grey water harvesting. So essentially, we have learners that are taught how to harvest rainwater at home that is then brought to the school for the gardens. So, the children bring it in containers. So those are the systems for a community garden. Now, if you're living in a homestead, for example, you're living in an RDP. Housing settlements you have limited space, say a square meter.

It's like a meter square. Right. So, we do what we call, it's an old terminology, a square foot garden. We taught how to do bio intensive agriculture on a very small space. So, what you do is if you have the size of a door 1 meter by 1 meter and then you create smaller squares inside that square. So, you probably get 9 to 16 little squares.

INTERVIEWER
OK.

PARTICIPANT
So, you put your tallest plants in the middle for example. I'd like to do the green pepper. Green pepper is taller, so I can put one green pepper, which you can harvest at least three or four harvests out of that, seasonal harvest. And you allow it to grow in the middle, and because it has a multi-function, it has the capacity to grow well with others. I'm just throwing little technical knowledge, so you understand.
So, what happens is you will be able to give your household an average of say 5 Peppers at a time, you grow your lettuce in one little square, you grow maybe 3 lettuces, you grow 2 cabbages, you can grow some carrots. So essentially you have very dense growing in a tiny space. And what's been working in Devon, they've been experimenting a lot on roof gardening.

INTERVIEWER
OK. Yeah.

PARTICIPANT
Yeah, there's lots of room. So that's the alternative for urbanization. If you are in the structure of the building that has roof space, flat roof you can utilise, you grow. And the thing is is your balcony. So those are the options of using all the little spaces available. All you need to understand is your sun angles, your wind velocity, shade areas, etc. So, these are the various, elements that you need to consider before your planting, but more importantly is the selection of your crops.

INTERVIEWER
Yes, because not everybody has that knowledge of what to grow together or where.

PARTICIPANT
Yes. So, it is essentially a little bit of technical skill as to what grows well together. That's we grow what we eat. So for example, I know kale is a superfood but that is not something that's on my diet. So, I'd rather not grow kale. I'd rather grow Moringa, for example, but the important thing is the maintenance of these plants as well. You may have a plant that you require. But if you don't like for example, a Moringa can grow like 5 metres high, but you can continuously keep it at a level where you can harvest and it doesn't outgrow your system that you have, or the space that you have.

INTERVIEWER
OK.

PARTICIPANT
It's the management of the growth of the plant. Your space and your needs.

INTERVIEWER
How do you approach pests and you know; do you use pesticides?

PARTICIPANT
We have we use an integrated pest management system where you do not use any chemicals, there's no pesticides even in terms of our soil conditioning. We do not add any chemicals. Whatever we add to the soil, whether it's any conditioning methodologies are based on natural.

Like, we encourage the use of cow manure, chicken droppings and also make our own compost, teach people how to make their own compost, to set up work farms. So, rather than because what happens? Is the chemicals start to leach into the soil and then it gets into the water system. When you add another system to, that is where we actually teach people of how to harvest seeds from their produce.

INTERVIEWER
OK, wow.

PARTICIPANT
So, the sustainability element is very important, Denise. See our systems are very structured. For example, if we are working with the Community Garden, the intervention is an 18-month period.

INTERVIEWER
OK.

PARTICIPANT
So, in those 18 months, you will structure every element or technical skill that a grower needs to make this system sustainable whether its soil conditioning, your water harvesting technique, pest management, your seasonal planting, we also expose them to business skills development. We have a whole section, and we call it. Our business box module. So, it's an entire value chain. The important thing is the entire value chain from A-Z is that you have exposure you have knowledge to all of that.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
Even if you are a homestead grower, you need to know what to grow, where to grow, how to water it, the type of soil you have you need, and how to build and maintain the levels of nutrition in your soil as well.
INTERVIEWER
Yeah. Wow. I have a few questions. Not about the specifics about permaculture, but I'm going to ask them anyway and then I'll come back to the specifics. So, I want to know how did you first became involved with permaculture? How did you figure that's what you're going to use for your teaching?

PARTICIPANT
OK, I I'm a former teacher Denise, and I've been in the teaching profession for 32 years, before I resigned to join food and trees for Africa as a permanent staff member, and I was teaching in a predominantly Indian school where people were resettled. And because you were taken out from an environment which was your own and it was displaced, people that were displaced from their homes. This was in the 80s mean and well before that it was under the apartheid regime and communities were displaced. And they set up the communities we set up in Chadswith?

And, I don't know, maybe it was a lack of aesthetic pride because you were now, I mean, from a huge area you put into a little kind of shoe box, and you had minimal space. And I told them I realized kids were walking to school through bush verges and it seemed like there was a lack of care. So, to conscientize kids in the areas, I started an enviro club and then it was essentially clean ups, it was adopting the verges and then I realized food was also an issue. So, I learned about permaculture food and trees for Africa offered some training for schools for teachers. So, I joined the first permaculture courses about 30 years ago.

And I joined the trees for Africa as a volunteer, as participant in their programs. And I pursued studies in environmental education, and I did a permaculture design course. So, the interest grew from there and when I saw the community changing, like our first pick up of litter was like 280 bags and like 5 streets and that six months later, there was literally nobody throwing litter around anymore. People started adopting the virtues and we started to grow back gardens for the school community, the parents, and the kids. And subsequently it grew and FTFA had these permaculture school competitions where I participated with the school I was teaching with. Then I realized how important it was for it to become a line to curriculum because I didn't want to see it as in many schools, where gardening was used a disciplinary measure. But here there was this transformation of, look at the science behind this, look you have access to fresh food. This becomes income generation. Then it was, not even called the spirit of Umuntu then, it was just good neighbourliness. You had extra vegetables you share, that was the principle on which we live.

INTERVIEWER
Yeah. And from what I've heard up until now, it's very infectious that if somebody started doing something, like a community garden or just a personal garden and it's successful and they start sharing, then their neighbours are also like they also want to do it. And so, they learn from the one next to them and it spreads.

PARTICIPANT
Yes, it has like a ripple effect. And subsequent to that I was posted at a special needs store. And special needs at that time had curriculum or you had a program that you had to follow, like a program on self-help skills, self-care where you do some basic literacy and some basic math so that they just get by.

PARTICIPANT
So, when I joined, I had a senior class and I realized, they may have had learning challenges, academic learning challenges, but if you looked at them as an individual holistically, you realize they have skills, they have potential, they had aspirations like everybody else.

So, I started dabbling a bit with diversity and because I came from the stomach of the background, and I had this knowledge. So, I structured the curriculum and presented to the principal and said this is what I'm going to teach these kids. Took a piece of land from the school and we started working and these kids were outside, they were free, and the important thing was they were learning. They started growing food, they started selling, and it has this whole like multiplier effect in terms of what they can do as skills because now you had access to many, which then resulted in entrepreneurship, they were drying herbs they were processing fruit and vegetables and selling, they were doing pickling, they were doing jams, they were drying, and they were selling.

Then it became garden maintenance, and it spilled into other little projects from the garden. Then I took the kids to the national competition and for the culture the kids won the competition.

So, then the kids realized if PARTICIPANT could teach it to us, they can teach it to others. Remember these kids can't read and write, or minimal reading and writing, but if they stood in front of you and said, Denise, do you want to learn about compost making, they'll teach you the whole process, because it was so practical and hands on.

INTERVIEWER
Yes, first-hand experience.
PARTICIPANT
So, I used to facilitate courses for other schools and I would take them as my cofacilitator and nobody knew any differently whether that these were challenged learners or impaired. So eventually this became a national school's curriculum. They've taken it, they've adjusted it, and they got the curriculum specialists involved and we now have agricultural studies as part of the decaps curriculum for special needs schools. This is how important this is for the country.

Because we're looking at various sectors of the community, for example their literacy level, their capabilities, their abilities, the differently abled, the curriculum can be applied across the spectrum.

INTERVIEWER
Yes. And from what I'm hearing, it's not only about providing food, but it's also a very social inclusive, way to revive communities, and even have as an economical aspect to it?

PARTICIPANT
Absolutely, well-being is a huge thing because people have moved so far away from indigenous knowledge systems that this curriculum actually brings you back to your roots. And the program has become so relevant and important that we now manage 300 schools nationally that have implemented permaculture as part of the curriculum across curriculars.

So, whether from grade R to grade 12, it plugs in somewhere, whether it's geography, whether it's maths. And because of my teaching background, we have been able to adjust and assess how we can plug this content into almost any syllabus. For example, in the Grade 5, they're learning about germination, and the seed structure, the cotyledon and the premial radical and the axis, and it's a basic thing the child is learning about seeds, to put it in a cotton world for germination, to teach them; this is what you need to do to see how each structure develops into the root, stem and leaves and where the food source is. Take the same number of seeds, and you got 30 children in the class, each one plants your beans, one in n a cotton wool and one in the garden. Your cotton wool will teach them the germination process and die if they don't transplant it and the one in the garden is going to develop into a bean giving plant.

So, the teachers are put through a training period of 18 months that is funded by corporate and we have facilitators throughout the country that run these projects for us. So, you'll have a cluster of schools that will go to each school, the facilitator will unpack content for that term, for example, this term was on bed preparation, transplanting of seedlings, healthy lifestyles, and the preparation of 12 conditioning Tees.
So, the teachers come to us, they undergo the training, we give them some compost and seedlings, they go back, they implement, they teach it as a subject and they implement.

And it's very well managed in the sense that we get feedback from the schools through our lighter communication where they post pictures and updates in the WhatsApp groups as to what is happening at their sites.

So, it culminates in a competition, and although that's not the purpose, these schools become food secure, they supplement the food, water, the feeding scheme, the national school nutrition program. They also have a list of the orphan and vulnerable, and so when there's extra food from their gardens, they supply food for those kids too.

INTERVIEWER
OK, yes, and that's also one of the ethics of permaculture.

PARTICIPANT
Right, but the add on is that our community members also attend our workshops, so it's not just confined to the boundaries of the school, it's replicated at homesteads too. So, it just continues, and it grows and grows.

INTERVIEWER
And so, how much weekly, or daily maintenance and interaction does these projects require?

PARTICIPANT
So, the teacher that comes to the workshop is project leader, they go back to their schools, and they disseminate the information and each class in the school is collectively responsible for their school's garden. So, they have their roster systems for when they water, when they harvest, etc. For example, grade 6B is going out to the garden today and they're learning about scouting, the process of identifying insects, and they take notes and learn. Then by the afternoon they will probably get a mixture made out of chillies, soap, garlic, onion, and other things, and then the next class goes in to administer the pest management that needs to be administered.

