

Wild Edible Plants in Rural Home Gardens: Livelihoods, Perceptions, Economic Value & Traditional Knowledge

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Abstract

The prevalence of hunger and malnutrition has been steadily increasing in the world over the past decades. The rate of food insecurity was further exacerbated by the COVID 19 pandemic which plunged millions more into hunger as a result of a recovering economy and high food prices. These challenges are mostly experienced in Africa and are estimated to worsen in this region already affected by conflict, poor healthcare, and natural disasters such as floods and droughts. The green revolution in the 1960's elevated agricultural production to play a pivotal role in the provision of food. However, production focused mainly on the cultivation of staple crops such as rice, wheat, and maize. The reliance on these crops has contributed to the lack of micronutrient intake and consumption of non-diverse diets. Wild edible plants (WEPs) which previously formed a significant part of indigenous people's diet, have been regarded as an important food source crucial for the alleviation of malnutrition and micronutrient deficiencies. Despite their nutritional qualities, they are often ignored, overlooked, and undermined by agricultural programmes and food security interventions. Additionally, WEPs are largely absent in modern diets, they are often surrounded by negative perceptions, they are economically undervalued, and the indigenous knowledge of these species is under threat. As a result, this study regards WEPs as important resources that can significantly contribute to improved livelihood outcomes such as income, food security and good health. Using the Sustainable Livelihoods Framework, this study evaluated the contribution of WEPs to sustaining livelihoods, providing economic value, and examined how WEPs are perceived as well as the relationship between their knowledge and consumption in rural areas.

This study was conducted in rural villages that are under the jurisdiction of the Moletjie and Matlala tribal authorities in the Polokwane and Aganang local municipalities, South Africa. Qualitative and quantitative research methods were employed for data collection. A total of 356 participants were interviewed for this study. Firstly, in-depth interviews were conducted with 20 elderly participants (Chapter 2). Semi-structured interviews were conducted with a total of 120 participants stratified by age, gender, and income groups (Chapter 3). A total of 96 household surveys were conducted in selected villages, this was complemented by direct observations and field surveys of the home gardens (Chapter 4). Questionnaires and freelists were administered to a total of 120 participants also stratified by age, gender, and income groups to collect data on indigenous knowledge of WEPs (Chapter 5). Thematic analysis were performed for interview data (Chapter 2) and data were summarised, descriptive statistics, chi

square tests (Chapter 3), Kruskal-Wallis tests (Chapter 4), ANOVA tests and correlation tests (Chapter 5) were performed using SPSS software.

The findings show that there has been a major nutrition transition characterised by changed meal composition, patterns, and frequency relating to the consumption of WEPs. The changes can be attributed to increasing western influence characterised by rising urbanisation, western lifestyle of church, school, and employment in an income-based economy dependent on retail stores to fulfil their daily dietary needs. Despite this, WEPs are still valuable to rural people, this is indicated by the fact that traditional foods are made optional at some modern and traditional celebrations.

Overall, most of perceptions (65.6%) regarding the consumption of WEPs were positive. The overwhelming majority of respondents agreed or strongly agreed that preparations from the local WEPs are relatively more tasty (98.3%), healthy (96.6%), nutritious (86.7%), and better represent the traditional foods (94.1%). Additionally, participants perceived WEPs to have health benefits in that they have medicinal properties to help prevent diseases, are a good source of energy, highly nutritious and they give strength. Despite these benefits and positive perceptions, most participants expressed doubt over the commercial success of WEPs if they were to compete with cultivated crops in the market. As a result, they perceive the future of WEPs to be bleak as 95% of participants believe that their consumption is in decline. This can be largely attributed to deagrarianisation, climate change, and preference of cultivated foods by the youth.

The study also showed that a diversity fruits and vegetables are available in rural home gardens, with cultivated fruits grown in abundance and WEPs available in almost all households (98%). WEPs represented 34% of the total estimated economic value of plants available in rural home gardens. Most of the home gardens produce food to supplement household food supply with only a few households engaged in trading. The trading of WEPs was recorded in 9% of the home gardens while 16% sold cultivated fruits and/or vegetables. Challenges such as lack of water and poor rainfall are shocks which affect the availability, richness, and abundance of home garden produce.

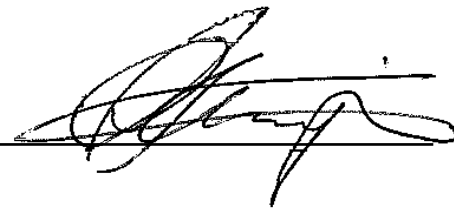
WEPs are generally well known in rural areas as participants listed an average of 8.4 ± 2.4 species. There was a significant statistical difference between the number of species listed by age group ($p = 0.009$) with the elderly listing a higher average number of species (9.3 ± 2.6)

compared to adults (8.1 ± 2.5) and the youth (7.8 ± 1.7). *Vangueria infausta*, *Sclerocarya caffra*, *Ximenia caffra*, *Amaranthus retroflexus* L. *retroflexus*, *Citrullus lanatus*, and *Cleome gynandra* were among the top listed species. There was also a significant positive correlation between the number of listed fruits with number of listed vegetables. The study also found a positive correlation between knowledge of WEPs and consumption. Most of the knowledge about WEPs was learned from a family member (89%), own observation (86%), a village elder (75%). This knowledge was mostly acquired from childhood through oral tradition (63%) and through participation (21%), and consumption (12%).

Declaration

I, **Frans Makwena Mothupi** hereby declare that this thesis is my own original work, and that all the sources consulted have been duly acknowledged within text and list of references. The thesis is submitted in fulfilment of the requirements for the degree of Doctor of Philosophy at Rhodes University and has not been submitted for any degree or under examination at any other university.

Signature:

A handwritten signature in black ink, appearing to be 'Frans Makwena Mothupi', written over a horizontal line.

Date: May 2023

Dedication

This work is dedicated to my late uncle, Frans Mothupi (2706/1945 - 06/11/2016) and the following family members who sadly passed during course of this work, May their souls Rest in Peace:

Johannes Mothupi - (16/03/1972 – 20/09/2018)

Anna Mothupi – (18/12-1957 – 03/11/2019)

Tshepo Ezra Mothupi – (30/09/1978 – 20/10/2020)

Johnny Mothupi – (14/01/1947 – 04/12/2020)

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Most importantly, I would like to extend my gratitude to the residents of the Moletjie and Matlala village-areas for accepting to be part of the study and for warmly welcoming me into their homes. This research would not be possible without their contribution. I appreciate the interactions I had with community members and the interest they have shown in my study. I am grateful for the time they accorded me and for allowing me into their home gardens and in some instances, not allowing me to leave empty-handed, I am forever grateful.

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List of Abbreviations

BWP	Botswana Pula
CASP	Comprehensive Agricultural Support Programme
CDM	Capricorn District Municipality
DAFF	Department of Agriculture, Forestry and Fisheries
DFID	Department for International Development
FAO	Food and Agricultural Organisation
IDS	Institute of Development Studies
IPCC	Intergovernmental Panel on Climate Change
KSh	Kenyan Shilling
MEA	Millennium Ecosystem Assessment
NDP	National Development Plan
NTFPs	Non-Timber Forest Products
SANBI	South African National Biodiversity Institute
SDG	Sustainable Development Goals
SLF	Sustainable Livelihoods Framework
STATS SA	Statistics South Africa
UN	United Nations
WEPs	Wild Edible Plants
WWF	World Wildlife Fund

Chapter 1

Introduction

1.1 Introduction

The Food and Agriculture Organisation (2022) has estimated that the demand for food and other agricultural products will rise by 50 per cent between 2012 and 2050 because of increasing populations and incomes. The current world population is projected to reach over 9 billion by 2050 (United Nations, 2021). This increase is likely to intensify some challenges that already persist such as malnutrition and food insecurity, that affect approximately one in seven people globally (Godfray *et al.* 2010). Additionally, undernourishment affects 900 million people and two billion people suffer from micronutrient deficiencies (Tulchinsky, 2010). Most of these challenges are acute in Sub-Saharan Africa (Tulchinsky, 2010). In the past, the increasing demand for food globally would be met by increasing the amount of land used for agriculture (Shumsky 2012). However, this will accelerate the extent of associated environmental problems such as land degradation, deforestation and reduction of several critical ecosystem services that accompany intensive agriculture (Shumsky 2012).

Since the inception of the green revolution in the 1960's, agricultural production focused mainly on cultivation of staple crops such as rice, wheat and maize (Bvenura & Afolayan, 2015). The cultivation of such crops has increased in developed countries and many developing countries (Bvenura & Afolayan 2015). The green revolution's focus on conventional crops meant that the value, development and cultivation of other crops, such as wild fruits and vegetables, was underestimated until recently (Bvenura & Afolayan, 2015). It was estimated that one billion people globally depend on such unconventional crops for a significant proportion of their dietary needs (Burlingame 2000). Wild edible plants are beneficial in a variety of ways, such as contributing to household food and nutritional security (Bvenura & Afolayan, 2015; Dop *et al.* 2020; Modi *et al.* 2006; Neudeck *et al.* 2012; Tata Ngome *et al.* 2017), dietary diversity (Dop *et al.* 2020; Kuhnlein & Chotoboriboon, 2022; Neudeck *et al.* 2012; Rammohan *et al.* 2019; Seyoum *et al.* 2015; Söukand, 2016), income diversification (Baydoun *et al.* 2017; Neudeck *et al.* 2012) and cultural values (Cocks *et al.* 2008; Kuhnlein & Chotoboriboon, 2022; Reyes-García *et al.* 2006; Bharucha & Pretty 2010). These benefits may translate into significant cash and home consumption value (High & Shackleton, 2000).

Wild edible plants (WEPs) can be defined as non-cultivated (indigenous and naturalised cultivated) plants that grow spontaneously in self-maintaining populations in natural or semi-

natural ecosystems and can exist independently of direct human action (Heywood 1999). The term WEPs in some instances is confused or used interchangeably with Non-Timber Forest Products (NTFPs). Although the two are not diametrically different, they can be discerned. NTFPs is an all-encompassing term that refers to a variety of edible and non-edible biological resources such as fuelwood, leaves, bark, berries, etc., while WEPs are a subgroup of NTFPs (Tata Ngome *et al.* 2017; Sardespande & Shackleton, 2020). FAO (1999) defines NTFPs according to location of harvest and this includes WEPs in addition to other tangible and physical resources such as plants, animals, and their products. WEPs are not limited to natural ecosystems as they can also be harvested and managed in home gardens, road verges and arable plots (High & Shackleton, 2000).

According to Fuleky (2002) there are approximately 350,000 plant species worldwide; 80,000 of these species are edible, 150 are actively cultivated and only 30 make up 95% of human calories and protein. This means that 99% of species are not formally cultivated, improved, or recognised in agricultural programs, statistics, or policy. Wild edible plants form part of these underutilised species (Bvenura & Afolayan, 2015). If WEPs can be encouraged more, they have the potential of increasing the pool of available cultivated plant species and dietary diversity (Bvenura & Afolayan, 2015). This is because WEPs play a significant role in the livelihoods of many indigenous farming and hunter-gathering communities (Turner *et al.* 2011). Although not all can be utilised to reduce current and anticipated future food shortages, many are likely to be more resilient to climate change (Wessels *et al.* 2021). They are also a better alternative for marginalised communities when cultivation of conventional crops has failed as a result of droughts, floods, or pests and diseases (Ong & Kim, 2017).

The use of WEPs throughout the world depends on whether or not species are primary or secondary sources of food in any specific location (Bvenura & Afolayan, 2015). Species are typically primary if they are common in their locality. A good example is in India where WEPs such as leafy vegetables are commonly consumed because of their high nutrient content (carotenoids) and as a result many of them have been promoted through domestication (Bélanger *et al.* 2010). In Belarus, WEPs have been used as fruits and vegetables since the 19th century (or probably earlier) till today; they have become part of the culture and lifestyle of the people in that society (Łuczaj *et al.* 2013). Widespread usage of WEPs has been reported in African countries such as Botswana, Ethiopia, Ghana, Kenya, Nigeria, and South Africa (Bharucha & Pretty, 2010). It is estimated that in 22 Asian countries and Africa, the mean use

of WEPs is between 90-100 species per community (Bharucha & Pretty, 2010). In South Africa, a total of 103 species from 33 plant families have been reported by different sources from five provinces; 58% of those species are in Limpopo, KwaZulu-Natal [27%], Eastern Cape [22%], North West [27%] and Mpumalanga [3%] (Bvenura & Afolayan, 2015). Although the average number of WEPs available in South Africa falls well within the mean use of WEPs use in Asia and Africa, this does not reveal anything about consumption patterns nor an accurate portrayal of the food security situation in the country or household (Bvenura & Afolayan, 2015).

1.2 The Importance of Wild Edible Plants in Food Security

“Food security (at the individual, household, national and global level) is defined as an achievement of physical and economic access to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active and healthy life of all people at all times” (FAO, 1996). To achieve this goal would require a combination of factors such as food availability, access, production, and consumption that are sustainable over time (Shumsky 2012). Given that the global demand for food is rising (FAO *et al.* 2022), it is likely that WEPs can play a bigger role in contributing to food production, availability, access, and consumption. In Africa, WEPs have been relied on for millenia for several purposes, including for food supply, health and income (Shackleton & Shackleton, 2004). Wild Edible Plants play four important roles (Shackleton & Shackleton, 2004) to which two can be attributed to the supply of food to households; the other two relate to income generation and contribution to culture (Tata Ngome *et al.* 2017).

1.2.1 WEPs in Daily Use

The first role has to do with the daily use of WEPs for household food needs (Tata Ngome *et al.* 2017; Shackleton & Shackleton, 2004). WEPs provide several important dietary benefits on a regular basis that some agricultural crops fail to provide adequately (Seyoum *et al.* 2015). For example, many WEPs are regarded as rich in vitamins, carotenoids, iron and to be the primary source of some micronutrients, which are vital for reducing malnutrition (Modi *et al.* 2006; Bharucha & Pretty, 2010; Tata Ngome *et al.* 2017). Regular intake of WEPs has the potential of minimising food and nutritional insecurity, while at the same time improving the health of the consumer.

Table 1.1: Examples of percentages of households using WEPs

% of households using WEPs	Location	Reference
100%	Gantund, Nyukani, Kenya	Shumsky <i>et al.</i> (2014)
96%	Konso, Ethiopia	Addis <i>et al.</i> (2013)
95%	Hamer, Ethiopia	
80 %	Shorobe Village, Botswana	Neudeck <i>et al.</i> (2012)
50%	West Himalaya, Nepal	Thakur <i>et al.</i> (2017)
41%	Tanzania	Cordeiro (2012)
68%	South Africa	Garekae & Shackleton (2020)

In Botswana, Neudeck *et al.* (2012) reported that 80% of households harvested WEPs in Shorobe village. Almost half of the study respondents stated that WEPs made up 51-75% of their annual household food supply while the remaining respondents gave a range of the contribution of WEPs to their food supply to which 25% was the minimum and 76% was the maximum (Neudeck *et al.* 2012). There are numerous studies which report the extent of consumption and benefit of WEPs for households (Table 1.1). Although this does not reveal anything about how households' benefit, such numbers do portray the importance of WEPs for many rural households.

1.2.2 WEPs as Safety Nets

The second contribution is the use of WEPs in times when there are food shortages caused during a period of stress or shock. WEPs, in this case, may be used during a hunger season characterised by poor rainfall and subsequently low crop yields (Arnold *et al.* 2011). There are other shocks such as: job loss or death of a breadwinner that impact on household income flow, losing crops to pests, land degradation and climate change all of which have the potential to negatively affect household food supply to the (Bharucha & Pretty 2010; Cocks *et al.* 2008; Mertens *et al.* 2000; Twine & Hunter 2011). The impact of a shock is determined by the resources at the disposal of a household to cope with such stress (Paumgarten & Shackleton, 2011). However, in most cases, the rural poor have weak insurance strategies and options and are thus vulnerable (Wong & Godoy, 2003; Delacote, 2009). For example, in South Africa

HIV/AIDS is one of the biggest household shocks in rural areas because of its long-term nature, impact on household labour and production resources (Twine & Hunter, 2011). The finding by Twine & Hunter (2011) demonstrate that adult mortality (as a result of HIV/AIDS) has a negative impact on household food security as compared to unaffected households. Furthermore, HIV/AIDS related death had a greater impact on household dietary diversity than a non-HIV adult death (Twine & Hunter, 2011). This is because the number of food items consumed by HIV-affected households is significantly lower compared to households not affected by HIV death or no death at all (Twine & Hunter 2011). A shock such the death of a breadwinner can leave rural households in a vulnerable state and searching for coping strategies. WEPs can therefore be used as safety-nets to mitigate the impact of stresses and shocks. WEPs can be collected and consumed for daily food intake.

Seyoum *et al.* (2015) in Ethiopia showed that WEPs are consumed when they are available and during periods of food shortage; WEPs are used as food supplements and are also used as substitute meals for breakfast and dinner. Challe & Struik (2008) reported how HIV/AIDS orphan-headed households in Tanzania (n=55) are dependent on gathering and selling wild orchids as a survival strategy. Although the authors don't specify the total income generated from the sale such orchids, the cash is used for purchasing food and school items (Challe & Struik, 2008). Tata Ngome *et al.* (2017) argued that even though WEPs are used as safety-nets, their use for such is irregular and hard to predict. This may be because safety-nets seldom offer long-term solutions to insecurity and adversity, however, they are vital for mitigating shocks (Paumgarten & Shackleton, 2011).

1.2.3 WEPs and Household Income

Another important role for WEPs is the generation of cash income through small-scale trade (Shackleton & Shackleton, 2004; Tata Ngome *et al.* 2017). Households can harvest WEPs to sell at local and more distant markets to earn cash. This strategy indirectly impacts household food security because the generated cash can be used to buy other important foods such as proteins (meat) or staples (maize) or other household needs (Tata Ngome *et al.* 2017). Cash from WEPs can be generated in two ways. WEPs can be sold fresh, dried, in raw form or WEPs can be used to prepare beverages or preserves that can be sold in local markets. Neudeck *et al.* (2012) showed that households in Shorobe, Botswana, depended on the sale of WEPs and *Mochema* and *Khadi* which are beverages made from WEPs. The sale of WEPs such as *Hyphaene petersiana*, *Cleome gynandra* and *Nymphaea nouchali* contributed significantly to

household income. In Shorobe, 69% of households earned money from the sale of WEPs and this was the second highest contributor to household income and a primary source of income for 21% of households (Neudeck *et al.* 2012). Similarly in Gatwe, Botswana, Lepetu *et al.* (2015) showed that 52% of the household sell WEPs like *Gynura bicolor*, *Corchorus olitorius*, and *Sclerocarya birrea*, earning approximately 50.00 – 100.00 BWP per week. The financial contribution of WEPs to rural households has created perceptions that WEPs are associated with low income households because they are more important for poorer households (Bharucha & Pretty, 2010). However, this was rejected by Neudeck *et al.* (2012) who found that WEPs are just as relevant for high-income households.

The sale of WEPs is not only limited to local markets in rural areas but can reach urban markets too. Sneyd (2013) reported that 66 wild foods were named and are available in city markets in Yaounde, Cameroon, including *Prunus africana*, *Afrostryax kamerunensis*, *Dacryodes edulis* and *Gnetum africanum*, amongst others. The availability of wild foods in urban markets is determined by factors such as seasonality, weather, access to the wild/fields and collecting the plants. Wild foods are available in different times of the year and that has an impact on demand (McMullin *et al.* 2012). For instance, *Dacryodes edulis* is available between April and October in Cameroon while in Kenya most of the demand is experienced during the rainy seasons in April and October (McMullin *et al.* 2012; Sneyd 2013).

Since urban residents mostly purchase rather than collect or harvest WEPs themselves, traders become an important link between harvesting WEPs and their availability in urban markets. Traders have to travel to the forests and fields to provide WEPs to urban areas. In Cameroon, traders are finding it less profitable to travel to areas of harvests to collect wild foods mainly because of police seizing their products (Sneyds 2013). In terms of income, in Kenya, the average unit cost per kilogram of stock is KSh 116 compared to the selling price of KSh 154 (McMullin *et al.* 2012). This shows that the sale of WEPs is not only important for rural households but for urban traders too.

1.2.4 WEPs in local culture

The fourth contribution of WEPs is related to their role and importance in local culture and traditions. While communities or households might have access to a variety of edible plant species in their surroundings, culture plays an influential role in what foods are preferred for consumption (Guisso *et al.* 2015; Ong & Kim, 2017). Preference is determined by individual taste and what is traditionally permissible or not (Tata Ngome *et al.* 2017). Preferred WEPs are

implanted in local traditions through stories, taboos, ceremonies, celebrations, and recipes which could evolve as a result of new foods, recipes, and social norms (Bharucha & Pretty, 2010; Tata Ngome *et al.* 2017).

1.3 WEPs and Home Gardens

According to Galhena *et al.* (2013) the earliest mention of home gardens as potential management systems for food and agriculture can be traced back to studies in the 1930s by Osche & Terra in Java, Indonesia. After decades of research on this subject, knowledge surrounding home gardens is becoming well understood in some regions. According to Michelle & Hanstad (2004), home gardens have five characteristics: 1) they are close to homesteads; 2) they have a high diversity of plant species; 3) production is supplemental rather than the main source of household income and consumption; 4) they are usually small; and 5) they are a production system that the poor can easily adopt.

Home gardens are not homogenous systems. They can be separated into different categories based on how intensively they are cultivated and their location relative to the household (Molebatsi *et al.* 2010). In terms of location, they could be categorised based on whether they are in developed or developing countries or in urban or rural areas (Galhena *et al.* 2013). From observations made in developed and developing countries Ninez (1984) defined them as “a small-scale production system supplying plant and animal consumption and utilitarian items either not obtainable, affordable, or readily available through retail markets, field cultivation, hunting, gathering, fishing, and wage earning. Household gardens tend to be located close to dwelling for security, convenience, and special care.”

Home gardens are regarded as the perfect repositories for the management and maintenance of WEPs. Home gardens are agro-ecosystems which encourage the coexistence of useful plants and animals (Vandermeer *et al.* 1998). They are located around homesteads, road verges and small plots and managed based on family labour to produce crops for household consumption and sale on local markets (High & Shackleton 2000; Serrano-Ysunza *et al.* 2017). Home gardens are vital for rural households because they promote agrodiversity; sometimes gardens may contain more than 200 useful species (Eyzaguirre & Linares 2004). Species composition in home gardens is variable even in areas of similar biophysical conditions because of factors relating to family preferences, socio-economic strategies and soil conditions (Serrano-Ysunza *et al.* 2017).

Seyoum *et al.* (2015) in Ethiopia showed that 76 % of their study respondents consumed WEPs while 54% cultivated them in their home gardens. This was because it was expected that cultivating wild fruits would benefit them in a variety of ways such as for food, medicine, market values and would help them cope with stress during famine (Seyoum *et al.* 2015). Additionally, respondents also wished to improve soil fertility, minimise erosion, feed goats and cattle, access to shade, timber and to improve the microclimate (Seyoum *et al.* 2015). The respondents who were reluctant to cultivate WEPs stated a variety of reasons for not cultivating them including: 1) lack of experience and culture, 2) lack of understanding of the value of WEPs, 3) lack of seedlings, 4) less attractive economic returns and 5) fear of competition and land resources (Seyoum *et al.* 2015).

The domestication of WEPs is not only for the benefit of people's needs; the promotion of agrobiodiversity in home gardens can also be a conservation mechanism. This is because species richness is maintained thus making home gardens more sustainable systems that convey robustness and resilience to local livelihoods and ecosystem functions (Nair, 2001). Wild edible plants in home gardens do not promote agrobiodiversity for food and environmental purposes only. Home gardens are important for cultural conservation too. While modernisation and globalisation threaten the existence of local indigenous knowledge systems (Davoren *et al.* 2016), home gardens can preserve cultural identity (Trefry *et al.* 2014). Culture plays an important role in influencing the character of home gardens (Das & Das, 2015). Nemudzudzanyi *et al.* (2010) showed that Zulu home gardens are organised environments which boast a remarkable reservoir of agrobiodiversity (Serrano-Ysunza *et al.* 2017). They comprise a wide range of species spanning different categories of food, medicine, ornamental and spiritual plants. Furthermore, these categories of plants are portrayed by how the garden is laid out. Rural Zulu home gardens revealed a specific pattern and occurrence of micro-gardens based on the different plant categories (Nemudzudzanyi *et al.* 2010). Food micro-gardens can be divided into two to consist of a vegetable and fruit patches and spiritual micro-gardens are small-scattered plantings that are governed by custom; they include pots around the house, lightning and snake repellents and protective charm plants such as *Lippia javanica* and *Euphorbia ingens* (Nemudzudzanyi *et al.* 2010). Such studies demonstrate the importance of home gardens as important components of culture and livelihoods (High & Shackleton, 2000; Nemudzudzanyi *et al.* 2010).

1.4 Perceptions Surrounding WEPs

Considering that development planners and food experts have rarely acknowledged the role of WEPs (Bharucha & Pretty 2010), the use of WEPs has always been surrounded by assumptions and stereotypes. The stereotyping began with the type of societies (hunter gathering and foraging societies) where harvesting WEPs is part of the society's social structure, culture and forms part of the local knowledge. The assumption surrounding such non-agricultural societies is that they represent a "backward cultural evolution" (Barnard 1999). The same societies and the practice of foraging or harvesting edible plants still exist to this day, and so do the negative stereotypes. Bharucha & Pretty (2010) argue that such assumptions reveal limitations because such societies are knowledgeable, sophisticated, and different from one another. The same can be said about communities that harvest WEPs in modern societies.

Despite the abundance of wild plants growing in natural habitats, the utilisation of many is declining because of westernisation of the African diet, taste, culture and the projection that WEPs are poverty foods (Bvenura & Afolayan, 2015). It is not surprising that studies would hypothesise that WEPs are consumed and most depended on by poorer households (Bharucha & Pretty 2010; Neudeck *et al.* 2012). However, the assumption that WEPs are poor household's foods is simplistic and demands a more nuanced analysis. Several analyses do not demonstrate unassuming associations between wealth and resource use (Allebone-Webb 2009; Neudeck *et al.* 2012). Rather, they show that WEP consumption is context-specific and dependent on a variety of socio-economic factors such as price, wealth, abundance, individual or cultural preference (Bharucha & Pretty, 2010). Neudeck *et al.* (2012) showed that high-income households benefit more than poorer households because they generate more money from the sale of WEPs through purchasing WEPs from lower income households and selling them at a higher price. However, such an examination is required across more contexts.

1.4.1 Reasons for Consuming WEPs

There are a multitude of social, cultural, and economic factors that influence the consumption of WEPs. The reasons can be perceived to be either positive or negative. As a result, some of the reasons why people in different settings use WEPs are also the same reasons why people do not use them. This section will outline some of the factors that drive the consumption of WEPs.

1.4.1.1 Availability

Availability is a common reason for WEP consumption; it is mainly addressed through the context of accessibility of wild food resources (Sõukand, 2016). People may be unable to consume WEPs as a result of them being unavailable or inaccessible (Sõukand, 2016). WEPs are collected from the fields by children and adults when they passing by, during play, or on the way to/from school/work (Sõukand 2016). The issue of availability then leads to an important process where WEPs are grown or encouraged in the home garden (High & Shackleton 2000; Bharucha & Pretty 2010; Sõukand 2016).

There are many factors that prompt people to bring wild plants into the home garden such as lack of time to collect WEPs, fear of collecting WEPs because of trespassing into private lands, fear of snakes, insects and infectious diseases (Sõukand, 2016). Additionally, many species grow spontaneously and are not deliberately introduced into home gardens, but are not removed either.

1.4.1.2 Taste

Taste indicates what particular people prefer to eat and it drives the desire for diversity in the diet. People would give different descriptions of how WEPs taste; the majority of those descriptions are not only related to wild fruits but to a variety of taxa including foods that comprise of wild plants such as forest fruits, flowers, green snacks, teas and breads which are perceived to be either tasty or not (Sõukand, 2016). Seyoum *et al.* (2015) in Arsi Zone, Ethiopia, compared people's choices between cultivated and wild fruit plants with 53 % preferring cultivated and commercial fruits and 42 % preferring wild edible fruits. One of the reasons for such a significant number of people choosing wild fruits was because of their special and sweet taste (Seyoum *et al.* 2015). Taste is not just an individual preference but is also culturally conditioned (Ghirardini *et al.* 2007). Some plants would be described as tasty, sour, sweet, fresh, and good. There is also a perception that taste is relative to time of consumption; according to Sõukand (2016) some respondents regarded wild plants to have tasted better in their childhood and it is precisely this that has resulted in them consuming those plants less or at all.

1.4.1.3 Health

The reason why WEPs have been seen as a potential alternative for food and nutritional security, especially in poor rural households, is for their health benefits. Wild edible plants are a healthy source of food mainly because many are rich in vitamins and micronutrients, which

are important for alleviating hidden hunger (Söukand, 2016). Yildirim *et al.* (2001) showed that the protein content of some wild leafy vegetable in South Africa such as *Chenopodium album* and *Streblus asper* ranged from 13.3% to 26.4% higher as compared to cultivated vegetables like cabbage, spinach, and lettuce. Similarly, Afolayan & Jimoh (2009) demonstrated how *Solanum nigrum* and *Urtica urens* are a source of crude fibre, containing 18% and 11% respectively. Furthermore, *Chenopodium album* has a high concentration of 6.94g/100g which meet the daily requirements for potassium (4.7g) for an adult and consumption of *Streblus asper* and *Urtica urens* which are high in iron may help reduce iron deficiencies (Afolayan & Jimoh 2009). Additionally, commonly consumed species in Africa such as *Amaranthus* and *Cleome gynandra* possess significant micronutrient content like iron, calcium, magnesium, zinc, manganese, and copper (Jimoh *et al.* 2018; Sadashiva & Shiddamallayya. 2013). Similarly wild fruits such as *Vangueria infausta* and *Sclerocarya birrea* are rich in micronutrients like Iron, calcium, zinc, manganese, and copper. (Chivenge & Senda. 2009). Rural people have acknowledged the health benefits of consuming WEPs, saying that they give them strength and vitality, they are digestible, refreshing and medicinal (Seyoum *et al.* 2015; Söukand, 2016). Maseko *et al.* (2017) showed that in rural Malawi, children consumed WEPs mainly for reasons related to health and nutrition (Maseko *et al.* 2017). They indicated that WEPs supplemented their diet, helped to prevent diseases, provide energy and protein c. However, there are also negative health perceptions about the consumption of some WEPs as fears of toxicity of some species like *Solanum nigrum* berries which are known to be poisonous (Bvenura & Afolayan, 2015; Söukand, 2016).

1.4.1.4 Culture

In the past, some wild species were collected and given as offerings at wedding ceremonies and today others serve as ingredients for local traditional brewing (Guissou *et al.* 2015; Shackleton *et al.* 2008). These are some of the most important ways WEPs have contributed to cultural value. Culture plays an influential role in the choice of which plants to eat regarding both individual species and food habits in general (Guissou *et al.* 2015). Culture is also responsible for people's choices on which WEPs to avoid. According to Guissou *et al.* (2015), nearly one-third of their respondents in Burkina Faso said that some species (such as *Leptadenia. hastata*) are not consumed because it is not their tradition. Even though the species are available and accessible people did not consume them for the simple fact that they are not part of their culture and therefore they did not like eating those plants (Guissou *et al.* 2015).

Another example is the cultural restrictions on certain wild foods during pregnancy (Chakona & Shackleton, 2019).

1.5 Drivers of change in WEP Consumption and Use

Factors which are driving change in WEP consumption in many regions range from biophysical (climate change, land degradation) to socio-economic (unsustainable harvesting, loss of indigenous knowledge and the expansion of markets) and cultural shifts.

1.5.1 Climate Change

The impact of climate change on food production widely known and accepted (Wheeler & von Braun, 2013). In recent times, South Africa has experienced frequent floods and droughts that have affected food production and its resulting food price increments (Masipa, 2017). Forecasting the precise impact of climate change on the availability and productivity of WEPs is difficult (Woodruff *et al.* 2006). However, it is plausible that climate change will have an impact on food production and consumption. Such an assertion is based on estimations by the Intergovernmental Panel on Climate Change (IPCC). The IPCC (2007) has estimated that by 2080, in Sub-Saharan Africa, agricultural yields will decrease from 21% to 9%. While some studies predict that climate change will impact species' boundaries, distribution, extinction and biodiversity loss (Thuiller, 2007) others find no evidence of the impact of climate change on human foraging and land-based subsistence livelihoods (Strauch *et al.* 2008). However, WEPs are found to offer a critical role in acting as a buffer against food stress as a result of climate change (Shumsky *et al.* 2014). In periods of low agricultural activity, WEPs potentially play a critical role because of their 'innate resilience' to rapid climate change (Fentahun & Hager, 2009). Therefore, climate change has a potential of resulting in either an increase or decline in WEP species distribution and hence consumption (Wessels *et al.* 2021).

1.5.2 Land Use Change and Degradation

Wild edible plants can be found in the fields and under intensively managed systems such as agroforestry, home gardens and others (Bharucha & Pretty 2010). In the fields, WEPs are threatened mainly by deforestation carried out for the expansion of cropping and grazing lands (Benítez-Badillo *et al.* 2018). Land use change as a result of expanding agricultural fields will be problematic in the long run because of the limited capacity it creates for ecosystems to produce and sustain habitats for WEPs (Foley *et al.* 2005). The expansion of intensive agriculture might imply the reduction, availability of and interest in consuming WEPs (Treweek *et al.* 2006). Land use change may result in vegetation cover change which makes it

harder for species to thrive (Guissou *et al.* 2015). In Mexico, Benítez-Badillo *et al.* (2018) showed that between 1993 and 2013 tropical forest cover has been lost due to the increase of human settlements and pastureland. It has resulted in six of the seven studied species (including *Couepia ployandra*, *Bellschiedia anay* and *Genipa americana*) to be at risk and susceptible to losses. The threat of land use change to WEPs can be combated through conservation plans that aim to put species under a particular management system to prevent species declines (Benítez-Badillo *et al.* 2018).