So, it's a structured roster system in the community gardens, and because of the size, they generally go twice a week., and when it's harvest time, they obviously go more often.

INTERVIEWER
OK, and so one of the topics of my research is also to create urban food systems that are regenerative. So, I'm not sure where that fits in yet because obviously some plants or some foods need to need to be harvested and replanted. But is there any part of these systems that are that can sustain themselves?
PARTICIPANT
Yeah, they are, and we call them the food forests. Initially, it's the development of the different layers that at some point start to take care of themselves. I'll give you an example, and other than that it looks like a for us, it has a lot of food. For example, I've got lemongrass, and I've found that lemongrass will self-generate via its roots. So, I've got one lemongrass tree and you'll find that new ones sprout up next to it, and then the parent plant maybe dies off, because maybe a lack of nutrition or something, but the new ones are sprouting. Also, your banana trees. I planted one, and I've got like, 20 now. Because once they bear the fruit, they generally start giving out suckers through their roots. So, from your one parent plant, you've got like five additional banana trees, which grow up into adults and they give you another 5 each. And obviously some of the plants you've got to maintain and prune them otherwise their fruit might become inaccessible, for example litchi trees.

We also don't rake up the leaves it, we leave it on the ground, it decomposes, and it acts as mulch, it creates an environment for your earthworms, which love the leaves, and so the whole system starts to work as an actual ecosystem.

INTERVIEWER
Yes, because if you can create a system that can sustain itself, people can be equipped to create systems that are they need to be interacting with it weekly, daily. But there's also a factor of it's also continuously giving them more to work with and providing to them.

OK. So, the next question might be a bit broad, but what are some of the main lessons that you have learned since your involvement with Permaculture started whether it's from the people or from the actual system?

PARTICIPANT
One thing of the larger systems is that it's a bit labour intensive, especially initially it is a bit labour intensive and then you also have the externalities which impact your system, like climate change, erratic weather patterns. But more importantly, I think it's the cultural values that emerge and the resilience of people. And when you engage, like I have the opportunity in KZN to work with 85 emerging farmers and the EtWikeni municipality, we found that the communities that initially started off with grassland, within six months had adequate food, and then we kept expanding until they started supplying bulk market.

And it shouldn't be handouts, I'd rather give you a bag of various seeds than giving you a bag of food because that will sustain you over a longer period.

So, I think the biggest thing is the human spirit.

INTERVIEWER
Yes, definitely. OK. And so, then another question, you've said about, say, a square meter space and dividing it into smaller squares, and say you have a larger project, maybe a garden of 100 square meters, is there also intensive designing that goes into your systems or is it more of a trial-and-error procedure?

PARTICIPANT
So, because you are taught how to identify the elements that you have, you scale up according to the size of your site. For example, if you have more than a square foot, you can introduce fruit, you can introduce your perennial herbs and there's a whole variety that you can introduce into the system and then obviously, you're increasing the volume that you produce as well. And the greater the space, the greater the diversity, the opportunity for diversity of space. But essentially the size really doesn't matter, you use what you have to maximize your yield.

INTERVIEWER
OK. And so my idea obviously just research at this point, research and practice are still is very far from each other, but the idea is to somehow in town planning practice, get to a point where whenever we're doing a layout for a new community or settlement or even an estate because it doesn't only have to apply to poorer communities, it can be for anyone is to eventually find a way that we can plan these areas with permaculture design principles or food growing practices in mind and eventually, when the development is finished and people start moving in, the people and the land is equipped to produce its own food…

PARTICIPANT
Denise, I think this there's a huge shift in the architectural and engineering space now? To ensure these elements are there, whether it's the water systems, whether it's the water harvesting, I know it's compulsory now to have water harvesting taking place on every side where you need to have JoJo text, whether it's the fancy ones, whether it's our huge, big green ones. Because I've seen designs have changed. For example, you have the rectangular ones that sit flat against the wall to harvest water.

Then you're having your grey water systems, or you have your roof water that is then channelled into your blue water systems and those are the things I think are coming into place and in some places, for every square meter of concrete there's X amount of green that you need to add in. So, I think even solar is really becoming a big thing that that needs to be incorporated in the system.

INTERVIEWER
Yes, definitely your seller is definitely growing, and more people are doing it. But one thing that I've now started to realise is there are a lot of environmental acts and environmental requirements for when a new development starts, but it's not structured. It's like OK, say you want to build 10 housing units and for every housing unit, there has to be 10 square metres of open space, but that open space can be a grassed park, that's fine. There are no regulations to ensure that these green open spaces are functional and holistically utilised, which could actually be great opportunities for growing food for that immediate community.

PARTICIPANT
Yeah, I think that that that's important. If people look at food security within the system, then it is important that they incorporate all these elements. Rather than ornamental, you know you do food growing, and food growing is not restricted to a food patch, it can be interspersed with your ornamentals.

INTERVIEWER
And so, what are your thoughts on implementing permaculture in urban areas and now you've done it and I've heard all of about your projects in urban areas and rural areas. But what are your thoughts of making

it more integrating it into policies and engineering, architecture, planning. Do you think there is a space for that within the professional field?

PARTICIPANT
It is. I think there are career opportunities within this space. People need to give thought to it and it's individuals like yourself, Denise, that are on these academic platforms that need to make your voices heard. We are the doers on the ground, we get involved in policy when it comes to climate change, we've been doing that quite a bit, but getting a foot hold in these spaces and I think the technical skills and the technical knowledge as to where and how needs to come from the academic and professional sectors. For example, town planning. Yes, they can come to us or maybe we could go to the town to training departments, but wheels turn very slowly.

INTERVIEWER
Yeah, absolutely. Because we, as town planners, we don't have any knowledge about how to apply permaculture or food growing practices, but we have knowledge about where the space is and what's happening where and so I think there's a very clear gap that can be filled within all these fields and knowledge and...

PARTICIPANT
You know, for example if the structure is going up, if a new development is coming up and there's the wetland on that site, you know that area is going to be untouched. But that area will need to be maintained because it's a filtration system for the earth, so you can grow around food that. So just like that, you can incorporate food at those areas. I know on Musgrave Rd, in Durban, there is a beautiful garden, and all the residents harvest off, and they have a designated agro-ecologist, or horticulturists there, so they've taken it upon themselves, a local initiative. Because sometimes if it's a top-down approach people don't buy into it.

INTERVIEWER
Yes, absolutely. OK well, that's all my questions. If you want to add something else.

PARTICIPANT
Like you were saying in terms of policy and development and new developments, I mean we'd love to see greater food spaces and more functional open spaces, and it’s not even just about food, it's about healthier food too. And because one of the things, one of the basic principles of permaculture is work with those who want to work.

Simple if you don't have that often, we've had situations where a funder will say, this is my alma mater, I want to go back and give back and create food security here and things and sometimes you don't have a buy-in because it's a top down and the developers go say, do what I want, I want you to do this and this and that, and it doesn't work like that.

INTERVIEWER
Yes, I agree, and I understand that. Because you don't want to put all the effort in to get something up and running and then nobody's enthusiastic and involved there with.

Thank you PARTICIPANT so much for your time and your insight.

PARTICIPANT
No, darling. Hope it is helpful and it helps you and all the best with your studies.

INTERVIEWER
Absolutely. Thank you again for your time

PARTICIPANT 5: Transcript

INTERVIEWER
Hi, PARTICIPANT. Hello. Thank you for joining me. Can you hear me?

PARTICIPANT
Yes, I can hear you fine. Just let me check this thing here, OK. Got it, got it. OK.

INTERVIEWER
So, thank you for joining me. Sorry about last week's misunderstanding. OK, so I'm going to start with just a little introduction about myself and then the floor is going to be yours because I don't have any experience with permaculture so I'm here to learn from you today.
Speaker
OK.

INTERVIEWER
OK, so I'm a postgraduate student in urban and regional planning and the problem statement for my study is with the more and more people moving to urban areas in the last few decades, the problem with hunger and poverty within urban areas are also increasing because of industrialized food systems, you know, a lot of people can't afford to buy food or they don't have access to food and we all depend on rural produce to come to the cities and be sold. So, the overall aim of my study is to explore whether food practices, especially permaculture, can be incorporated in spatial planning to create urban systems that provide its own food. So basically, urban food systems. And so, the purpose of this interview is merely to just get a better understanding of permaculture in practice, because I have a lot of theoretical permaculture background, after reading a lot of articles and projects and stuff, but I don't have any understanding of permaculture in practice, and that's where you come in.

PARTICIPANT
Is that such a short introduction?

INTERVIEWER
Is it short? No, what more can I say?

PARTICIPANT
So just tell me a little bit more. So, you're based where? In the northwest? Or where are you now? And where did you grow up?

INTERVIEWER
I live and work in George, Western Cape and today I'm doing this interview from Mossel Bay, and I grew up in Pretoria actually.

PARTICIPANT
Pretoria and so but NW university, is that Potch?

INTERVIEWER
Yes, it's in Potchefstroom.

PARTICIPANT
OK. Right. That's very nice, you've gone down to the garden route.

INTERVIEWER
Yes, well, it's much better than the towns inland.

PARTICIPANT
Yes, and maybe you can grow more food down there.

INTERVIEWER
Yeah, absolutely. There's actually a lot of people here already doing it over here so it's very inspiring.

PARTICIPANT
Yes, I know. My wife and I have just acquired a property in Hoekwil.

INTERVIEWER
Oh wow. Yes, it's very nice there. It's just beyond wilderness.

PARTICIPANT
Yes, yes. And we have a lot of our people, that we work with. I'm not sure whether you've connected with Alex Kruger?

INTERVIEWER
No. I've contacted her, but I haven't had any response from her. I wanted to meet with her, but she didn't get back to me via e-mail.

PARTICIPANT
OK. Well, we work with her, you know, in terms of she does a lot of training on the ground and she's probably one of the people who have done the most sort of permaculture training.

You know, permaculture started with this idea of a 72-hour training course. You know a 72-hour training course and people exposed to a lot of the of the main themes and ideas of permaculture during that program and she's actually coming here on Saturday.

And we're going to be running a permaculture design course focusing in two areas. One is going to be working with four sort of focus points in in four villages somewhat linked to the mining industry, around which I would say is urban really and driven by the same issues that you're talking about and also obviously issues like you know what is going to happen when the mining economy slows down, because it's already slowing down, you know.

And in time, it might not operate. And what happens to these thousands of people who are living in mining communities and a lot of them who actually were there, before the mines came, you know. And so, then the mines came, and they drilled through the aquifers, and they collapsed those aquifers and whatever they doing to get water, they supply it now as part of whatever they do. But obviously their concerns with what would happen later, so a quite a bit of the focus. In fact, we also working with a research scientist from Wits University who's doing also, I think as a geographer and urban planning guy in his 50s and we've worked with Royal Bafokeng Institute for some time and actually was on our board for a while. And he's also now, you know trying to make some ground into post mining strategies and you know what does the solution side of landscape planning or urban design that builds in some local resilience and local food producing systems, all the sort of stuff I'm sure that your kind of inspired about.

INTERVIEWER
Yes absolutely.

PARTICIPANT
Of course, it's how to get it. Yes, it's potential and we can see models all over the world of these things working, but how do we work? How do we actually get to the implementation strategies. And what's needed, what knowledge systems are needed to work with the complex setup that we have, all the different people, different ideas, different ways of seeing the world. You know where we work in our place at Thlolego with farmworker families, Tshwana farmworker families who come from their traditional villages and for whatever reasons came and eventually worked on farms. And that's who we've mostly worked with over the years. You know we've had obviously many people visit us from all over the world, from universities, everywhere but on the ground every day, most people are farmworker guys. And we've seen, well, how do we build a community? The sort of starting point of our work was at the certain particular time when South Africa was going through this transition in the late 80's. And you know, we had the Mandela period coming in and there was a very positive energy and we had reconstruction and development. We had all these really exciting programs to work with and so we were looking at ways to build a common future. How do we look at land practices? Of course, there was the issues of environmental concerns and the way that we were managing land and how to build this common future with these knowledge systems. And you know, it was interesting because, you know, it's been a long journey, and for people who've come out of the farmworker families, there's just a different view on the world.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
You know, those people didn't have time to think longer term, haven't had time to develop a reason of for example, If I work like this, I can develop this later. So, where we would say, it's interesting like two things that sort of came out where we were thinking well, we need to think more. Because permaculture starts with this idea of protracted and thoughtful observation.

You know this idea, it sounds very good, right. And for a lot of people who do thinking, that makes a lot of sense. But you know the feedback we would get from our former guys was, well for you guys, you know who grew up learning to think, but you must remember that when we grew up, we were taught not to think.

INTERVIEWER
Oh wow. OK.

PARTICIPANT
And we were taught to do dig that hole over there and then call me and I will come and do the thinking about what to do with the hole next.

INTERVIEWER
Yes, that's very true.

PARTICIPANT
So, maybe if I was digging the hole, I would be thinking about what you would be thinking about when you came to think about the hole. Not thinking about what it was I was actually doing and why that was important. And we are full of these anomalies.

INTERVIEWER
Yeah, absolutely.

PARTICIPANT
All these things. And so those are going to be important things. The other issue that I've found quite important to understand were things like. You know the same guy who you know who, who are really living with that well, this is what I'm dealing. I have to think of how to learn how to think, and sometimes, I think okay and sometimes I don't think okay, based on how I learn to think. And the other question or sort of interesting idea that came up was that, you know, the same guy was saying, well, you know, I can't work if I don't get paid immediately.

If I didn't get something from that work, then it just like my emotional, psychological physiology just didn't work, it didn't manage that, just the condition. So, I needed to get something. So, the idea of swear equity of doing something because of what it's going to give me in the future, is not necessarily a process to work with for a particular sector of the of the population.

INTERVIEWER
Yes, absolutely. Because they don’t have the means to sustain themselves until the produce and the in the future starts giving back to them.

PARTICIPANT
And sometimes it was just to escape the hardship of the work conditions, so you know, work is terrible, it's hard, I'm being exploited, give me something. I want to take it and go live for today.

So, they’re all issues of productivity and all those things that make permaculture systems work, you know, knowing that there are these extraordinary efficiencies built into our ecological systems. And obviously they're us too because we are the ecology. It's not that we're looking at nature, we look as nature, we are nature.

INTERVIEWER
Yeah, absolutely.

PARTICIPANT
And so, there's that as well, where if we want to build the efficiencies of working systems, then what do we need to know? You know, is it the next generation that gets that opportunity? Maybe not even the next generation, it depends where, because in the farm worker sector, I would imagine that the next generation are looking at their parents as people who didn't have anything. So, the idea of permaculture isn't a real

understanding of what this is about. In fact, if I don't know about it, it's better in a way, so I don't need to know, you know, ignorance is bliss, you know. Maybe, you know, worrying about the issues in the world and why we need food and who's deciding to grow our food and what is the issues of fake food and how do we even get to grow food with poison in the 1st place and what are they and who's behind the systems? And it is an extraordinary situation that for most people, they're like, don't bring that to me please.

And even me, that has been in it for nearly 35 years, I can also see sometimes I would like not to be in it, you know because it's negative. So, there are all these sorts of anomalies. I don't know when the food runs out and we have to face death. Then do we just die easily or is it, you know, do we still have some energy? You look a bit younger, so you have more left in your batteries, a bit more charged. You've got more to deliver. You know I'm in my mid 60s and so my life see is different in a way, especially with the world we're living in. It just it seems to be getting more absurd by the moment.

But at the same time there's this incredible opportunity and potential. So as the problem grows, so does the driver for the solution, so I think that these things are in balance in some way? And so how do we capture that opportunity? And I do see that in a young generation like yourself and a new generation that we working with here at Thlolego, which are young African people in their 30s, mostly professional, trained, have young families, who see the world differently?

INTERVIEWER
Yes.

PARTICIPANT
And so, this becomes now in our terms of being able to mentor in a new leadership capacity here at Thlolego, which has mostly been run by myself and my wife over these long years and working with a group of farm worker families and then running training programs and running all this stuff but those of us who've been driving it and being responsible are waking up at 2:00 o'clock in the morning and worrying about; how we pay the bills or doing and those sorts of worries. A lot of the time, even though our farm worker families and a lot of them have been trained to provide hospitality services, cook food, and work in the garden. But people still need micromanagement to make that work. It's not a self-driven system. You know, the best permaculture systems that I've seen is where everyone is doing it because they understand the reasons to do it, so they're sort of self-managing people. Maybe there's expertise giving guidance to how things work, but people want to do it, they love being in the garden and they understand they're able to receive, they're able to do forest bathing. Do you have you come across this concept called forest bathing.

INTERVIEWER
No, I haven't.

PARTICIPANT
It's a Japanese concept. It's a very special name and the English translation is forest bathing and people went to the forest to bathe in the quality of the forest. You know, we come from the forest so it's nourishing and it's healthy and all of that. So, a lot of people know and even gardens in urban spaces. I remember many, many years ago in New York City getting in with this group, called the green Gorillas.

INTERVIEWER
I've heard of them.

PARTICIPANT
And they were a group of urban permaculture guys who were taking any bit of space in Manhattan, at that time and they were taking a small parking lot and turning it into a beautiful place with vines and people on their wheelchairs would wheel themselves in and sit in the garden and just to be able to see life around them.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
And that was already a nourishing tonic type of health promoting something. So, you know what we may find now is with our farm worker families that the next generation see this poverty and they just want money because they believe that money is the thing that gets them out, because I somehow don't have money. But of course, money is not an isolated thing, it comes with the awareness of money. You know, how do I think about all those things. So, the next generation may pursue money until they get to know, maybe if

they're lucky enough to get some or have some realisation that life is more than the money system and that money can be just a problem. I mean it's an important resource. but it could be a problem that doesn't necessarily generate lots of solutions. So then maybe in the next generation they may realize oh I was standing on a piece of land that had healthy soil and a sustainable source of water and I was bathed in the knowledge of how to, you know, create abundance out of it but I couldn't see it. So that might be two or three generations away, so for us trying to then direct and provide strategic resources for the development at that level might not be a good strategy for sustainability.

INTERVIEWER
Yeah, but that's also something that people struggle to with and that's why it's not so easily implemented because it's easier to just care about the now than to actually do something for 40-50 years in the future.

PARTICIPANT
Yeah, and you know, my programs don't allow me to perceive something then they just don't. And I may have a program in there running that you know doesn't have a spreadsheet, so I can't do spreadsheet stuff and I can't work out numbers because I don't have the program. I have another progress in spreads. These spreadsheets are banned. And look what's happening today to young kids and certainly for a lot of African people. Look what most people have had to deal with for you know 3-4-5 hundred years of exploitation.

So, how has that contributed? And yes, some of these older programs has come through to some people, because those elders have passed that on, but people have had to grow up and live in pretty difficult situations and that it interrupts things. Although, I'm finding now that this new generation of people, or say about 20% of them, seem to have a deep awareness and need of connecting to their ancient wisdom, the knowledge systems that were in foundation and they are completely self-driven, motivated, amazing people.

INTERVIEWER
Yes, I would say our generation there is a very clear division between either a deep understanding in one direction, let's say sustainability and going back to more traditional ways of living, or then the other side of it, the leaning into the technological and virtual ways of living.

PARTICIPANT
Well, that's a very interesting point because there seems to be a bifurcation, you know things are bifurcating and some of us are moving towards world of machine. Like in the matrix, you know that movie, it seems to be very much real and happening now. You know when I saw it 30 years ago it was interesting and I could see those patterns, and it was nice that it could be in the future? And now it is, you know.

But I still think, if you come back to urban planning, you know one has to go back and you might know that much better than me is that what were the driving forces for urban and the landscaping systems in traditional urban planning, you know.
INTERVIEWER
Well, that's very intersting hearing you say that because some of the very first urban planning theory that evolved, I mean that was like 1800s was the Garden City of Ebenezer Howard, and it was a circular or concentric model and it was based on the concept of designing an urban community fully centered and integrated into a garden and then in the industrial period, you know, everything went concrete and by that time, the Garden City concept was put on the backburner for a very long time until now you know when everything has basically urbanised and people are now again yearning for that type of communities.

PARTICIPANT
I mean, when I think of how I grew up and I look at where we grew up in Johannesburg and I look at my grandparents and they lived in one of the suburbs of Johannesburg. There was always a garden there full of fruit trees, and at the back there was a veggie garden and probably sometimes there were chickens or something, so there was chicken, fruit trees and veggies in everybody's backyard and I don't know whether it's an influence of sort of European landscaping and the idea of you know this aristocracy, and how these places were built and how the lawn was manicured. And in those days before lawn mowers, they had lots of people with little scissors and cutting the grass to make sure that were manicured and so there was this Scottish kind of this being right and that being wrong. And you know, now we have everyone's little house is sort of trying to follow that in some way, I mean I'll give you another example. Very interesting example because we're close to the Royal Bafokeng Nation probably 10 minutes away, the main village and I don't know whether there's about 30 or so villages in the whole Bukeng because they sit on a lot of platform rights, and they've been able to amass certain amounts of wealth with that money. And so, we were always

connecting to that from the very early days of Thlolego, we would know people from Bukeng and when I walked around Bukeng it was like the Garden of Eden.