1.5.3 Unsustainable Harvesting

Unsustainable harvesting of wild plants, especially in hotspots for malnutrition and hunger, can lead to a rapid decline of WEPs in some areas (Bharuch & Pretty, 2010). Unsustainable ways of harvesting WEPs are largely attributed to destructive methods of collection, which include breaking and cutting branches instead of picking fruit (Neudeck *et al.* 2012). In Botswana, it was suggested that perhaps people should harvest for their own consumption and not for sale; and that harvesting licenses be introduced (Neudeck *et al.* 2012). The introduction of such regulations was thought to be a good initiative to curb the unsustainable harvesting of WEPs. The introduction of licenses would restrict people to specific quantities of plants (Neudeck *et al.* 2012). This would ensure the continued availability of WEPs for future harvests and consumption. However, this would only apply to WEPs collected in the wild and not in home gardens where people can harvest however, they like.

1.5.4 Loss of Indigenous Knowledge

Indigenous or traditional knowledge is knowledge which is exchanged and maintained through family and collectively within a community (Turreira-García *et al.* 2015). This knowledge is required for the identification, collection, and preparation of WEPs (Pilgrim *et al.* 2008). However, as households increasingly integrate food from the stores that contribute to the westernisation of local diets, this knowledge becomes threatened. The distribution of this knowledge is related to age, gender, and formal education (Reyez-Garcia *et al.* 2005; Cruz *et al.* 2013). Another important variable that can be associated with indigenous knowledge is the frequency of consumption and its relationship with age and gender. For example, in Brazil, Cruz *et al.* (2013) found that there was a correlation between indigenous knowledge and age, with older people tend to know more about WEPs. In this case, it was hypothesized that more knowledge would translate to more consumption by elders. However, according to Cruz *et al.* (2013) both young and old consumed WEPs at similar frequencies, therefore the correlation

between age and consumption was nullified. Furthermore, this study also found no association between WEP use and gender as both male and female use WEPs similarly. This differs fundamentally with the findings of Modi *et al.* (2006) who found that knowledge can be attributed to elderly females, and, in terms of consumption, even though men consumed WEPs it was less than women in general and elderly women in particular. Some research has demonstrated the decline of local knowledge as young people working outside villages don't have the chance or arguably the desire to learn this knowledge (Pilgrim *et al.* 2008; Somnasang *et al.* 1998). As societies experience cultural change the interest in consuming WEPs may decline.

1.5.5 Social and Economic Change

As societies modernise, there is a concern that WEPs will be increasingly undervalued and consumed less (Wooten, 2016). As rural-urban migration intensifies and commercial markets expand into rural areas WEPs can be substituted by other foods on the market (Pereira *et al.* 2014). The replacement of WEP by store-foods can be linked to declining dietary diversity and the rise of chronic conditions such as obesity and diabetes (Batal & Hunter, 2007). Wild edible plants may be disregarded by socio-economic transformation as people move and opt for more modernised diets comprising of store-foods and cultivated crops. However, other studies show that as markets expand, WEPs can be accommodated and be sold in the markets. For example, Pemberton & Lee (1996) in South Korea analysed the presence and abundance of wild food plants. The continuation of the availability of WEPs was linked to a strong culture of WEP consumption despite rapid modernisation and industrialisation (Pemberton & Lee, 1996). Socio-economic change can cause either a decline or an increase in WEP consumption and utilisation, depending on how societies adapt to that change. In regions where modernisation is minimal, traditional food systems persist (Bharuch & Pretty, 2010). This persistence can be a result of the diverse agricultural systems characterised by the coexistence of cultivated crops and WEPs in home gardens.

1.6 Home Gardens and WEPs in South Africa

Using tropical West Africa as an example Fernandez & Nair (1986) defined home gardens as land-use systems that involve the management of agricultural crops and livestock within household compounds. The definition is not different from early definitions such as Ninez (1984) because of defining factors such as the size of the garden, the proximity to households and the diversity of plant species. In developing countries such as South Africa, home gardens

are differentiated by their location, i.e. rural or urban home gardens. According to Molebatsi *et al.* (2010) urban home gardens are regarded as luxury spaces around the household used as a place for relaxation, playing, keeping pets, outdoor eating and cultivating ornamental plants. Rural home gardens, on the other hand are used primarily for food production, medicine, and spirituality (Das & Das, 2005; Nemudzudzanyi, 2010; Semenya & Potgieter, 2014). Home gardens in South Africa cannot be limited to the dichotomy between rural and urban since the defining factors of these two can overlap. Home gardens are also not limited to just urban and rural contexts. Molebatsi *et al.* (2010) categorises them into three (urban, rural, and peri-urban) while Davoren *et al.* (2016) differentiated between traditional and westernised home gardens. In South Africa and other developing countries, home gardens are an interesting case study because of different factors such as history, culture, urbanisation, agro-ecological zones amongst many other factors which makes them unique.

One of the important characteristics of home gardens is the preservation and management of a diverse group of plant species. Plant diversity is essential for providing people with ecosystem goods and services, such as provisioning, regulating, supporting and cultural services (MEA, 2005). Throughout time, farmers and households have selected plants that they desire to grow in their gardens for commerce and subsistence (Molebatsi *et al.* 2010). In North-West, Molebatsi *et al.* (2010) found that home gardens which contained both cultivated and indigenous plant species had a mean size of 1 600 m². Molebatsi *et al.* (2010) also recorded a total of 525 plant species from 163 home gardens in urban, rural, and peri-urban areas in North-West. This included fruit trees such as *Grewia flava*, *Eriobotrya japonica*, *Punica gratum*; medicinal plants like *Ziziphus mucronata*, *Vachellia erioloba* and *Erythrina lysistemon*; ornamental plants *Verbesina encelioides* and *Tagetes erecta* as well as food plants such as *Amaranthus viridis*, *Bidens bipinnata* and *Eleusine coracana* (Molebatsi *et al.* 2010).

The choice of which species people prefer is determined by taste, pleasure and culture and this varies for different home gardens (Marco *et al.* 2010). There are several studies in South Africa which show that cultivated plants and tree species tend to be preferred and valued more than indigenous ones (Molebatsi *et al.* 2010; Mosina & Maroyi, 2016; Semenya & Potgieter, 2014). However, High & Shackleton (2000) demonstrated that wild plants represented 31% of the value of plants species grown in Dingleydale B as compared to domesticated plants. Similarly, Paumgarten *et al.* (2005) showed that 80% of trees in three Eastern Cape villages home gardens were cultivated. Labadarios & Steyn (2001) have cautioned against the reliance on cultivated

fruits and vegetables because it could result in indigenous plants being regarded as inferior even when most of them are nutritionally superior. Despite the nutritional superiority of many wild species, cultivated species such as *Mangifera indica*, *Psidium guajava* and *Carica papaya* still dominate in home gardens (Labadarios & Steyn 2001). Instead, Labadarios & Steyn (2001) have suggested that indigenous plants be promoted as a way for cultural appropriation and to increase nutrient intake nationwide (Maunder & Meaker, 2007).

Contrary to Molebatsi *et al.* (2010) defining urban home gardens as luxurious spaces mainly for cultivating ornamental species, Mosina & Maroyi (2016) came to different conclusions as their research found that 40% of urban home gardens contain food plants. Many home gardens in South Africa are used for producing food, whether they are rural or urban. Urban and rural home gardens grow and maintain fruit species such as *Prunus persica*, *Persea americana* and *Citrus sinenses*, amongst others (Mosina & Maroyi, 2016), whilst the maintenance of wild vegetable such as *Amarunthus hybridus*, *Cleome gynandra* is mostly common in rural home gardens (Molebatsi *et al.* 2010). Besides the maintenance of food crops, there are also ornamental and medicinal species available in rural and urban micro-gardens (Davoren *et al.* 2016; Molebatsi *et al.* 2010; Mosina & Maroyi, 2016; Nemudzudzanyi *et al.* 2010). For instance, Molebatsi *et al.* (2010) found that 17% of plants recorded in Tswana home gardens were medicinal, while 54% were ornamental. The different categories of plant species are represented by micro-gardens within home gardens. The proportion of which category of micro-gardens (food, medicinal and ornamental) dominates within a home garden is dependent on several factors such as the location of the home garden (urban or rural), culture, affluence (socio economic status of households) and preference (Molebatsi *et al.* 2010; Davoren *et al.* 2016). According to Davoren *et al.* (2016) culture plays a role with regards to the management of plant species in home gardens because it includes processes such as indigenous knowledge systems.

The role of culture was demonstrated by Molebatsi *et al.* (2010) and Nemudzudzanyi *et al.* (2010), who in their respective studies of a Tswana *tshimo* and a Zulu *muzi*, found that the home gardens of these two different cultural groups portray unique garden designs characterised by micro-gardens. Tswana *tshimos* consist of more ornamental species, while Zulu *muzis* consist of more medicinal plants (Molebatsi *et al.* 2010; Nemudzudzanyi *et al.* 2010). There is a correlation between indigenous knowledge and use of indigenous wild plant species. According to Nemudzudzanyi *et al.* (2010) residents in peri-urban and urban areas

prefer well-known and readily available cultivated species over indigenous plants. This may represent the fading away of traditional practises and it is indicative of the emergence of a growing African middle class (Davoren *et al.* 2016). The agrobiodiversity that is apparent in home gardens of different cultural groups in South Africa is indicative of the diversification strategies that are employed by households to sustain their livelihoods. The role that cultures plays in influencing the choice of species available in home-gardens cannot be ignored. Livelihood strategies, the role of institution and processes such as culture for improved and sustainable livelihoods are components of the Sustainable Livelihoods Framework which is employed for this study.

1.7 Rationale

Food insecurity, hunger and malnutrition has been gradually increasing around the world over the past two decades (UN, 2021). Over 800 million people around the world are still experiencing hunger, with Africa having the highest prevalence of undernourishment at 20% (FAO *et al.* 2019). This number was made worse by the COVID-19 pandemic which plunged around 50 million more into hunger as a result of damaged economies and high food prices (FAO *et al.* 2022). With the population of the world projected to reach 9 billion by 2050 (UN, 2021), the rise in numbers of people facing hunger because of the pandemic is a setback that will make achieving ‘Zero Hunger’ a mammoth task. Regional disparities persist; however, Africa is the hardest hit region currently with one in five people experiencing hunger (FAO *et al.* 2022). These challenges are made worse by conflict, poor healthcare, and natural disasters such as floods and droughts that continually burden this continent (FAO *et al.* 2022). Agricultural intensification is the leading narrative on how to reduce world hunger and solve food insecurity (Ickowitz *et al.* 2019). Certainly, agricultural production has played an important role in the provision of food for societies for thousands of years. The intensification of agriculture over the past few decades has kept pace with food demands and ended hunger for millions of people around the world (Hall *et al.* 2022). However, the problem with agricultural intensification is its preoccupation with calories, leading to food production approaches focusing mainly on the cultivation of a small number of staples such as cereals, rice, wheat, and maize (Tanamonure *et al.* 2021). The reliance on these crops for alleviating hunger is short-sighted as it contributes to micronutrient deficiencies which is a bigger challenge affecting 2 billion people across the world (Hall *et al.* 2022; Keatinge *et al.* 2015). This calls for the evaluation of the current food system to an alternative system where the fight

to mitigate hunger does not neglect the need to improve dietary quality, diversity, the protection of landscapes and natural resources (Hall *et al.* 2022).

This study regards WEPs as important resources that play a crucial role in alleviating poverty and hunger thus leading to improved livelihood outcomes such as income, food security, culture and good health (Bvenura & Afolayan, 2015; Faber *et al.* 2010; Galhena *et al.* 2013; Lulekal *et al.* 2011; Neudeck *et al.* 2012). WEPs have formed part of rural people's diets for millenia and have been regarded as an important food source vital for the alleviation of malnutrition and micronutrient deficiencies (Bvenura & Afolaya, 2015; Jimoh *et al.* 2018). Despite their nutritional qualities, they are often ignored, overlooked, and undermined by agricultural programmes and food security interventions (Uprety *et al.* 2012). Additionally, WEPs are largely missing in modern urban diets, they are often surrounded by negative perceptions, their economic value is ignored, and thus the indigenous knowledge about these species is endangered.

Traditional food consumption practices have undergone major shifts over the past century and accelerated over the last three decades (Viljoen *et al.* 2005). The changing economic and political landscapes which resulted in deagrarianisation, urban migration and a shift to a cash-based economy, is largely liable for changes in food choices and consumption (Pereira *et al.* 2014). There are many studies reporting dietary changes in urban areas or comparing the consumption of wild fruit or wild vegetables between rural and urban households (Garekae & Shackleton, 2020; Gido *et al.* 2017; Kheir *et al.* 2021; Sneyd, 2013). However, there are few recent studies in South Africa evaluating changes in consumption of WEPs amongst modern rural households. It is also evident that people's perceptions and attitudes play a crucial role in determining the rate and frequency of WEP consumption and the level of importance they accredit WEPs in their daily lives. Most studies examine perceptions such as health, preference, taste, and tradition (Maseko *et al.* 2017; Seyoum *et al.* 2015; Sōukand, 2016), but very few have studied perceptions around trade and commercialisation by individuals from different socioeconomic backgrounds. There has also been a paucity of research in South Africa assessing the economic value of WEPs especially in rural home gardens. most of the studies compare WEPs use and value between home gardens in rural, remote, and urban areas (Chaudhury *et al.* 2022; Davoren *et al.* 2016; Uprety *et al.* 2012; Vorster *et al.* 2007); this study compared the availability, diversity and value of fruit and vegetable plants species in home gardens. Taking all these issues above into consideration, this prompted this study to

investigate changes of WEPs consumption and use in rural households, how perceptions affect the use and consumption of WEPs, the extent of WEPs availability, abundance, and economic value in rural home gardens and the relationship between indigenous knowledge and WEPs use.

1.8 Aims and Objectives

The aim of this research was to assess the contribution of WEPs in rural home gardens to sustainable livelihoods. This was divided into four objectives, each with accompanying research questions.

1. To assess changes of WEPs consumption and use in rural households

- What are the comparisons of the household consumption patterns of WEPs in the past and present?
- What are the comparisons of the consumption of WEPs during traditional ceremonies in the past and present?
- Which factors are responsible for driving changes in WEPs consumption in rural households?

Hypothesis: There might be a significant difference in the consumption pattern of the WEPs (daily routine consumption and/or consumption on special events/traditional ceremonies) among the local communities during past and present in the study area possibly due to evolving culture, traditions, lifestyle, personnel preferences, and economics.

2. To Explore perceptions of WEPs consumption and Use

- Who consumes WEPs and which WEPs are consumed?
- How often are they consumed?
- What are the perceptions people have about consuming WEPs?
- What perceptions do they hold regarding the commercialisation of WEPs?
- What do they perceive to be the main reasons underlying consumption of WEPs?
- How do perceptions differ with age, gender, and income?

Hypothesis: Local people of different ages and genders hold positive perceptions about the use, consumption, and commercialisation of WEPs.

3. To examine the extent of WEPs abundance, availability, and economic value in rural home gardens

- What is the availability, abundance and richness of cultivated fruits and vegetable species in comparison to WEPs?
- What are the benefits and challenges of growing and maintaining species in home gardens?
- What is the economic value of cultivated fruits and vegetables species as compared to WEPs?
- What is the households' spending in relation to the purchasing of fruits and vegetables from markets?

Hypothesis: WEPs are abundant and have significant value in rural home gardens, however, their value and abundance is not higher than cultivated species.

4. To explore the relationship between indigenous knowledge and WEP Use

- How many wild edible fruits and vegetable species participants know?
- How their knowledge of these species was produced and transferred?
- Which WEPs species are consumed and how often?
- What is the correlation between the number of species known, the number of species consumed and how this changes with age and gender?

Hypothesis: There might be a positive relationship between the number of WEPs species known with the number of species consumed. Additionally, the number of species known would increase with age.

1.9 Theoretical Framework

1.9.1 Background

The study employs the Sustainable Livelihoods Framework (SLF) as its conceptual underpinning. The framework is used to understand how communities and households make a living and sustain livelihoods through the use and consumption of WEPs. Since the concept of sustainable livelihoods was coined in the early 1990s, it has become the go-to framework for

both academic and applied fieldwork especially in rural areas in the third world (Natarajan *et al.* 2022). Given its focus on development and poverty, it was expected that this concept would attract and be regularly featured in academic literature even though its origins were rooted in development interventions rather than as a research methodology (Morse & McNamara, 2013; Natarajan *et al.* 2022). Additionally, Sustainable Livelihood Approach is adopted by literature of project proposals and programme reports that are required as a condition for obtaining funding from development partners (Morse & McNamara, 2013). Development organisations such as Oxfam, Care International and the UK's Overseas Development Administration played a progressive role transforming Sustainable Livelihoods Approaches into the Sustainable Livelihoods Framework as we know it today.

According to Morse & McNamara (2013) the concept and the ideas surrounding sustainable livelihoods could be traced back to the 1960's where there was a gradual evolution of systems' approaches and participatory methods in development. However, it was at the 1992 Earth Summit where the concept of sustainable livelihood arose, promoted by Agenda 21 when it stated everyone must have the "opportunity to earn a sustainable livelihood (Perrings, 1994). In 1997, the UK Government adopted a White Paper on International Development which committed the UK to the International Development Target of reducing the people living in poverty by one-half by 2015 (Farrington *et al.* 1999). One way of achieving this was through a better understanding of poverty and how it can be addressed. Poverty was previously understood in income and consumption terms (Krantz, 2001). After decades of limited success addressing it, there was a realisation that poverty was not only a question of low income but includes other factors such as a sense of insecurity, voicelessness, poor levels of health, illiteracy, lack of social services, and access to assets etc. (Farrington *et al.* 1999; Krantz, 2001). The dissatisfaction with the income/consumption definition of poverty gave rise to basic needs approach which places more emphasis on basic needs such as health, clean water and other services which can prevent people from getting poor (Farrington *et al.* 1999). It is within this broader context SLF emerged.

1.9.2 The Sustainable Livelihoods Framework

Sustainable Livelihoods Framework (SLF) was coined in 1999 by the Institute of Development Studies (IDS) and Scoones (1998), where a sustainable livelihood was defined as a livelihood (capabilities, assets, and activities) which was able to persist through periods of stress and shock without undermining the natural resource base (Scoones 1998). The Sustainable

Livelihoods Framework is a tool used to understand the nature and complexity of livelihoods. The SLF is a people-centred approach used to study livelihoods at a range of scales (from individual, household, to regional and national (Scoones 1998). The SLF consists of five components which are: institutions and processes, livelihood assets, vulnerability context, livelihood strategies and livelihood outcomes (Figure 1.1).

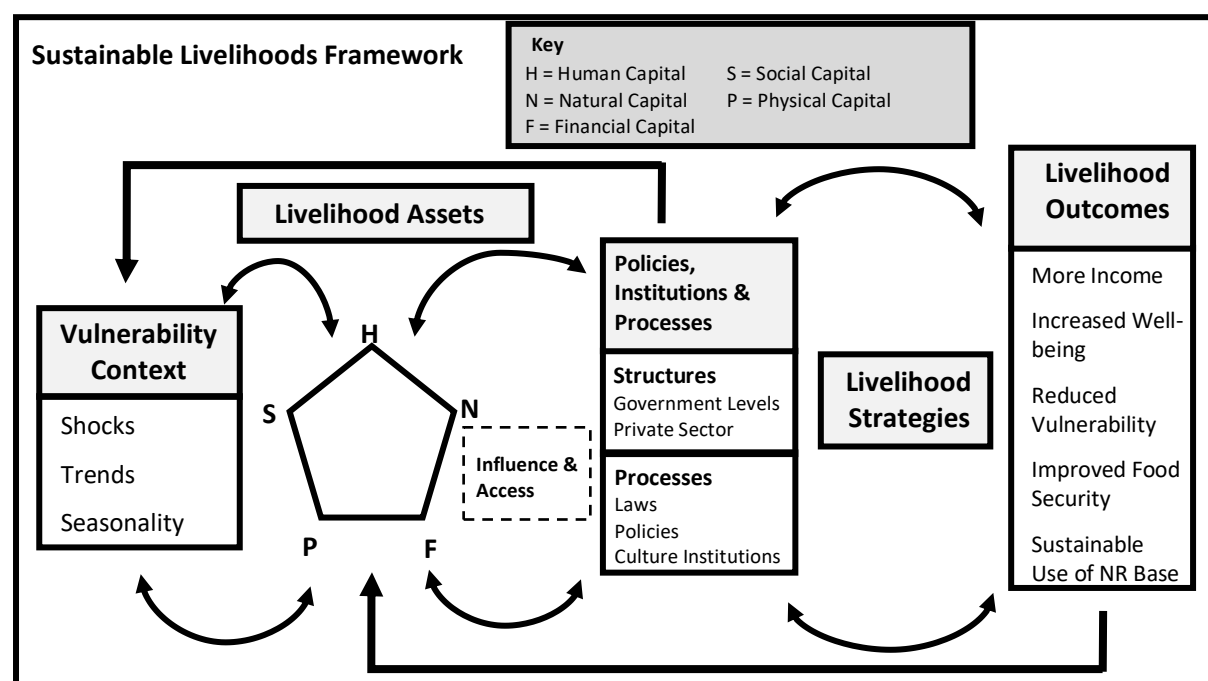


Figure 1.1: The Sustainable Livelihoods Framework. Source: (DFID 2000)

Policies, institutions, and processes are one of the most important components of the SLF. This is because these different types of decision-making bodies are important for the integration with other components such as livelihood assets within the framework. They are also important in determining access to livelihood strategies and set the exchange between livelihood assets and returns to any livelihood strategy (DFID 2000). These structures and institutions can also be regarded as a regulator because of how influential they are in linking livelihood outcomes with vulnerability context and assets (DFID 2000).

Livelihood assets are comprised of five capitals which are regarded as the needs and necessities of obtaining livelihood outcomes:

- 1) Human Capital – refers to the skills, knowledge, labour, and physical activities necessary for performing livelihood activities.
- 2) Social Capital – are the social resources (networks, social relations, and affiliations).

- 3) Natural Capital – are the natural resource stocks such as water, soil, air, coupled with environmental services like (hydrological cycle, nitrogen cycle, pollution sinks, etc.) which are vital for the functioning of livelihoods.
- 4) Physical Capital - includes infrastructure (housing, fields, roads, dams, and irrigation)
- 5) Financial Capital – is the capital base (cash, credit/debit loans and other economic assets).

Livelihood strategies are regarded as a collection of activities that people engage in to expand their livelihoods (Scoones 1998). They can be divided into: agricultural intensification, livelihood diversification and migration. Agricultural intensification is concerned with improving yields by placing more land under cultivation or improving technology. Livelihood diversification is when people are involved in more than one activity as a strategy to better their livelihoods, while migration is when people seek better opportunities elsewhere (Scoones 1998). The vulnerability context is particularly important because it determines the sustainability of livelihoods as they can be derailed by trends, shocks, or seasonal variations (Farrington *et al.* 1999). The livelihood outcomes are the goals or end-result of livelihood. They are measured in positive or negative terms, for example, when a livelihood has seen an improvement or decline in household income or food security.

1.9.3 Strengths and Weaknesses of SLF

The SLF evolved into a framework that made it easier to understand poverty and livelihoods, how they manifest at different levels and how they directly and indirectly determine poor people's access to livelihood assets (Krantz, 2001). It is a realistic framework that can be used for assessing the multidimensional nature of livelihoods rather than being limited to level of income (Natarajan *et al.* 2022). The SLF provides a holistic view of the links between assets and activities that make up a livelihood; this includes physical and natural resource but social and human resources (Krantz, 2001). The framework also offered participatory approach to development rather than an expert driven approach to development and research (Natarajan *et al.* 2022). Another strength of the framework is that it can be applied to multiple development projects, academic research projects and in any context where people have a livelihood (Morse & McNamara, 2013). Despite its wide application, the framework has certain weaknesses that require attention.

Firstly, for claiming to be a people-centred approach, the SLF has trouble locating the poor people that they are trying to assist (Krantz, 2001). Within the framework, there are livelihood

capitals one of which is the human capital, however, there is no identification of people (Morse & McNamara, 2013). Secondly, it perpetuates the viewing of livelihoods in income or economic terms to the detriment of other aspects that encompass the broader definition of poverty such as culture and socio-political factors (Morse & McNamara, 2013; Natarajan *et al.* 2022). As a result, there is little consideration for culture, even though this forms an important aspect of livelihoods (Tao *et al.* 2010). Additionally, although the SLF touches on structures and processes (policies) there is little attention paid to “politics” where issues such as inclusion, equity, and social justice are neglected (Natarajan *et al.* 2022). In other words, there is a lack of emphasis on the need to empower and improve the rights of poor people to change social relations (Carney, 2002). It downplays the issues of class, gender and other power relation that shape and affect livelihoods (Natarajan *et al.* 2022). Thirdly, SL framework is not sensitive to gender issues. It operates with an inherent assumption of equality between men and women in poor rural communities. This may be short-sighted because it turns a blind eye on the difference in vulnerabilities that exists between men and women (Krantz, 2001). It is not clear how to analyse or measure livelihood assets, additionally, it is also not clear whether if all the assets should be measured (Morse & McNamara, 2013). This relates to the critique by Farrington (2000) who argued that some aspects of livelihoods are difficult to quantify and consequently, it would be unknown if any progress is made. It will be difficult to measure the reduction of poverty if other assets which can lead to poverty reduction are not quantifiable or it’s not clear how to measure or analyse them (Farrington, 2000). Finally, shocks and trends such as the outbreak of diseases, political instability and economic crises have enormous impact for livelihoods at the household and individual level (Morse & McNamara, 2013). Although the framework does attempt to analyse vulnerability, it is limited by the unpredictability of such shocks and trends especially at a macro scale (Morse & McNamara, 2013). These are considerable achievements and limitations of the framework which together make a case for the revising and improving of the framework to have a better analysis of livelihoods (Natarajan *et al.* 2022).

1.9.4 WEPs and the Sustainable Livelihoods Framework

It has been established that many households in Sub-Saharan Africa make a living from the sale and consumption of WEPs (Cordeiro 2012, Neudeck *et al.* 2012, Addis *et al.* 2013, Seyoum *et al.* 2015). However, the number of households that make a living from WEPs does not reveal much about the quality nor the contribution of WEPs to improved livelihoods. The SLF can be useful in analysing and understanding the complexity of livelihoods in this case.

Firstly, WEPs are a form of natural capital and the use of WEPs can be seen as a livelihood diversification strategy. This is because there are other livelihood strategies household participate in such as arable farming, livestock farming, formal employment, pension grants, small business, all of which contribute to household income and food supply (Neudeck *et al.* 2012). Furthermore, it can be argued that to a certain extent, the management of WEPs in a home-garden system can be regarded as an agricultural intensification strategy. This is because less land is placed under management for production of a diverse range of plant species, with a significant number of them being food species (Davoren *et al.* 2016; Mosina & Moroyi 2016).

The structural and institutional component of the SLF is central for the analysis of livelihoods. It has been argued that WEPs have generally been ignored by institutions and decision-making bodies such as governments and international agencies (Neudeck *et al.* 2012). Some authors are calling for governments to regulate WEPs to promote their development and sustainability because they tend to undervalue WEPs (Shumsky 2014). However, regulation is unlikely to apply to WEPs that are collected in home gardens because they are already under a management system. Instead WEPs management is influenced by culture. This study will probe, to what extent and in what ways does culture impact WEP use and how do livelihood assets such as indigenous knowledge (human capital) link and interact with a structure and process such as culture. In terms of the vulnerability context, seasonality along shocks and trends such as climate change and land use change are important factors relating to WEPs. Seasonality, in this case, can be understood when certain WEPs have identified periods of availability (e.g. rainy summer season) and scarcity (dry winter season) (Sneyd, 2013). Seasonality is important for determining the collection of WEPs (Mollee *et al.* 2017). For example, in Southern Africa wild leafy vegetables such as *Cleome* and *Amaranthus retroflexus* are available for collection during the rainy summer season for home consumption and trade (Bvenura & Afolayan, 2015). Households may be left vulnerable during certain seasons when WEPs are not in abundance. However, the accessibility of certain WEPs especially wild vegetables could be prolonged for the offseason through preservation; a strategy that can improve household food security all year round (Bvenura & Afolayan, 2015). WEPs can also be used during periods of shocks such as drought or famine when food shortages are experienced. Previous studies such as Akkinnifesis *et al.* (2004) showed that rural households in Southern Africa face food shortages for three or four months in a year and sustain their livelihoods through the use and consumption of WEPs. Recent studies also show that WEPs are important sources of food and nutrition during shocks such as the COVID 19 outbreak or

when cultivated crops are facing production challenges thus resulting high food prices (Merchant *et al.* 2022). The SLF will provide a holistic view of all these components, how they interact and how they help in understanding how WEPs contribute to sustaining livelihoods.

1.10 Structure of the Thesis

This thesis is comprised of a total of six chapters. Chapter 1 provides a detailed background of the research topic, presents the problem statement, local and global debates, rationale for the study and its theoretical underpinning. Chapter 2 to 5 present the empirical results of the study.

Chapter 2 assessed changes relating to the consumption of WEPs. This was done by evaluating general meal compositions and meal patterns of the past as compared to the present. Similarly, meal composition during traditional ceremonies of the past and present were evaluated. The chapter explored the drivers responsible for the nutritional changes in rural diets.

Chapter 3 explored perceptions and attitudes relating to the use and consumption of WEPs. Perceptions regarding the importance, benefits, and commercialisation of WEPs were explored. The relationship between WEPs consumption and perceptions was analysed. Differences in perception between different age, gender and income groups was analysed. The chapter ended by providing perception of future use and consumption of WEPs.

Chapter 4 provided information of the different fruit and vegetable species available and abundant in rural home gardens. The availability, abundance, richness and the estimated economic value of cultivated fruits and vegetable species were compared to WEPs. Challenges to growing and maintaining fruit trees and vegetable species in home gardens were explored. And whether food produced from the home gardens was for trade or subsistence was analysed. Spending habits of households towards fruits and vegetables was also analysed.

Chapter 5 provided insights regarding the indigenous knowledge people obtained regarding WEPs. It analysed the number of WEPs people know, how that knowledge was acquired and transmitted. Difference in knowledge was analysed using age and gender. The correlation between knowledge and consumption of WEPs was also explored. Chapter 6 presents the synthesis and discusses key findings from all the empirical result chapters. The chapter also provides recommendations for future research, policy, and practice.

A paper-based format was employed for this thesis. This format has each empirical result chapter containing the following sections: Introduction, Methods, Results, Discussion, Conclusion and References.

1.11 Study Area

The study was conducted in selected villages in the Capricorn District Municipality (CDM) in Limpopo Province. Limpopo is the most northern province in South Africa which borders Zimbabwe to the north, Botswana on the west and Mozambique to the east. The Capricorn District Municipality is one of the five district municipalities in the province, and it consists of five local municipalities (Polokwane, Lepelle-Nkumpi, Blouberg, Aganang and Molemole) (Figure 1.2). It is the third largest district municipality (after Waterberg and Vhembe) with an area of 21,705 km² and the second largest population of 1 261 463 (Stats SA, 2011). The CDM is characterised by the Limpopo and Makhado Sweet Bushveld in the north and the Polokwane Plateau Bushveld in the south; it has drained soils with high base status and plains with short open tree layer and occasional trees at higher altitude (Mucina & Rutherford 2006). The altitude ranges from 700 m to 1 000 m in the Limpopo bushveld and from 1 000 to 1 500 m in the plateau bushveld (Mucina & Rutherford 2006). The climate is characterised by summer rainfall (November to February) and very dry winters (May to August). The mean maximum temperature for Polokwane is 33.2 °C and a mean annual precipitation of 400 mm (Mucina & Rutherford 2006).

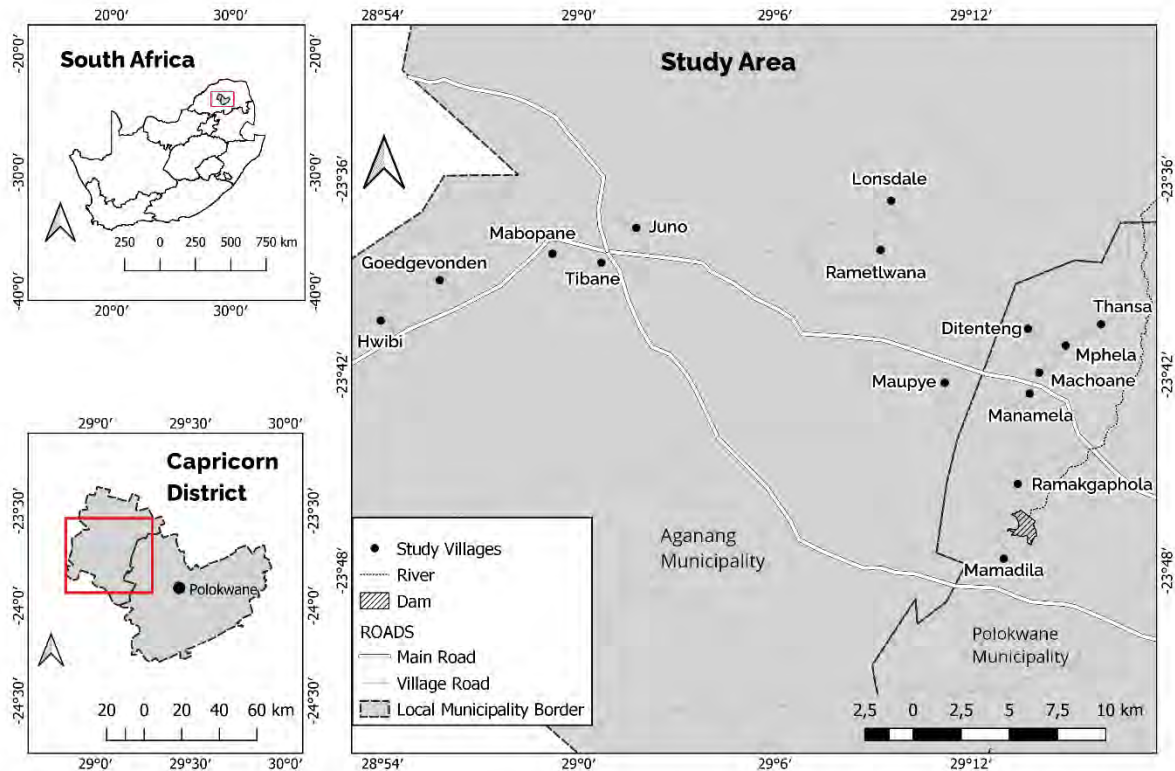


Figure 1.2: Map of the study area

The racial makeup of the district is 96% black, 2.8% white, 0.5% coloured and 0.4 % Indian and the dominant language is Northern Sotho spoken by 84% of the population, followed by Afrikaans with 3%, Tsonga with 2.6%, English with 2% and others at 7.5% (Stats SA, 2011). The population of CDM is 53% female and 47% male. In terms of socio-economic statistics, the CDM has an unemployment rate of 37%, the average household size is 3.6 similar to the provincial average of 3.7 (Stats SA, 2011). The average household income is R69 220 per annum which is more than 100% increase from 2001 and 50 % of the household are female-headed (Stats SA, 2011).