It was so incredibly, I mean, there were just fruit everywhere, you know, avocados and mangoes and it's and on that side of the Magaliesburg mountain. You know, we already are a bit limited where we are because we can't really do the subtropical stuff too well because we get the cold winds coming down. But the Magaliesberg protects everything on the other side and Bukeng is on that side and so avocado, look what we pay for them, can you imagine what avocado trees are worth today. And slowly, as certain affluent people have moved in or made money, they've got rid of all of that and it looks just like a Johannesburg house with a sort of a European landscaped garden with, you know nothing that we even knew and almost not a single thing that produces anything, some pretty flowers. But there's no focus on that, there was functionality in the design and collection of the plant communities.

INTERVIEWER
Oh, that's sad.

PARTICIPANT
And I'm seeing more of more of that change. So, it's only those people who can't afford but the ones who have some money are presenting a very different urban plan. So, they're influencing the future and maybe they think well I can buy my stuff and there's a Woolworths down the road, so I'll go and buy my food but we're not setting any example. And we've always tried to do that, but it does cost, you know, changing and developing new complex systems but that requires complex resources and if we don't have those resources, we can't implement, so the ideas are just in the realm and not practically on the ground of I can feel I can touch this. So, we're actually losing that vision away and so at some point in time we hope to try and connect to that and to see that, but it hasn't been easy to do. And also, because the knowledge of doing it well, is not necessarily embodied in our communities, otherwise we would be doing that. It's sort of a postmodern construct rather than a more traditional way of doing things, and so even in the rural villages in northwest where there was self-reliance around and, in those days, where there was more space if conditions were a little bit drier or whatever people could move the cattle out and the system could expand and contract according to the movement of the of the natural systems.

Then where things got more developed and people got locked into that space, they couldn't do this anymore and then there wasn't the knowledge of how to intensify and redesign those systems so they could become more productive. And so, the system started to get downgraded and then as we see now, all the trees are gone because everything’s been used. We haven't known how to change that around. So, the knowledge has not been there to adapt to the modern world that we live in now. That's by the way, do you have? You come across Brad Lancaster's work?

INTERVIEWER
No, I haven't.

PARTICIPANT
You'll find quite a lot of his work around. So, I think he’s in New Mexico or somewhere there in the United States, and I think of course we want to find examples here in our own country, South African examples, or examples or close by. He lives in a very urban area, he studied permaculture, and he did everything he could to get that permaculture system. In fact, he travelled around the world, and I think he got connected to this guy Phiri in Zimbabwe who was an elder who understood water flows and was, you know, working swells and contours and you know, he generated a landscape, and he talks about it in all of his books, but it's quite a nice idea to see what sorts of things could happen on a small scale?

And I've got a friend of mine in Johannesburg in Orange Grove who's starting to try and do this and in fact also David Holmgren’s work and you've seen his late Thinking in urban design and you know, trying to take the culture into urban area and you know, even if you had a place where people could remove the internal fences of the urban land and use that internal space.

INTERVIEWER
Well, that’s actually interesting to me because permaculture it seems to have in its origin, had a sort of an urban side to it. It initially had a very strong connection to urban areas and just the more I read, especially my one article is just about existing permaculture research, in the last five years and it's all rural, there's no urban integration with permaculture whatsoever. So, again like urban planning, it started as a green concept within urban areas sort of and it grew because I think it's because most people who need food systems like permaculture and other food growing practices, as you said, are people from farm families and poverty

areas outside these urban areas. But then we have the problem of these very high densely clustered urban peripheries, you know, like every big city has a poverty struck peripheral area with very high densities where they actually have a lot of land between them to grow, but they don't.

PARTICIPANT
Yes, absolutely. And I think the ideas are everywhere where we live and just how we live and in which way we relate to the environment around us and how you know whether if I live on a flat up on the 60th floor, I can do something over there or in various different situations. I also think that the pressure for change hasn't been strong enough to drive more innovation on one level, and on the other level, the alternatives have been the large industrial food generating systems have much more capital and strategy to drive what they're trying to do into the food system. And the more ecologically aligned practices, haven't been able to work with that well enough, just keep being overrun by this modern world and look where it's going now, you know, it just seems to be getting crazier and crazier. Do you know Vandana Bandanashiva?

INTERVIEWER
No, I haven't, please tell me about her?

PARTICIPANT
She is a very, very amazing lady from India and I would say she's globally right at the forefront of a whole food movement globally. And you know, she trained in nuclear physics as a young girl in India and at that time, if I understand correctly, her family lived in a certain area where the women would have access to the forest and in the forest, they found medicines and they did all those things for hundreds of years. And those forests were being threatened and there was a movement of women to stop that happening and somehow, she got caught up in the activism and the politics of forest preservation. And that led her to an entire career and she's very prolific in what she's written and her work in seed and soil and is just amazing.

INTERVIEWER
Oh definitely. I'll definitely check her out.

PARTICIPANT
Yes, I will definitely encourage you to look into what she is talking about, certainly philosophically and certainly in terms of just talking about what's happening in the current food system with this fake food/fake system that we are being forced into right now and she's one of the only people that I've seen have really pointed out these multinational guys like Gates and them so she's really taking on a lot about. And then she's also linked into a whole other network around the world that are from the Eco village movement, the global permaculture movement. Have you come across this group called the ecosystem restoration camps movement.

INTERVIEWER
Unfortunately, I haven't. My focus to date has been strictly academic journals.

PARTICIPANT
But I mean these guys are probably doing a lot of academic stuff around that and it's slightly different, but people are working and it's linking in all those different movements that are you know engaged in all kinds of solutions or ways to work with our world at the moment, and especially around food and I'm sure within that, there's a lot of stuff around water and urban design. So, I think at the end of the day that we're full of potential, it's just a question of how we inspire that. And I mean, look at where we're getting to a point, look what's even happening at the AU, where, if certain people have their way, it will be illegal to use your traditional seeds that you inherited from your grandfather, right, because they might have a microbe in there that might not be good, might get caught by a dangerous microbe.

INTERVIEWER
Oh no. But there, there are a lot of movements. There's a definite need from people who want to get involved with green movements and food movements, but I feel it's being completely overshadowed at the moment by other things going on in the world that. You know, with all the activisms, and the wars going on. I mean there's not really space for food concerns from the general population in the world at the moment. But there are definitely people who want and yearn to engage in such movements.

PARTICIPANT
Absolutely, you know Alex Kruger, she lives near Hoekwil, and she's got some very nice agroforestry systems that she's been developing around there. And in fact, if you could follow her on Facebook or wherever she's I think there's an agroforestry course coming up fairly soon. I think it might be just after

she's finished here at Thlolego. But there may be some interesting threads that you haven't yet connected in with there?

INTERVIEWER
Yes, absolutely.

PARTICIPANT
But definitely to see the models that she's building the one I saw there, must've been maybe a hectare in scale. Yeah, I mean, I don't know whether you come across this group called Kilt?

INTERVIEWER
No, also not.

PARTICIPANT
They're based in Knysna, and they support the school system. And I think they support 11,000 kids at all of the government schools, and they provide a lot of resources for those capacities that one wouldn't find at government schools, you know that the private schools have like they provide all kinds of specialist services.

And that obviously is an important pathway. The young ones and the young ones, because at the end of the day, we're only going to look after that which we love, because that which we love, we want to care for and for so many people, if they didn't find to be able to have a love, maybe so many kids are growing up in informal settlements, how do one even have love in a lot of those environments that are so difficult. So, if they see a plant or something, it's the last thing they have a love for so therefore they're not going to care. But I see it now when we have little kids come to visit us or parent brings their little, teeny ones and we take them around the garden, and just to connect with the scent of these plants, you know lemon verbena. And ohh, you could see they would just *in awe* while they walked around, they oohhh, and then they want a watering can and want to go look after all the plants.

INTERVIEWER
Oh wow.

PARTICIPANT
Yes, so that comes through that, and I think that that's we need, is to be able to inspire something like that. And whether it's a combination now of working with urban planners or whoever. Alex works with a few urban planners in Knysna, and I wonder to what extent they are, you know thinking about these things throughout.

INTERVIEWER
The thing is, I work in the private sector at the moment, but I know that the municipalities are usually very orientated to urban greening in the spatial structures and objectives and stuff, and they are really trying to do a good effort. Trying to push developers toward more green developments, but you know, at the end of the day, they still follow the same legislation as always and the legislation is not very encouraging for green practices and green development. What people want to do, especially the urban planners and, another problem as well here is the planners are very set in their ways and they're all doing the same thing as they did when they started here 30 years ago. And nothing's changing. And I'm just hpoing that when the time and the drivers, like me and other young graduates come along, that they'll be open to changing and adapting their ways!

PARTICIPANT
All of that, I wonder how they've been thinking that through in Stellenbosch, you know, with a lot of influence from the Sustainability Institute, and there have been, I mean it's been quite a long program. I do hear of programs going on there might be another, I don't know whether you've had any chance to connect in with people from the Sustainability Institute.

But I don't know whether there's certain or examples or projects or innovation taking place there. I mean, the other thing that's kind of interesting. If I go you up from Hoekwil and then past Hoekwil there's a there's a Township there I forget the name of it now.

INTERVIEWER
Touwsranten, I think.

PARTICIPANT
Yes, that's it. Touwsranten, yeah. There's quite a little bit of food growing there.

INTERVIEWER
I've actually seen it. Yes, they're a very independent community, actually. I guess they're working on the farms around them. But they have a very good system going there with food and schools and everything.

PARTICIPANT
I think you might find some interest if you maybe check out what Alex is doing on her next agroforestry course. It just might be a nice network of people.

INTERVIEWER
I will definitely get in contact with her in the future. So, I want to know about Thlolego specifically, what's the set up with your permaculture garden, do you have multiple gardens going, is it one big garden? Tell me more about the set up at Thlolego?

PARTICIPANT
Right. Well, there's some infrastructure that was the old farmhouse and those areas that have been converted over the years into a facility where people can come and stay and there's some accommodation for about 20-30 people and some of our gardens are there.

Some of it is under shade netting and so that's one area and then we have areas where there are people who are permanent residents here and then where we are, over the years we've built ourselves a house. You can see these earth walls behind me that's raw earth.

I can actually show you around a little. We've got this whole Earth building. And then that goes up to the to the waterless composting toilet.

INTERVIEWER
Oh, wow, yes, I see.

PARTICIPANT
Yeah. So that's all you know, twin chamber composting toilets and then this is the lounge area and then I have to take you outside now so you can see what we're doing. Just see the sort of rough landscaping and we've got a wraparound deck all the way around.

And then there's garden stuff, so we're growing all around. On the outside is all our water harvesting basins and then trees on the downside of that? And were building up the fertility inside those beds and we haven't been growing in the for a while so currently it's just the perennial systems that are functioning. But there's lots of food growing everywhere.

INTERVIEWER
Did you, and how seriously did you follow the principles of permaculture when you designed your gardens?

PARTICIPANT
Absolutely, and I mean we just keep applying the principles, but I mean at this stage I've been doing it so long that I think the thoughtful observation is a good way to begin.

And then almost the next stage comes about. There are always more layers, there's the base layers. Like how water flows across the ground the most important thing as far as I can tell, so that's a base layer.

And then what tree or what main perennial system is built into that. And here it was quite easy because we have quite a bit of indigenous plants around and then within what system one just keeps layering into it and keep building the soil. And then nature is teaching us and we're interacting with that, so it's ongoing learning. I don't know whether you've come across village homes in Davis, CA. It's another quite interesting urban planning model and Davis, CA is the area where a lot of the agricultural knowledge is concentrated. But many years ago, even when I was first sort of starting out on this journey, I would visit Davis and it is basically a housing system, you know, urban housing with beautiful water harvesting, landscaping and common foodstuff in-between and it's a good model to build upon and to see if you were thinking of urban design in a new situation, but not only in a new situation, because I think that's what David Holmgren's talking about. How do you take a block of urban or maybe six houses and you know if if one knew all the owners and one could transform those places. So that that was quite a good one. Here I think we've done

reasonably well in terms of the foundation stuff and then there's just always more to layer in. I mean we've got chillies still growing, I see there's still some tomatoes, there's lots of green stuff and a wonderful patch of dandelion. You know the dandelion.

INTERVIEWER
Yeah, yeah, I know dandelion.

PARTICIPANT
People think they're a little weed thing, but they're actually the most precious little plant. It's super nutritious, the root is wonderful, it could be roasted and had as a coffee type of experience.

INTERVIEWER
Oh, wow okay. And so, how work intensive are your gardens? How much interacting do they require from the persons that live there?

PARTICIPANT
You know, they still need some attention and it I think it depends on how much one wants to get out? I think it's possible to design a permaculture system that require much lower maintenance.

For instance, you could put ground covers down and certain tree systems and maybe it's not going to be highly productive, but it's still going to produce something and wouldn't need that much maintenance. But then if you want to eat from it every day, then you're doing gardening inside the permaculture system. Because permaculture is sort of the design of a system, but then if you want to do farming or organic growing then you would be doing organic growth, so you'd need to then be increasing the fertility of the soil. And you've got to make your little seedlings and then plant those seedlings and look after them and water them and deal with the water issues and find mulch somewhere and somehow have to solve all of those issues. But there are other ways to do that because I see an urban design in a way that it doesn't necessarily mean every person must become a farmer in the urban area. But it may be just a few people or an organization that utilizes the productive landscaping system of a neighbourhood. So, say for instance in Bukeng there's 1000 or 2000 households, this is a theoretical thing, and maybe if everyone's got 2 citrus trees, that's an orchard of 4000 citrus trees. That's 70% people are just leaving to nothing, so if they had worthy community leadership… But I've got a friend, in Orange Grove in Johannesburg, who's got this project called Neighbors?

So, he's been doing sort of social justice work his whole life and the last few has got very interested in permaculture and so he got his chickens going and he's got some something happening and they meet his neighbours and they're trying to understand who and what are the different people living there and they're beginning to think of how to have a little market and share surpluses. So, they're trying to find solutions to that I think in some ways, maybe we have to find our way there too.

INTERVIEWER
Yeah, definitely.

PARTICIPANT
And I think the landscaping could be improved to be a foundation for more productive urban food security. We could organize our land better to support urban food security and we don't necessarily have to develop all the multiple layers of it, but at least get the foundation in place. A simple example is to let's try and keep water in the ground rather than the normal way of get the water away. And that's where Brad Lancaster did some quite interesting work in the infiltration.

INTERVIEWER
Yes, I'll definitely check it out.

PARTICIPANT
But then you have to have those discussions and it's quite interesting if you go to a parking lot in the urban areas, and they're all different, but I see some in Rustenburg, some very good stuff, but often there's a little thing around the trees to literally stop the water going to the tree, like a little curb around that keep the water from going to the plants.

And even sidewalks, the sidewalks are designed to take the storm water away, but I see in Rustenburg now one or two of the of the Strip mall developments have done it completely differently. Between the two

cars, there's a section of, you know, a concrete element, but it's pervious and it's got holes in the concrete element and it's flat with the surface of the asphalt so water can actually find its way into the ground.

INTERVIEWER
Yes, I've also seen it around.

PARTICIPANT
And it's got vegetation, and the vegetation could also be Linganna and those plants that are good for coal, you know, we could include more of our indigenous plants that are good for us, you know?

INTERVIEWER
They are like parking lot trees don't have to be just trees you know, if we get to a point where we can plant fruit trees or any types of food trees everywhere, you know that would be ideal.

PARTICIPANT
But we can s see which ones would be a first layer you know because the permaculture model has so many different layers, so which ones would suit to as a pioneer system? Yeah and maybe, Alex, even if you did get a chance to meet up on that course, you could have those conversations with her. What do you think would be a pioneer system in this particular thing? Could it work? Where would it work where you know why?

INTERVIEWER
And so, what would be some of the lessons that you've learned with your interaction with permaculture over the years, just like one or two main lessons that you have learned working with permaculture?

PARTICIPANT
I did think of the lesson… I do have a lot of lessons, as you can imagine. I was trying to think of the ones, because I did a master's after starting Thlolego, I studied engineering originally.

And then I got all into the permaculture stuff and then after about ten years or so, I then went to the sustainability institute, and I did their masters in sustainable development.

INTERVIEWER
Oh, okay wow, that's wonderful.

PARTICIPANT
And then I had a chance to reflect on what I was doing at Thlolego. I guess there's two things, there's the design science of permaculture which I think is quite a brilliant design science just if one looks at the way to actually design landscapes and then there's the movement of people who love permaculture and who think it's a social movement. And those are different interesting things that I think that in some way, to me, permaculture sort of seemed it's a postmodern construct, you know, it's come as a result of the negative aspects of modernity. And then we have to think what modernity has got this problem and how do we think of it in a postmodern way, so that's already quite a lot of advanced thinking. I then went and I did a lot of reading on Ken Wilbur's work on integral theory and come across Ken Wilbur's work quite a lot, and that would show stages of development.

You know that from our early hunter gatherers stage to, you know, village type systems and then at the beginning of the great traditions and the influence of those structures, and then modern systems and post-modern systems and then post post-modern systems. And sometimes permaculture, the language, and the construct in which it emerges doesn't easily, or I think our way of communicating these ideas, we need to try to develop a more integral strategy and more integral way of communicating to the way in which we perceive knowledge at different stages of our development. I don't know, I probably didn't do a very good job of explaining that, but I explained it better probably when I did my write up for my master's thesis, but that was something that that was important to learn from a development practitioners point of view and also to think as a practitioner, one can get to a certain point of understanding quite a broad and deep understanding of the content. But at some point, in time, it's my perspective of the context, and it's not the context. And at some stage I need to have a cosmic address for my own world view. And say, well, that's just the way I see it, but the bigger picture is all these world views.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
Because the technical issues of permaculture as a design science and building food security is it's fairly straightforward if one spends time learning it, there's certain skills to do with, understanding insects, understanding plants, understanding soils, understanding trees, understanding those sorts of things which we know quite well today, and then there's some skills to integrate them, which permaculture does quite well. But how do we communicate it amongst ourselves as people? How do we help to find commonality and I think that becomes maybe the more important lessons at the end.

INTERVIEWER
Yeah, because I saw with my article that I had to write. It was a review of existing permaculture literature and it's used in a very broad sense. The movement of permaculture and what it represents, it's not only to designing food systems, but it also has a lot more potential, and it can reach people in different parts of life and it has a lot of reaching potential.

PARTICIPANT
But I wonder if the way that Bill Morrison left all of the literature, the emphasis was more on the practical design.

INTERVIEWER
Yeah, definitely.

PARTICIPANT
And less on how we do it as people and what limitations do we have as people for resonating with what it is we're trying to do. Cause it made sense to him and you know, we spent time with him over the years and he visited here at Thlolego at some point as well.

INTERVIEWER
Oh wow.

PARTICIPANT
Yeah, and so I think that's as I mentioned, in the beginning, as I was talking about some of our farmer families, that's why I think we need you know that, well, if I wasn't brought up to think, then how do I relate to these systems? And I might not want to see an integrated ecology, because the way my mind is ordered I see things in separate parts, and I don't see them as an ecological system.

And I might not be interested in the diversity myself personally, because I'm only interested in beetroot, onion, spinach, etc., so I only need those five plants and I can grow them in this way, and I don't need to think beyond that. Because the ecological sciences, to me, bring us into sort of a post-modern beginning of thinking. Because we didn't really include a lot of the ecological connectivity in in the study of, you know, the earlier sciences.

For example, when I was at school, there wasn't even something called the environment, it didn't seem to exist anywhere. And it was that way for many generations before that, so I see the challenges in that holding us up and of course having good examples in each area and maybe different strategies.

INTERVIEWER
Yeah, definitely.

PARTICIPANT
You know, maybe finding people who have a love of nature, that's the right person to introduce to the culture.

INTERVIEWER
Yes, definitely.
PARTICIPANT
And the same with someone who's living in rural poverty, there are many people who just somehow have a love of nature and you put them inside nature, and they just start to thrive and then to support those people to come up with the very best design system. And then we might have the tangibility so we can move beyond the languaging of this is what it is, but taste it, feel it, touch it, because that will then communicate across.

You know, if we can find a way to help us put our monkey mind into neutral.

INTERVIEWER
I actually recently saw along the highway on my way to Plett, there is this informal settlement coming over the hill along the highway, and we saw a guy with quite a big yard, and it is covered in vegetables and green. And it's not organized but it's visible and then his portion is so green and then the neighbour next to him, you can see he's started also planting things recently. So, it's a clear vision where you can see he was inspired because there's guy has an established garden and now this guy is also starting with small seedlings.