1.11.1 Aganang district municipality

Aganang is one of five local municipalities in the Capricorn district. It is located between the Tropic of Capricorn in the north and 24°00 latitude line south. It is surrounded by the Blouberg municipality in the north, Molemole in the east, Polokwane in the south and Mogalakwena in the west. It is the smallest municipality in the Capricorn district with an area size of 1852.22 km². The vegetation type of the municipality is mostly the Makhado mixed bushveld and the Polokwane plateau bushveld (Table 1.2) (SANBI, 2018). It is characterised by dry winters and

wet summers with average maximum temperatures of 24° C and 32°C for winter and summer, respectively (Aganang Local Municipality, 2009). The areas in this municipality receive a mean annual precipitation of 550 mm (Aganang Local Municipality, 2009). The soil conditions for the area are generally shallow and well drained. The type of soils dominant in the area are sandy and sand loams with minimal red soils and black vertisols (Aganang Local Municipality, 2009).

Table 1.2 Aganang village profiles

<i>Characteristics</i>	<i>Villages</i>						
	<i>Hwibi</i>	<i>Juno</i>	<i>Mabopane</i>	<i>Goedgevonden</i>	<i>Tibane</i>	<i>Maupye</i>	<i>Rametlwane</i>
Village area	Matlala	Matlala	Matlala	Matlala	Matlala	Moletjie	Moletjie
Latitude	23°40'19" S	23°37'29" S	23°38'13" S	23°39'07" S	23°38'28" S	23°42'29" S	23°38'08" S
Longitude	28°53'59 E	29°01'51 E	28°59'12 E	28°55'48 E	29°00'47 E	29°11'16 E	29°09'15 E
Altitude	1040m	1100m	1100m	1060m	1100m	1300m	1200m
Avg max Temp	27.7°C	27.7°C	27.7°C	27.7°C	27.7°C	27.7°C	27.7°C
MAP	550mm	550mm	550mm	550mm	550mm	550mm	550mm
Vegetation (SANBI,2018)	Makhado sweet bushveld	Makhado sweet bushveld	Makhado sweet bushveld	Makhado sweet bushveld	Makhado sweet bushveld	Polokwane plateau bushveld	Mixed bushveld
Population	1539	1301	1371	1013	1818	705	2348
No. of households	454	330	353	253	439	176	577
Household size	3.4	3.9	3.9	4	4.1	4	4.1
HH with piped water	0.7%	10%	4%	41.3%	0.7%	1.7%	1.4%

(Source: STATS SA, 2011ab)

Aganang is a rural municipality with a population of 131 164 and 33 918 households in 106 villages divided by 18 wards that are under the jurisdiction of four tribal authorities (STATS SA, 2011a). All the study villages were part of the former Lebowa homeland. The municipality has an average of 4 people per household and most households (56.2%) are female headed. The majority population group in black African at 99% and the most spoken language is Sepedi at 88.8% followed by IsiNdebele (5%), Xitsonga (2.6%) and others (3.6%). Villages in this municipality are characterised by low levels of education and skills, economic inactivity and high dependence on government grants (STATS SA, 2011a). 37% of the population is between the ages of 0 and 14 years, 10% is elderly (over 65) while 52.7% are in the working age (15-64) (STATS SA, 2011). However, the unemployment rate is 50.4% with youth unemployment standing at 65% (STATS SA, 2011a). Only a percentage of the population has degree qualification while 21.4% of the population above the age of 20 has a matric and 15% has no schooling (STATS SA, 2011a). Many of the households (29%) in this municipality have an

income range of between R9 600 – R19 600 while 13.2% have no income at all. Aganang has a negative economic growth rate of -1.13% (STATS SA, 2011a). The most economic contributions come from the government services sector (40.3%), followed by finance and business sector (15.9%) and catering and accommodation (10.8%) (STATS SA, 2011a). Over 90% of villages have access to electricity. However, the biggest challenges villages in this municipality face are lack of sanitation and water accessibility for domestic and agricultural use (Aganang Local Municipality, 2009).

1.11.2 Polokwane district municipality

Polokwane is one of five municipalities in the Capricorn district. It has a size of 3765.98 km² and it is located at the centre of the province (Polokwane Local Municipality, 2016). It shares its name with Polokwane which is the biggest town in the province and located within the municipality. It is surrounded by Aganang and Molemole municipalities to the north, Greater Tzaneen to the east, Lepelle-Nkumpi in the south and Mogalakwena in the west. The vegetation type is dominated by the Polokwane plateau bushveld with small patches of the Mamabolo mountain bushveld in the east, the Makhado sweet bushveld in the east and the Strydpoort summit sourveld in the south (SANBI, 2018). The municipality is characterised by wet summers (November to February) and dry winters (May to August). The mean maximum temperature for Polokwane is 28.5 °C and a mean annual precipitation of 575 mm (Mucina & Rutherford 2006).

Table 1.3: Polokwane village profiles

Characteristics	Villages							
	Manamela	Ramakgaphola	Mamadila	Machoane	Thansa	Mphela	Ditenteng	Lonsdale
Village Area	Moletjie	Moletjie	Moletjie	Moletjie	Moletjie	Moletjie	Moletjie	Moletjie
Latitude	23°42'40" S	23°45'11" S	23°47'42" S	23°42'06" S	23°40'30" S	23°41'04" S	23°40'36" S	23°36'39" S
Longitude	29°13'46 E	29°13'38 E	29°12'58 E	29°14'05 E	29°15'55 E	29°14'57 E	29°13'44 E	29°09'38 E
Altitude	1260m	1280m	1300m	1240m	1200m	1300m	1230m	1200m
Avg max Temp	28.5°C	28.5°C	28.5°C	28.5°C	28.5°C	28.5°C	28.5°C	28.5°C
MAP	578mm	578mm	578mm	578mm	578mm	578mm	578mm	578mm
Vegetation (SANBI,2018)	Polokwane plateau bushveld	Polokwane plateau bushveld	Polokwane plateau bushveld	Polokwane plateau bushveld	Makhado sweet bushveld	Polokwane plateau bushveld	Polokwane plateau bushveld	Makhado sweet bushveld
Population	1355	1525	1295	3723	843	698	1207	2230
No. of households	323	380	317	836	281	178	258	552
Household size	4.2	4	4	4.4	3.9	3.9	4.6	4
HH with piped water	44.3%	3.9%	2.2%	1.6%	1.5%	27.5%	1.2%	4.5%

(Source: STATS SA, 2011ab)

It is the most populous municipality in the province with a population of 628 999 and the second most populated in the country (STATS SA, 2011b). It is also a mostly rural municipality with 78% of the population residing in rural villages (Polokwane Local Municipality, 2016). Polokwane municipality has 178 001 households and an average household size of 3.4 people (STATS SA, 2011b). Unlike Aganang, most households (56.2%) are headed by males. 92.9% of the population is black African and 80% speak Sepedi as their home language followed by Afrikaans (5%) and English (3%) (STATS SA, 2011). 30% of the population is young and 5% is elderly while 65% is in the working age (STATS SA, 2011b). The unemployment rate is at 32.4 % while youth unemployment stands at 42% (STATS SA, 2011b). The municipality has several public schools and tertiary institutions notable the University of Limpopo, University of South Africa, and Tshwane University of Technology. 3.6% of the population has a higher education qualification, the majority (38%) have some primary education while 2% have no schooling (STATS SA, 2011b). 13.8% of households not have income while the majority (19.7%) have an income between R19 601 – R38 200 (STATS SA, 2011b). The economic growth of the municipality is 2.13%.

1.11.3 Village selection

There was a total of 15 villages selected for study; seven were in Aganang and eight in Polokwane municipality. Study villages were selected firstly, because they were under the respective jurisdiction of the Moletjie and Matlala tribal authorities in the Polokwane and Aganang municipalities, respectively. Moletjie and Matlala area village areas that are each comprised of over 30 villages which are all under their respective jurisdiction. Villages also formed part of the former Lebowa Bantustan, which were areas the previous Apartheid regime used to segregate black people to and used primarily as labour reservoirs for white-owned farms and mines (Rogerson & Letsoalo, 1981). These areas today are typically characterised by poor living conditions such as poor roads and infrastructure, lack of water and sanitation, poor economic development, and high unemployment (Census, 2011). Most importantly villages were selected because generally, rural areas have a higher frequency of WEPs consumption and use. This section will provide a detailed description of how and why villages were selected for each individual result chapter.

Chapter 2 assessed changes relating to the consumption of WEPs. Due to the small sample size of 20, only two villages were selected. Manamela and Ramakgaphola were purposefully selected because they are two of the oldest villages in the area where it was likely to find elderly participants who have been residing in villages their whole lives. This was important because it was used to compare and assess their past and current use and consumption of WEPs.

Chapter 3 explored perceptions and attitudes relating to the use and consumption of WEPs from different age, gender, and income groups. Four villages namely Manamela, Machoane, Ditenteng and Rametlwane in the Moletjie area were randomly selected. Villages are large with population of over 1000 people and over 250 households (table 1.2 and 1.3). The choice of four villages was determined based on sample size of 120 to which selecting 30 participants from each village was seemingly a fair sample size.

Chapter 4 provided information of the different fruit and vegetable species available and abundant in rural home gardens. Eight villages namely Manamela, Ramakgaphola, Mamadila, Thansa, in the Polokwane Municipality and Maupye, Juno, Goedgevonden and Hwibi in the Aganang Municipality were selected. Initially, a target of 120 households in ten villages (five from each municipality and twelve households from each village) was set. The target of twelve households per village was determined by the need to avoid spending too much time in a single

village due to the length of the questionnaires. The target of ten villages was determined by the need to cover a wider geographic area in both municipalities. However, due to unforeseen circumstances relating to village access by tribal authorities only eight villages were sampled.

Chapter 5 provided insights regarding the indigenous knowledge people obtained regarding WEPs. Like Chapter 3, participants were stratified by age, gender, and income groups. Four villages namely Mphela, Lonsdale, in the Moletjie area and Mabopane and Tibane in the Matlala area were randomly selected. Like Chapter 3, the selection of four villages was determined based on sample size of 120.

1.12 Research Design

This research employed a mixed method approach for data collection. The methods for data collection in this study included a combination of ethnobotanical and qualitative methodologies such as household surveys, field surveys, freelists, semi-structured interviews, observations, and in-depth interviews. A mixed method research approach involves the collection of both quantitative and qualitative data in response to the research questions (Creswell, 2014). The two forms of data collected are then combined to form interpretations during the analysis. The timing of the collection of data (collecting one type of data sequentially or concurrently) is also an important procedure of this research approach (Creswell, 2014). This research method has gone through periods of developments such as a formative stage, philosophical debates, and procedural development among many others; this approach is used in different disciplines in many countries (Creswell, 2014).

A mixed method approach is chosen because it utilises the strengths of both qualitative and quantitative whilst minimising their limitations. Having access to both qualitative and quantitative data can be beneficial in several ways. Using both data allows for comparison to be made between different perspectives and quantitative results can be explained by following up with qualitative results and analysis (Creswell, 2014). There are challenges to using this approach as it requires extensive data collection and it is also time consuming to analysing both qualitative and quantitative data.

There are different types of mixed methods, this includes convergent parallel, explanatory sequential, and exploratory sequential research approach. In this study, the convergent parallel mixed method approach was employed for data collection (Figure 1.3). This method involves collecting qualitative and quantitative data separately then comparing results to see if the

findings corroborate each other (Creswell, 2014). With this approach, qualitative and quantitative data can be collected simultaneously or sequentially but analysed separately without one form of analysis informing another. The key idea is to collect both qualitative and quantitative data using the same variables or concepts (Creswell, 2014). The assumption is that both methods will yield different types of information with qualitative data producing detailed views, narrations, or explanations while quantitative data provides numbers, frequencies, and scores (Creswell, 2014). However, the different types of information provided by both methods should yield similar results.

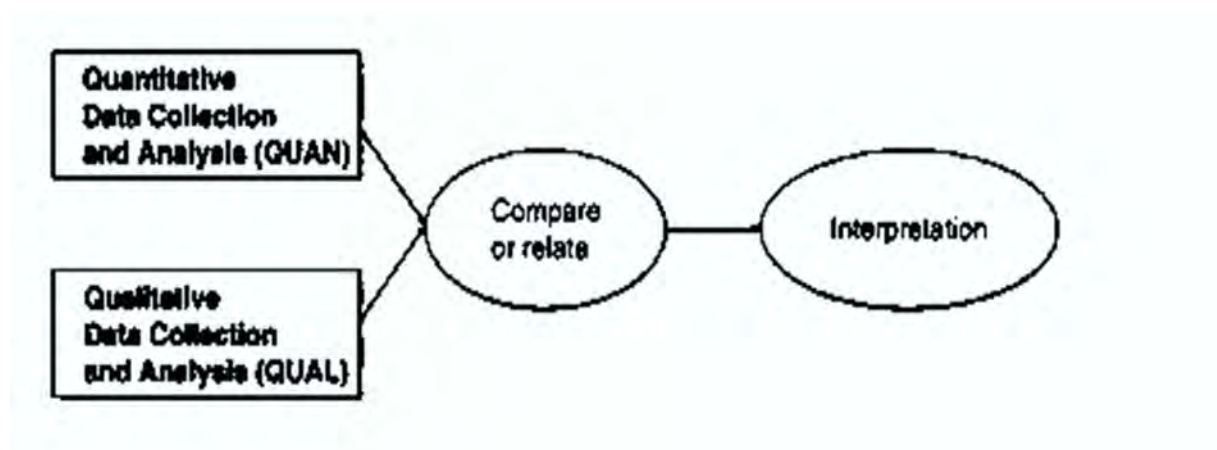


Figure 1.3: Convergent parallel mixed method approach (Source: Creswell, 2014)

1.13 Ethics

This research will comply to the Rhodes University policy of ethics. Access will be negotiated and potential participants will be presented with a consent form which explains what the study is about and how they could assist. During the data collection process participants' independence will be respected and their privacy will be protected. Their right to refuse and/or pull out from the research will be respected and upheld. The research will be transparent and honest to participant in terms of potential risk or benefits. After the data collection process, the researcher will also uphold reliability and honesty by not distorting the views of participants during the data analyses process.

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Chapter 2

Assessing Changes in Wild Edible Plant Consumption and Cultural Use: A Life History Approach

2.1 Introduction

Human diets have been changing over the past thousands of years (Jew *et al.* 2009). Humans have been through diets dominated by fruits and vegetables, lean meats, seafoods to processed foods containing high levels of fat, sodium and low levels of fiber (Jew *et al.* 2009). The choice people make regarding what foods to consume is dictated by a multitude of factors. These are related to a wide range of environmental, cultural, economic, and personal preferences (Kuhnlein *et al.* 2013). The influence of ecology and culture on indigenous peoples' traditional food systems is strong. Their hunting and gathering traditions are important for their dietary diversity and their knowledge about the natural environment where they source their foods from, has given them a reputation as monitors of environmental health and species diversity (Kuhnlein & Receveur, 1996; Turner *et al.* 2013). However, in many parts of the world, indigenous people's diets have undergone rapid changes in a process that is described as "nutrition transition" (Keding, 2016; Mbogoni & Muchera, 2019).

Studies of traditional food systems in Southern Africa and around the world show that indigenous peoples consumed a balanced diet from hunting or keeping animals and gathering and cultivating plants. Examples include the studies by Lee (1984) of the !Kung bushmen of the Kalahari desert in Botswana whose diet resembled a Paleolithic diet comprised 35% of energy from some 54 species of game meat and 65% of energy from 85 species of wild plants. Studies of the Nuxalt of British Columbia also show that they consumed a diet of fish, game, beach foods, cultivated fruits and vegetables, berries, and wild greens (Kuhnlein *et al.* 2013). Consumption of these traditional foods depends on seasonality and availability (Kuhnlein, 2014; Powell *et al.* 2013). Additionally, studies of indigenous African people in South Africa show that their diet was typified by hunted animals, wild plants, cultivation of food crops and kept livestock as an essential part of their culture (Fox & Norwood-Young, 1982). For example, the Xhosa people's diet was described as rich in milk and meat, cultivation of corn and millet, gathering of wild onions, roots, and berries (Alberti, 1968). Similarly, the Pedi cultivated crops

such as sorghum, millet and *Citrullus lanatus*; gathered indigenous wild plants such as *Amaranthus spp*, *Cleome gynadra* and indigenous fruits like *Sclerocarya birrea*, *Ximenia caffra* and *Vangueria infausta*; they kept livestock and sometimes hunted. They also indulged in insects such as Mopani worms, grasshoppers, bugs and more (Quin, 1964). This diet was regarded as healthy, adequate, and diverse, thereby limiting diseases and malnutrition (Quin, 1964). As a result of western influence, many of these foods have been ignored culminating in nutritional and cultural changes with implications for health. It is uncertain when western influence started to have an impact on the traditional African diet. However, scholars started reporting African farmers introducing foreign crops such as maize, peanuts, and pumpkins as part of their cultivated crops several centuries ago (Quin, 1964; Fox and Norwood-Young, 1982), thus, marking a significant period of dietary change. These changes were gradual but according to Viljoen *et al.* (2005), they picked up momentum from the mid-1960s where more western eating patterns and food choices were adopted accompanied by increased urbanization, market integration and declining cropping.

There are several causes of dietary change that indigenous people can go through. Dietary change can be caused by climate change, economic change, cultural change, or political change (Kuhnlein, 2014; Kuhnlein & Chotiboriboon, 2022). In South Africa, dietary change of indigenous Africans was arguably largely triggered by economic and political change where discriminatory and coercive means were used to dismantle African agriculture (Bundy, 1972). It is difficult for indigenous people to retain their cultural practices in the face of discrimination, oppression and marginalisation; an experience that is familiar with colonised indigenous people around the world (Kuhnlein & Chotiboriboon, 2022).

In South Africa, after the discoveries of gold and diamond, capitalist interests had a vested need for cheap labour (Suping, 2022). A type of exploitation emerged in Southern Africa where black rural communities were dispossessed of their land and confined to small enclaves called 'homelands' whose primary purpose was to supply labour for mines, settler farms and later for the manufacturing industry (Amin, 1973; Rogerson & Letsoalo, 1981). Most of the population was confined to 13% of the land and as population steadily increased in these areas, the number of kept livestock increased too (Bundy, 1972; Fox & Norwood-Young, 1982). Consequently, overstocking and overgrazing were inevitable, and together with the use of steel ploughs, led to the degradation of the soil (Fox & Norwood-Young, 1982). To improve these conditions, the state introduced betterment planning where programs of stock culling, land reallocation and

restrictions of ploughing land were enforced (Rogerson & Letsoalo, 1981). For the majority, these regulations characterised by unequal land reallocations meant that agricultural livelihoods were no longer viable (Rogerson & Letsoalo, 1981). There were reports of declining yields and African rural families were no longer able to sufficiently provide for their own needs but could only subsist with remittance wages from migrant labourers (Bundy, 1972; Rogerson & Letsoalo, 1981). This means that indigenous Africans transitioned from being cultivators, animal herders, and gatherers of wild foods to being urban dwellers who can neither cultivate lands, keep animals nor gather wild foods and whose primary source of food is the urban trading store (Fox & Norwood-Young, 1982).

Dietary changes and food consumption patterns continued to shift for decades leading to 1994. However, changes were dissimilar for urban and rural households. For example, urban residents increasingly adopted a western eating pattern such as having three meals a day and a diet with an increased intake of meat, milk, sugar, bread, soft drinks, fat, and tinned foods (Viljoen *et al.* 2005; Walker, 1996; Ronquest-Ross *et al.* 2015). In rural households, a traditional eating pattern of two meals a day was still followed except for school going children who consumed three meals (Crous & Borchardt, 1986; Oudkerk, 1965). Maize meal consumed with cultivated or wild vegetable as a relish was still the main meal for rural households whilst meat and bread were consumed a few times per month (Viljoen *et al.* 2005). After 1994, certain changes unfolded that had an impact on food consumption patterns such as increasing urbanization, rising per capita incomes and the increasing growth of supermarkets even in rural towns (WWF, 2012). To assess the impacts of these changes on food consumption, studies were conducted to investigate the commonly consumed foods by South Africans, including studies specific to black South Africans (Ronquest-Ross *et al.* 2015; Viljoen *et al.* 2005). These studies revealed that South Africans have shifted to a diet of increased meat intake, processed packaged foods, edible oils, sweetened beverages, and decreased fruit and vegetable consumption (Ronquest-Ross *et al.* 2015). This shift has major consequence for public health as these food choices contribute to increasing occurrence of diabetes, obesity, heart diseases and other non-communicable diseases (Kruger *et al.* 2005; Pretorius *et al.* 2012; Ronquest-Ross *et al.* 2015; Keding, 2016).

From this overview, traditional food consumption practices have undergone major shifts over the past few decades. The changing economic and political landscape which resulted in deagrarianisation, urban migration and a shift to a cash-based economy is largely liable for

changes in food choices and consumption. With most dietary changes reported to be prominent in urban areas, it begs the question of to what extent have the consumption of traditional foods (wild fruits and vegetables) changed in the modern rural household. In the face of increasing urbanisation, westernisation, and increasing reliance of food from retail stores; this study assessed changes of WEPs consumption and use in rural households. The objectives of this study were to: (1) compare the household consumption patterns of WEPs in the past and present; (2) compare the consumption of WEPs during traditional ceremonies in the past and present; (3) evaluate factors responsible for driving changes in WEPs consumption in rural households.

2.2 Study Area

Refer to Chapter 1 for detailed information on study areas.

2.3 Methods

A life history interview is a method that requires the research participant to look back at the events and details of their entire life (Bryman, 2012). This includes their experiences, and how they define, understand, and interpret the world around them (Faraday and Plummer, 1979 cited in Bryman 2012). The adoption of the life history approach for this study was done to gain a better understanding of the participants' WEPs consumption and cultural use over the period of their life. The interviews were conducted with twenty elderly citizens over the age of 60 in two villages namely Manamela and Ramakgaphola. These participants were selected because they could provide a long-term overview of WEPs consumption through personal experiences, stories, and narratives.

2.3.1 Sampling

Access to the villages was negotiated with the respective village headmen. Snowball sampling was used to select individual participants older than 60 years. Snowball sampling is a method where the initial identified participants are asked to identify others who share the same characteristics (Matthews & Ross, 2010). A semi-structured interview schedule was prepared and used as a guide for the interviews but an open, conversational approach was adopted. The schedule was divided into sections that were centered around a theme. The themes were 1) childhood and family background, 2) tradition and WEPs use, 3) current WEPs use, 4) changes in WEPs use and 5) future of WEPs use.

Twenty elderly citizens were interviewed, ten per village (Manamela and Ramakgaphola). The interviews were conducted during June 2018. Twelve were female and eight were male. Interviews were conducted in one session of 1 -2 hours at the participants' homes. Interviews were conducted in the local language of Northern Sotho which the researcher is fluent with. After permission was granted, interviews were recorded on a tape recorder and were later transcribed and translated.

2.3.2 Data Analysis

After the interviews were transcribed, they were transferred into Atlas ti to code transcripts and categorise codes into categories and themes as the basis for thematic analysis. Thematic analysis is defined as a process of working with data through categorising and segmenting prior to final interpretation (Grbich, 2007). Qualitative analysis is about getting a better understanding of words, stories, and explanations of the research participants (Matthews & Ross, 2010). Additionally, a Sorenson index was calculated to determine the level of similarity between food species consumed in the past and the present. A Sorenson index is a measure of similarity or overlap between two sets (Sorenson, 1948). It ranges from 0 to 1; with the value of 0 indicating no overlap and the value of one indicating a complete overlap or similarity (Sorenson, 1948). The Sorenson index is calculated using this formula: $\text{Sorenson index} = (2 \times |A \cap B|) / (|A| + |B|)$. $|A \cap B|$ represents the number of overlapping elements and $|A|$ represents the cardinality of set A and $|B|$ represents the cardinality of set B.

2.4 Results

2.4.1 Participant Profile

There were 12 female (60%) and eight male (40%) participants. Their ages range from 61 to 100 with an average age of 75 ± 9.6 years. Almost half of the participant (45%) indicated primary schooling as their highest level of education, while 40% had attained some secondary level education and the remaining 15% reporting no schooling. All the participants are retired, and they are recipients of social grants as their main source of income. Only 15% are involved in farming or other businesses as an additional source of income. The average household size is 7.2 ± 2.5 people ranging from three to 13 members.

Table 2.1: Summary profile of participants

Variable	Category	No.	(%)
Gender	Male	8	40
	Female	12	60
Education	No Schooling	3	15
	Primary	9	45
	Secondary	8	40
Childhood residence	Current village	13	65
	Peri-urban	1	5
	Other village	6	30
Age	Mean $\pm$ SD	75 $\pm$ 9.6	
Household size	Mean $\pm$ SD	7.2 $\pm$ 2.5	

2.4.2 Childhood background

Most of the participants were born in the village they are currently residing in (n=13) while others come from neighboring villages (n=1), peri-urban areas (n=1) or other villages (n=5). Their parents were mostly farmworkers (both parents), whilst mothers were domestic workers fathers were farmers, mineworkers or carpenters. Most of the participants grew up in the village while the remaining few grew up on white-owned commercial farms or in urban townships. Those who grew up in the village reminisced on how simple life was when they were young. They described villages as lush, green, and where agricultural activity was high. Although, they bemoaned a lack of services such as easy access to water and electricity that they enjoy today; they commended the livable state of the community devoid of current social ills like child abuse, violence, and crime. They described communities as safe, lawful and where children were not out of control.

“It was really nice growing up here although very different from how it is now. We used to dig for water at a well unlike getting it from a tap. So, we would line up in the morning, help each other collect water, carry it with containers on our heads and walk a long distance to get home.” - Participant 12

“It was a rural village, it was very green, because the rainfall was good back then. It was very agricultural. It was very difficult growing up then. There was no electricity, women fetched water from a local river. Women would use tins. The river was too far, and the water

was not of good quality, we grew up drinking that dirty water, cows would pee into the water. But we did not get sick...” - Participant 15

“It was alright, it was safe, we did not fight, we did not carry knives, there was very little violence”. – Participant 4

Participants who grew up on white-owned farms told a different story. These were people whose land has been dispossessed and compelled to work on farms to make a living. They worked on farms and their payment was being allowed to stay on the farm. They give accounts on how they were treated. The long working hours they endured and the harsh conditions they lived under.

“My parents were farm workers; they worked the land. They did not have tractors then, they used cows to prepare the land for planting. They worked for a white farmer. The farm produced potatoes and maize. Picked potatoes were categorized according to their size. My parents were treated badly, they worked long hours under the hot sun. If you mess up with the categorization of the picked potatoes, you get beaten.” – Participant 10

Being allowed to stay on the farm did not necessarily mean shelter was guaranteed. Families that lived on farms either had shelter built for them on the farm or they were allocated a piece of land to build their own shelter. *“It was a rondawel house that we built ourselves, the farmer did not contribute anything, because us living on his land was enough for him not to contribute.”* (Participant 10). People in the past built their rondawel shelter with mud bricks and used thatch for roofing. Most of the participants described their childhood homes this way. The houses would be painted and decorated using clay. Others used wood as the structure of the house and used mud to cement the wood in place. These structures still exist in many rural households to this day, often as a kitchen where cooking takes place.

Participants mentioned that their families were typically big in those times. The highest number of household members mentioned was 11 and the lowest was five; the average number of household members was 7 ± 1.70 . Participants had, on average, four siblings making a total of five children that their parents had. They would also stay with their grandparents or other extended family members as additional members of the household. Some participants mentioned that they were the only male or female child in the family which meant that the role boys or girls performed relied solely on them. Boys were responsible for herding cattle, whilst

girls were responsible for household chores like assisting with fetching water, collecting firewood, collecting wild vegetables and assisting with cooking.

“When girls come back from school, they had to go into the garden to collect wild vegetables. In the past when a baby is born, when people ask about the sex of the baby if it’s a girl they say “ oh, she will collect wild vegetables for us” if it’s a boy they say “oh, he will herd livestock for us.” - Participant 16

There were instances where a household did not have a boy or a girl to perform those gendered roles. In those cases, one of two things might have happened; either the boy/girl will perform the role of the other or the family might ask the neighbors if their child can perform those roles. For example, if there was no boy in a household, one of the girls in the household might perform the boy roles like milking cattle, or the family might ask one of the neighbour’s sons to herd their cattle for them.

“When I started growing up, I used to go fetch water with a tank. My mother told me it was time I learned to cook. I learned to iron and do laundry. This went on until it became part of my chores, I was a boy but I did girls work. It was only when I went to school that she would cook for us. So back then, as boys we still had to look after livestock. Our parents had sent a message to the school to release boys at 10 am to go look after livestock. But we did this in turns”. Participant 17

“They taught us how to milk a cow. If there was no boy in your family, you as a girl will have to teach yourself.” Participant 7

“If the neighbour’s did not have a boy child who can herd their cattle, they would go and ask if the neighbour’s boy can herd their cattle too, in exchange for labouring at the neighbour’s fields”. Participant 18

The quotations above demonstrate the importance that gender plays in the traditions and the ways of living of the past. These gender roles were not fixed but could change and adapt to different situations as demonstrated above. The different roles girls and boys performed also had some effect on the food that they ate.

2.4.3 WEP Use

2.4.3.1 General diet

2.4.3.1.1 General diet in the past

Participants listed a total of 29 species of foods that they consumed in the past. The list includes grains like maize (*Zea mays*), sorghum (*Sorghum bicolor*), pearl millet (*Pennisetum glaucum*), cowpea (*Vigna unguiculata*), and bambara groundnuts (*Vigna subterranea*). Wild leafy vegetables included: cleome (*Cleome gynandra*), amaranthus, cowpea leaves, and jews mallow (*Corchorus olitorius*) amongst others. Wild fruits such as marula (*Sclerocarya birrea*), red milkwood (*Mimusops zeyheri*), wild medlar (*Vangueria infausta*), stem fruit (*Englerophytum magalismontanum*) and sourplum (*Ximenia caffra*) amongst others (Table 2.2). Meats such as chicken, beef, pork, and mutton. These foods came from a variety of sources.

Table 2.2: List of species consumed in the past

Food types	Species	Local Name	Part Used	Wild/Cultivated	Source	Current supply
Grains	<i>Pennisetum glaucum</i>	Leotja	Seeds	Cultivated	Plantation	Abundant
	<i>Zea mays</i>	Mafela/Mmidi	Seeds	Cultivated	Plantation	Abundant
	<i>Sorghum bicolor</i>	Mabele Thoro	Seeds	Cultivated	Plantation	Abundant
Legumes	<i>Vigna subterranea</i>	Dinawa	Seeds	Cultivated	Plantation	Abundant
	<i>Vigna unguiculata</i>	Ditloo marapo	Seeds	Cultivated	Plantation	Abundant
Vegetables	<i>Amaranthus retroflexus</i>	Theepe	Leaves	Wild	Home garden	Abundant
	<i>Bidens pilosa</i>	Mokolonyane	Leaves	Wild	Home garden	
	<i>Citrullus lanatus subs. citroides</i>	Motšhatšha	Leaves/seeds	Cultivated	Plantation	Abundant
	<i>Cleome gynandra</i>	Lerotho	Leaves	Wild	Home garden	Abundant
	<i>Corchorus olitorius</i>	Thelele	Leaves	Wild	Fields	Abundant
	<i>Cucumis zeyheri</i>	Monyaku/Moraka	Leaves/Fruit	Cultivated	Home garden	Abundant
	<i>Cucurbita maxima</i>	Lephotse/Mophotse	Leaves/Fruit	Wild	Home garden	Abundant
	<i>Ipomoea batatas</i>	Potata	Tuber	Cultivated	Plantation	Abundant
	<i>Spinacia oleracea</i>	Sepinatshe	Leaves	Cultivated	Home garden	Abundant
	<i>Vernonia fastigiata</i>	Lehlanye	Leaves	Wild	Fields	Scarce
	<i>Vigna unguiculata</i>	Monawa	Leaves	Semi	Plantation	Abundant
Fruits	<i>Sclerocarya birrea</i>	Marula	Fruit/Kernels	Wild	Fields	Abundant
	<i>Mimusops zeyheri</i>	Mmupudu	Fruit	Wild	Mountain	Scarce
	<i>Vangueria infausta</i>	Mabilo	Fruit	Wild	Fields	Abundant
	<i>Englerophytum magalismontanum</i>	Mohlatswa	Fruit	Wild	Fields	Scarce
	<i>Ximenia caffra</i>	Motšhidi	Fruit	Wild	Fields	Scarce
	<i>Carissa bispinosa</i>	Dithokolo	Fruit	Wild	Fields	Scarce
	<i>Citrullus lanatus</i>	Legapu/dithotse	Fruit/seeds	Wild	Plantation	Abundant
	<i>Citrullus lanatus subs. citroides</i>	Lerotse	Fruit	Semi	Plantation	Abundant
	<i>Grewia flava</i>	Moretlwa	Fruit	Wild	Fields	Scarce
	<i>Ziziphus mucronata</i>	Mokgalo	Fruit	Wild	Fields	Scarce
	<i>Euclea crispa</i>	Mokwerekwere	Fruit	Wild	Fields	Scarce
	-	Ditlowane	Fruit	Wild	Fields	Scarce
	-	Ditlontlodi	Fruit	Wild	Fields	Scarce

Participants also listed other foods such as watermelon, pumpkin, sugarcane, sweet potatoes, and spinach which they grew in their home gardens. Watermelon and pumpkin seeds were also consumed. Insects such as mopani worms and grasshoppers were also a regular part of their diet. Livestock was kept in a kraal in the homestead; grains were grown in home gardens and in fields; wild leafy vegetables were collected from the wild and some grew around the home gardens and wild fruits were collected from the wild.

“There was maize, wild leafy vegetables, Lerotse melon, pumpkin, sugarcane, watermelon and sweet potatoes growing in our home garden. But our main crop was maize.”