PARTICIPANT
Right. And also, what's happening, I'm going down to the store and I want to buy something at the store, and I realize it's twice the price as it was last week. So, I realized the guy next door happened to be eating something straight out of his garden and then that's not even the knowledge of the toxicity of the food in the mainstream. And so, I'm seeing more and more people becoming aware and, I think especially since COVID as well, that it has opened a lot of awareness to people about their health, their immunity and taking some responsibility for that as well.

So, there's that too, to work with. I would love to be able to incentivize those things in some way, you know, to find a sort of positive driver and to see what sort of innovation and to support people who have that potential and love and see what they can come up with by using this brilliant, beautiful science that they, you know, were supported.

INTERVIEWER
Absolutely, yes, and you have to find like-minded people to move forward with.

PARTICIPANT
Yeah. And I guess in urban planning, one has to work right across the board, and I think it is important trying to find the middle ground across these different spheres in the system. You know, to see we're also part of something whole, we all share this aspect, and we can always go to the bigger context that connects us.

INTERVIEWER
Yes, absolutely.

PARTICIPANT
And then we may find which one thread in that bigger context actually allows, creating an opening for the possibilities to come through and then to where you are with more like minded people then you could concentrate to develop it more.

INTERVIEWER
Yeah, definitely.
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PARTICIPANT
And there's a lot of people, I mean, look at you, that's what got us excited about hopeful. There's a lot of people who want to figure all this out, and there's a lot of people that are trying to figure out access to land and I think people are trying to look at land moving forward. I think there's something in that space and that you may connect into some of that through, you know, one of these agroforestry things, Alex is up to there.

And they may be quite interesting because there's a lot of potential and a lot of potential to be unlocked in the whole Garden route. And I'd love to connect up with you when I'm down there and talk more about that because I think there's a lot of potential and there's a lot of work and we need to work with urban planners too, to understand what needs to be thought about in order to be effective and to be able to present ideas to Council that make sense and fit into certain situations?

INTERVIEWER
It would be good to have your goals and objectives and the urban planning side's goal and objectives, and to see where we can find a middle ground.

Okay, and so your thoughts on permaculture, let's say permaculture design more specifically for the purpose of this interview, what are your thoughts of permaculture in urban areas in terms of do you think there's potential?

PARTICIPANT
Yeah, absolutely, we need to be able to sustain ourselves. So, permaculture would be very much even if it's not even about food, it's just about biodiversity, of course, let's make it also about food. There's such a broad potential and untouched potential. Because the landscape architects are also putting in this French aristocracy, this aristocratic landscaping, wherever they got that in the landscape box. No, we must get some of those guys on a agroforestry / permaculture design course with some urban planning thinking going into that.

INTERVIEWER
Yeah, absolutely.

PARTICIPANT
And say to them look, if you do a good permaculture design in an urban environment, it's like walking in the Garden of Eden. And that's basically what it's about, because if you walk through a beautiful permafrost, it isn't barren, no it has nourishment that we could nourish ourselves with.

And even the normal landscaping, it's nice, almost like the pseudo nice, but when you go close to it, there's poison on the grass. So, it's merely a visual thing at this stage. But then we now need to add our other senses to it. We need nourishment, we need our sensors So there's so much more to open up. And there's this lady in Cape Town, Kathy Ackermann, and she's got this farm just outside Cape Town where she's done this beautiful design.

It's an all-organic design built on biodynamics. So, people are seeing, of course, that's what we want, and they have it. So, in all these levels it is there, and which are those examples?

PARTICIPANT
And often people don't want to have edible trees because they make a mess and then we have to clean the mess. So, there's all sorts of other reasons about why they're not engaging in these types of food growing.

And so, there was not the knowledge because we weren't taught about lengthening the table, you know. We know about war and security fencing, but if we knew about tables, maybe there was another way.
INTERVIEWER
Yes, definitely.

PARTICIPANT
So, because I don't know how you see it, and that's a big problem in urban design, is that I don't know how to connect to my neighbour. And maybe there are ways of, OK, I'm going to take off a branch, I'm going to collect all those avocados, I'm going to take them to a certain place and I'm going to distribute them. Because it will never really work if we in urban communities keep isolating ourselves.

And now if we own no walls, we're caught within this whole paradigm of crime vs food security and now we want to go to war?

And we might aspire to that as a long-term future vision, but in order to achieve that today we may need some real deep thinking and ways in which we can start to find, and that's what is so wonderful about permaculture, it does find a way to connect everyone regardless of here they're from. Yeah, but then we come together in a permaculture course when we get inspired, but then we all go home to these different situations, which are not all that conducive to nourishment and people in informal settlements, and they've got noise on top of them all the time and so that's not an easy solution. But I think we lean in towards the solutions or do we not want to look at it? But if we don't look at it, that problem just grows bigger. You know, it doesn't go away, they're going to get bigger. What happens?

And I did some work at one point in the Eastern Cape in what would have been Ciskai and I got to learn that the most amount of forced removals were inside the homelands and not in the so-called South Africa but in the homelands themselves and we have communities that have these hundreds of year old permaculture systems and living fences with their goats and sheep and trees, and it's just complete permaculture systems and they were distributed around the neighbourhood as we see in a sort of rural village setup and they were about 80% self-reliant.

And then when apartheid came in, we then removed people from that setting, put them into like a little gridded type of setup of about not more than 500 square meter blocks or something like that in an urban

grid, and then people went to get 80% of their remissions from the border industries that were set up just in the South African side over the border.

So, they were moved closer to the border and then of these in industries, God knows where people came, and they took up their incentives. To come and do whatever they get free infrastructure, whatever. So they went from 80% self-reliance to 80% dependent on the border industries and then went to social grant so went from 80% self-reliance to 80% self-reliant on social grant.

INTERVIEWER
Yeah, that's sad because a lot of those families survived before everything. They were content and they were feeding themselves, they weren't reliant on outsourcing foods.

PARTICIPANT
Absolutely. And you know it was interesting because the living fences are still existing in the landscape.

INTERVIEWER
Oh wow.

PARTICIPANT
And the huts and things have come down because they were earth, so they've melted back to the earth, but the actual fence lines of these most of them were aloe, various you know, that sort of edge pipe aloe that's what most of them were. And they've got some beautiful models of what, and they've got this little sort of monument in a way, that you stand on it and there's this beautiful sort of granite, round hut, and in the Round Hut is a round bench all the way around and in the bench, it shows this family the name of the family and it points 3 kilometres that way. And yeah, so that's all they have now, is that monument of what it was, and maybe some models of seeing the one place there was a model of what a firm homestead could look like but already it's a few generations passed and so a lot has been lost.

But that was where probably, many African families originated from, self-reliance systems. So how do we reorganize that and now people are eating what are they consuming, GMO maize grown with Monsanto's, you know.

INTERVIEWER
Yeah. And the effect of growing in each individual food you buy today is so.

PARTICIPANT
Yes, you know we've got a food industry that knows nothing about health and a health industry that knows nothing about food. And the more they keep themselves apart, the more money both of them make.

INTERVIEWER
Yeah, absolutely.

PARTICIPANT
Yes, so I think that in some ways the Garden route has a lot of potential to do some really interesting work. I feel that it’s one place with certainly a massive potential there of human resources.

INTERVIEWER
Yeah, and many of the people who now migrate here, come here for that reason is because they want to move away from the machine mindset, especially from Johannesburg and Pretoria for example.

PARTICIPANT
Sure. And you know there's not a lot of potholes out in the western bank.

INTERVIEWER
There’s not one pothole. It’s actually funny that since I've moved here, the people in Pretoria were always moaning moaned about the governments not fixing the roads and not fixing the potholes. And the people here constantly moan about why are they constructing the roads again? Like, why are they working on the roads again?

PARTICIPANT
Yes, and we have to learn to participate more ourselves. Yeah, you have to engage it, because if we wait, I see sometimes, the other day we drove out and I don't know some place and there's a pothole, right? Out in the front of somebody's place, and I was thinking, why don't they just fix them up themselves?

We need to start engaging in what's improving not only our individual space, but the collective space that joins us together. And its very much permaculture thinking, you know, the example that I'm thinking of is that of common land that was always open for people to take their sheep or whatever into the Commons, and that Commons got smaller and smaller and smaller until it just became a legal line? And what that's doing to the ecological systems is that it's reducing the ecological systems to a legal line?

But they don't work with legal minds, the ecological system needs space for insects and birds, and for annual varieties, biodiversity to work so that biodiversity Commons is we need to build that within our communities and permaculture can be quite helpful in helping to understand the ecological spaces that we try to create.

INTERVIEWER
Yes, definitely.

PARTICIPANT
Cause we may find we all need that common thing. Not everywhere, but it may help in some ways, and that may be another way to integrate permaculture in urban areas is that it's a strategy for neighbouring, for building, for standing out those neighbours.

INTERVIEWER
Yeah. No, absolutely.

PARTICIPANT
Yeah, and I mean, maybe there's a way that you know, is it the Council that needs the income that is driving that, you know, and what are those drivers and are there ways to that may be from urban planning where you could really look at that in detail to, how do you open that up for the ecology or for the biodiversity, and what are the value systems coming back and how to manage that in terms of the expectations of Council and that's what you were talking about earlier, that's your work of seeing how these things can be connected, you know.

INTERVIEWER
Yes absolutely, to find a middle ground for everyone. Well, thank you, PARTICIPANT so much for your time. Please let me know when you come this to the side, I would like to meet up with you.

PARTICIPANT
That would be great, and do you have Alex's contacts, or do you do you want me to send you anything or do you?

I'll send it to you or at least follow her on Facebook.

INTERVIEWER
Okay, thank you so much, PARTICIPANT and thank you for your time.

PARTICIPANT
Pleasure. If you need any other questions or just you know, just drop me a line.

INTERVIEWER
Oh well, thank you so much and good luck with everything you're doing.

PARTICIPANT
Thank you.

INTERVIEWER
It's my pleasure.

PARTICIPANT
And I. Look forward to connecting up when we get down to the Garden Route.

INTERVIEWER
Yes, please, I'm always here.
Speaker
All right.

INTERVIEWER
OK, bye.

PARTICIPANT
Great. Alright, thanks. Bye.

ANNEXURE F: INTERVIEW CODING ANALYSIS

THEME	TOPIC	EXCERPTS FROM INTERVIEWS
	1 URBAN	There is all that space in urban areas that is not necessarily being utilised.
		So, there're these sorts of inherent, almost systemic, challenges before you even get down to the real, what does it actually mean to try and grow a vegetable in concrete and rubble and all that polluted shit.
		I think there is a huge opportunity to integrate systems view and to integrate holistic thinking into how we design our urban spaces.
		I think there's a bit of tension between policy and politics and the need for resilient and regenerative human settlements.
		I still think, if we come back to urban planning, one has to go back and recollect, what are the driving forces for urban and landscaping systems in traditional urban planning.
		I think landscaping can be improved to be a foundation for more productive urban food security.
		A simple example is to let's try and keep stormwater in the ground rather than the normal current way to get the water away as fast as possible.
		And even the normal landscaping, it's nice, almost like pseudo nice, but if you look closer, there's poison on the grass.
		Permaculture can be summed up for me as food production that is not dependent on fossil fuels
		You start with the back door and build from there and if you go too big for what you can tolerate, you lose the ability to manage and regulate it because you may not have enough resources or time to keep it going and support it.
		I recommend to people in the city that they look into grey water systems to reuse their water in the house in the garden.
		And what is bad is that in many places in the country, the by-laws do not allow grey water systems to be installed and in other places in the country, where it is encouraged, the legislation around it is not as strictly enforced as it should be.
		Integration is very important to me because it is very difficult for me when I come to a client, and they tell me they have identified a piece of land for his permaculture garden and the piece of land is there far away from the house in the corner of the property.
		Permaculture's goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources.
		Even if you are a homestead grower, you need to know what to grow, where to grow, how to water it, the type of soil you need, and how to build and maintain the levels of nutrition in your soil.
		For example, if you've got more than a square foot, you can start introducing fruit and perennial herbs to your space.
		But essentially, the space doesn't matter, you use what you have to maximise your yield.

4 DESIGN	Rather than ornamental open spaces, do food growing, it can be interspersed with your ornamental spaces.
	For example, if a structure is going up, if a new development is coming up and there's a wetland on the site, that area is going to be untouched. But that area will need to be maintained because it's a filtration system for the earth, so you can grow food around that.
	We'd love to see greater food spaces and more functional open spaces. And it's not only just about growing food but about healthier food too.
	If you do a good permaculture design in an urban environment, it's like walking in the Garden of Eden.
	A big problem in the design of urban communities is that I don't know how to connect to my neighbour because we are caught in this whole paradigm of crime vs food security (in this instance).
	In the homelands, there are actually still some remnants of traditional south African rural communities that had these living fences that were distributed around the neighbourhood.
2 INFRASTRUCTURE	We call it a square foot garden where we teach how to do biointensive agriculture on a very small space for example a balcony or on a roof.
	Well, there was some infrastructure eon our land that was the old farmhouse that we have converted over the years into a facility where people can come and stay with some of our gardens also integrated there.
3 SPACE	The European version, they call it allotments, where they have sections of the town, which have been planned by town planners, for vegetable gardens where the local communities come and grow their vegetables because especially in the UK, everyone is living in this very sort of cramped houses where nobody has personal gardens so there's designated public spaces specifically allocated for vegetable gardening by the community.
	We call it a square foot garden where we teach how to do biointensive agriculture on a very small space for example a balcony or on a roof.
	And I think the ideas are everywhere where we live and just how we live and in which way we relate to the environment around us and you know whether I live on a flat up on the 60th floor, I can do something there.
	And the more ecologically aligned practices haven't been able to work with that very well enough, just keep being overrun by this modern world and it just seems to be getting crazier and crazier.
5 EDUCATION	So, we have a very structured curriculum where we teach children to be able to adapt permaculture and the implementation thereof in spaces that are available to them.
	If water is a poor resource, we teach them to harvest water. For example, we teach our students how to harvest rainwater at home which they then bring to school for the gardens.

	So, in our 18-month curriculum, we structure every element or technical skill that a grower needs to make a sustainable permaculture system, whether it is soil conditioning, water harvesting, pest management, seasonal planting, and we even expose then to business skills development.
	So, we took a piece of land at the school, and we started working and these kids were outside, they were free, and the important thing is they were learning. They started growing food, they started selling, and it was a whole like multiplier effect in terms of what they can do as skills, and it resulted in entrepreneurship. Soon enough they were drying herbs, processing fruits and vegetables, they were doing pickling, and they were selling.
6 **UNDERSTANDING**	Unfortunately, the people who mostly come to these PDC's usually have deficient skills and garden dignity and knowledge. The do not even have the basic knowledge of gardening, composting, working with earthworms, how animals work, etc. so the PDC's become a basic gardening course. But the idea is actually that someone comes to a PDC to advance their existing gardening skills and attend the design course to become physically more advanced in order to design a permaculture system from which all the basic knowledge and skills are only a few components of the system.
	Here where we live, there are so many members of the community who want to buy in and become part of such a community but there is not necessarily someone to direct it, but people are eager to learn and get involved and it is actually the ideal opportunity for an intentional community.
	I think when we're talking about food insecurity and addressing the real needs of hunger and unemployment in South Africa, we need to be careful not to get caught up in the line between agroecology, permaculture, etc.,
	You know, these guys don't understand Rand per kilo. Then I'm like if you don't understand it you mustn't farm or you must learn it. And just because one part of the population went to lower quality of schools, doesn't mean they don't have the ability to learn or understand.
	But people still need micromanaging to make it work. It's not completely a self-driven system. The best permaculture systems that I've seen are where everyone is doing it because they understand the reasons to do it, so they're sort of self-managing people.
	The technical issues of permaculture as a design science and building food security is it's fairly straightforward of one spends time learning it, there's certain skills required, understanding insects, plants, soils, trees, etc., and then there's some skills to integrate them, which permaculture does quite well. But how do we communicate it and help to find commonality amongst ourselves?
7	Even if you are a homestead grower, you need to know what to grow, where to grow, how to water it, the type of soil you need, and how to build and maintain the levels of nutrition in your soil.
	Well-being is a huge thing because people have moved so far away from indigenous knowledge systems that our curriculum actually aims to bring you back to your roots.

	SKILLS & KNOWLEDGE	And that's probably where many African families related form you know, is form self-reliance systems.
		So, the teachers come to us, they undergo the training and they become the facilitators for these school projects. And so now you already have the teachers and the students learning new skills and knowledge.
		And as things were getting more and more developed and people got locked into smaller spaces, they couldn't freely "farm" anymore and there wasn't the knowledge of how to intensify and redesign those systems to become more productive in smaller spaces. And so, the systems got downgraded and all we see now is all the fruit giving trees are gone because everything's been used and the knowledge to sustain it has been lost in the modern world to the everyday person.
	8 **RESOURCES**	You start with the back door and build from there and if you go too big for what you can tolerate, you lose the ability to manage and regulate it because you may not have enough resources or time to keep it going and support it.
		Permaculture's goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources.
		When I design permaculture systems, to make it applicable to our country for example, I first check out what resources are at my disposal to use in the system and we always come back to the principles with each design and when the design is almost done, I go back to see if I have taken all the principles into account.
	9 **WATER**	We had just a pipe that came in and the overflow that went out, and just through our time together to manage and redirect that water, our "green" exponentially enlarged.
		Water is the most important component of designing a permaculture system and that is one of the misconceptions that people come to our courses with, they will just put up another rainwater tank if one is not enough and then they have double the rainwater tanks, then I ask them, okay, but did you quickly work out how much water you will need if you water a garden 2 times a week for an hour, are you going to have enough water for the non-rainy season? And if you make that little sum, 20000 litres of water will only give you water for 2 weeks in the summer, and then your tanks don't fill up again until the raining season.
		Then if you want to take it further, you can integrate your grey water system with certain plant systems that then remove bacteria from the water and put other nutrients back in to make it usable in the garden.
		Then we have grey water systems that channel into our blue water systems.
		But your shower water, your bath water, and your washing machines' water are very large volumes of water that can be reused by building in a grey water system.
		How water flows across a landscape is the most important thing for designing a permaculture system as far as I can tell so water should always be your base layer.

	10 SOIL HEALTH	So, what happens is the schools are given the tools of the operation of permaculture. For example, soil is the most important. What do we do in a situation where there is minimal access to arable land? So, if you have a space between two classrooms you can do what we call sheet mulching to keep the soil from drying out too fast. And you start building up an ecology for food in that space available.
		We have an integrated pest management system where we don't use any chemicals, there's no pesticides in our soil. So, we encourage the use of cow manure, chicken droppings, and we make our own compost and teach people to make their own compost and how to harvest seeds from their own produce.
		We also don't rake up the leaves, we leave it on the ground, it decomposes, and it acts as mulch to create an environment for your earthworms, and the whole system starts to work as an ecosystem.
		So, permaculture can actually help regenerate degraded land and we as humans have a key role to play as a species within restoring these ecosystems.
	11 ECOLOGY / BIODIVERSITY	Most of the benefits you have from integrated crops are to do with attracting useful pests and insects. For example, Marigolds attract carnivorous beetle that will then eat the aphids and pests on the plants and so they already lower the need for using pesticides.
		We categorise our projects based on what their main needs are and where they would get their resources from because that is usually a big challenge.
		The ecological system needs space for insects, birds, annual varieties, biodiversity to work so we need to build that into our communities to try and create ecological spaces through permaculture.
	12 COMMUNITY	In our projects, only about 10% of produce is actually for their own consumption and then they donate the rest to the community, and it's such a weird double because on the one side you've got Kwaal and on the other side the community will harvest 80% of their crops and donate it to churches or schools.
		So, there's that real sense of giving and generally speaking, you'll find that a huge proportion of the vegetables are kept and eaten by the members themselves and donated freely to local community members who are suffering.
		So, these gardens play a massive role in local food security within these communities.
		Because sometimes, if it is a top-down approach, people won't and don't buy into it.
		Because permaculture will never work if we in urban communities keep isolating ourselves and supporting the centralised food system. We have to find a way to connect everyone, regardless of where they are from.
	13 ATTITUDE	We have a phenomenon known as Kwaal in the communities. Kwaal is a sense of jealousy but kind of worse because it often comes with malicious intent. So, if you're working in a community garden, often the space is divided into plots for each person. Then, instead of working together and integrated, they segregate themselves and isolate each person. So, if it happens then that there is someone who is really passionate, their little plot starts producing good and a lot and they'll