- Participant 20

“We had Mabele (sorghum) they would grind and filter them. Our everyday porridge was from Mabele and Leotja (Pearl Millet). The white maize meal came after, the dominant crop around the village was Mabele. We had Lehlanye (Vernonia fastigiata), Theepe (Amaranthus) and Lerotho (Cleome) growing too.” - Participant 15

From the list of the available foods, it appears that the consumption of grains and wild leafy vegetables was common in those days. These two types of foods can make a meal that could be consumed throughout the day. Grains (sorghum, maize, or pearl millet) can be cooked with water to make a porridge. This is a staple food which is consumed in a variety of meals. Wild leafy vegetables are eaten as a relish and a variety of such leafy vegetables are eaten interchangeably to form part of different meals. Sometimes watermelon or pumpkin seeds were eaten as substitutes for wild leafy vegetables. Porridge was also eaten with milk and sometimes with meat depending on the occasion.

“We ate porridge, wild vegetables and milk. That was our diet. I preferred porridge and milk. But my favorite wild vegetables were Cleome and Mophotse (pumpkin leaves).” -

Participant 19

“We ate wild leafy vegetables for a living, even when we came back from school, we would eat them..., even if you get tired what else can you eat? When we went to school you took a piece of porridge and ate it with wild vegetable even when you came back you eat the same thing.” - Participant 1

“...today you eat the bitter Mohlanye (Vernonia fastigiata), tomorrow you eat Monawa (Cowpea leaves) or Mochacha (Lerotse Melon leaves). You can't choose that you want this

particular wild vegetable because you eat what is cooked and eaten by the whole family”. - Participant 5

Since boys were responsible for herding cattle, it was common for them to eating and drinking milk, while it was common for girls to consume wild vegetables. However, this does not mean that these were the respective sole diets of males and females. Males also ate wild vegetables and females drank milk too. Additionally, when boys were herding livestock they collected wild fruits, and girls collected wild fruits on their way to school or when they went to collect fire wood or water from the river.

“We ate sorghum porridge and wild vegetables, but we as boys usually ate porridge and either cow or goat milk. These are the foods that boys were supposed to eat at that time.” - Participant 2

“I used to go herd cattle with the boys, that’s when we collected Ditlowane and Ditlontlodi, we dig them from the ground, and they don’t require cooking. So, we did not starve when we were in the fields herding cattle.” Participant 9

“When we were young, we would go to the river to pick Mabilo, and pick Marula from the ground, Dithokolo and Dikwerekwere. And when we went to collect firewood, we would also bring along Dikgokgothwane.” Participant 17

2.4.3.1.2 Current general diet

Participants listed a total of 73 foods species from different food groups that form part of their current general diet in addition to what they consumed in the past. Their diet is now comprised of baked goods, grains, dairy, meats, fruits, and vegetables (including WEPs). There has been a significant upsurge in consumption of fruits and vegetables that now form part their diet, such as cabbage, beetroot, tomatoes, onions, and wild leafy vegetables such as *chomolia*. Rural home gardens are dominated by fruit trees such as mangoes, avocado, oranges, bananas, and guavas, amongst others, which were previously not consumed. Furthermore, their meals contain more meat products than before.

“Tea and bread for breakfast, for supper we eat porridge and meats (chicken feet, necks, intestines, canned fish) but we do sometimes eat wild leafy vegetables.” - Participant 10

“Here we eat a lot of things that are going to make us sick (laughs). On Monday we eat chicken intestines, Tuesday chicken feet, Wednesday kidneys, Thursday chicken livers, Friday main chicken pieces. That’s the whole chicken. But personally, I like porridge and wild leafy vegetables, the leafy vegetable here is the dried one so, when you dry it, it loses its nutrients and vitamins. The dried leafy vegetable is used when there is nothing else to eat, it is not eaten because it has nutrients.” - Participant 6

Table 2.3: List of species consumed currently

Food types	Species	Local Name	Part Used	Wild/Cultivated	Source	Current supply
Grains	<i>Zea mays</i>	Mafela/Mmidi	Seeds	Cultivated	Plantation	Abundant
	<i>Sorghum bicolor</i>	Mabele Thoro	Seeds	Cultivated	Plantation	Abundant
Legumes	<i>Vigna subterranean</i>	Dinawa	Seeds	Cultivated	Plantation	Abundant
	<i>Vigna unguiculata</i>	Ditloo marapo	Seeds	Cultivated	Plantation	Abundant
Vegetables	<i>Amaranthus retroflexus</i>	Theepe	Leaves	Wild	Home garden	Abundant
	<i>Bidens pilosa</i>	Mokolonyane	Leaves	Wild	Home garden	
	<i>Citrullus lanatus subs. citroides</i>	Motšhatšha	Leaves/seeds	Cultivated	Plantation	Abundant
	<i>Cleome gynandra</i>	Lerotho	Leaves	Wild	Home garden	Abundant
	<i>Corchorus olitorius</i>	Thelele	Leaves	Wild	Fields	Abundant
	<i>Cucumis zeyheri</i>	Monyaku/Moraka	Leaves/Fruit	Cultivated	Home garden	Abundant
	<i>Cucurbita maxima</i>	Lephotse/Mophotse	Leaves/Fruit	Wild	Home garden	Abundant
	<i>Ipomoea batatas</i>	Potata	Tuber	Cultivated	Plantation	Abundant
	<i>Spinacia oleracea</i>	Sepinatshe	Leaves	Cultivated	Home garden	Abundant
	<i>Vernonia fastigiata</i>	Lehlanye	Leaves	Wild	Fields	Scarce
	<i>Vigna unguiculata</i>	Monawa	Leaves	Semi	Plantation	Abundant
	<i>Convolvulus farinosus</i>	Motantane	Leaves	Wild	Fields	Abundant
	<i>Cucurbita pepo</i>	Mophotse	Leaves	Cultivated	Home garden	Abundant
	<i>Gymnosporia senegalensis</i>	Mophato	Leaves	Wild	Fields	Abundant
	<i>Oxygonum sinuatum</i>	Tshehlo	Leaves	Wild	Fields	Abundant
	<i>Citrullus echinrhosus</i>	Phara	Leaves	Semi	Home garden	Abundant
	<i>Cucumis hirsutus</i>	Senotwanotwane	Leaves	Semi	Home garden	Abundant
	<i>Waltheria indica</i>	Mohutasele	Leaves	Wild	Fields	Scarce
	<i>Allium cepa</i>	Eiye	Tuber	Cultivated	Home garden	Abundant
	<i>Allium sativum</i>	Garlic	Tuber	Cultivated	Home garden	Abundant
	<i>Beta vulgaris</i>	Beetroot	Tuber	Cultivated	Home garden	Abundant
	<i>Brassica oleracea</i>	Khabetshe	Leaves	Cultivated	Home garden	Abundant
	<i>Brassica rapa</i>		Leaves	Cultivated	Home garden	Abundant
	<i>Cucurbita moschata</i>	Pumpkin	Leaves	Cultivated	Home garden	Abundant
	<i>Daucus carota</i>	Kherote	Tuber	Cultivated	Home garden	Abundant
	<i>Ipomoea batatas</i>	Potata	Tuber	Cultivated	Home garden	Abundant
	<i>Moringa oleifera</i>	Moringa	Leaves	Cultivated	Home garden	Abundant
	<i>Solanum lyopersicum L.</i>	Tamati	Fruit	Cultivated	Home garden	Abundant
	<i>Spinacia oleracea</i>	Speneche	Leaves	Cultivated	Home garden	Abundant
Fruits	<i>Sclerocarya birrea</i>	Marula	Fruit/Kernels	Wild	Fields	Abundant
	<i>Mimusops zeyheri</i>	Mmupudu	Fruit	Wild	Mountain	Scarce
	<i>Vangueria infausta</i>	Mabilo	Fruit	Wild	Fields	Abundant
	<i>Englerophytum magalismontanum</i>	Mohlatswa	Fruit	Wild	Fields	Scarce
	<i>Ximenia caffra</i>	Motšhidi	Fruit	Wild	Fields	Scarce
	<i>Carissa bispinosa</i>	Dithokolo	Fruit	Wild	Fields	Scarce
	<i>Citrullus lanatus</i>	Legapu/dithotse	Fruit/seeds	Wild	Plantation	Abundant
	<i>Citrullus lanatus subs. citroides</i>	Lerotse	Fruit	Semi	Plantation	Abundant
	<i>Grewia flava</i>	Moretlwa	Fruit	Wild	Fields	Scarce
	<i>Ziziphus mucronata</i>	Mokgalo	Fruit	Wild	Fields	Scarce
	<i>Euclea crispa</i>	Mokwerekwere	Fruit	Wild	Fields	Scarce
	<i>Boscia albitrunca</i>	Mohlopi	Fruit	Wild	Fields	Scarce

	<i>Grewia caffra</i>	Mofarelatshwene	Fruit	Wild	Fields	Abundant
	<i>Cyphostemma dasyleurum</i>	Mokgampule	Fruit	Wild	Fields	Scarce
	<i>Ehretia rigida</i>	Morobe	Fruit	Wild	Fields	Scarce
	<i>Euclea undulata</i>	Mokwerekwere	Fruit	Wild	Fields	Scarce
	<i>Ficus burkei</i>	Mokumo	Fruit	Wild	Fields	Abundant
	<i>Lannea discolor</i>	Mokgokgothwane	Fruit	Wild	Fields	Scarce
	<i>Lenthepu</i>		Fruit	Wild	Fields	Scarce
	<i>Cordia grandicalyx</i>	Mokankane	Fruit	Wild	Fields	Scarce
	<i>Sersia leptodictya</i>	Mohlohlo	Fruit	Wild	Fields	Scarce
	<i>Carica papaya</i>	Phopho	Fruit	Cultivated	Home garden	Abundant
	<i>Citrus limon</i>	Swiri	Fruit	Cultivated	Home garden	Abundant
	<i>Citrus unshiu</i>	Nariki	Fruit	Cultivated	Home garden	Abundant
	<i>Citrus x sinensis</i>	Namune	Fruit	Cultivated	Home garden	Abundant
	<i>Litchi chinensis</i>	Lichi	Fruit	Cultivated	Home garden	Abundant
	<i>Malus domestica</i>	Apola	Fruit	Cultivated	Home garden	Abundant
	<i>Mangifera indica</i>	Mango	Fruit	Cultivated	Home garden	Abundant
	<i>Morus nigra</i>	mulberry	Fruit	Cultivated	Home garden	Abundant
	<i>Musa acuminata</i>	Panana	Fruit	Cultivated	Home garden	Abundant
	<i>Persea americana</i>	Avocado	Fruit	Cultivated	Home garden	Abundant
	<i>Prunus domestica</i>	Plum	Fruit	Cultivated	Home garden	Abundant
	<i>Prunus persica</i>	Perekisi	Fruit	Cultivated	Home garden	Abundant
	<i>Psidium guajava</i>	Kwebere	Fruit	Cultivated	Home garden	Abundant
	<i>Punica granatum</i>	Garenate	Fruit	Cultivated	Home garden	Abundant
	<i>Pyrus communis</i>	Piere	Fruit	Cultivated	Home garden	Abundant
	<i>Vitis vinifera</i>	Terebe	Fruit	Cultivated	Home garden	Abundant
	<i>Ficus carica</i>	Feiye	Fruit	Cultivated	Home garden	Abundant

Wild edible plants are still relevant to the rural diet. However, their consumption is dictated by seasonal changes. During winter, their consumption is minimal because they are not available in the home garden hence people eat meats, cultivated vegetables like cabbage, and spinach. Even though dried wild leafy vegetables are consumed in winter, the frequency of consumption would be different from the rainy months when they are abundant in the home garden. The Sorenson index indicated that the similarity between species consumed in the past and the present is 0.55, indicating a moderate level of similarity.

“During leafy vegetable season we would on average eat two or three meals containing those leafy vegetables per week. They are delicious and its hard eating these meats, even my daughter is cooking it, I just feel like eating it sometimes, I prefer wild leafy vegetables. But we won’t go for a week without eating vegetables, we will eat cabbage or spinach. This is because the season for leafy vegetables has passed.” - Participant 3

Today, households do not have a monotonous diet like in the past. A household has different diets for different members. *Zea mays* is a staple crop used to make porridge and it is consumed alongside meat almost daily. Members mostly likely to be consuming meat are the youth. The elderly are selective on when they eat meat, they may eat it for only a few times per week. The frequency of household meat consumption is subjective and is dependent on which household member the question was posed to. Household members don't all eat the same meal, there are individual preferences.

"We eat porridge and meat almost every day now, what else can we eat? But during the rainy season when wild vegetables have grown in the home garden, we eat wild vegetables as a substitute for meat. I can also eat wild vegetables while the rest of the household eats meat. So, household members can eat what they like. If you want porridge with eggs you can, it's no longer like in the past when we were subjected to eating wild vegetables daily." - Participant 19

"...We can give meat a break. The rest of the family can be eating meat, but if I feel like I've been eating too much of it then I would eat my wild vegetables." – Participant 7

There are times when there is no option for other household members to avoid eating wild vegetables. This might happen when there is no meat or conventional foods to eat and all the members of the household then eat wild vegetables. In this case, according to the participant, usually the youth would prefer to prepare the wild vegetables in their own modern way. Traditionally, wild vegetables were cooked with just water and only salt was added. Today, wild vegetables are cooked with vegetable oil and a variety of ingredients such as tomatoes, onions, milk, or powdered soup, can be added to improve the taste, especially by the youth.

"Wild vegetables are cooked with water and you only put in salt. In the past there were no tomatoes to put in, but now there are and we add them. The youth cook them with oil, onion, and tomatoes, they say it's delicious. But I'll cook it the way I like it, with water and tomatoes." - Participant 6

"Yes, they now add tomatoes to wild vegetables, some people add milk or oil and peanut butter in Monawa." - Participant 11

Although some participants say they welcome the new ways of adding more ingredients to the wild vegetables they still also prefer the old ways of preparing wild vegetables. They say the

new modern way of adding ingredients creates diversity and new preferences for consuming wild edible plants. As a result, the new added ingredients have not really improved nor worsened WEPs meals, they diversified them instead.

“There is diversity, now aided by individual preferences. People can cook WEPs how they like, there is no improvement but personal preferences.” - Participant 7

“No, they have not improved, it boils down to preference at the concerned time, sometimes I want my wild vegetables traditionally cooked, another day I want it cooked the modern way.” - Participant 19

2.4.3.2 Traditional ceremony foods

Families participated in a variety of traditional ceremonies in the past. Traditional ceremonies could either be private, intimate family events or they could involve the community at large. Traditional ceremonies such as weddings and traditional dances involved the community, while funerals and ancestral ceremonies were private family affairs but may involve community members to some extent. The food that was served and consumed at these ceremonies was different from what was consumed daily and contributed to the overall diversity of the diet at that time. Today, families still participate in traditional ceremonies, although, these ceremonies have now become modernised. Weddings and funerals ceremonies have changed drastically, their practice is Christianised, and the associated meals have modernised. According to participants, ancestral ceremonial practices and traditional dancing have reduced, initiation schools are available in a few villages and Christian holidays and practices have now been assimilated as the new modern tradition.

2.4.3.2.1 Weddings in the past

Wedding were described as jubilant occasions where two families celebrated their unification with the rest of the community. Preparations for the event began a week prior, where an alcoholic beverage made from sorghum was brewed, and all the girls from the village would come every day of the week leading to the wedding to sing and clap in preparation for the welcoming of the bride. The day before the wedding, the sorghum beer would have fermented and when the bride arrives it would be ready to be served. According to Participant 11, when the bride arrives and is welcomed to her new home, she had to be covered in a blanket and crawl into her new home together with her bridesmaids who would be dressed in animal skins. During the wedding day, sorghum porridge will be served with beef and washed down with

sorghum beer. *“There would be no wild leafy vegetables served on the wedding day, on such a special occasion there were no people who would say they don’t eat meat, everybody will be eating meat”* said another participant. If the wedding happens during the marula season, then marula beer could also be served, added another participant.

2.4.3.2.2 Modern weddings

Today, families choose to either have white weddings, traditional weddings, or both. If both types of weddings are held, they can be held as a single event or separate events with either a traditional or white wedding held first and followed by the other. Participants also mention that today’s traditional weddings have evolved and are dissimilar to the traditional weddings of the past in practice and diet.

“The traditional wedding of the past as compared to the traditional wedding of today are different. Today at weddings they eat rice, a variety of meats and salads. Past traditional weddings the bride wore a blanket and bridesmaids wore animal skin clothing. Today’s traditional weddings are modern, they wear cloth, there are modern decorations, and the foods is mostly western, you will never see wild vegetables there now.” - Participant 11

However, other participants countered this, stating that in some weddings they do serve traditional beer, eat wild leafy vegetables, and are entertained by *dinaka* traditional dancing. *Mmapadi*, which was a dance performed by women during weddings, has faded away and replaced by modern stepping dance.

“At wedding ceremonies, there would be dinaka traditional dancing...meats like beef, mutton, goat is served; these ceremonies will usually accommodate anyone, so even wild leafy vegetables would also be available.” - Participant 2

2.4.3.2.3 Traditional dancing ceremonies

Traditional dancing ceremonies are gendered ceremonies that can be divided into two. *Mmapadi* is performed by women and *Dinaka* is performed by men. Participants describe *Mmapadi* as a dance which could be performed at weddings and on its own special occasions, usually during weekends. *Dinaka* was also performed on its own special occasion. When these dances are hosted on their own occasions, dancers bring a variety of foods. Participants explained how any participants could bring anything; *“if someone brings wild vegetables we will eat, if someone brings a cow head that’s what we will eat.”* Therefore, food consumed during these ceremonies was dependent on the preference of the person bringing the food,

which was usually a piece of meat or cooked wild vegetables. Traditional sorghum beer was also served at these ceremonies.

2.4.3.2.4 Funerals in the past

Funerals were small, private, intimate ceremonies that did not invite community involvement like weddings and traditional dances. Participant 10 describes the funeral procedure as follows: *“When there is a funeral, the day after the death will be used to inform others about the death. Boys will be sent to deliver the message. We as children we were told that the person who passed away was taken by a Hyena, in that way you won’t even remember the person. During the day of the funeral we just saw people going in and out of the house, we did not know what was happening; the people were not gathered, we just see them going in and out. After the burial that’s when they would call us (children) and they would lash us with a thorny plant and whisper into our ears that this person was taken by a Hyena. But in other locations it is different because they tell the children while they are sleeping. That was done so that we don’t worry, and you will never hear anyone one of us crying about it.”*

Participant 7 who grew up in a different location explained that the deceased was buried the day after the death took place. The burial happened in the afternoon, and it was a silent ceremony where no singing takes place. However, what was the common practice even in different locations was that no cow was slaughtered for the funeral ceremonies. The foods consumed at a funeral were porridge (sorghum) and a small sheep or goat. Also, children did not take part in any of the funeral proceedings *“they would be sent away maybe to a neighbour’s house until the burial and funeral proceedings are concluded...they did not know what was going on”* concluded participant 7.

2.4.3.2.5 Modern funerals

Unlike in the past where the deceased was buried in less than two days after death, families now bury approximately a week after death. The week leading to the funeral the immediate family will inform extended family, friends, and relatives, organise funeral proceedings and buy food. Funerals have evolved from being small private family events to big community-wide events. In the few days leading to the funeral, neighbours, family, and relatives will assist each other to prepare food that will be eaten after the burial for the masses of people who will be in attendance. During the day of the funeral, a pastor will be conducting the proceedings at home and at the cemetery. After the proceeding, food is served; the food is totally different to what was consumed at funerals in the past. Unlike in the past where porridge was served with

meat of a slaughtered goat, funerals today accommodate a wide range of foods. They serve a selection of grains like maize porridge, sorghum sour porridge, and rice; meats like beef, chicken, pork, and a range of vegetables and salads like spinach, cabbage, beetroot, carrots, potatoes, etc.

“When I started growing and attending funerals, we ate porridge and beef, rice, spinach, cabbage, beetroot, beans, mayonnaise. What was not available at funerals was tomato sauce, even today it’s not there.” - Participant 17

Another difference between funerals in the past and now is that in the past beef was not served. *“There is now a tradition of eating meat from the iron sheet, which did not exist in our time, I don’t know when this tradition started and why, but I think it began when there were mortuaries.” This refers to meat (usually beef) cooked and eaten by men separately from the rest of the food prepared at the funeral.* None of the participants mentioned consumption of wild leafy plants at current day funerals. Today, children do attend funerals unlike in the past.

2.4.3.2.6 Ancestral ceremonies and other ceremonies in the past

These are ceremonies that entail some form of communication with ancestors. This may be through dance (*Malopo*) or during a significant event in the family (new birth, ill family member or for thanksgiving, etc.). Ancestors are communicated with through a special plant in the home garden. Traditional beer would be brewed and served, and a goat would be slaughtered too.

“We did Malopo (spiritual dances) we sang a lot. This is different from Dinaka and Mmapadi which are performed at weddings or at happy occasions. Malopo is spiritual, it has to do with healing and communicating with ancestors.” - Participant 16

“During the ancestral ceremonies, if it’s a big ceremony, we ate porridge and meat. And every group of people would eat at the same place, Men would eat from the same dish together, the same with women, children, etc.” - Participant 8

There were other ceremonies and events that families participated in that typically prompted a deviation from the daily diet. These included initiation schools (male and female) and Christmas in families that were converted to Christianity. The account on the foods consumed

at initiation schools were distinct; a participant who went to a female initiation school reported no foods served there, while another participant who went to a male initiation reported consuming *Kgodu* (a porridge made from *Citrullus lanatus subs citroides*). *“After initiation there would be a big ceremony at home, traditional beer will be served and a cow will be slaughtered, neighbours, family and other relatives would be called, and everyone will be having a good time.”*

“Christmas was also another special occasion that became a tradition over the years. “During Christmas we did not eat wild vegetables, they slaughtered a chicken. Chickens were only slaughtered on Christmas and when we had a guest. So, we kept a lot of them.” - Participant 10

2.4.3.2.7 Modern ancestral and other ceremonies

Participants still practice ceremonies of communicating with ancestors. Even amongst Christian believers the foods eaten on this occasion are similar to what is served at funerals and weddings. People are served porridge, recently slaughtered meat accompanied by several vegetables and traditional beer.

“We make traditional beer from sorghum; we slaughter a goat and spill the blood in the yard. We then cook the goat meat.” - Participant 1

“We eat porridge, cabbage, potatoes, pumpkin, rice, meat and we drink traditional beer. It is rare to find people eating wild leafy vegetables at those occasions.” - Participant 4

It is rare, according to participants, to find wild leafy vegetables being served at these ceremonies today. This is also applicable to initiation school ceremonies, traditional dancing ceremonies, and Christian holidays (such as Christmas, Easter) that families participate in. These occasions are dominated by the consumption of grains, meats, and a selection of cultivated vegetables.

2.4.4 Drivers of Change

Participants noted that there have been considerable changes relating to the consumption of WEPs, which they ascribe to a plethora of factors. Amongst them were a deterioration in traditional beliefs and cultural norms and practices, climate change, and socio-economic and political change. According to the participants, this was a result of modern society with technological advances, the rise of religion, and changed land use patterns. All these changes

influenced what people eat, the frequency of WEPs consumption and changes in the preparation methods of meals containing WEPs.

2.4.4.1 Socio-Economic and Political Change

All the participants grew up during the height of the apartheid period where some of their parents worked at white-owned farms after their lands were dispossessed. It was at these farms where people were exposed and introduced to new fruits and vegetables that they had never seen nor consumed before. These are vegetables such as tomatoes, potatoes, onions, and spinach, and fruits like bananas, guavas, oranges, and mangoes which some participants and their families laboured to produce in those farms. Eventually, these foods started to become part of the diet not only for the farm workers but in urban townships and villages too. In the villages, these foods were introduced via trade and consequently, people started adopting and growing them in their home gardens. Today, rural home gardens typically host a combination of wild and cultivated species.

“We did snack on the wild fruits. But in my garden, we started growing pawpaw, peaches, and oranges. There was a man who used to go buy oranges from white farms and sold them here in the village. We did not have wild fruits growing in the garden we only fetched them from the wild. Now I have two marula trees in my garden today, the first one I uprooted it from the wild and planted it here, but it does not bear any fruit. The second one I also uprooted it while it was still small, luckily it produces fruit, they can enjoy it here at home.” -

Participant 14

After the end of apartheid in 1994, the new government aimed to introduce several policies for socio-economic redress. One of those policies were social grants, to which several social groups such as children, orphans, and the elderly, amongst others, qualified for. All the participants in this study are recipients of these social grants which are their main source of income. Most participants (85%) come from households earning between R1 000 to R5 000 per month of which two-thirds spend less than R1 000 on food, while 35% spend more than R1 000 on food. According to participants, this has created choice of what foods to buy and consume; this choice has challenged the importance and relevance of WEPs to the rural diet, especially by the youth.

“Because the government gives us grants, a child today can say no to eating wild vegetables, they would rather ask for money to buy bread. For us (the elderly) WEPs are still

important. We have failed to convince our children to eat wild vegetables. They have rights, they get child grants. They will tell you that they can't eat wild vegetables when they have their money." - Participant 16.

"I think is because we get paid social grant now that we can afford to go buy meat. On the first of each month after getting my grant I buy a sack of chicken for my boys. When I cook my wild vegetables, they say "you are eating that?" "We don't want it, we want meat." - Participant 9

2.4.4.2 Modernisation

Technological advancement is one of the major components of modernisation. Innovations such as the refrigerator have revolutionised the relationship people have with food. Today, all the participants have a fridge in their households. The availability of a fridge has encouraged consumption of certain foods such as meats and dairy. Today, 65% of participants' households consume meat products four or more times per week. Some participants report using the freezer to store wild vegetables as a method of preservation. According to them, the sun-drying method of preservation does not retain the plants' nutrients.

"No, it's is no longer the same, the culture has been changed by technology (refrigerator), some of the food are eaten because of the fridge, such as meat and milk. In the past we would eat wild vegetables if there are leftovers you would finish it the following day." Participant 4

Another component that can be considered when referring to modernisation is what people perceive to be a modern diet, especially by the youth. Participants have indicated which foods form part of their current diet. The list includes both conventional foods and WEPs. Research participants declared their preference for WEPs containing meals for certain days of the week. However, they reported that the youth have a negative perception towards WEPs, especially wild vegetables. "They say eating wild vegetable is like eating grass" said Participant 12. "The youth are difficult to convince to eat wild vegetables, you can convince them for a day and tomorrow they will lie to you that the wild vegetables are upsetting their stomachs, because they don't want to eat again the following day" added Participant 1. This attitude towards WEPs consumption by the youth, might be caused by factors such as lack of WEPs (products) in retail shops, and their absence in media (TV, radio, print and social media). This absence of

WEPs on modern platforms might encourage the reluctance of the youth to consume WEP and normalise their absence from the modern and future diet.

2.4.4.3 Climate Change

Participants report WEPs as species heavily dependent on rain. WEPs become abundant and are mostly consumed during the summer rainy season. In the past, rainfall was described as very good as compared to today. Poor rainfall is touted as being responsible for the disappearance of certain WEPs species such as *Corchorus olitorius* and *Grewia flava* that are no longer available in the same quantities like in the past.

“Lehlanye (Vernonia fastigiata) is no longer available that much because it was mostly found in the fields when it rained. Now, it’s very scarce because its eaten mostly by goats.” - Participant 12

“WEPs are not available because its dry today. Even when it is the rainy season, the quantity is not the same as in the past.” - Participant 13

2.4.4.4 Land Use

According to the participants, changing land use patterns have affected the availability, abundance, and diversity of WEPs species. Participants reported high land usage mainly for agricultural purposes in the past. This land was used for planting crops in the fields and around homesteads was also home to a diversity of WEPs species. Today, these fields lie fallow, partly because of the climate change and the modernised agricultural system characterised by equipment such as tractors and other inputs such as pesticides which most of the rural populace does not have access to.

“In the past, the plant (Vernonia fastigiata) was very abundant in the fields. Today the fields have disappeared because people don’t farm anymore. The culture of ploughing in the fields is gone and we are left with only home gardens. We used donkeys and cattle to plough the field. Today if you want to farm you need a tractor which is very expensive, that is why people do not farm anymore. In the past home gardens produce was for household subsistence and field produce was taken to the factories, today we only depend on home garden produce.” - Participant 12

2.5 Discussion

2.5.1 Participants' childhood background

The study was conducted in an area that formed part of the Lebowa homeland. This is where most participants were born, grew up and currently reside. Lebowa was in the then Northern Transvaal and was established for the Northern Sotho speaking people (Rogerson & Letsoalo, 1981). It was the third most populous homeland after KwaZulu and Transkei with a *de facto* population of 1.6 million people (Letsoalo & Rogerson, 1982). An additional 850 000 people lived and worked outside the homeland in the so-called white areas (Letsoalo & Rogerson, 1982). Participants report their parents working in these areas as carpenters, traders, domestic workers, and farmworkers since the intended purpose of these homelands were to provide cheap labour. For farmworkers, living and working on white-owned farms possibly came as a result of being evicted from their land. Forced removals could have occurred in one of two ways, firstly, families that owned land that was located outside the homeland were forcibly removed off their land to either work on white-owned farms or they could be relocated to the notorious closer settlements described as areas with no prospects for employment or agricultural production (Desmond, 1971).

Secondly, forced removals could have also taken place as a result of betterment planning that the state introduced as a rehabilitation strategy to curb rising stock numbers, and the amount of land allocated for ploughing (Rogerson & Letsoalo, 1981; Letsoalo & Rogerson, 1982). This was implemented to mitigate further land degradation. A spatial transition occurred where rural villages were changed from a system where homesteads were spatially dispersed to a system where homesteads were closer to each other in a grid system with lands around the village allocated for grazing and ploughing (Murray, 1967). This system is still evident today in many rural villages. Nevertheless, betterment planning schemes were widely resisted not only in Lebowa but in other homelands too as they were seen as interference and residents associated them with economic hardship and deprivation (McAllister, 1989).

Participants described their villages and surroundings to have been lush, green, and high in agricultural activity. Even with reports of poor agricultural output and self-sufficiency (Bundy, 1972), not all families had members working outside the reserves to make a living. Some participants report that their parents were farmers who continued to work the land to produce food subsistently for their families. Lush and green surrounding could be an indicator of good rainfall which is favourable to the availability and abundance of wild fruits and vegetables.

Similar observations pertaining to colonisation and forced removals of indigenous people and the impact on dietary changes can be made in many areas around the world. For example, in the United States Warne & Wescott (2019) observed that the forced removals of American Indians from their ancestral lands to reserves limited their access to traditional foods and thus created dependence on food subsidies. This contributed to poverty, alcohol and substance abuse and widespread non-communicable diseases (Warne & Wescott, 2019). Additionally, the Tsimane of the Bolivian Amazon rainforest who subsisted on hunting, fishing, and gathering wild plants gradually transformed to a cash-based economy reliant on cash cropping, logging, employment, and unskilled labour upon the arrival of the Spanish missionaries and colonising farmers (Reyes-Garcia *et al.* 2014). As a result, the retention of traditional knowledge and traditional food systems becomes difficult for indigenous people when they are oppressed and marginalised (Kuhnlein, 2014).

2.5.2 Food consumption practices

2.5.2.1 Past and present food practices

Participants listed a variety of food from different sources that they consumed in the past (Table 2.1). This list matches with the list provided by Quin (1964) who conducted a survey to investigate which foods formed part of the Northern Sotho peoples' diet. From that list, six categories of food sources were provided namely, cultivated plants, indigenous plants, indigenous fruits, insects, domestic animals, and indigenous fauna (Quin, 1964). Cultivated plants traditionally included: sorghum, millet (*Pennisetum spicatum*) wild melon (*Citrullus vulgaris*) and later included maize and pumpkin, amongst many others (Quin, 1964). In this study most participants report the availability of maize in their planted fields, which indicates that maize was extensively used when they were growing up. Sorghum, millet, and maize were consumed as soft and hard porridges (Fox & Norwood-Young, 1982). Quin (1964) reports identifying 20 species of indigenous vegetables which were not named; however, they were regarded as nutritiously comparable to western vegetable crops. Indigenous vegetables formed an important role in Northern Sotho's diet and livelihoods because they were consumed as daily relishes, which were inseparable from porridge dishes. Other relishes consumed with porridges included: roasted seeds, bean gravies, insect dishes, meat, milk, salt, and fruit sauces (Quin, 1964). Indigenous fruits were not cultivated but collected from the fields or wilds. This is where boys learned what they can and cannot eat when they are herding. Some participant in this study confirmed that this was an important method of acquiring knowledge about wild plants. Indigenous fruits such as *Sclerocarya caffra*, *Ximenia caffra*, *Dovyalis caffra*, and

Vangueria infausta were also reported by Quin, (1964) to be used as ingredients for porridge meals, however, participants in this study didn't mention preparing porridge using wild fruits. They did, however, prepare porridge using *Citrullus lanatus* to make a sweet orange porridge called *kgodu*. Indigenous fruits such as *Sclerocarya birrea* was used to make an alcoholic beverage usually consumed during special occasions such as weddings.

According to Fox & Norwood-Young (1982) there was a period where meat was a regular part of indigenous Africans' diet. It is not clear when and how this consumption pattern changed but in the 1960s (or even earlier), meat was described as a "visitor" in most rural areas, reserved for celebrations or for traditional ceremonies (Fox & Norwood-Young, 1982; Quin, 1964). The Northern Sotho kept animals such as cattle, goats, and sheep which were an important part of traditional ceremonies. Indeed, participants from this study shared similar experiences regarding the consumption of meat and gave accounts of the importance of animals for traditional occasions.

Until 1939, the consumption of two meals a day was the norm (Bryant, 1939). The first meal was consumed in the late morning or afternoon while the second meal was enjoyed just after sunset between 5 and 8 pm (Viljoen *et al.* 2005). For both meals, stiff porridge was served with a relish. Stiff porridge was usually made from sorghum or millet, however, as maize gained prominence it became the staple grain but sorghum and millet were also still extensively used (Bryant, 1967). In this study, participants mentioned that the primary choice of relish was either milk or wild leafy vegetables. Different species of wild vegetables could be consumed interchangeably throughout the week. This meal pattern during the week was also the same over weekends (Viljoen *et al.* 2005).

2.5.2.2 Current food practices

This study corroborates other studies that showed that the introduction of modern foods such as white flour, bread, sugar, sweets, and maize products like samp, mielie rice, maize meal contributed immensely to dietary change (Walker, 1996). Today, maize is available in most rural home gardens and is the most preferred grain over sorghum and millet. Wild vegetables are consumed supplementarily a few times a week as cultivated vegetables and meats are also consumed as relishes. This study hypothesised that consumption pattern of WEPs in the past differed significantly with that of the present. The consumption of WEPs for several times a week could be a safety net for when other relishes are not available as a result of a shock such as food shortage or less income. Some participants in this study refer to cultivated vegetables

like spinach and pumpkin leaves as the new *morogo*, others report consuming carrot and beetroot leaves as a *morogo* too. *Merogo* which previously referred to indigenous vegetables, is now an all-encompassing term which now refers to both indigenous crops and cultivated vegetable species like spinach and cabbage whose leaves are consumed as a relish. Meat consumption has increased since 1994 becoming the most preferred relish, with chicken being the most consumed animal protein (Ronquest-Ross *et al.* 2015). Participant 6 put it succinctly when he explained that different parts of a chicken (heads, feet, intestines, etc.) can be consumed interchangeably throughout the week.

Unlike in the past, the consumption of three meals a day is now the norm. The first meal is consumed in the early morning and it comprises of a soft porridge (maize or sorghum) or bread with spread or eggs and tea (Viljoen *et al.* 2005). Participants in this study corroborate similar meals. Several participants also reported consuming *kgodu* with tea as a favourite breakfast meal. For lunch, bread with spread and tea or bread with achaar and chips or stiff maize-meal porridge and relish (meat, vegetables relish or both) can be consumed (Viljoen *et al.* 2005). For supper (main meal) stiff maize-meal porridge with relish either meat (chicken, beef, pork, mutton) or vegetable-based (wild vegetables, cabbage, pumpkin, spinach) is consumed (Viljoen *et al.* 2005). With food surveys showing a decreased intake of vegetables (Ronquest-Ross *et al.* 2015), meat became the most preferred and consumed relish. Elderly participants in this study explained that they avoid eating meat for certain days of the week in preference for a vegetable relish. This type of consumption pattern where different household members chooses to eat what they prefer is a new norm, participants explained that in the past all household members consumed the same meal.

2.5.3 Traditional ceremony foods

Participants described and gave accounts of different traditional ceremonies that were held in the past. Ceremonies that indicated different life stages such as name-giving, initiation, weddings, funerals, and spiritual ceremonies were celebrated and practised. Traditionally, these are the occasions where meat is consumed as part of the ceremonies (Fox & Norwood-Young, 1982). Participants gave differing descriptions of what foods were served on such occasions and most agree that serving stiff porridge (sorghum), meat (goat or beef) and traditional beer (sorghum, marula) was the norm. This is corroborated by several studies (Fox & Norwood-Young, 1982; Quin, 1964). Wild vegetables were rarely served in such occasions.

Today, several traditional ceremonies are no longer practiced; similarly other celebrations are added. For example, according to Viljoen *et al* (2005) name-giving and initiation celebrations have fallen away, similarly, none of the participants in this study mentioned those celebrations. Nowadays, in addition to funerals, households celebrate the end of mourning period for widows and the unveiling of tombstones; birthdays, graduations, Christian holidays such as Easter, Christmas and New Year's Day are also celebrated (Viljoen *et al.* 2005). Weddings and funerals have modernised and this is evident in the foods that are consumed in these occasions and other modern celebrations. To accommodate both the elderly and the youth or those who prefer traditional dishes at these occasions, both modern and traditional dishes are served side-by-side. Modern foods such as rice, maize porridge, samp with a variety of cultivated vegetables like spinach, potatoes, beetroot, carrot amongst others, variety of meats, and alcoholic beverages. Traditional foods like sorghum porridge, sour sorghum porridge and traditional sorghum are also served (Viljoen *et al.* 2005). Wild leafy vegetables are still a rarity in these occasions.

2.5.4 Rules and Taboos about WEPs

Most of the participants (n=18) said they were not aware of any rules or taboos relating to the consumption of WEPs. Instead, they mentioned how they were taught when and how to pick fruits and leafy vegetables, they were warned about which species to avoid and which species not to consume too much of. One of the participants mentioned that people used to believe that if the fruits of *Mimusops zeyheri* were collected before the fruit had ripened, there will be poor rainfall that season. This could have been one of the ways species were protected from poor harvesting methods or overharvesting. Another participant recalls a rule where households in the villages were taxed one Lerotse (*Citrullus lanatus subs citroides*) by the Chief during harvest season. “Food had to be taken to the royal house, they will have a list of which households brought Lerotse and which did not. So, if you don't take the food to the royal house, you can be fined one cow” concluded the participant. Offering food or drink to the chief or village headmen appears to have been a common cultural practice in rural areas. Shackleton & Shackleton (2005) in their study in Bushbuckridge (Limpopo) report a traditional practice called *Xikuba* where marula-brewing households gathered to present a specific amount (2 or 5 litres) of beer to the village headman. Households that did not attend could be fined a non-attendance fee (Shackleton & Shackleton, 2005). The authors argue that these types of practices serve to reinforce and maintain the position, functions, and authority of traditional institution in society (Shackleton & Shackleton, 2005). Structures and processes such as rules from

traditional institutions are also an important component of the Sustainable Livelihoods Framework as they regulate the influence between livelihood outcomes and livelihoods assets (DFID, 1999).

2.5.5 Drivers of change

According to several studies (Oudkerk, 1965; Walker *et al.* 1992), the 1960s marked a period where a nutritional transition became noticeable. This was characterised by the introduction of new food items and changing meal patterns. This transition was largely initiated and triggered by socio-economic and political policies of the time, which were responsible for the beginning of sustained urbanisation that ensued. This study hypothesised that changes in consumption patterns of WEPs was possibly due to evolving culture, traditions, lifestyle, and economics. According to the UN, the urban population of South Africa was just over 40% in the 1960s. In the Lebowa homeland, the urban population in the 1980s was just over 30% (Rogerson & Letsoalo, 1982). Urbanisation is highlighted because of its influence on the types of foods that were consumed not only in urban areas but in the villages too. Participants gave accounts of how they were introduced to new crops like potatoes, tomatoes, mangoes, oranges while working at white-owned farms. These crops were soon cultivated in the villages. Urban trading stores played a major role in the increased consumption of foods like bread, milk, tea, and soft drinks which became popular in urban and to some extent in rural areas too (Viljoen *et al.* 2005). These foods were also responsible for changing meal patterns from two meals a day to three. Bread and tea were a popular breakfast meal especially for school going children in urban and rural areas (Oudkerk, 1965; Quin, 1964). Since some participants' parents worked as domestic workers in white households, their employment there was another contributing factor not only for introducing new food items but for changing how other traditional dishes were prepared (Viljoen *et al.* 2005). It became prominent for domestic workers who learned how to bake (cakes, scones, bread) and became familiar with European ways of preparing foods like meats, salads, fruits, and vegetables during that period (Viljoen *et al.* 2005). Preparation of foods extended to wild vegetables as well. According to Manning *et al.* (1974), wild vegetables started to be prepared by adding tomatoes, onions, oil, and spices. Participants in this study corroborated that the preparation of wild vegetables in this way is practiced especially by the youth. Participants described the youth as disliking to consume wild vegetables; however, they can tolerate consuming them when prepared the modern way. The negative attitude of WEPs consumption by the youth can be addressed by promoting and creating awareness campaigns in the media (Tv, radio, social media, books etc). This is where nutrition facts about WEPs

could be presented and where their economic or income generating potential could be highlighted. The impact of the media on the consumption and the use of WEPs is not one dimensional. Recent studies have shown that the media can influence how people perceive and consume WEPs based on how they are portrayed. For example, a study showed that in the Soviet Union, WEPs were promoted in books during World War II (1941 – 1943) and after the war (1953 – 1989) by the Soviet government (Bexultanova *et al.* 2022). This was because the availability of agricultural products was severely hampered by the war.

Modern technology has also played a part in altering the way people stored, preserved, and prepared their food. All households in this study have access to electricity and most households have electrical appliances such as refrigerators, and electric or gas stoves. The availability of refrigerators has meant that products like meats could be bought in bulk and stored for longer, thus increasing their consumption. Some participants reported also storing wild vegetables in refrigerators. During informal talks with participants, they report that this method of preservation keeps wild vegetables fresher. It is not clear how common this new method of preservation is as compared to the traditional sun-drying method and how true their claims are. This would require further research. Other informal discussions revealed that some marula beer traders would not sell all their beer during production season, they would instead keep some stored in the refrigerator and sell it during the off-season at a higher price.

Since WEPs depend on rainfall for their availability and abundance, their consumption could be affected if rainfall conditions were unfavourable. Some participants described their environment when they were growing up as lush and green with good rainfall, while others recalled periods of drought. According to some participants during good rainfall, WEPs thrived and grew in abundance, hence they were widely consumed. Today, species like *Vernonia fastigiata*, *Corchorus olitorius* and *Grewia flava* are described as not growing as widely as they used to. According to Foden & Potter (2005) *Vernonia fastigiata* and *Grewia flava*'s biodiversity assessment is of least concern nationally while *Corchorus olitorius* is not evaluated. It is possible for a species to be of least concern nationally but threatened locally, however, this would require further assessments. The community could take several measures to preserve these plant species. Community member could receive theoretical, practical planting and maintenance of WEP crops (Vorster, 2007). Additionally, seed harvesting tips and other methods of pest control could be encouraged (Vorster, 2007). Poor soil quality was listed as another factor affecting the availability of WEPs. Perhaps these soil conditions could be

related to spatial planning of the previous regime which resulted in overpopulation and overgrazing in the homelands (Rogerson & Letsoalo, 1982). Today most of these lands remain largely underutilised as food is mainly purchased from retail stores (Pereira *et al.* 2014).

2.6 Conclusion

This research showed WEPs were a major contributor to sustaining livelihoods in the past. Today WEPs have been relegated to foods that are supplementarily consumed several times a week. These changes in WEPs consumption are multi-factored. The transition from consuming wild vegetables daily to consuming them occasionally by a few household members, is complex. The most influential factors being socio-economic and political as well as bio-physical. The transitions could be traced to have initiated in the 1950s where apartheid with its attendant spatial planning schemes played a crucial role in dismantling a once thriving African peasantry where families for the most part were self-sufficient (Bundy, 1972). They consumed a diet which Quin (1964) described as adequate, with consumption habits that could alleviate malnutrition and diseases. With gradually increasing western influence, characterised by rising urbanisation, western lifestyles of church, school, and employment in an income-based economy dependent on retail stores to fulfil their daily dietary needs; traditional foods could be further ignored. In rural areas, it is evident that the consumption of WEPs is still important, especially to the elderly who still consume wild vegetables as a relish a couple of times a week. Additionally, the fact that traditional foods are made optional at some modern and traditional celebrations shows how valuable they still are to some people. There is also the emergence of new modern preparation methods for wild vegetables where they are cooked using oil and cultivated vegetables such as tomatoes, onions, and potatoes. This shows that people are adapting to modern food preparations methods and that WEPs and other traditional foods could have a place in modern meals and diets. Participants gave accounts of how the changing climate impacted on the availability of WEPs in the past. During good rainfall WEPs were abundant and diverse in the fields and widely consumed, while during dry conditions consumption declined. With future climate uncertainty, the availability, richness, and abundance of WEPs could be threatened or enhanced. If it's the latter, educational and nutritional programmes should be established to educate people about the importance of WEPs. Ultimately, WEPs could form part of the meals served for school feeding programmes, they could part of the diet served and recommended at clinics and hospitals and WEPs and their products could be sold in retail stores to compete with existing products. The adoption of these measure could ensure

future use of WEPs and that their value should not be limited to the rural household but could play a bigger role in the economy.

2.7 Reference List

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Chapter 3

Perceptions of the Use, Consumption and Commercialisation of Wild Edible Plants

3.1 Introduction

Throughout history, humans have been consuming edible plant species from their surrounding environments for food, cultural and medicinal purposes (Cruz *et al.* 2014). WEPs form a significant part of the diet and livelihoods for many societies and cultures around the world (Andriamparany *et al.* 2014; Tanimonure *et al.* 2021; Turner *et al.* 2011). The consumption of such plants has been of topical interest to researchers for decades. One of the areas that has received considerable research attention is people's thoughts and feelings towards these foods. The use of WEPs has always been surrounded by assumptions and stereotypes (Bharucha & Pretty, 2010). For example, Barnard (1999) observed that the consumption and use of WEPs are often viewed as 'backward' and non-progressive by non-agricultural societies; a view that is still projected in many modern societies (Reyes-Garcia *et al.* 2014; Van der Hoeven *et al.* 2013). This underpins current day perspectives by many that WEPs are poverty foods (Venter, 2007) consumed mostly by elderly women and low-income households in rural areas (Faber *et al.* 2010; Taruvinga & Nengovhela, 2015). Thus, research about this topic aims to make sense of what informs such negative perceptions and given the reported benefits of WEPs, researchers seek to understand if there has been a shift in thinking and a change in attitudes to what was previously assumed.

The value and benefits of WEPs for livelihoods at the individual and household levels are well documented. Studies such as Tata Ngome *et al.* (2017), Lepetu *et al.* (2015) and McMullin *et al.* (2012), among many others, have shown the importance of WEPs for food security, income generation and reducing overall vulnerability of households during times of shock. However, there are several other reasons people consider when consuming WEPs, including the medicinal and nutritional benefits from consuming them (Faber *et al.* 2010; Oguttu *et al.* 2021). This has prompted several researchers to hypothesize or make a link between consuming WEPs with perceptions of taste, health, and tradition (Cruz *et al.* 2014; Guissou *et al.* 2015; Van der Hoeven *et al.* 2013; Sōukand, 2016).

There are two fundamental topics related to the understanding of perceptions concerning WEPs consumption. Firstly, is that perceptions can influence people to choose to consume certain plant species over others. Second, perceptions can influence which groups of people are more likely to consume WEPs over others. In relation to the former, perceptions such as taste, health, nutrition, and tradition of WEPs use can significantly influence the choice of the species consumed (Senyolo *et al.* 2019). Taste is one of the indicators used to appreciate species, allowing preferences for species to be ranked based on taste. Taste can be defined by individual preference but can also be indicative of cultural acceptance (Ghirardini *et al.* 2007). The taste of any species can be described using adjectives such as tasty, sweet, sour, bitter, dull and fresh (Sõukand, 2016). Species described as tasty, sweet, fresh are likely to be consumed more than those deemed to be bitter or dull. Another prominent perception that many have is that WEPs are healthy and nutritious. In some instances, WEPs are perceived to be more nutritious than conventional crops (Taruvunga & Nengovhela, 2015). Perceptions relating to nutrition are not only based on people's beliefs; they are supported by a variety of studies. For example, Amaranth (a well-known and consumed leafy vegetable) has a higher nutritional value than spinach and cabbage because of its higher levels of protein, calcium, vitamins, and minerals (Afolayan & Jimoh, 2009; Jimoh *et al.* 2018). Additionally, some WEPs have also been reported to boast medicinal properties, for instance, *Momordica balsamina* leaves are used to treat eye infections of children and *Cleome gynandra* is perceived to be good for eyesight and to provide energy (Van der Hoeven, 2013; Van der Heever & Venter, 2007). Culture also plays an influential role in people's choices of which WEPs to consume or avoid. A diversity of species may be available and accessible in a particular location, however, what determines consumption may be whether the species are traditionally permissible. For example, in Burkina Faso culture is a major reason why people consume several species such as *Hibiscus cannabinus*, *Corchorus sp*, *Bombax costatum* and *Amarunthus spp*. (Guissou *et al.* 2015). Even though other edible species might be available locally, people may choose not to consume them because it's not their culture. Some species may be taboo for certain people or at certain times, such as during a pregnancy (Chakona & Shackleton, 2019).

Perceptions can also determine the likelihood of consumption of WEPs by different groups. Socio-economic factors such as gender, age, education, household income, market accessibility and affordability of WEPs all influence the consumption of WEPs (Senyolo, 2019). Regarding gender, in most societies women are responsible for the collection, preservation, purchasing, and preparation of wild vegetables for the household (Lewu, 2011; Tumwet *et al.* 2014). Since

adults and the elderly are more knowledgeable about WEPs (Reyes-Garcia *et al.* 2014) and more likely to consume them regularly, they may extend this influence to young children (Gido *et al.* 2017). However, some argue that when children become adolescents, they become disinterested and unwilling to consume particular WEPs (Matenge *et al.* 2012). Western education has had a negative influence on consumption, as higher levels of education may lead to lower levels of WEPs consumption (Bruyere *et al.* 2016; Senyolo *et al.* 2019). This is probably because the higher the education level, the higher the household income (Taruvunga & Nengovhela, 2015). Some studies show that with increasing household income the likelihood of consuming WEPs declines (Faber *et al.* 2010; Modi *et al.* 2006). Household income provides a good foundation for understanding purchasing patterns and consumer behaviour regarding WEPs in some societies.

Commercialisation of WEPs has received increasing research attention over the years (Ham *et al.* 2007; Nonjabulo *et al.* 2020; Rampedi, 2010; Schunko & Vogl, 2018). This is because more people are becoming cognisant of the importance and value of WEPs, especially in urban populations. Even though WEPs are mainly produced in rural areas, they are distributed to both urban and rural inhabitants through formal and informal markets (Ngugi *et al.* 2007; Muanji *et al.* 2011). The formal market includes supermarkets, green groceries, and local open-air outlets where a diversity of fruits and vegetables are available, well packaged and prices are consistent (Munhanji *et al.* 2011). Informal markets are operated by hawkers usually on the roadside or by door-to-door distribution in rural and urban localities (Gido *et al.* 2016). The stark differences between the formal and informal markets in relation to handling of products and prices (Gido *et al.* 2016), creates different attitudes, preferences and perceptions about the quality, accessibility and affordability of WEPs. For instance, WEPs sold at supermarkets are perceived to be of higher quality than those sold at open-air outlets (Van der Lans *et al.* 2012). Consumers who perceive WEPs prices to be affordable are more likely to spend more on them (Senyolo, 2019).

Taking all the above into consideration, it is evident that people's perceptions and attitudes play a crucial role in determining the rate and frequency of WEPs consumption and the level of importance they accredit WEPs in their daily lives. The regular consumption of WEPs in general, can be attributed to positive perceptions that many rural people have about WEPs (Cruz *et al.* 2014; Gido *et al.* 2017). This has led to better dietary diversity, a diversification of livelihoods and overall improved livelihood outcome such as improved incomes and food

security (Bvenura & Afolayan, 2015; Faber *et al.* 2010; Galhena *et al.* 2013; Lulekal *et al.* 2011; Neudeck *et al.* 2012). However, in rural areas where consumption frequency of WEPs is often high (Gido *et al.* 2017), differences in perceptions may exist between and within households. Most studies examine perceptions such as health, taste, and tradition, but very few have studied perceptions around trade and commercialisation by individuals from different socioeconomic backgrounds. Secondly, perception studies usually compare households in rural with those in urban areas (Gido *et al.* 2017). In contrast, this study examines the perceptions of the use and consumption of WEPs. The aim was to determine: (1) Who consumes WEPs and which WEPs are consumed. (2) How often are they consumed? (3) What are the perceptions people have about consuming WEPs? (4) What perceptions do they hold regarding the commercialisation of WEPs? (5) What do they perceive to be the main reasons underlying consumption of WEPs? All these questions are used to gauge if attitudes and perceptions regarding WEPs differ between people of different ages, genders, and economic backgrounds. The study hypothesises that local people of different age and genders generally hold positive perceptions about the use, consumption, and commercialisation of WEPs.

3.2 Methods

3.2.1 Study Area

Refer to Chapter 1 for detailed information on study areas.

3.2.2 Sampling

Permission to conduct interviews in each of the four villages in the Moletjie area was granted by the respective village headmen. A stratified purposive sampling technique was employed to identify 120 individuals; Thirty participants (one from each household) were randomly selected from each village (namely Manamela, Machoane, Ditenteng and Rametlwane). Stratified purposive sampling is concerned with sampling participants within groups where there is some variation that allows comparisons to be made (Matthews & Ross 2010). Within the 120 participants, three age groups of 40 participants each were established: youth (18-35 years), adults (36-59 years), and elderly (over 60 years old). In each group, 20 participants were male, and 20 were female. This age and gender group balance allowed comparisons of perceptions of WEPs consumption. At the selected household, a semi-structured interview was conducted with a household member who met the age and gender criteria as specified above. The interview schedule was divided into four different sections which included: consumption of WEPs, perceptions of WEPs, perceptions of WEPs commercialisation and perceived benefits

of WEPS. Additionally, the questionnaire comprised of a profile section where participants were asked to provide information about their households, such as household size, education status of members as well as household income. Information on monthly income was used to categorise households into low income (R0 – R5 000), middle-income (R5 000 – R 15 000) and high-income (over R15 000). A mean wealth index was formulated by normalising and summing up participants' list of the number of available assets in their households such as livestock, car, bicycles, tv, radio, fridge, etc. This index calculated by dividing the number of a particular asset with the highest number of that asset from the dataset and summing up the totals for each asset.

Upon arrival at each participants household, a consent form, which stipulated the nature of the study and how their participation was voluntary, was presented. Interviews were conducted face-to-face in the local language of Northern Sotho; each took between 30 and 45 minutes and were tape-recorded. These data were collected between June – July 2018. The Department of Environmental Science Ethics Committee, Rhodes University, provided ethical approval for this study (No. ES18/26).

3.2.3 Data Analysis

Interview data were transferred into Microsoft Excel to prepare them for analysis. Data were summarised, and descriptive statistical analyses were performed. Chi-Square tests were performed in Statistical Package for Social Science (SPSS) version 20 to determine associations between perceptions and variables like age, gender, and household income.

3.3 Results

3.3.1 Participants' Profile

There was a total of 120 participants stratified by age (20 participants for each group) and gender (60 participants for each group). The average age of all participants is 46.7 ± 17.5 years, ranging from 19 to 82 years. The average age for each group is: youth 26.3 ± 3.9 , ranging from 19 to 35; adult 47.1 ± 6.9 , ranging from 36 to 59, and the elderly is 66.7 ± 5.4 ranging from 60 to 82 (Table 3.1). Most of the youth (77.5%) have completed secondary schooling, and from this group, 42.5% have a tertiary qualification. Yet 55 % of the youth are unemployed, 22.5% are students, and the remaining 22.5 % are either employed or self-employed. Over half of adults (52.5%) are unemployed. Most of the elderly (85%) are pensioners who receive an old age grant, and the remaining 15% supplement their social grant income with a salary or income from farming activities. The average household size is 5.6 ± 2.4 people, ranging from one to

fourteen household members. Most of the households (87.5%) fall within the low-income range (R0- R5 000 per month). The mean wealth index for households was 1.2 ± 0.7 ranging from 0.3 to 4.1 out of a possible maximum of 7.

Table 3.1: Summary profile of participants (n=120)

Variable	Category	No.	(%)
Gender	Male	60	50
	Female	60	50
Age	Youth	40	33
	Adult	40	33
	Elderly	40	33
Occupation	Employed	11	9.2
	Self-employed	16	13.3
	Unemployed	43	35.8
	Student	12	10.0
	Retired	38	31.7
Education	No Schooling	14	11.7
	Primary	23	19.1
	Secondary	41	34.2
	Matric	18	15.0
	Tertiary	24	20.0
Household head	Male	76	63.3
	Female	44	36.7
Household income	Low	105	87.5
	Middle	8	6.7
	High	7	5.8
Household size	Mean $\pm$ SD	5.6 ± 2.43	
Wealth index	Mean $\pm$ SD	1.2 ± 0.71	

3.3.2 Wild Edible Plant Consumption

All the participants (n=120) indicated that they consume WEPs. Participants reported WEPs that they recently consumed. *Vangueria infausta* was reported to be consumed by most of the participants (35%), followed by *Kgodu*, (a porridge made from *Citrullus lanatus* subsp. *citroides/mansf* (28.3%)) and *Vigna subterranean* (21.6%). The most consumed wild vegetable was *Vigna subterranean* leaves, which was consumed by 15.8% of the participants, followed by *Cleome gynandra* at 8.3% and *Amaranthus retroflexus*. (7.5%). On the other hand, the most consumed wild fruits were *Vangueria infausta* (35%), *Grewia flava* (10.8%) and *Sclerocarya*

birrea (7.5%). Participants indicated which WEPs type they preferred between wild fruits and wild vegetables. Most of the participants (52.5%) reported that they preferred wild vegetables, 32.5% preferred wild fruits, and 14.2% did not prefer one over the other. There was a statistically significant association between WEP type preferred with age group ($\chi^2_{2,118} = 10.50$, $p = 0.03$) indicating that the adult and elder age groups are more likely to prefer wild vegetables than the youth, while the youth were more likely to prefer wild fruits than both the adult and elder groups. There was no statistically significant difference between the type of WEPs preferred by gender ($\chi^2_{1,118} = 3.90$, $p = 0.42$).

Table 3.2: WEPs consumed

Local Name	Latin Name	Part used	Source	No of Consumers
Kgodu	<i>Citrullus lanatus</i>	Fruit	Home garden	33
Dinawa	<i>Vigna unguiculata</i>	Seeds	Home garden	24
Lerotho	<i>Cleome gynandra</i>	Leaves	Home garden	10
Theepe	<i>Amaranthus retroflexus</i>	Leaves	Home garden	9
Marula	<i>Sclerocarya birrea</i>	Fruit	Wild	9
Lenthepu	*	tuber	Wild	2
Matshidi	<i>Ximenia caffra</i>	Fruit	Wild	7
Maraka	<i>Cucumis zeyheri</i>	Fruit	Home garden	1
Dithetlwa	<i>Grewia flava</i>	Fruit	Wild	13
Monawa	<i>Vigna unguiculata</i>	Leaves	Home garden	19
Dithokolo	<i>Carissa bispinosa</i>	Fruit	Wild	2
Mabilo	<i>Vangueria infausta</i>	Fruit	Wild	42
Mahlatswa	<i>Englerophytum magalismsontanum</i>	Fruit	Wild	3
Makankane	<i>Cordia grandicalyx</i>	tuber	Wild	1
Mokgalo	<i>Ziziphus mucronata</i>	Fruit	Wild	1
Thelele	<i>Corchorus tridens</i>	Leaves	Wild	1
Mochacha	<i>Citrullus lanatus</i>	Leaves	Home garden	5
Mokgampule	<i>Cyphostemma dasypleurum</i>	Fruit	Wild	2
Mobupudu	<i>Mimusops zeyheri</i>	Fruit	Mountain	2
Mantlalekgere	<i>Sonchus oleraceus</i>	Leaves	Wild	1

The average consumption frequency of WEPs was 2.7 ± 1.7 times per week ranging from 0.25 to seven times per week. The frequency of consumption of WEPs was not different amongst participant groups. Figure 3.1 depicts that most of the participants consumed WEPs twice or

thrice per week, especially the youth. The elderly group has the highest frequency of daily WEPs consumption. There was no statistical significance between the frequency of WEPs consumption with the different age groups ($\chi^2_{2, 120} = 4.80, p = 0.09$), with all being approximately 2.8 times per week. There was also no significant association between frequency of consumption with gender ($\chi^2_{1, 120} = 4.80, p = 0.81$), as both genders recorded an average consumption frequency of 2.5 times per week. There was a negative relationship between frequency of consumption with income class, albeit not quite significantly so ($\chi^2_{2, 120} = 5.55, p = 0.06$); the low-income group had a weekly consumption frequency of 2.7 ± 1.7 times compared to 2.5 ± 1.4 times for the higher income group.

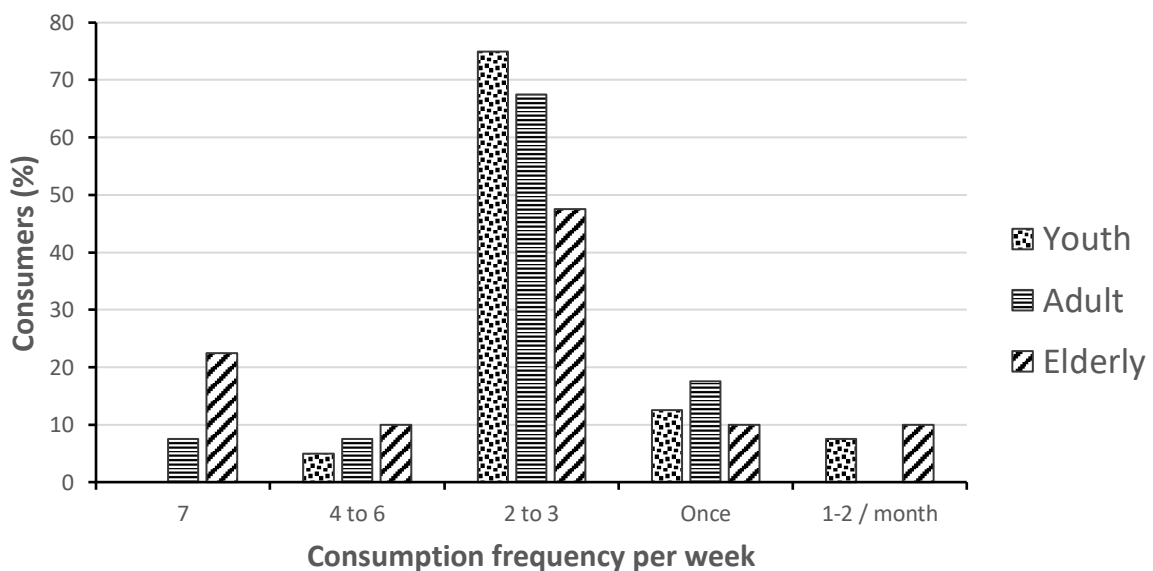


Figure 3.1: Frequency of WEP consumption by age group

3.3.3 Perceptions of Wild Edible Plants

Overall, most respondents had favourable perceptions towards WEPs consumption. Almost two-thirds (65.6%) of the respondents agreed or strongly agreed to positive perceptions about WEPs, while 30% either disagreed or strongly disagreed; a minor 4.4 % of the responses were neutral. The overwhelming majority of respondents agreed or strongly agreed that preparations from the local WEPs are relatively more tasty (98.3%), healthy (96.6%), nutritious (86.7%), and better represent the traditional foods (94.1%) (Table 3.2). Most of the respondents (81.6%) strongly disagreed that WEPs are poor people's foods or are only meant to be consumed by

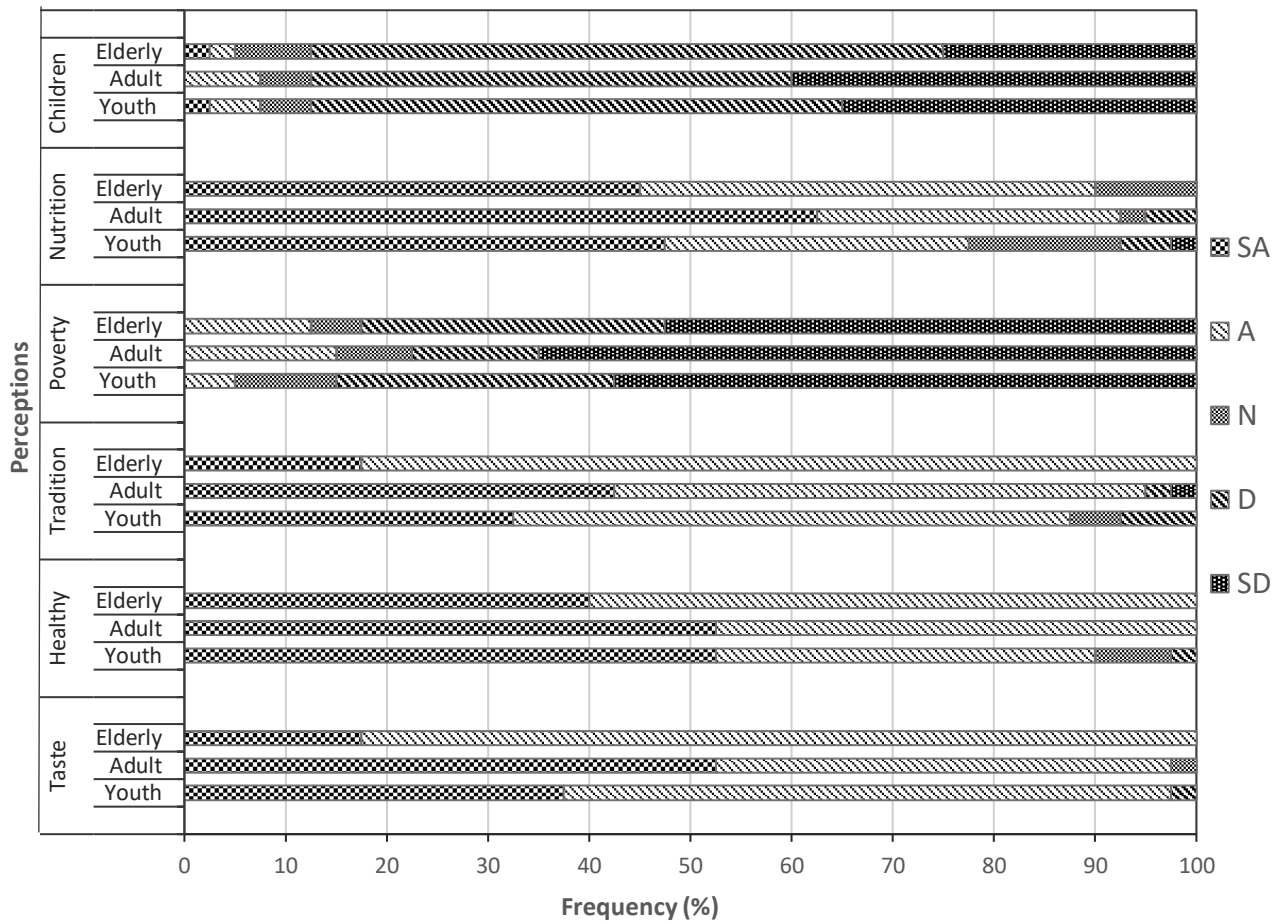
children (87.5%). Overall, 95% of participants echoed the importance of consuming WEPs and how they are beneficial to their daily lives.