	start to have other community members buy vegetables. The other members, who have been less successful, rather than being inspired by that person and asking for help, they become jealous and start sabotaging that person's plot. They'll start isolating and alienating that individual to the point that he becomes unpopular in the community due to his success.
	How do we heal hearts? How do we fix the mindset?
	Motivation. That is the main thing, that is the key.
	So, I think the biggest thing is the human spirit and just good neighbourliness.
	And when it comes to working to address food insecurity, most people, they're like, don't bring that to me please. Ignorance is bliss.
	You know, maybe finding people who have a love for nature, that's the right person to introduce to permaculture.
	Here where we live, there are so many members of the community who want to buy in and become part of such a community but there is not necessarily someone to direct it, but people are eager to learn and get involved and it is actually the ideal opportunity for an intentional community.
14 **APARTHEID**	You know, there's all that space and land that is not being utilised, but again, there's a slightly historic negative attitude towards agriculture form the poor communities, especially among the men, who would have a white boss back in apartheid, and as a black farm worker, there's this negative association.
	And it was interesting because, it's been a long journey, and for people who've come out of the farmworker families in apartheid, there's just been a different view on the world. You know, those people didn't have time to think long-term, haven't had time to develop a "reason" of "if I work like this, I can develop this later". And so, we need to learn how to think more because permaculture starts with this idea of protracted and thoughtful observation.
15 **HEALTH & WELL-BEING**	And it's not only just about growing food but about healthier food too.
	Even the luxury stores, I know for a fact that their produce goes through all the radiation processes to prevent their food from browning and going off.
	Well-being is a huge thing because people have moved so far away from indigenous knowledge systems that our curriculum actually aims to bring you back to your roots.
16 **SENSE OF BELONGINESS**	And it also has a refuge and a point of safety. A lot of the women joining our projects want to have people to talk to and something of to do during the day, but also as a safe place where they feel in power and safe.
	And then there's a lot of gardens where income generation is not the point and I think that's another interesting thing, is the importance of these gardens from a point of greening in the community, some sort of giving life within these poor communities and greenery goes a long way to improving just the whole feel of a community.

	So, it cumulates into a competition, and although that is not the purpose of our school garden program, these schools become food secure, they supplement food, water, the feeding scheme, the national school nutrition program. They also have a list of orphan and vulnerable, and so when there's extra food from their gardens, the donate food to those kids as well.
	And so soon, our community members also start attending the workshops, so it's not just confined to the boundaries of the school, its replicated at homesteads too. So, it just continues and grows and grows.
	And we have to start engaging in what's improving, not only our individual space, but the collective space that joins us together. And it is very much permaculture thinking you know, to see our nation holistically.
17 **POVERTY**	And the same with someone that's living in rural poverty, there are many people who just somehow have a love for nature, and you put them inside nature, and they just start to thrive and then start supporting and motivating those people to come up with the very best food system. You know if we can find a way to get our monkey mind into neutral.
	Permaculture's goal is to grow as much food as possible where people live, to make the supply chain as short as possible, and to, as far as possible, not be dependent on external resources.
	The biggest level at which permaculture works is at the community level, so you have to look at how you can organize a community, and many times, it starts informally, and it also stays informal.
	And something positive which we often see at PDC's is a group of guys who have called to buy a piece of land together and are going to start from scratch with their families, an integrated permaculture community, or ecovillage, and they come to our PDC's to get the knowledge and skills.
	That's why is say community level, because where you live, in your community, you create a system and try to entice your neighbours and invite them and often it spreads out in that way.
	And our idea was to go into those poor communities and the informal settlements and establish fresh produce gardens within the communities and then develop and look between those communities and the more sort of high-end retail and restaurant outlets so that they could sell their produce for top dollar.
18 **SELF-SUSTAINMENT**	How is it that every community, every household, there's like probably 1 or 2 cows, yet there's no one person producing or selling milk, butter, cheese, or cream? There's no one baking bread, there's no bakery. They wait for the Blue Ribbon or Sasko to arrive on Tuesday at the nearest shops. There's no local produce and that in a sense, I think speaks to people's mindsets, speaks to the history of disadvantage, and it almost speaks to kind of broken souls. And that's actually the biggest challenge.
	And I do see that in a young generation and the new generation that we work with here at our permaculture farm, which are young African people in their 30's, mostly trained, have young families, who see the world differently, positively.

		And I'm finding that in this new generation, say about 20% of them, seem to have a deep awareness and need for connecting to their traditional wisdom, the knowledge systems of their ancestors and they are completely self-driven, motivated, amazing people.
	19 LABOUR	But the point of permaculture systems is really that it is minimum input for maximum output.
		It's also about moving away from irresponsible agriculture and petro-chemicals and really toxic pesticides, and then trying to maximise production in small areas for commercial farmers, its easy because its al mechanised. So, you've got a big fancy tractor that connects to satellites and drives itself by Wi-Fi and its extremely precise and they're able to just cut down on intensive about costs associated with agriculture, which is ironic because in South Africa, where we have a real need for employment, agriculture offers a real solution in that it is extremely about intensive if you don't mechanise. (RELEVANT?).
		That said whether you're doing it commercially with all the pesticides and the chemicals, or if you're doing it full on permaculture, it's really hard and I think that's another misconception people have because farming, in any way, is incredibly difficult.
		We expect project members to be there at least 5 days a week because the gardens that we work with are typically the project members' sole income. Sometimes there may be an owner who's got six people who work part time on their land with them and it's still classified as a project, but generally speaking, 5 to 7 days a week interaction is require don most of our projects.
		If we are working with a community garden, the intervention is an 18-month period where we get them "on their feet" and equip them with the necessary skills and knowledge to sustain their garden.
		We've also got what we call "food forest" which is the development of different layers of a system, to a point where it starts taking care of themselves.
		One of the things of larger permaculture systems are that they are very labour intensive, especially initially and responding to externalities that impact your system (climate change, weather patterns, etc.,).
		We have just one labourer and then volunteers throughout the year. For example, we run monthly 3-week volunteer programs where we would have anything from 2 to 10 volunteers at a time.
	20 MAINTENANCE	They still need attention, but I think it depends on how much one wants to get out and invest into the permaculture system because I do think it is possible to design a permaculture system that require much lower maintenance. But then if you want to eat from it every day, it will require much more interaction.
		Often people don't want to have edible trees because they make a mess, and they require too much maintenance. So, there's all sorts of reasons about why people are not engaging in food growing practices.

	21 **TIME & MONEY**	You start with the back door and build from there and if you go too big for what you can tolerate, you lose the ability to manage and regulate it because you may not have enough resources or time to keep it going and support it.
		The idea is that it requires minimum of your time and money, and carbon input, and once you have a system up and running, then it is easy to exponentially expand your system.
		And so, one can become somewhat independent of the monetary system as well, because one kilogram of honey for example, is always equal to X amount of eggs, and it is the fixed exchange value that these types of trade items have with each other. So, if one guy is farming bees and another community member has chickens, they always have honey and eggs. And so, the “price” of your food does not vary as randomly as in the shops.
		And it’s sad, because what we’ve experienced is, instead of retaining money within their community, they export all of their finance to the nearest towns to buy produce instead of growing their own.
		Another interesting thing we’ve seen is someone saying well you know; I can’t work if I don’t get paid immediately.
		And sometimes it was just to escape the hardship of work conditions, like, you know, work is hard, I’m being exploited, give me something, I want to take it and go live for today.

ANNEXURE G: ETHICS APPROVAL CERTIFICATE



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ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC)**, the Faculty of Natural and Agricultural Sciences Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-SCRE) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Towards regenerative edible urban landscapes through Permaculture: A spatial planning perspective
Study Leader/Supervisor: Dr K Puren
Student: D Janse Van Rensburg

Ethics number:	N	W	U	-	0	1	2	0	3	-	2	1	-	A	9
	Institution				Study Number						Year			Status	

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application type: Single **Risk Category: Minimal**

Commencement date: 01/02/2021
Expiry date: 31/01/2025

Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):

- The following documentation are archived by FNASREC and should be complete and kept up to date:
  - Research proposal
  - Signed approval from the scientific committee indicating the proposed risk category
- All researchers involved in the study should submit signed NWU code of conduct statements annually.
- All researchers of low risk studies should submit proof of relevant ethics training every two years.
- All researchers that take part in activities that pose a safety and security threat to the researchers or the environment should submit a risk assessment form annually.
- All research involving human interaction should follow best ethical practise and keep documents as proof. This includes informed consent, questionnaires, incorporation of risk-benefit, and responsible data management.
- Any research at governmental or private institutions, permission must still be obtained from relevant authorities and provided to the FNASREC. Ethics approval is required BEFORE approval can be obtained from these authorities.

General conditions:
While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, the following general terms and conditions will apply:

- *The study leader/supervisor (principle investigator)/researcher must report in the prescribed format to the FNASREC:*
  - *annually (or as otherwise requested) on the monitoring of the study, whereby a letter of continuation will be provided, and upon completion of the study; and*
  - *without any delay in case of any adverse event or incident (or any matter that interrupts sound ethical principles) during the course of the study.*
- *The approval applies strictly to the proposal as stipulated in the application form. Should any amendments to the proposal be deemed necessary during the course of the study, the study leader/researcher must apply for approval of these amendments at the FNASREC, prior to implementation. Should there be any deviations from the study proposal without the necessary approval of such amendments, the ethics approval is immediately and automatically forfeited.*
- *Annually a number of studies may be randomly selected for an external audit.*
- *The date of approval indicates the first date that the study may be started.*
- *In the interest of ethical responsibility, the NWU-SCRE and FNASREC reserves the right to:*
  - *request access to any information or data at any time during the course or after completion of the study;*
  - *to ask further questions, seek additional information, require further modification or monitor the conduct of your research or the informed consent process;*
  - *withdraw or postpone approval if:*
    - *any unethical principles or practices of the study are revealed or suspected;*
    - *it becomes apparent that any relevant information was withheld from the FNASREC or that information has been false or misrepresented;*
    - *submission of the annual (or otherwise stipulated) monitoring report, the required amendments, or reporting of adverse events or incidents was not done in a timely manner and accurately; and / or*
    - *new institutional rules, national legislation or international conventions deem it.*
- *FNAS-REC can be contacted for further information or any report templates via Roelof.Burger@nwu.ac.za 018 299 4269*

The FNASREC would like to remain at your service as scientist and researcher, and wishes you well with your study. Please do not hesitate to contact the FNASREC or the NWU-SCRE for any further enquiries or requests for assistance.

Yours sincerely,



Prof Roelof Burger
Chairperson Faculty of Natural and Agricultural Sciences Ethics Committee (FNASREC)