Table 3.3: Participants' level of agreement with statements about wild edible plant consumption (% of responses)

Statements	SA	A	N	D	SD
WEPs are tasty	35.8	62.5	0	1.7	0
WEPs are good for my health	48.3	48.3	2.5	0.8	0.0
Consuming WEPs is my tradition	30.8	63.3	1.7	3.3	0.8
WEPs are foods meant to be consumed by the poor	0.0	10.8	7.5	23.3	58.3
WEPs are more nutritious than cultivated foods	51.7	35.0	9.2	3.3	0.8
WEPs are children's foods	1.7	5.0	5.8	54.2	33.3

Note: SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree

There was a slight difference in perceptions amongst the different age groups (Figure 3.2). From the statements of perception provided to participants, there was no association between age group with the statement on WEPs being healthy ($\chi^2_{2, 120} = 10.96, p = 0.089$), being poverty foods ($\chi^2_{2, 120} = 6.28, p = 0.392$), being more nutritious ($\chi^2_{2, 120} = 10.56, p = 0.228$), and being mostly children foods ($\chi^2_{2, 120} = 4.54, p = 0.805$). However, there was a significant association between age groups with the perception of taste ($\chi^2_{2, 120} = 12.44, p = 0.014$) and tradition ($\chi^2_{2, 120} = 17.11, p = 0.029$). The elderly group agreed that more WEPs are tasty than the adult and youth groups. Similarly, the adult and elderly groups were more likely to agree that WEPs were traditional foods than the youth. There was no significant association with gender and any of the statements. There was also no significant association between income group with any perceptions except with respect to taste ($\chi^2_{2, 120} = 12.58, p = 0.013$); lower and middle-income households were more likely to agree that WEPs are tasty, than were high-income households.



Note: SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree

Figure 3.2: Perception of WEPs consumption by age group

The perception towards the commercial demand for WEPs relative to cultivated crops reveals slightly different results, with just over half of the responses (58%) being favourable towards cultivated crops compared to 42% for WEPs. When asked why, participants listed a variety of reasons including preference (29%), knowledge (24%), economic (16%), followed by environmental (10%), health (7%), social (stigma) (7%) and others (7%) (Figure 3.3a). From Figure 3.3b, it is evident that the youth cited preference as compared to the elderly who mostly cited lack of knowledge as the reason cultivated crops can be sold more than WEPs. There is no significant association between these perceived reasons with age group ($\chi^2_{2,120} = 12.92, p = 0.679$) or gender ($\chi^2_{1,120} = 8.79, p = 0.360$) but there is an association with income groups ($\chi^2_{2,120} = 30.49, p = 0.016$) as participants from the low-income group mostly citing preference of cultivated crops as their reason for snubbing WEPs.

3.3.4 Perception of WEPs Commercialisation

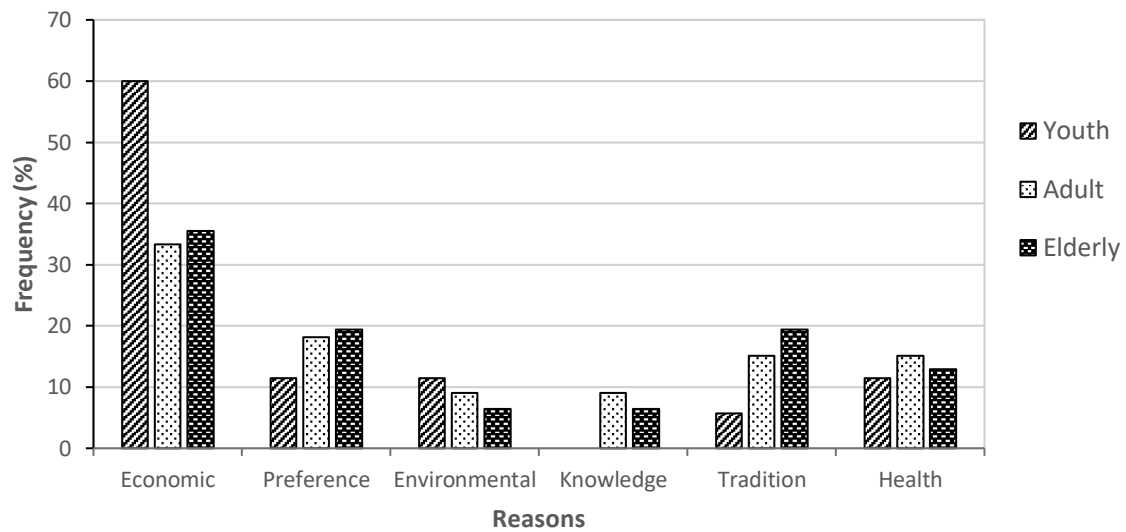


Figure 3.3a: Perceived reasons people in different age groups would buy WEPs.

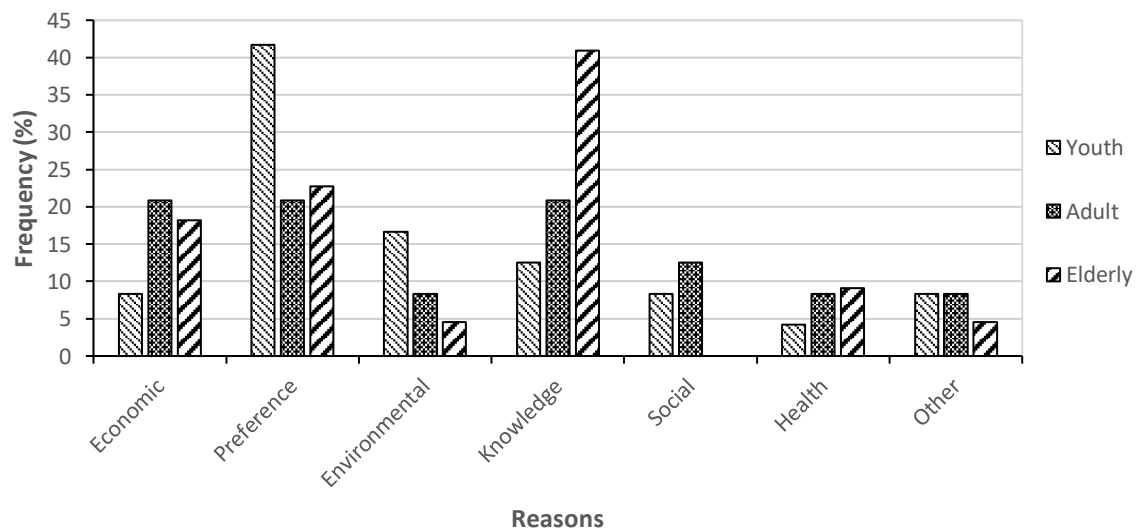


Figure 3.3b: Perceived reasons people will not buy WEPs over cultivated crops.

Despite a preference for WEPs, the majority (70%) widely agreed that WEPs cannot replace cultivated crops. The mostly cited reasons for this question were individual preference (37%), environmental problems such as lack of rain (24%) and knowledge (14%) (Figure 3.5). Interestingly, 11 % of the responses showed optimism that WEPs can co-exist with cultivated crops without one replacing the other.

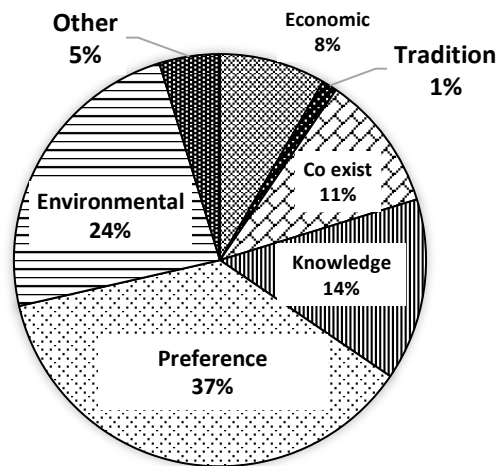


Figure 3.5: Perceived reason why WEPs will not replace cultivated crops.

3.3.5 Perceived Benefits of WEPs

There is wide agreement amongst participants that WEPs have benefits, with 96% of respondents showing a favourable perception. The benefits that were cited centred around the theme of health and nutrition. The most cited benefit was that WEPs help in preventing diseases and illness (26%), followed by good nutrition (23%) and that they give strength (21%), they are healthy (21%) and that they are good source of energy (10%) (Figure 3.6). There is no significant association between benefits with age group ($\chi^2_{2,120} = 10.03, p = 0.438$), gender ($\chi^2_{1,120} = 1.39, p = 0.925$), or income group ($\chi^2_{2,120} = 6.43, p = 0.778$). Figure 6 reveals that the elderly mostly cited nutrition (26%), while the adult group cited illness prevention (26%) as the main perceived benefits; the youth who previously perceived WEPs as not preferred also cited nutrition (30%) as their main perceived WEPs benefit.

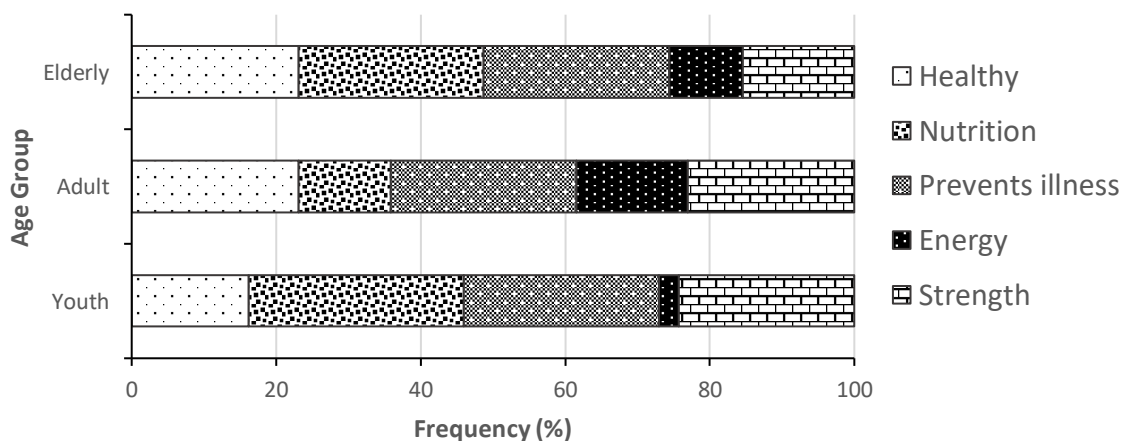


Figure 3.6: Perceived benefits of WEPs

Although participants acknowledged the benefits of WEPs, 30% stated that some of the WEPs have negative effects, including, causing constipation, diarrhoea, or sore throat. Regardless, most of the participants (92.5%) still perceive WEPs as healthier than cultivated food crops.

3.3.6 Future of WEPs

Participants expressed doubt that WEPs may be used in the future because 95% believe that consumption is in decline. When asked why this was the case, participants provided a variety of reasons ranging from deagrarianisation, climate change, preference of cultivated foods and westernisation. One recurring response was that there is less consumption of WEPs by the youth. When participants (from all age groups) were asked about the youth and the consumption of WEPs, even though there was no significant association ($\chi^2_{2, 120} = 2.40, p = 0.663$), a resounding 95% of participants agreed that the youth do not like WEPs. Interestingly, most youth participants also agree and admit that they (and their peers) do not like to consume WEPs. A variety of reasons were cited on why this is the case, including that they have little knowledge about WEPs (24%), they prefer other foods (24%), they are not interested (16%), and they dislike WEPs (14%), amongst many other reasons.

3.4 Discussion

3.4.1 Consumption of WEPs

This study shows that all the participants consume WEPs. This supports studies that show that WEPs are widely consumed in many rural communities in South Africa (Vorster *et al.* 2007; Lewu & Mavengahama, 2011; Mncwango *et al.* 2020) and elsewhere (Bortolotto *et al.* 2015; Cordeiro, 2012; Ong & Kim, 2017; Shumsky *et al.* 2014) leading to improved food and nutrition security and contributing to better livelihoods. The most consumed species were the dried fruits of *Vangueria infausta*, followed by *Citrullus lanatus* and *Vigna subterranean*. The fruit of *Citrullus lanatus* is mixed with porridge to make an orange-colored porridge that is usually consumed as a breakfast meal in usually during winter. The leaves of this species are also consumed as a vegetable, just like species such as *Cleome gynandra* and *Amaranthus retroflexus*. to which several studies (Faber *et al.* 2010; Mosina & Maroyi, 2016; Rankoana *et al.* 2015) have found them to be the common wild vegetable relish in this region. These species are amongst some of the most consumed wild vegetable species in the country alongside species such as *Corchorus tridens* and *Bidens pilosa* (Vorster *et al.* 2007).

About 53% of participants reported preferring wild vegetables to wild fruits. Preference of WEPs type differed with age, as the adult and elderly preferred wild vegetables, while the youth preferred wild fruits. A possible explanation for this is that, since the adults and elderly are more knowledgeable of the species (Gido *et al.* 2016), and have a longer history of their consumption, they prefer to consume wild vegetables as a relish more than the youth. All the age groups consume wild fruits at similar rates; however, preferences differ regarding consumption of wild vegetables as a relish. Adults and the elderly consume wild vegetables mainly for cultural reasons because they prepare them the traditional way (cooked with salt and water) and eaten as a relish. This appears to be problematic for the youth to consume them in this way. The youth reported that wild vegetables prepared in this way is like eating dirt or grass (Mncwango *et al.* 2020). Additionally, labels such as backward knowledge has been associated with the consumption of wild vegetables by the youth (Modi *et al.* 2006). Studies in other countries reveal mixed results regarding the attitudes of the youth towards WEPs. This study corroborates international studies such as Cruz *et al.* (2014) which found that the rural youth were uninterested in consuming WEPs, but instead preferred modern foods from neighbouring cities. Additionally, the youth associate WEPs consumption with low social status (Cruz *et al.* 2014), a perception that has been recurrent in several South African studies (Vorster *et al.* 2007; Lewu & Mavengahama, 2011; Mncwango *et al.* 2020; Modi *et al.* 2006). However, other studies such as Dovie *et al.* (2008) and Guissou *et al.* (2015) show that there is no difference in consumption between the old and the young because they eat and live together, therefore, they know more or less of the same species. This lack of difference between young and old regarding consumption and knowledge of WEPs has been observed in remote villages or where villages are isolated from the urban food markets and also in villages where traditional practices are upheld (Guissou *et al.* 2015; Matenge *et al.* 2012; Mncwango *et al.* 2020; Reyes-García *et al.* 2005). Shopping centres, which are in proximity, surround the study areas for this research; one is 15 km to the west whilst another is 20 km to the east. The proximity of these shopping centres makes modern foods easily accessible to the rural youth in these locations and might be contributing to widening the gap between the youth and the consumption of traditional foods.

The study has revealed that the frequency of consumption of WEPs is mostly between two and three times per week, although for some it is daily. This is supported by numerous studies that have arrived at similar results in South Africa (Mncwango *et al.* 2020). Consumers regard WEPs as important because they provide energy, prevent illnesses, and offer an improved

dietary diversity. Issues relating to health and nutrition are the most common reasons why the respondents chose to consume WEPs. For the majority, wild vegetables are consumed complementarily as meals for certain days a week, while for a few adults and elders WEPs are a main source of subsistence since they are consumed daily. This study did not find any significant statistical difference between consumption frequency with age and gender. Even though that was the case, males showed a slightly higher consumption frequency than females. This is in contradiction with several studies that have found females and the elderly to be the most frequent consumers; this was shown to be the case in Madagascar (Andriamparany *et al.* 2014) and in the Phillipines (Ong & Kim, 2017). This is likely because of female traditional roles and their preference of eating less modern foods (Lewu & Mavengahama, 2011; Mncwango *et al.* 2020; Modi *et al.* 2006). However, most of these studies were evaluating consumption of wild leafy vegetables rather than WEPs in totality.

In terms of income, this study did not find any significant statistical difference between the consumption frequency of WEPs and household income. This is contrary to previous literature where WEPs were labelled as poverty foods (Faber *et al.* 2010; Modi *et al.* 2006; Vorster *et al.* 2007), implying that they were consumed more by low-income households. This study found that all households, regardless of income, have members that consume WEPs in similar rates. Lower income households are mostly recipients of social grants that assist to diversify their livelihoods by enabling households to purchase food. This is mostly beneficial to the youth who prefer consuming meats, other processed and ‘modern’ foods. Even though high-income households may enjoy more purchasing power than lower income households, some of the household members (usually the adults and elderly) still complementarily consume WEPs regularly. This is contrary to international studies such as Sulaiman *et al.* (2022) who found that in Syria, wild plant usage decreased with increasing household income during periods of conflict. Similarly in Kenya, Gido *et al.* (2017) showed that household with a large budget allocated for food purchasing consumes less wild leafy vegetables. The conflicting findings between this study and other might demonstrate that the relationship between consumption of WEPs and household income is complex as there might be other contributing factors.

3.4.2 Perceptions of WEPs

Most of the participants expressed favourable perceptions towards the consumption of WEPs. This supports our hypothesis that local people hold positive perceptions about WEPs and corroborates studies that show that, generally, rural communities harbour favourable

perceptions towards WEPs (Taruvunga & Nengovhela, 2015). This is because WEPs may be popular and frequently consumed in rural areas, supplementing the households' food supply and overall seen as a valuable food source vital for sustaining livelihoods (Taruvunga & Nengovhela, 2015). There was wide agreement that WEPs are healthy, nutritious, tasty, and traditional and there was also wide disagreement that WEPs are poverty foods. The positive perceptions relating to the consumption of WEPs can be attributed to participants viewing WEPs as natural capital which provide tasty, healthy, and more nutritious foods than cultivated species. Some of the perceptions relating to WEPs consumption differed with age. Adults and elders were more likely to agree with the perceptions that WEPs are healthy, nutritious, tasty, and traditional than did the youth. The youth were more likely to agree that WEPs are not poverty foods. This relates to the earlier explanation that adults and elders value WEPs more because of traditions, knowledge, and experience hence they prefer them more than the youth. These results do not support our hypothesis that local people of different ages and genders hold positive perceptions about WEPs. According to Vorster *et al* (2007) the youth lack awareness of nutritional content of WEPs, while the elderly perceives them to be healthy and nutritious because the previous generation survived on them. Many studies often cite that WEPs are perceived to be poverty foods (Faber *et al.* 2010) a perception that was vehemently repudiated by participants in this study, including the youth. Some studies show that creating awareness about the value of WEPs to the youth can elevate their interest and changed their perceptions leading to their increased demand for information and seed (Vorster *et al.* 2003).

3.4.3 Perceptions Regarding Commercialisation

Almost all the participants are aware that WEPs are sold in local markets. They mention often seeing people on the side of the road selling wild fruits collected from the surrounding lands. They are also aware that some households sell dried wild vegetables, especially during the winter season as a livelihood diversification strategy. Participants indicated that they are less likely to buy WEPs because they have the same plants growing in their own gardens and in the surrounding landscapes. This included lower income households who perceived WEPs to be more tasty were also more likely to buy cultivated crops than WEPs. However, they would be interested in buying WEPs from retail stores if they were available. This is contrary to Gido *et al.* (2016) who found that rural households in Kenya preferred local, open-air markets over retail outlets. In my study area, the presence of central, open-air markets that sold WEPs was minimal. Instead, there are informal markets in the nearby urban centre where street hawkers

sold WEPs. However, participants would still prefer to buy in retail stores than in informal markets, possibly because they would perceive the products to be of higher quality.

Even though there was no statistical significance between the agreeability of the purchasing of WEPs with the age, gender and income group, the youth, males, and high-income household were the mostly likely to buy. This may be because the youth are less involved with the collection of WEPs species and if WEPs were available at retail stores, they will be more likely to buy. According to Mncwango *et al.* (2020), most young people frowned on harvesting WEPs and considered the activity to be degrading their dignity even though they participated in their consumption. Traditionally, males were not involved in the collection or preparation of WEPs, as it was regarded to be a female's role (Njume *et al.* 2014). Therefore, buying WEPs might be convenient because some youth find the process of harvesting and preparing WEPs to be unsuitable for their busy lifestyle (Matenge *et al.* 2012). Similarly, higher-earning households are more agreeable to buy because they have more to spend since they regard WEPs to be cheaper than cultivated foods (Gido *et al.* 2016).

Participants provided several reasons why they think people would buy WEPs from retail stores, mostly economic reasons. Even though WEPs grow abundantly after good summer rains, they become scarce during the dry winter months. WEPs are perceived to be high in demand in urban areas. Therefore, local rural scarcity caused by seasonality and demand in urban areas are perceived (mostly by the youth) to be the main reasons people would buy WEPs. The willingness to buy WEPs highlights dietary changes that rural communities are currently undergoing. This transition is characterised by the integration of food plants into the markets which ultimately leads to the commodification of the food system (Reyes-García *et al.* 2019).

When participants were asked whether WEPs or cultivated crops would likely sell more if WEPs were available in retail stores, the majority (58%) would buy cultivated foods more. This may be because food or dietary choice depends on food availability, affordability, convenience, desirability and culture (Herforth & Ahmed, 2015; Guissou *et al.* 2015). Therefore, cultivated crops are the backbone of agriculture, they are mostly cultivated, they are widely accessible and available to buy throughout the year. WEPs on the other hand are seasonal, spontaneous, and not widely available and accessible in shops. This leads some to dry them for home consumption or to sell them because prices are high in winter (Shackleton *et al.* 1998). Therefore, cultivated foods are highly favoured (especially by the youth) but in

the same light, WEPs are also regarded as valuable. Participants did not think WEPs can dominate and replace cultivated crops in the future, however, both can co-exist in the markets and that is ideal for dietary diversity. Rural communities and many cultures around the world are undergoing rapid dietary, nutritional and socio-economic change where their diets depend on foods bought from the markets (D'Ambrosio & Puri, 2016; Reyes-García *et al.* 2019; Whiting & MacKenzie, 1998). Some studies show that people living in isolated villages consume a more diverse diet than those living closer to markets (Reyes-García *et al.* 2019). If rural communities' access to markets has increased and if WEPs are integrated into those markets even though they still prefer cultivated foods, how will this affect dietary diversity of both rural and urban households? Will this lead to less diverse diets in rural areas since people will now be closer to markets? Will it lead to more diverse diets in urban areas? This would require further research and analysis.

3.4.4 Future of WEPs

Most of the participants expressed concern regarding the future of WEPs and their contribution to livelihoods because they believe they will decline for a variety of reasons, including climate change, land use change, and preference of cultivated crops by the youth. For example, Wessels *et al.* (2021) examined the risk of climate change to 1 190 plant species in Southern Africa under two future scenarios, and projected a decline of 69% for wild vegetables under a high emission scenario where temperatures increase by 4 °C by 2081 - 2100. Similarly, intensive land use reduces pollination that in turn affects the reproductive success of wild plants (Bennett *et al.* 2020). This is particularly concerning since WEPs depend on favourable climatic conditions and better land use management.

Another reason participants perceived WEPs to have a dim future is the relationship between the youth and WEPs. The youth, generally, hold positive perceptions about WEPs, and they consume them at almost identical rates as the adult and elderly groups. However, by their own admission, they do not like consuming WEPs, especially wild vegetables. The reasons they cited were that they have little knowledge about WEPs, they lack interest, they dislike WEPs, and they prefer consuming “modern” foods. This is in agreement with other studies that showed that the youth perceive WEPs as old-fashioned foods (Mncwango *et al.* 2020). International studies also corroborate the assertion that the youth consume less WEPs (Cruz *et al.* 2014; Gido *et al.* 2017). Additionally, other studies showed that the youth have little knowledge and skills for preparing WEPs, and nutritional information about WEPs or lack thereof was considered a

hindrance (Matenge *et al.* 2012). This study also showed that the youth were less likely to agree that WEPs are nutritious as compared to the other age groups. Some studies show that the youth in traditional isolated villages still know and consume WEPs in similar rates to the elderly (Guissou *et al.* 2015; Reyes-García *et al.* 2005, 2019). For future preservation of WEPs, there is a need for education campaigns and knowledge transfer (at home and schools) to address the limited information about WEPs to the youth. With societies currently undergoing socio-economic change, rural communities' access to markets is increasing as well as the youth aspiring to live and work in urban areas, the future of WEPs consumption becomes unclear. Will the consumption of WEPs continue to decline under the threat of urbanisation and modernisation or will the commercialisation and market integration of WEPs secure the future consumption of WEPs?

3.5 Conclusion

This study has shown that WEPs are widely consumed in the study areas by most people regardless of their age group, gender, or household income. It also found that in general, respondents held positive perceptions towards WEPs as hypothesised, however, some perceptions differed with age and gender. They perceived them to be healthy, nutritious, tasty, and traditional foods that are also important for diversifying their diets, for food security, improving their livelihood outcomes and for cultural value. They perceived them to have a promising commercial status as most people would be interested in buying them if they were widely available in retail stores. However, the future of the consumption of WEPs appears to be blurry. On the one hand, there is climate change and land use change that threaten the abundance of WEPs. On the other hand, there is the weakening relationship between the youth and the future consumption of WEPs. The youth consume WEPs at almost similar rates as the other age groups; they hold positive perceptions about WEPs but somehow still find them undesirable and would prefer consuming cultivated and processed foods instead. Some researchers have recommended for education to be prioritised from a young age to preserve knowledge about WEPs; commercial availability of WEPs products in retail stores target both young and old; modernisation of WEPs to improve acceptability and preference (Matenge *et al.* 2012). Further research would be required to assess the impact of such interventions on improving perceptions and acceptability of WEPs by the youth.

3.6 References

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Chapter 4

Availability, Abundance and Economic Value of Cultivated and Wild Edible Plants in Home Gardens

4.1 Introduction

The Sustainable Development Goals' (SDG) target of achieving zero hunger by 2030 seems to be moving in the wrong direction (FAO *et al.* 2022). This is because, between 2014 and 2019 the number of people experiencing hunger has risen, increasing from around 615 to about 650 million people (UN, 2021). This number has increased further to an estimated 828 million in 2021 as a result of the outbreak of COVID 19 which was responsible for additional hunger of 150 million people as compared to before the pandemic (FAO *et al.* 2022). In Africa, it is estimated that 278 million people were affected by hunger in 2021 and this number may worsen leading to 2030 as Africa has the highest prevalence of hunger in the world (FAO *et al.* 2022). These high numbers of people affected by hunger are driven by challenges such as conflict, natural disasters such as droughts and floods, economic shocks that create high food prices further affecting quality and quantity of foods (FAO *et al.* 2022). As a result, international bodies tackling these challenges are calling for a transformation in the food system and advocating for more people to have access to healthy and affordable food (FAO *et al.* 2022; UN, 2021).

In South Africa, it was estimated that 6.8 million people experienced hunger in 2017 (Stats SA, 2019). This was a decline from 13.8 million that were estimated to be affected by hunger in 2002 (Stats SA, 2019). Despite this decline, food insecurity is still a major problem in the country. South Africa is reported to be food secure on the national level; however, food insecurity persists at the household level (Mahlangu *et al.* 2020). According to Stats SA (2019), there were approximately two million households in 2017 that were experiencing hunger. Since the dawn of the new democratic dispensation, addressing challenges related to poverty and hunger alleviation through policy and other interventions were central tasks of the new government. The agricultural policy of 1998 aimed to build a competitive agricultural sector by improving and supporting smallholder farming while simultaneously sustaining the natural resource base (DAFF, 1998). To achieve this vision, several other policy introductions and agricultural programmes were formulated over the years. The diversity of programmes and plans may be necessary when faced with the complexity of food insecurity which may require multiple strategies (Galhena *et al.* 2013). In South Africa this include the Comprehensive

Agricultural Support Programme (CASP) which aims to support land reform beneficiaries and other private land owners who are engaged in farming for local markets and for exports (DAFF). The National Development Plan (NDP) plans to expand irrigation agriculture by putting 1.5 million hectares of land, especially in communal areas, under production while aiming to create a million jobs by 2030 (NDP, 2014). The *Fetsa Tlala* programme aims to support subsistence and smallholder farming by a further one million hectares (DAFF, 2013). Similarly, the Integrated Food Security Strategy aims to address food insecurity by implementing food garden programmes in communities (Mahlangu *et al.* 2020). This is because access to food at household level is determined by household cash income and the majority (84.4%) of households in South Africa are not agriculturally active (Stats SA, 2019). Home gardening is regarded as one of the best strategies for households to alleviate hunger and generate income in the face of an intensifying food crisis (Galhena *et al.* 2013).

Home gardens, also referred to as back/farmyards, compound or homestead gardens are an old cultivation practice where food is produced on small plots adjacent to human homesteads (Galhena *et al.* 2013; Ninez, 1987). Based on Ninez's (1984; 1987) research about home gardens in both developed and developing countries in five continents, they can generally be defined as small-scale production systems comprised of plant and/or animal produce for subsistence and/or income generation; they are usually in close proximity to households for convenience, security and special care (Galhena *et al.* 2013). Additional characteristics of home gardens, besides their small size and proximity to households, as listed by Michelle & Hanstad (2004) are that they: contain a high diversity of plant species; they supplement the household's food and income supply rather than being the main source; and they are a production system that the poor can easily part take in at some level. This is the case in South Africa where poverty affected provinces such as Limpopo (25%), Eastern Cape (20%) and Kwa-Zulu Natal (20%) have the highest proportion of household involved in agriculture (Stats SA, 2019). A significant percentage (44%) of these agriculturally active households are the recipients of government social grants. Therefore, the high levels of agricultural involvement by these particular households is important because of the role that home gardens play in sustaining and diversifying their livelihoods. Participating households do not only produce food for subsistence but also have the potential to generate income and create employment from the sale of home garden produce (Galhena *et al.* 2013; Oguttu *et al.* 2021; Philander & Karriem, 2016).

There are several factors responsible for giving home gardens their different structure and functions. Chief amongst them include location (Molebatsi *et al.* 2010), socio-economic status (Davoren *et al.* 2016; Galhena *et al.* 2013), and culture (Nemudzudzanyi *et al.* 2010). These factors can, to some extent, influence whether a home garden is for subsistence or commerce (Vogl *et al.* 2004) and it also influences the diversity of plant species therein. Generally, in South Africa, most of the home gardens produce food for household consumption and most home gardens contain fruits and vegetable species (Stats SA, 2019). However, differences in the function and types of plant species in home gardens can be discerned when the location of the home garden is considered. In terms of locations, studies such as Molebatsi *et al.* (2010) and Nemudzudzanyi *et al.* (2010) studied home gardens in rural, deep rural and peri-urban areas and observed differences among the three. They noted that peri-urban home gardens showed no evidence of specific pattern for plant management; instead, food, spiritual, medicinal, and ornamental plants were dispersed randomly throughout the yard (Nemudzudzanyi *et al.* 2010). Rural home gardens on the other hand displayed a management system where the gardens consisted of five or more micro-gardens each containing different plant groups (Molebatsi *et al.* 2010; Nemudzudzanyi *et al.* 2010). Additionally, peri-urban home gardens contained more cultivated fruit species while rural gardens retained more wild or indigenous fruit tree species (Molebatsi *et al.* 2010; Nemudzudzanyi *et al.* 2010). The choice of which plant species are found in home gardens may depend on individual taste and preference (Marco *et al.* 2010); although preferences are influenced by factors such as socio-economic status and culture (Davoren *et al.* 2016). According to Davoren *et al.* (2016), households with an improved socioeconomic status have home gardens that reflect a western colonial design characterised by many cultivated species, lawns, flower beds, and trees and shrub groups (Ignatieva & Steward, 2009). This is in comparison to rural or traditional home gardens associated with lower socioeconomic households characterised by the presence of a greater number of indigenous and native plants as well as useful food and medicinal plant species (Davoren *et al.* 2016).

The high number of indigenous and native plant species in rural home gardens could be a reflection of the cultural value of these local plants and how important they are for the transfer of indigenous knowledge (Nemudzudzanyi *et al.* 2010). Native plant species have been shown to be economically valuable too, contributing to 31% of the value of all plants found in rural home gardens in Dingleydale B village in Limpopo Province (High & Shackleton, 2000). However, Dingleydale had irrigation which is likely to have affected values and ratios (High &

Shackleton, 2000). Labadarios & Steyn (2001) have called for the promotion of more indigenous plants in home gardens for nutritional security and indigenous knowledge preservation. This is because WEPs are often overlooked and ignored by government agencies and food security interventions who regard them as weeds that should be managed (Vorster *et al.* 2007; Uprety *et al.* 2012). Similar observations were made in Kenya where government extension services and NGOs disregarded the value of wild fruits for improving livelihoods, instead, they promoted cultivated fruits such as mangoes (Kehlenbeck *et al.* 2013). This is problematic and short-sighted because WEPs have nutritional, cultural and economic value. Studies around the world show that WEPs are economically important and have potential to uplift households and local communities. For example, in Lebanon, *Cichorium intybus* (a wild leafy plant) was ranked as one of the most economically important species that could contribute to local scale cultivation and has value-chain potential (Baydoun *et al.* 2017). Additionally, in India, a survey conducted with local vendors and households showed that WEPs significantly contributed towards improving livelihood outcomes in a form of food and income (Chaudhury *et al.* 2021). As a result, WEPs were shown to have contributed between 5 to 75% of family income (Chaudhury *et al.* 2021). These results demonstrate significance of WEPs to local livelihood and the potential role they can play to diversify and expand local economies.

From all the issues discussed above, the importance of home gardens for household food and nutritional security is transparent. More especially if the home gardens contained a diversity of plant species, including WEPs. Since most of the studies cited above were comparing between home gardens in rural, remote, and urban areas; this study was a comparison of fruit and vegetable plants species in home gardens. The aim was to examine the importance and value of fruits and vegetable species in home gardens to rural households. The objectives were to: 1) assess the availability, abundance and richness of cultivated fruits and vegetable species in comparison to native ones. 2) Identify benefits and challenges of growing and maintaining species in home gardens. 3) Evaluate the economic value of cultivated fruits and vegetables species as compared to native ones. 4) Assess households' spending in relation to the purchasing of fruits and vegetables from markets and 5) identify other sources of household food and income. Factors such as household socio-economic status, land size, and household size were used to analyse if they had any influence on the home gardens' plant diversity and economic value. The study hypothesised that WEPs are abundant and have significant value in rural home gardens, however, their value and abundance is not higher than cultivated species.

4.2 Research Methods

4.2.1 Study Area

Refer to Chapter 1 for detailed information on study areas.

4.2.2 Data Collection

Quantitative data was collected from eight randomly selected villages in the Polokwane and Aganang District Municipalities that are under the jurisdiction of the Moletji and Matlala tribal authorities. Permission to conduct the study was granted by the relevant authorities in each village. The main approach for this study was a household survey which was complemented by direct observations and field surveys of the home gardens. The household survey was used to conduct interviews with 96 randomly selected households, i. e. 12 households in each of the eight villages (Manamela, Ramakgapola, Maupye, Thansa, Mamadila, Juno, Goedgevonden, Hwibi). The interviews were conducted from April to June 2019.

The interview schedule was divided into four sections: the first section dealt with the availability, abundance, and richness of WEPs and cultivated species (fruits and vegetables), as well as benefits and challenges of growing them in the home gardens. The second section dealt with the sale of home garden produce and the value thereof. The third section was about the purchasing of fruits and vegetables from the markets or retail stores. The last section dealt with other sources of household foods. Direct observation and field surveys were done simultaneously with the household interviews, as some questions required species to be counted in the home garden. Participants were also asked to provide estimates of quantities of fruits and vegetable picked from their gardens in the previous harvest season (2018/19). This data was quantified using sacks and buckets.

Additional data about the profile of the household was collected pertaining to household size, wealth and available assets, and plot size. When the size of the plot was unknown, Google Earth was used to identify the plot and relevant measurements were made. The interview accompanied by direct observation and field surveys took approximately 60 minutes for most households. In some of the home gardens where plants were abundant, surveys took up to two hours. The interviews were conducted in Northern Sotho to which the researcher is fluent. Plant species were identified using local names. A list of unknown species was compiled and submitted to the Larry Leach Herbarium at University of Limpopo for identification.

4.2.3 Data Analysis

Data were coded and entered in Microsoft Excel 2016. SPSS and Microsoft Excel were used to summarise the data using descriptive statistics. Pearson's Chi-square tests were performed in SPSS to determine variance and Kruskal-Wallis tests were also performed in SPSS to determine statistical differences of species availability, abundance, and richness between villages. The mean household wealth index was calculated by normalising and summing up the listed number of available assets.

Amounts of collected fruits and vegetables which were previously quantified as sacks and buckets were converted into metric units. The economic value of cultivated fruits and vegetables was determined by multiplying their weight with local market prices. The value for wild vegetables was determined by firstly weighting dried plant matter in a cup and multiplying with the average price from different sellers. The value of dried wild vegetable was determined to be 42 g x R14 which was the average price per cup from all the sampled villages. Since the estimated weight of harvested wild vegetables was for the fresh or wet plant matter, the data had to be converted into dry matter. A cup of fresh wild vegetable leaves weighs 170 g therefore $42\text{g}/170\text{g} = 0.25$ which means wild vegetables lose 75% of their weight when dried. The value of wild fruits i.e., *Sclerocarya birrea*, was determined by quantifying the processed beverage and calculating with the local average price per litre. Other wild fruits were valued by converting their quantity in buckets into metric units and were calculated using local prices. The quantity of cultivated fruits and vegetables was also converted into metric units and prices from local informal markets were used to determine their market price. If a species was not available in the informal market, local people were asked how much they would sell it for per unit and then converted to kilograms.

4.3 Results

4.3.1 Household profile

A total of 96 households were visited for this study. The average household size was 5.0 ± 2.74 members, ranging from one to thirteen members. The households were equally headed by males and females. Most of the households (71%) received some types of social grant, mostly old age grants (47%) and child grants (45%) (Table 4.1). Grants were the most important source of cash income to 36% of the households, only edged by households (38%) who have an employed member(s), whilst 14% receive remittances. Therefore, most of the households (77%) fall within the low-income range of between R0 – R5 000 per month; 18% occupy the

middle-income range of R5 000 – R15 000 and only 5% earning high income of over R15 000 per month. The average plot size was $2\,042 \pm 702$ ranging from 1 000 m² to 5 000 m². Most of the villages had one or two boreholes from where households would source water, while other villages sourced water from a dam. The overall wealth status of households was 2.2 ± 0.97 ranging from 0.67 to 5.93 out of a possible 11.

Table 4.1: Summary profile of sampled households (n=96)

Variable	Category	No.	(%)
Household size	Mean $\pm$ SD	5.0 $\pm$ 2.74	
Household head	Male	48	50
	Female	48	50
Household income	Low (R0 - R5000)	74	77
	Middle (R5 001 -R15 000)	17	18
	High (> R15 000)	5	5
Receive Social grants		71	74
Social grant type	Child grant	45	47
	Disability	1	1
	Old age	47	49
Largest cash income source	Grants	35	36
	Farming	5	5
	Business	7	7
	Salary	36	38
	Remittances	13	14
Water source	Own Borehole	1	1
	Dam	24	25
	Community Borehole	71	74
Plot size (m ²)	Mean $\pm$ SD	2 042 $\pm$ 702	
Wealth status	Mean $\pm$ SD	2.21 $\pm$ 0.97	

There was a significant difference ($H = 47.7$, $p < 0.001$) in plot sizes across all eight villages. The largest plot sizes were observed at Mamadila ($2\,650 \pm 1\,702$ m²), followed by Thansa ($2\,233 \pm 281$ m²) and Manamela ($2\,200 \pm 148$ m²) (Table 4.2). *Post hoc* tests showed no significant differences amongst all the villages except for when villages were paired with Maupye which had the smallest plot sizes ($1\,267 \pm 231$ m²). Plot sizes in Maupye ranged from 1 000 m² to 1 800 m², whilst in Mamadila they ranged from 1 000 m² to 5 000 m².

Table 4.2: Number and proportion of wild and cultivated vegetable species in home gardens (n=12 per village).

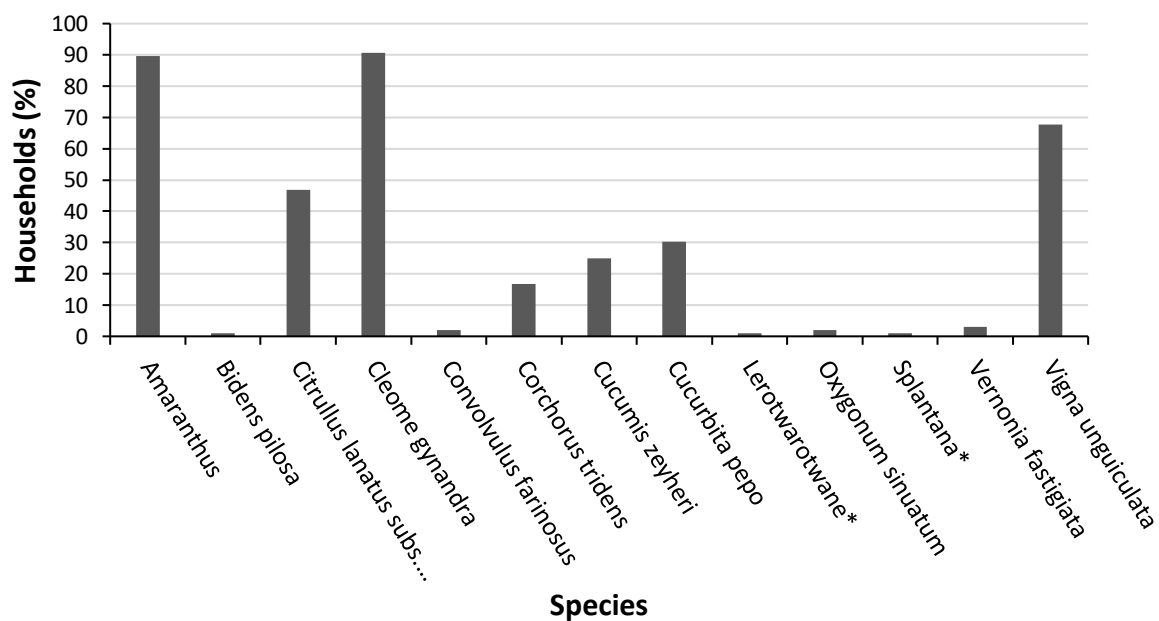
	Villages								Mean $\pm$ SD
	Manamela	Ramakgaphola	Maupye	Thansa	Mamadila	Juno	Goedgevonden	Hwibi	
Plot size m ²	2200 $\pm$ 148	2092 $\pm$ 29	1267 $\pm$ 231	2233 $\pm$ 281	2650 $\pm$ 1702	1917 $\pm$ 204	2042 $\pm$ 67	1983 $\pm$ 175	2048 $\pm$ 550
No. of veg spp/village	17	14	13	16	14	12	16	12	14.3 $\pm$ 1.9
No. of wild spp/village	8	9	6	9	7	8	9	7	7.9 $\pm$ 1.1
No. of cultivated spp/village	9	5	7	7	7	4	7	5	6.3 $\pm$ 1.6
% of wild	47.0	64.3	46.0	56.3	50.0	66.7	56.3	58.3	
% of cultivated	53.0	35.7	54.0	43.7	50.0	33.3	43.7	41.7	
No of veg species/hh	6.7 $\pm$ 2.4	5.2 $\pm$ 1.7	5.1 $\pm$ 2.4	6.8 $\pm$ 2.6	5.7 $\pm$ 2.0	5.0 $\pm$ 1.3	6.6 $\pm$ 2.2	6.4 $\pm$ 3.1	5.9 $\pm$ 2.3
No. of wild veg/hh	4.0 $\pm$ 1.3	4.2 $\pm$ 1.5	2.8 $\pm$ 1.4	3.9 $\pm$ 1.8	3.6 $\pm$ 1.2	4 $\pm$ 1.3	3.9 $\pm$ 1.4	3.7 $\pm$ 1.2	3.9 $\pm$ 0.4
No. of cultivated veg /hh	2.7 $\pm$ 2.6	1.0 $\pm$ 0.8	2.3 $\pm$ 2.5	2.9 $\pm$ 1.8	2.1 $\pm$ 1.6	1 $\pm$ 1.1	2.7 $\pm$ 2.2	2.7 $\pm$ 2.2	2.2 $\pm$ 0.8
% of wild veg	59.7	81.0	55.0	57.3	63.2	80.0	59.0	57.8	
% of cultivated veg	40.3	19.0	45.0	42.7	36.8	20.0	41.0	42.2	

* spp = species; hh = household

4.3.2 Production of vegetable species per household

4.3.2.1 Wild vegetables

Wild vegetables were present in 97% of the home gardens across all the villages. Most of the households (94%) emphasised the importance of having wild vegetables in their home gardens, mostly for health and nutritional benefits. The average number of wild vegetable species per household was 3.7 ± 1.5 across all villages. There was no significant difference ($H = 9.8$, $p > 0.05$) in the number of wild vegetable species between villages. The most species per household were observed at Ramakgaphola at an average of 4.2 ± 1.5 species, and the least at Maupye with an average of 2.8 ± 1.4 (Table 4.2). The most widespread species were *Amaranthus retroflexus* and *Cleome gynandra* (see figure 4.2) which were present in over 90% of the households, compared to species such as *Bidens pilosa* and *Oxygonum sinuatum* which were noted in less than 2% of the households (Figure 4.1).



*denotes unidentified species

Figure 4.1: Frequency of wild vegetable species available in home gardens (n=96)



Figure 4.2: *Cleome gynandra* in the home garden (Goedgevonden)

4.3.2.2 Cultivated vegetables

Slightly fewer households (78%) had cultivated vegetables available in their gardens as compared to wild vegetables (97%). The overwhelming majority of those households acknowledged the importance of having cultivated vegetables mainly for health and economic benefits. The average number of cultivated vegetable species per garden across all villages was 2.2 ± 2 , with the highest observed at Thansa (2.9 ± 1.8) and the lowest at Ramakgaphola (1 ± 0.8) (Table 4.2). There was no significant difference ($H = 13.34$, $p > 0.05$) in the number of cultivated vegetable species available across the villages. The most available species was *Spinacia oleracea* (See figure 4.3), present in only 28% of the home gardens, followed by *Allium cepa* (22%), *Beta vulgaris* (21%) and *Daucus carota* (15%). The least available cultivated vegetable was *Allium sativum* which was present in only 2% of the home gardens (Figure 4.4).



Figure 4.3: *Spinacia oleracea* in the home garden (Hwibi)

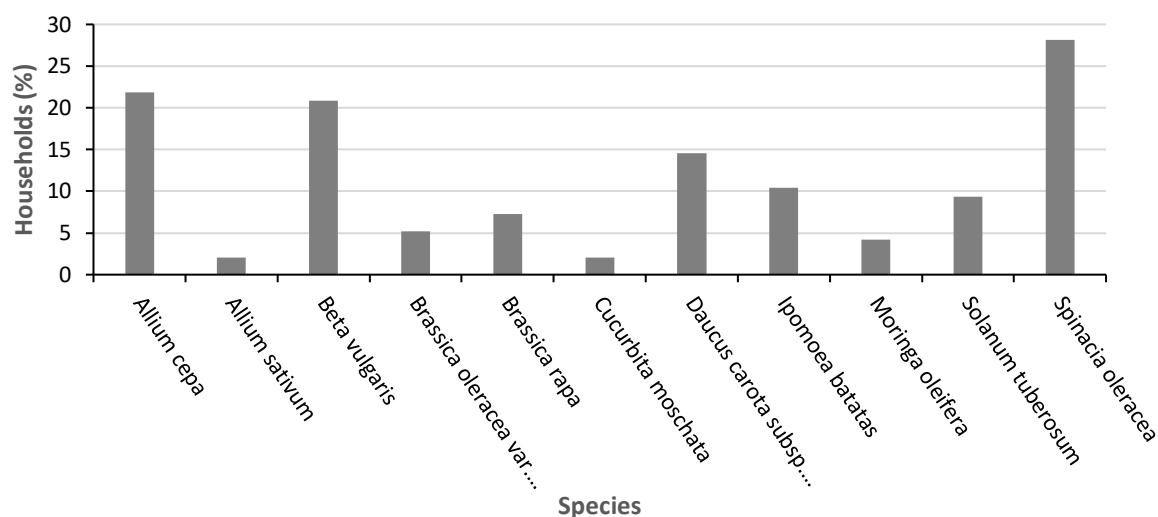


Figure 4.4: Frequency of cultivated vegetable species available in home gardens (n=96)

4.3.3.3 Vegetable species richness

Twenty-four vegetables species were recorded across all eight villages, 11 cultivated and 13 wild. Manamela had the highest number of vegetable species (17), whilst Juno and Hwibi had the least, both with 12 species (Table 4.3). In five of the eight villages (Ramakgaphola, Thansa, Juno, Goedgevonden, and Hwibi), the number of wild vegetables species was higher than cultivated ones. Wild vegetable species such as *Amaranthus retroflexus*, *Cleome*, and *Cucumis zeyheri*, and cultivated species like *Spinacia oleracea* and *Beta vulgaris*, were prevalent in all villages. Other species like *Oxygonum sinuatum* and *Moringa olifera* were present in only one or two villages (Table 4.3). There was no correlation between number of wild and cultivated vegetables per household, ($r=-0.145$; $P = 0.159$).

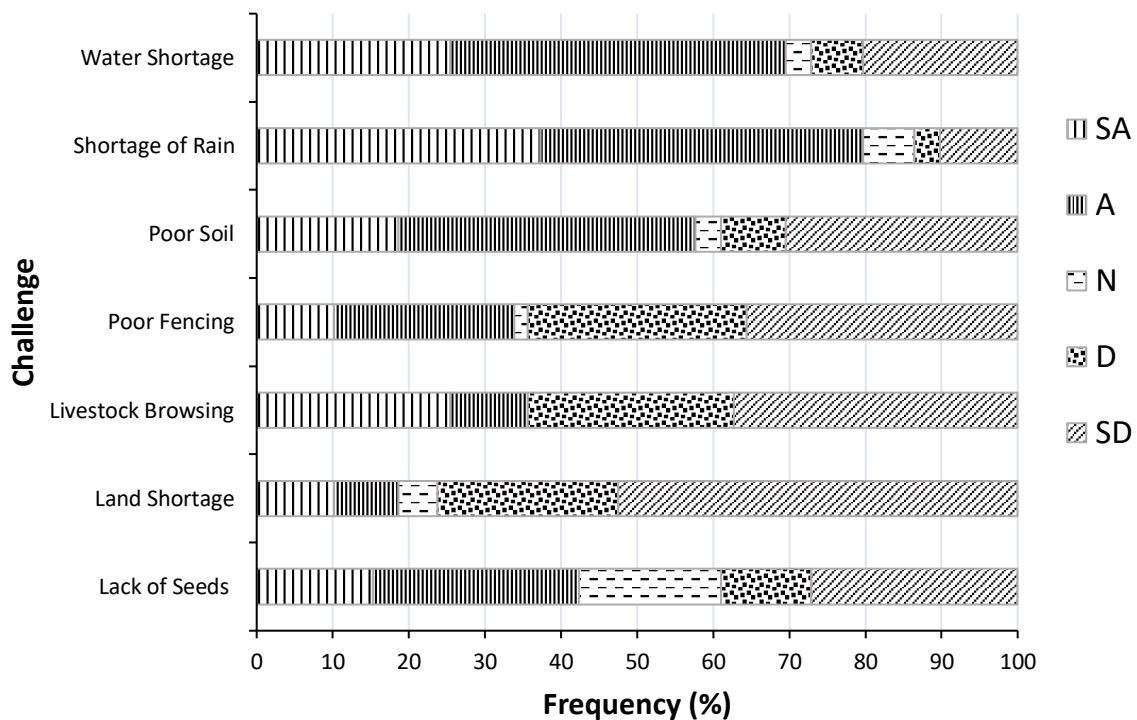
Table 4.3: Vegetable species and the number of households recorded per village

Species	Wild/Cultivated	Manamela	Ramakgaphola	Maupye	Thansa	Mamadila	Juno	Goedgevonden	Hwibi	Villages
<i>Allium cepa</i>	E	5		3	3	1		5	4	6
<i>Allium sativum</i>	E		1		1					2
<i>Amaranthus retroflexus</i> L. <i>retroflexus</i>	W	11	11	11	10	10	10	11	11	8
<i>Beta vulgaris</i>	E	2	1	2	2	3	2	5	2	8
<i>Bidens pilosa</i>	W	1								1
<i>Brassica oleracea</i>	E	2			2	1				3
<i>Brassica rapa</i>	E		1	1	3			1		4
<i>Citrullus lanatus</i>	W	6	8	4	6	1	7	6	5	8
<i>Cleome gynandra</i>	W	11	11	10	10	12	12	10	10	8
<i>Convolvulus farinosus</i>	W				1			1		2
<i>Corchorus tridens</i>	W		1	2	3		4	4	2	6
<i>Cucumis zeyheri</i>	W	1	2	1	2	1	3	4	2	8
<i>Cucurbita moschata</i>	E	2								1
<i>Cucurbita pepo</i>	W	7	3		5	9	3	2		5
<i>Daucus carota</i>	E	1		2	3	2		3	2	6
<i>Ipomoea batatas</i>	E	1		4		2	1		2	5
<i>Lerotwarotwane*</i>	W							1		2
<i>Moringa oleifera</i>	E	1					1	1		3
<i>Oxygonum sinuatum</i>	W		1		1					2
<i>Solanum tuberosum</i>	E	2	1	1	1	3		1		6
<i>Solanum lyvopersicum</i> L.		4	1	4	5	6	3	6	8	8
<i>Spinacia oleracea</i>	E	5	2	4	3	2	1	5	4	8
<i>Splantana*</i>	W	1								1
<i>Vernonia fastigiata</i>	W		1					1	1	3
<i>Vigna unguiculata</i>	W	8	9	6	7	9	8	8	8	8

Note: * denotes unidentified species

4.3.3.4 Challenges to wild vegetable availability

Households were presented with a list of constraints that might affect wild vegetable availability in their home gardens. Participants had to select (on a scale) whether they agree or disagree with those statements. Since WEPs generally grow in the rainy, summer season and some species are dependent on rain, it was not surprising to see the lack of rain as a challenge that most households (80%) encounter (Figure 4.5). This was closely followed by shortage of water (70%) and poor soil (58%) as the other constraints that affect the availability of wild vegetables in their home gardens. Livestock and lack of fencing does not appear to be a problem to most households with 65% them disagreeing with these two challenges. Also, land appears to be a minor challenge as 77% of the households do not perceive it to be a constraint that affects wild vegetable presence in their gardens. However, not all households experience challenges the same, for example, water shortage affects lower-income households (50%) more than middle-income (17%) and high-income (20%) households. Additionally, land shortage was a challenge mostly at Maupye affecting 25% of households in the village.

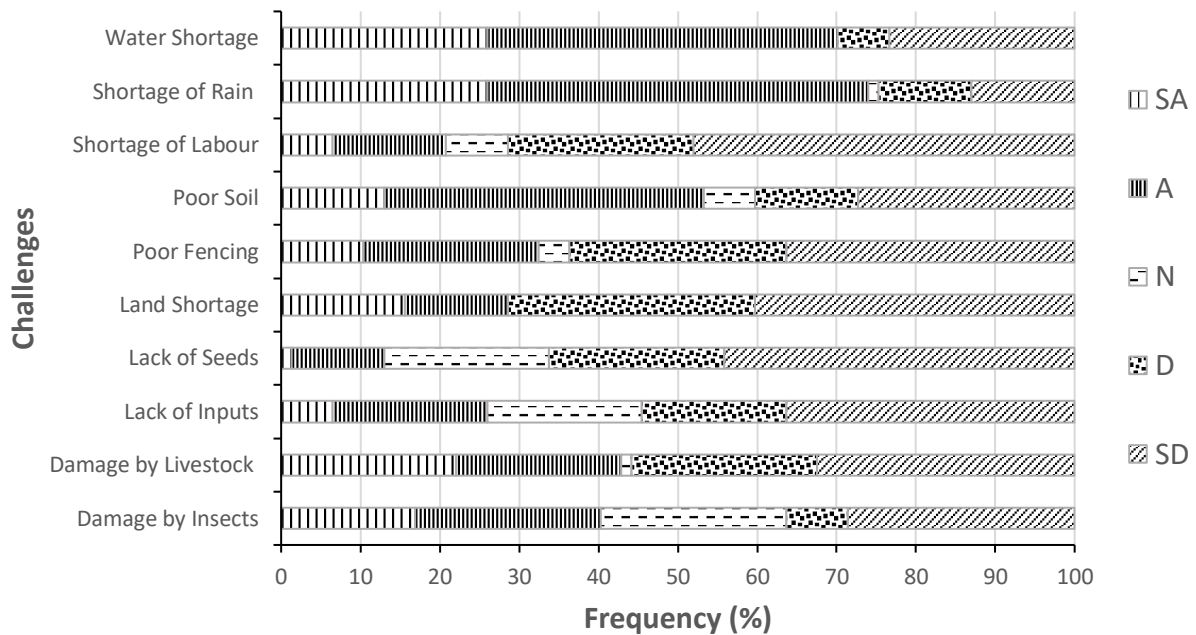


*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.5: Challenges reportedly affecting wild vegetable availability in home gardens

4.3.3.4.2 Challenges to cultivated vegetable availability

Constraints to cultivated vegetable production were not dissimilar to those of wild species. Lack of rain (74%), shortage of water (70%), and poor soil quality (53%) were perceived to be the biggest challenges (Figure 4.6). A good example of the impact of shortage of water on species availability was observed at Ramakgaphola where households actively chose to plant fewer cultivated vegetable species because of their poor access to running water. Similarly, most of the households do not perceive poor fencing (63%), livestock (56%), access to seeds (66%), and land (71%) to be a hindrance to growing cultivated vegetables. Additionally, labour and access to inputs such as fertilizers does not appear to be a constraint to most households. However, households had mixed reactions towards the effect of insects, as 40% of households perceived them to be a challenge compared to 37% who do not, whilst 23% were neutral.



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.6: Reported challenges to growing cultivated vegetable species in home gardens

4.3.4 Availability of fruit tree species

4.3.4.1 Wild tree species

Fruit trees are abundantly available in most households (97%). Wild tree species were present in 58% of households across all villages. Maupye and Mamadila had the highest percentage of home gardens with the most wild fruit tree presence at 75% for both, while Thansa and Goedgevonden had the lowest percentages being at 42% and 33%, respectively (Table 4.4). The average number of wild fruit trees in home gardens across all villages was 2.5 ± 0.78 , with the highest number at Juno (2.8 ± 0.71) and the lowest recorded at Maupye (2.0 ± 0.71). There was no significant difference in the number of wild fruit species between villages ($H = 7.8$, $p > 0.05$).

Table 4.4: Number and proportion of wild and cultivated fruits species in home gardens (n=12 per village)

	Villages								Mean $\pm$ SD
	Manamela	Ramakgaphola	Maupye	Thansa	Mamadila	Juno	Goedgevonden	Hwibi	
Plot size	2200 $\pm$ 148	2092 $\pm$ 29	1267 $\pm$ 231	2233 $\pm$ 281	2650 $\pm$ 702	1917 $\pm$ 204	2042 $\pm$ 67	1983 $\pm$ 175	2048 $\pm$ 550
No. of ft spp	14	14	17	15	16	19	15	18	16.0 $\pm$ 1.7
No..of wf spp	2	2	3	2	3	3	2	4	2.6 $\pm$ 0.7
No. of ef spp	12	12	14	13	13	16	13	14	13.4 $\pm$ 1.2
% of wf spp p/vill	14.0	14.0	18.0	13.0	19.0	16.0	13.0	22.0	
% of ef p/vill	86.0	86.0	82.0	87.0	81.0	84.0	87.0	78.0	
% of hh with trees	100	100	100	100	100	92.0	92.0	92.0	
No. of trees	10.3 $\pm$ 7.1	7.3 $\pm$ 4.3	19.8 $\pm$ 27.2	12.3 $\pm$ 6.5	10.3 $\pm$ 5.1	9.8 $\pm$ 11.2	7.0 $\pm$ 3.0	8.6 $\pm$ 7.0	10.7 $\pm$ 7.8
% of hh with wf trees	67.0	58.0	75.0	42.0	75.0	67.0	33.0	67.0	
No. of wft/hh	2.4 $\pm$ 0.9	2.3 $\pm$ 0.8	2.0 $\pm$ 0.7	2.6 $\pm$ 0.5	2.7 $\pm$ 0.7	2.8 $\pm$ 0.7	2.5 $\pm$ 1.0	2.5 $\pm$ 0.9	2.5 $\pm$ 0.2
% of hh with ef trees	100	83.0	100	100	92.0	83.0	92.0	83.0	
No. of eft/hh	8.6 $\pm$ 7.1	7.0 $\pm$ 4.2	18.5 $\pm$ 27.7	11.3 $\pm$ 6.6	8.8 $\pm$ 5.0	8.9 $\pm$ 11.0	6.1 $\pm$ 2.3	7.7 $\pm$ 6.7	9.6 $\pm$ 7.9

*wf=wild fruit; ef=cultivated fruit; ft=fruit tree; p/vill=per village; hh=household; spp = species

4.3.4.2 Cultivated fruit trees

Many more households (92%) also had cultivated fruit trees in their home gardens (see figure 4.7). All the sampled households in Manamela, Thansa and Maupye had cultivated trees compared to villages like Mamadila and Hwibi where cultivated trees were available in 92% and 83% of the households, respectively. The average number of species per home garden across all villages was 9.7 ± 12.05 , with the highest mean observed at Thansa (11.3 ± 6.57) and the lowest at Goedgevonden (6.1 ± 2.25). There was no significant difference ($H = 6.2, p > 0.05$) in the number of cultivated fruit trees across all villages.



Figure 4.7: Cultivated fruit trees in the home garden (*Mangifera indica* and *Prunus persica*)

4.3.4.2.1 Fruit tree preferences

There were a total of 999 trees in all 96 sampled households across all villages; 142 were wild (14%) and 857 were cultivated (86%). Most of the trees (15%) were recorded in Mamadila, while the least were recorded at Goedgevonden with 8%. From these trees, 23 species were identified, 17 (74%) were cultivated and 6 (26%) were wild. Juno and Hwibi had the highest richness of fruit tree species, with 19 and 18 species, respectively, while Manamela and Ramakgaphola had the least (14 each) (Table 4.4). Wild fruit species like *Sclerocarya birrea* and *Vangueria infausta* were available in all the villages (figure 4.8). Similarly, cultivated fruit species such as *Psidium guajava*, *Mangifera indica* and *Prunus persica* were also prevalent in all villages (Tables 4.5). Unlike with wild vegetable species, wild fruit trees were present in fewer households. The most available wild tree species across all villages were *Sclerocarya birrea* and *Vangueria infausta* present in 39 % and 29%, respectively (Figure 4.9). On the other hand, the most present cultivated fruit trees were *Prunus persica* (64%), followed by *Mangifera*

indica (61%) and *Punica granatum* (40%) (Figure 4.10). There was a significant positive correlation between the number of wild fruit species and cultivated fruits species ($r = 0.234$; $P = 0.022$).



Figure 4.8 *Vangueria infausta* (A) and *Sclerocarya birrea* (B) in home gardens

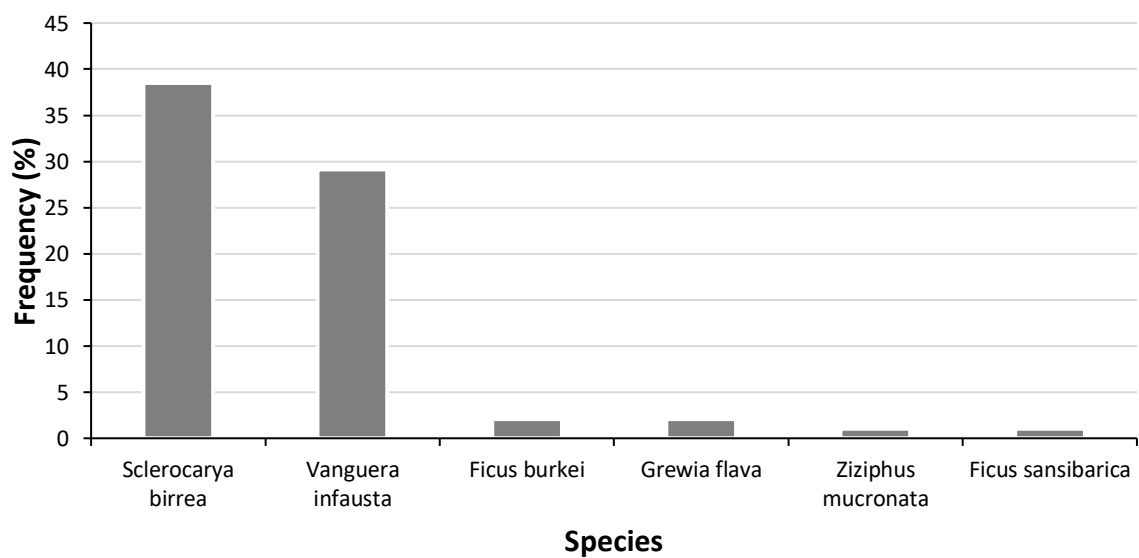


Figure 4.9: Frequency of wild fruit tree species in home gardens (n = 96)

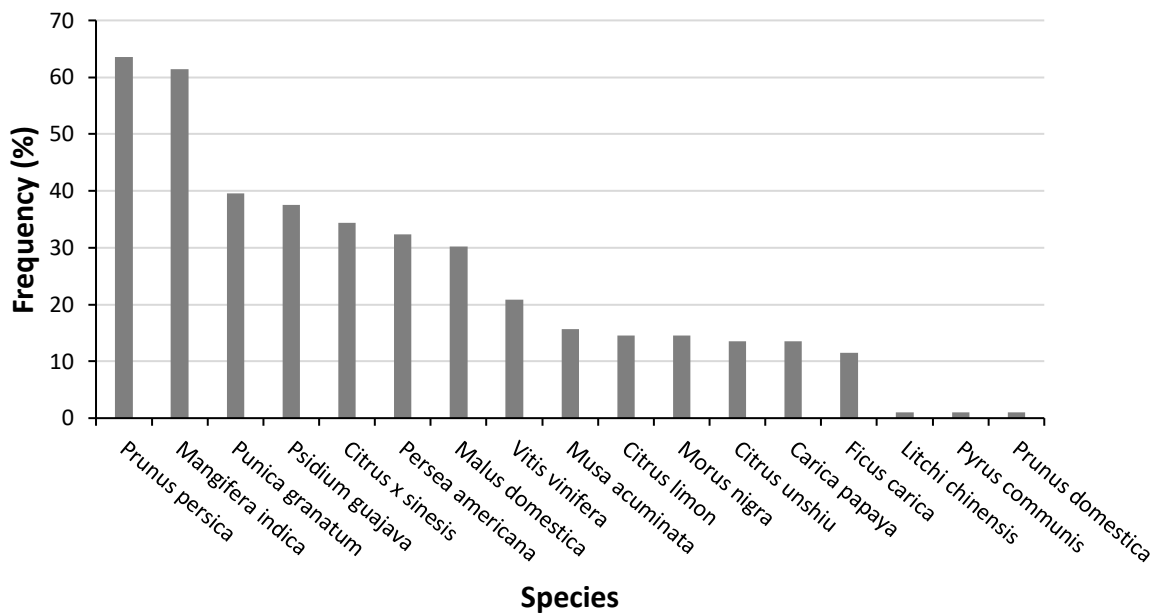


Figure 4.10: Frequency of cultivated fruit trees in home gardens (n = 96)

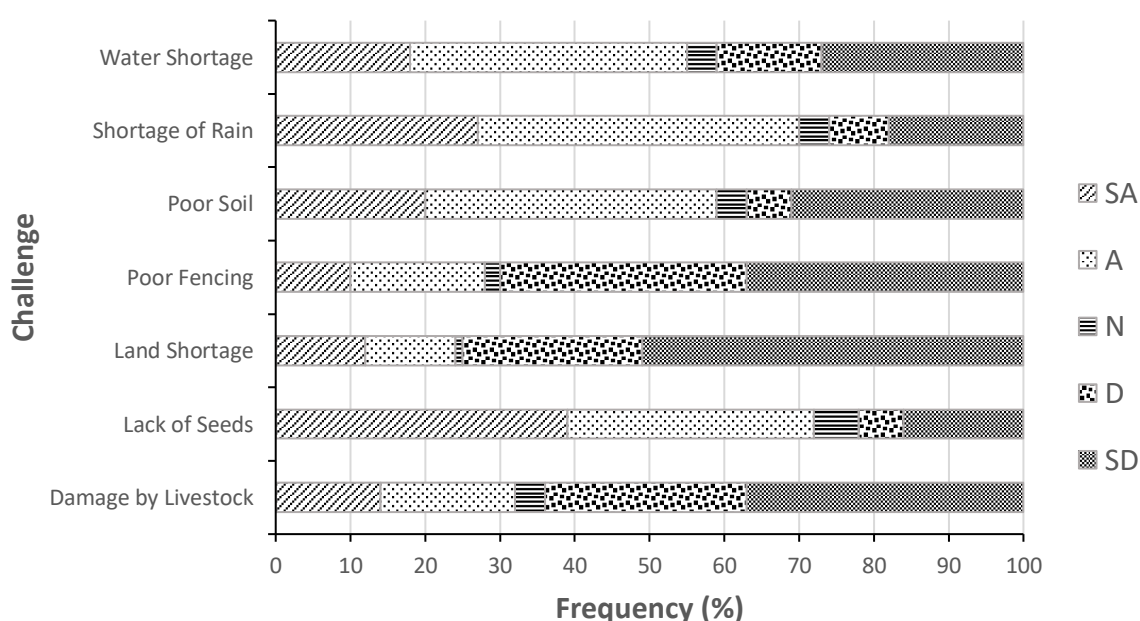
Table 4.5: Fruit species and the number of households recorded per village

Species	Wild/Exotic	Manamela	Ramakgaphola	Maupye	Thansa	Mamadila	Juno	Goedgevonden	Hwibi	Villages
<i>Carica papaya</i>	E		1	3	1		2	2	4	6
<i>Citrus limon</i>	E	1	3	4		3	2	1	1	7
<i>Citrus unshiu</i>	E	3	2	1	1	2	2		4	7
<i>Citrus x sinensis</i>	E	5	5	2	4	3	3	4	7	8
<i>Ficus burkei</i>	W		1	1						2
<i>Ficus carica</i>	E			4	1	2	1	2	1	6
<i>Ficus sansibarica</i>	W								1	1
<i>Grewia flava</i>	W						1		1	2
<i>Litchi chinensis</i>	E					1	1		1	3
<i>Malus domestica</i>	E	6	1	7	4	5	3	2	1	8
<i>Mangifera indica</i>	E	7	7	10	4	7	6	11	7	8
<i>Morus nigra</i>	E	1		2	1	3	2	2	4	7
<i>Musa acuminata</i>	E	2	1	5	4			3	3	6
<i>Persea americana</i>	E	11	5	4	6	3	1	2		7
<i>Prunus domestica</i>	E						1			1
<i>Prunus persica</i>	E	11	9	9	5	9	8	3		7
<i>Psidium guajava</i>	E	5	2	5	4	4	3	3	5	8
<i>Punica granatum</i>	E	6	4	4	3	3	6	5	6	8
<i>Pyrus communis</i>	E						1			1
<i>Sclerocarya birrea</i>	W	6	5	4	3	7	6	2	5	8
<i>Vangueria infausta</i>	W	3	4	5	2	3	4	2	4	8
<i>Vitis vinifera</i>	E	3	1	3	1	2	7	1	1	8
<i>Ziziphus mucronata</i>	W					1				1

4.3.4.3 Challenges to fruit trees availability

4.3.4.3.1 Wild trees species

Most of the households (62%) perceive wild fruit species to be on the decline in their gardens. Some of the reasons provided for the decline are that there is lack of seeds (72%), poor rainfall (70%), poor soil (59%) and a shortage of water (55%) (Figure 4.11). Since wild trees grow spontaneously around home gardens, their decline is not by lack of trying to plant new trees. Households report extracting seedlings or young trees from the wild to plant them in their gardens, however, most often the trees die because of some of the challenges mentioned above, i.e. poor soil and lack of rain. The decline is also caused by the removal of trees from the home gardens because they are either too old, or damaging infrastructure (roots are causing cracks to the house or trees are too close and damaging the fence) or they are removed to make space for new developments around the homestead. Some households (17%) report growth of new wild fruit trees in their gardens and overall, an increase in trees in their gardens.



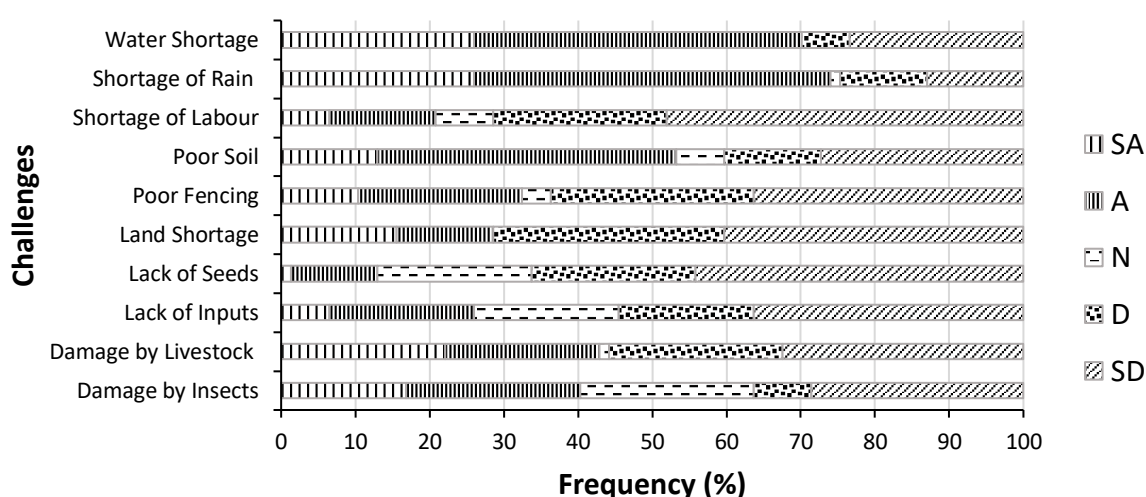
*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.11: Challenges affecting wild fruit trees availability in home gardens

4.3.4.3.2 Cultivated fruit trees

The perception by households about cultivated fruit trees is the opposite to wild species because most households (62%) report that the number of fruit trees is increasing in their home gardens. Despite this increase, households still face similar challenges faced with wild species such as

lack of rainfall (74%), shortage of water (70%) and poor soil (53%) (Figure 4.12). However, unlike with wild fruit species, lack of seedlings is not a challenge as households find cultivated tree easier to grow than wild trees. There is evidence of households removing cultivated species for similar reasons they remove wild ones from their gardens, however, removed trees can be easily replaced by planting more trees if required.



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.12: Challenges affecting cultivated fruit tree availability in home gardens

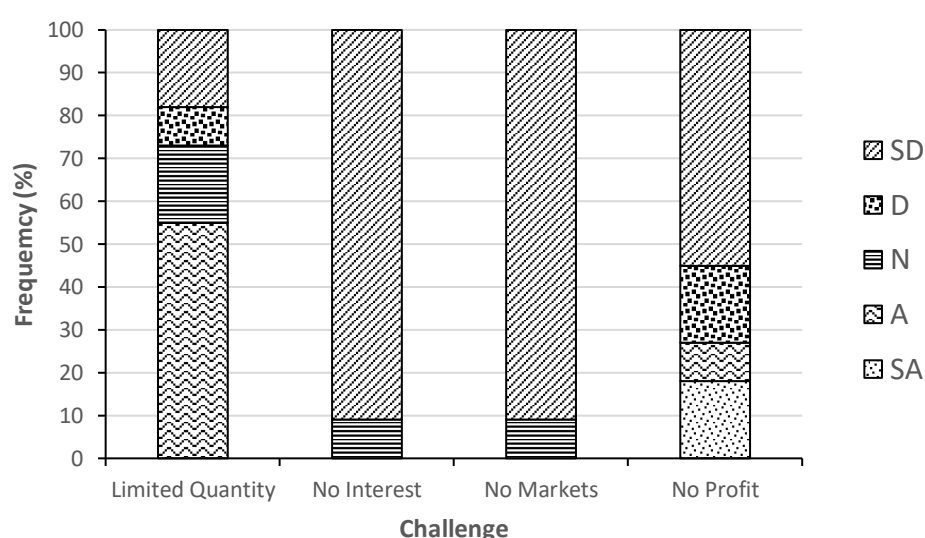
4.3.5 Sale of home garden produce

4.3.5.1 Wild species

Most of the households (93%) consume wild vegetables for subsistence with 7% involved with trade and 11% of households are involved in the sale of processed wild fruits. Besides subsistence, other reasons given for not selling wild species are that households do not produce adequate quantities, or people already have them in their own gardens or households are just not interested in selling. On the other hand, households that do sell do so because they produce more than enough and there is an opportunity to make extra income. Households sell wild vegetables such as *Amaranthus retroflexus*, and *Cleome gynandra* from their homes, while fruits of *Sclerocarya birrea* are processed into an alcoholic and non-alcoholic beverage (morula beer and juice) for sale too. Wild vegetables are sold dry and sell for (on average) R14 per cup while beverages (alcoholic and non-alcoholic) made from wild fruits go for R10 per litre or R20 in other neighbouring villages.

4.3.5.1.1 Challenges to selling wild species

Sellers were presented with a list of potential challenges that may affect their businesses to measure their level of agreement. Most of the sellers strongly disagreed with most statements such as whether there is no market for WEPs (91%), lack of interest from people (91%) and WEPs being less profitable (55%) (Figure 4.13). However, most of them (55%) agreed that WEPs, especially wild fruits, were limited in quantity, therefore constraining how much extra income they can generate.



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.13: Challenges affecting the selling of WEPs from home gardens

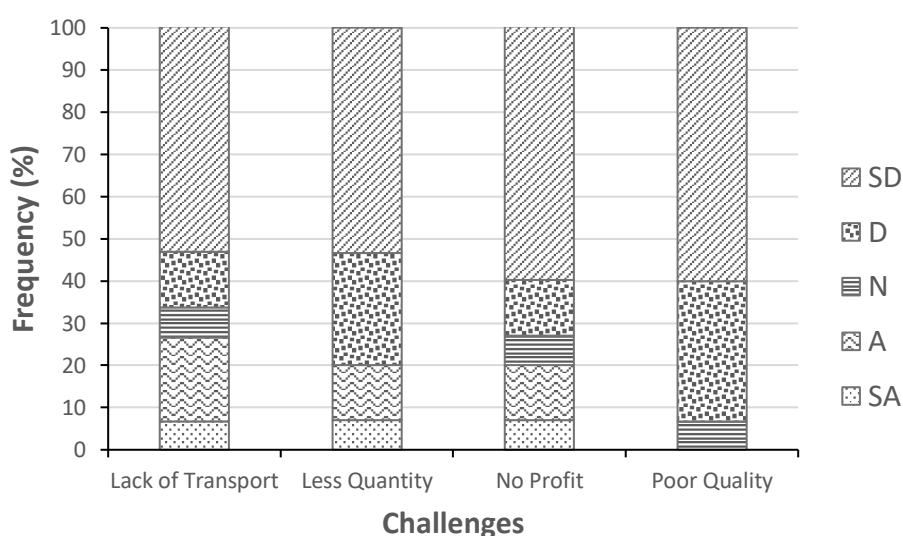
4.3.5.2 Cultivated species

Slightly more households (16%) are involved in the sale of cultivated species as compared to wild species. The reasons for selling were similar to those of wild species because the aim was to generate more income when households' subsistence requirements are achieved. They sell fruits of species like *Mangifera indica*, *Citrus x sinensis*, *Citrus unshiu* and vegetables like *Spinacia oleracea* and *Beta vulgaris* from their homes or on the side of the main road. A crate of *Citrus x sinensis* sold for R65 while a bunch of *Spinacia oleracea* is sold for R10.

4.3.5.2.1 Challenges

Only a few sellers indicated facing challenges even when selling cultivated species. Most of the sellers strongly disagreed with statements about potential challenges they may have encountered. They (strongly) disagreed (74%) with the statements that there is more

competition (73%), lack of transport (66%), less profit (73%), less quantity (80%) and low quality (93%) (Figure 4.14).



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.14: Challenges affecting sale of cultivated species from home gardens

4.3.6 Value of WEPs

From a total of 47 fruit and vegetable species recorded across all eight villages, the total sum of the estimated value of all the produce was R706 641 (Table 4.6). Cultivated species accounted for 64% of the total estimated value relative to wild species, which represented 36% of the value. Cultivated fruit was the category with the highest value of R365 662 which made up over half (51.7%) of the total estimated value. Wild vegetables were the second highest ranked category at a value of R222 102 (31.4%), which was over twice the value of cultivated vegetables. Wild fruit was the least valued category representing less than 5% of the total value. Overall, there was no relationship between the value of species per home garden and richness of species ($r = -0.010$; $P = 0.924$).

Table 4.6: Summary of estimated values of different plant species categories

Type	Value (R)	%	Mean value per Household (R) ($\pm$)
Wild vegetables	222 102	31.4	2 314 $\pm$ 3 124
Wild fruits	33 258	4.7	346 $\pm$ 854
Cultivated vegetables	85 619	12.1	892 $\pm$ 2416

Cultivated fruits	365 662	51.7	3 809 ± 5426
Total	706 641		7 361 ± 1901
Total value of wild species	255 360	36	2 660 ± 1989
Total value of cultivated species	451 281	64	4 701 ± 3786

4.3.6.1 Wild Vegetables

The highest sum of the estimated value of wild vegetables across all eight villages was recorded in Manamela with a value of R43 932 while the lowest was recorded in Maupye with a value of R7 408. Overall, the average value of wild vegetables per household across all villages was R2 388±R3 146 ranging from R12 to R17 500. The average value per household was the highest at Goedgevonden with an average of R3 743±R5 399 followed by Manamela with R3 661±R4 230 while the lowest was at Maupye with R 673±R418.

4.3.6.2 Cultivated Vegetables

The mean value of cultivated vegetables across all study villages was R892±R2 416 ranging from R0 to R15 384. The mean value per household was also high in Juno (R1 942±R4 173) and low at Ramakgaphola with (R42±R88). The total estimated value of cultivated vegetables was lower than of wild vegetables across all villages. The highest sum was recorded in the Juno village with an estimated value of R23 313 while the lowest was recorded at Ramakgaphola with a total sum of R504.

4.3.6.3 Wild Fruits

The mean value of wild fruits across all study villages was R346±R853 ranging from R0 to R5 600. The mean value per household was the highest in Mamadila with an average of R568±R1 616 while the lowest was in Thantsha with an average of R26±R71. The estimated value of wild fruits was the lowest relative to other categories with a total sum of R33 358 across all villages. The highest sum was recorded in Ramakgaphola with a value of R6 206 while the lowest was in Thantsha with a value of R312.

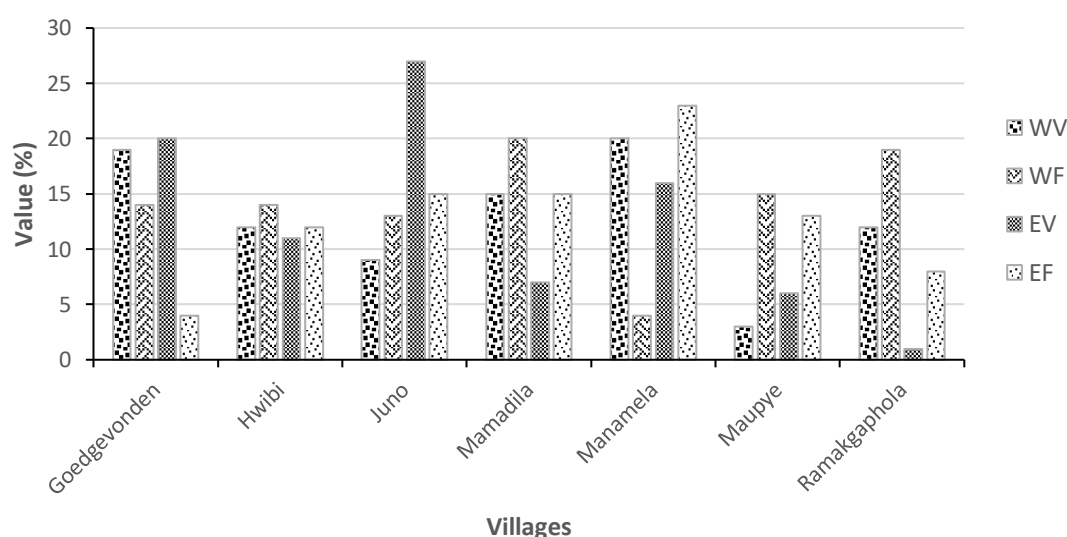
4.3.6.4 Cultivated Fruits

Across all villages, the mean value of cultivated fruit species was R3 808±R5 435 ranging from R0 to R29 825. The average value per household was also high at Manamela with R7 005±R5 419 while it was low at Goedgevonden as well with an average of R1 450±R1 405. From a total of 17 recorded cultivated fruit species, the total estimated value of the species in

home gardens was R365 662. The highest sum was observed in Manamela with an estimated value of R84 061 relative to Goedgevonden where lower value was recorded at R17 410.

4.3.6.5 Value by Village

The value of the four categories of species was different across all study villages. Manamela and Goedgevonden had the largest share of the total value of wild vegetables at 20% and 19%, respectively, while Maupye had the least at 3% (Figure 4.15). The highest value of cultivated vegetables was recorded in Juno (27%) and Goedgevonden (20%) while least was recorded in Ramakgaphola (1%). Similarly, Mamadila (20%) and Ramakgaphola (19%) had the highest value of wild fruits while Thantsha (1%) had the least. Manamela also has the largest share of the value of cultivated fruits (23%) while Goedgevonden had the least at 4%. These figures correlate with the observed total sum of values as well as the mean value per household reported in the previous sections.



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.15: Percentage of species' estimated values by category across study villages.

4.3.6.6 Value by Species

Species with the highest values recorded in home gardens were *Mangifera indica*, *Persea americana*, *Cleome gynandra* and *Psidium guajava* (Table 4.7). It was not surprising to see cultivated fruit species and wild vegetables species topping the list of the highest valued species since these were the highest valued categories. Cultivated fruits were found to be easier to grow and maintain while wild vegetables grow abundantly in home gardens and around livestock

kraals during a good rainy season. This is in comparison to wild fruits that are harder to grow and maintain, while cultivated vegetables require regular access to water especially during the dry season. As a result, cultivated fruits and wild vegetables grow abundantly and acquire greater value especially after good rains while cultivated vegetables are planted less and have a lower value. Therefore, the top five most valued cultivated vegetables such as *Beta vulgaris*, *Spinacia oleracea* and *Ipomea batatas* have a combined value of less than 8% relative to the wild vegetables with a combined value of 28%. Similarly, the top five wild fruits such as *Sclerocarya birrea*, *Vangueria infausta* and *Ficus burkei* have a combined value of less than 5% as compared to the top valued cultivated fruits with a combined value of over 35%.

Table 4.7: Estimated value of the top five individual species from home gardens

Category	Species Name	Value (R) (Per entire sample)	%
Wild Vegetables	<i>Cleome gynandra</i>	60 900	8.6
	<i>Amaranthus retroflexus</i> L.		
	<i>retroflexus</i>	48 970	6.9
	<i>Vigna unguiculata</i>	37 100	5.3
	<i>Curcubita pepo</i>	23 012	3.3
	<i>Citrullus lanatus</i>	27 883	3.9
Cultivated Vegetables	<i>Beta vulgaris</i>	18 080	2.6
	<i>Spinacea oleracea</i>	13 620	1.9
	<i>Ipomoea batatas</i>	13 038	1.8
	<i>Allium sativum</i>	4 801	0.7
	<i>Brassica oleracea</i>	3 948	0.6
Wild Fruits	<i>Sclerocarya birrea</i>	29 918	4.2
	<i>Vangueria infausta</i>	2 340	0.3
	<i>Ficus sansibarica</i>	500	0.1
	<i>Ficus burkei</i>	400	0.1
	<i>Grewia flava</i>	100	0.0
Cultivated Fruits	<i>Mangifera indica</i>	78 480	11.1
	<i>Persea americana</i>	72 075	10.2
	<i>Psidium guajava</i>	55 515	7.9
	<i>Punica granatum</i>	31 676	4.5

4.3.7 Store-bought goods

Despite the value of WEPs and cultivated plants growing in home gardens, households do purchase fruits and vegetables from stores and markets as part of their food supply and diversification strategy. Almost all households (97%) purchase cultivated fruits and vegetables from retail and other markets. However, low-income households (95%) were marginally less likely to purchase foods as compared to middle-income (100%) and high-income households (100%). There was no difference on which is preferred more between fruits and vegetables as they are almost equally purchased with a percentage of 49.4% and 50.6%, respectively. The most purchased fruits were *Musa acuminata* (78%), *Malus domestica* (76%) and *Pyrus communis* (32%), while the most purchased vegetables were *Solanum lycopersicum* (58%), *Allium cepa* (52%), and *Brassica oleracea* (47%) (Figure 4.16). There was no relationship between production value of species from a home garden and engagement in buying ($r = -0.177$; $P = 0.090$).

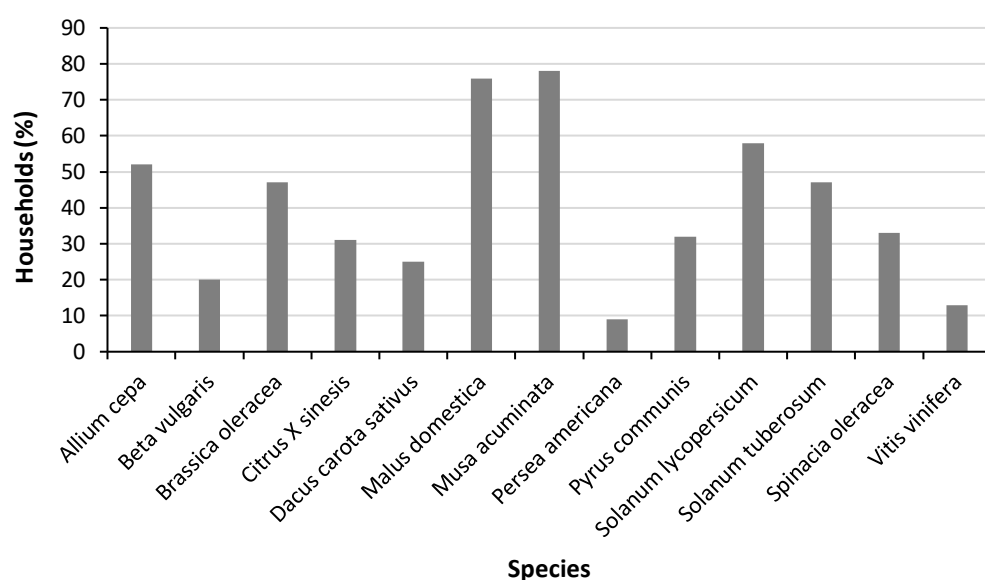
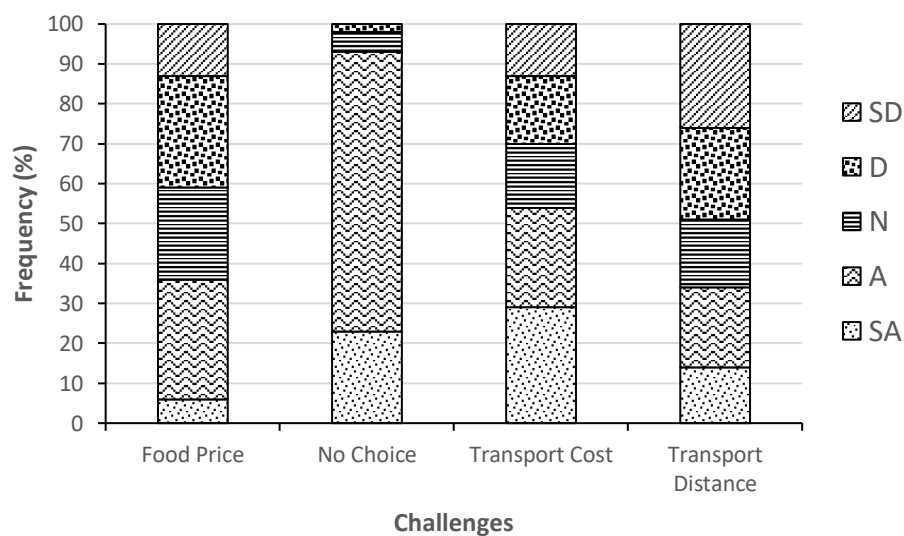


Figure 4.16: The most purchased fruit and vegetable species by household

A large proportion of households (44%) spend between R50 – R150 per month followed by 37% who spend R151 – R300 and 15% who spend over R300 per month buying fruits and

vegetables. Households do most of their purchasing at retail stores in town (57%), followed by rural shopping centres (34%), while the least purchasing is done at township malls (6%), local rural stores (2%) and informal markets (1%). There are various reasons that influence households to purchase fruits and vegetables. Two of the most important reasons were firstly, the inability of households to produce certain species such as *Malus domestica* and *Musa acuminata*, secondly, the inability of households to produce sufficient quantities of certain fruits and vegetables adequately and regularly for their daily consumption needs. Households face several challenges relating to the purchasing of fruits and vegetables, chief among them being no other choice but to buy (93%), and the cost of transportation (54%). However, there were mixed feelings regarding challenges relating to distance travelled to access the stores and the price of the products (Figure 4.17).



*SA = Strongly Agree; A = Agree; N = Neutral; D = Disagree; SD = Strongly Disagree

Figure 4.17: Challenges of buying fruits and vegetables

4.4 Discussion

4.4.1 Availability, abundance, and richness of vegetables

Vegetables are available in nearly all (98%) home gardens in the study villages. Wild vegetables dominate as most households (97%) have them in their home gardens as compared to cultivated vegetables (78%). This corroborates Molebatsi *et al.* (2010) who found that rural

and peri-urban home gardens in the North West Province contained more wild vegetable species (28) than cultivated vegetables (24). However, this did not support our hypothesis that cultivated species would be higher than WEPs. There was an average of four wild vegetable species compared to two cultivated species per home garden. Limpopo Province (which this study was conducted) is reported to be the leading consumer of wild vegetables in the country, although this claim should to be reviewed by extensive provincial ethnobotanical survey (Bvenura & Afolayan, 2015). From the list of 24 vegetables species recorded in the study area, 54% (13) were wild. This is consistent with Molebatsi *et al.* (2010) who found 53% of the total vegetable species in home gardens were wild. This included wild vegetable species such as *Amaranthus retroflexus*, *Cleome gynandra*, and cultivated species like *Spinacia oleracea* and *Beta vulgaris* which were prevalent in all study villages. *Spinacia oleracea*, *Beta vulgaris* and *Brassica oleracea* are amongst the most prevalent cultivated vegetable species in both rural and urban home gardens reported in other studies too (Maroyi, 2017; Mosina *et al.* 2014; Mosina & Maroyi, 2016; Ngcaba & Maroyi, 2021). *Amaranthus spp*, *Cleome gynandra* and *Bidens pilosa* are some of the species identified to as having the highest potential to alleviate food insecurity in Limpopo Province (Bvenura & Afolayan, 2015). This may be because wild vegetable species are more preferred, hence their prevalence and abundance in rural home gardens (Bvenura & Afolayan, 2015). This is because WEPs grow naturally requiring fewer inputs, some others can grow under poor conditions due to their tolerance to low quality soil, fires, insects, and pests (Akinola *et al.* 2020). Wild vegetables are also available throughout most of the year; even though harvesting is seasonal, preservation methods like drying are common (Bvenura & Afolayan, 2015). Additionally, such wild vegetables are touted to be nutritionally superior to cultivated vegetables such as *Spinacia oleracea* and *Brassica oleracea* (Jimoh *et al.* 2018; Lewu & Mavengahama, 2011). Overall, vegetable production in home gardens is important for rural livelihoods because of the positive contribution it makes food production, nutrition, income, providing and overall raising people standards of living (Falola *et al.* 2022). Thus, they contribute several livelihood capitals, including, natural, financial, and human.

4.4.1.1 Constraints of growing and maintaining vegetables

Vegetable production in rural home gardens faces several challenges that affect the availability and abundance of both cultivated and wild vegetable species. From a list of mentioned challenges, shortage of water, rain and poor soil quality emerged on top for both types of vegetables. These challenges are not uncommon and are to be expected especially in dry areas,

as observed in other studies (Maroyi, 2009; Merchant *et al.* 2022). Wild vegetables grow naturally after good rainfall and if the rainfall is poor, abundance would be lower. Other studies show that wild vegetable to be tolerant to dry conditions as many species are adapted to limited water supply and high temperatures, unlike cultivated vegetables which are sensitive to such conditions (Chivenge *et al.* 2015; Stöber *et al.* 2017). Cultivated vegetables on the other hand require reliable irrigation and consistent water supply; something which was lacking in many households across the study villages. One village in particular (Ramakgapola) had such poor water supply that households were disengaging from growing and maintaining cultivated vegetables in favour of wild vegetables. This village had the highest average of wild vegetable species as compared to other villages. Other challenges highlighted were the lack of seeds, land shortage and damages caused by insects; however, these were minor. These challenges may be more prominent in future with the looming threat of environmental and climate change. Shortage of land affects the quantity of vegetables produced in the home garden. Additionally, cultivated and wild vegetables compete for suitable land and water resources with other human activities that are also exacerbated by an increasing human population (Keatinge *et al.* 2015). Lack of seeds is another major impediment to the development and growth of wild vegetables. Therefore, seed development, production and supply systems are paramount to the growth of wild vegetables and to increase their accessibility beyond rural home gardens and fields (Keatinge *et al.* 2015; Korth *et al.* 2014). This has been shown at West and Central Africa where farmers got involved in cultivating indigenous fruits trees in nurseries to improve their livelihoods, income, diet, and health (Tchoundjeu *et al.* 2006; Tchoundjeu *et al.* 2010).

4.4.2 Availability, abundance, and richness of fruit trees

Fruit trees are available in almost all (97%) households in the sampled villages. A total of 999 individual trees were recorded from 96 households; an average of 10.7 ± 8.9 trees per household. This result is consistent with several studies in South Africa and on the continent at large which demonstrate the appreciation rural people have for trees in their home gardens (Kehlenbeck *et al.* 2013; Paumgarten *et al.* 2005; Seyoum *et al.* 2015; Thondhlana & Ruwanza, 2019). This result also support our hypothesis that cultivated species would be higher than WEPs. The average number of 10 trees per household for this study is similar to the 11 trees per household found by Thondhlana & Ruwanza (2019) in Zimbabwe. Both these studies were in similar environments of the dry savanna but this study focused only on fruit trees while the other included all trees found in the home garden. Trees in general are planted and maintained for the ecosystem services they provide such as aesthetic, spiritual, provisioning, regulating and

cultural benefits (Shackleton *et al.* 2008). Fruit trees in particular are planted for their fruits, for home consumption and at times for income generation. Studies elsewhere show that fruit trees are used as shade and fruits are used to produce alcoholic and non-alcoholic beverages for home consumption and to generate income (Kalaba *et al.* 2009; Thondhlana & Ruwanza, 2019).

The majority of trees observed in this study are cultivated trees, making up 86% of the total recorded. From the 23 species of fruit trees identified, 17 (74%) were cultivated and 6 (26%) were wild. These figures are consistent with studies in similar environments such as Thondhlana & Ruwanza (2019) who recorded 21 fruit trees with eight being wild fruits and Mosina & Maroyi (2016) who also recorded 21 fruit species and three of them were wild. All these studies including this one show that cultivated fruit trees are preferred over indigenous ones. This preference of cultivated fruit trees by households is also noted in other studies in both urban and rural home gardens (Kaoma & Shackleton, 2014; Mosina & Maroyi, 2016; Paumgarten *et al.* 2005; Thondhlana & Ruwanza, 2019). This can be attributed to how cultivated trees are found to be easier to grow and how they yield faster (and often larger fruits) than wild fruit trees (Thondhlana & Ruwanza, 2019). In this study, the most prevalent cultivated fruit species were *Psidium guajava*, *Mangifera indica* and *Prunus persica* that were found in home gardens in all study villages. Other Limpopo Province studies also found the same species alongside *Carica papaya* among the top most prevalent species in people's home gardens (Mosina & Maroyi, 2016; Paumgarten *et al.* 2005). Earlier studies such as Grundy *et al.* (1993) and Mbwapo (2000) in Zimbabwe and Tanzania, respectively, also showed that people preferred planting those species in their home gardens. Wild fruits are also appreciated, however, they are not actively planted like cultivated species; instead they are found and maintained when the household was established or through self-propagation (Paumgarten *et al.* 2005). Participants in this study reported small individuals of wild fruit trees like *Sclerocarya birrea* and *Vangueria infausta* from the wild when they are still young and transplanting them in their home gardens in the hope that they would grow. However, in most cases they are unsuccessful.

4.4.2.1 Constraints to fruit tree planting and maintaining

Participants listed a variety of challenges that hindered tree planting in their home gardens. Challenges differed depending on the type of fruit tree in question. The biggest difference was that wild fruit trees lacked seeds for people to actively plant them. The scarcity or poor

availability of wild fruit trees in home gardens can be as a result of the absence of seed keepers in communities (Voster, 2007). The traditional role of seed keepers in communities has remained stagnant and not transmitted leading to loss of genetic diversity of plant species for future needs (Voster, 2007). Participants report throwing wild fruit seeds around their home gardens in the hope that they might germinate and grow; they would also transplant young *Vangueria infausta* seedlings from the wild into their home gardens but this would often fail because other listed challenges such as poor soil and lack of rainfall. Since the study area is in a dry ecological zone, challenges relating to lack of water and rainfall are not surprising; they affect both cultivated and wild indigenous fruit trees. Water scarcity constraints are well documented in many studies in subtropical countries (Khumalo & Sibanda, 2019; Oguttu *et al.* 2021; Paumgarten *et al.* 2005; Thondhlana & Ruwanza, 2019). In this study, many households access water through community boreholes which are not reliable because at certain times there is little to no water. This does not only hamper tree growing, but all agricultural activities in the home garden as well as the normal day-to-day household activities. This inconsistent water supply means that households would sometimes have to fetch water using buckets at a nearby well. To mitigate this challenge, households could dig and construct their own boreholes to have access to a consistent and reliable water supply, however, only affluent households can afford such developments. Even though this is the case, these challenges do not affect cultivated fruit and wild fruit species the same way. This is because participants are reporting an increase in cultivated trees in their home gardens and a decline in wild fruit trees. To overcome the challenges that affect wild fruit trees availability in home gardens, several measures could be considered. Firstly, farmers and home gardeners could be trained to propagate trees using techniques such as rooting cutting and grafting, through a process called participatory domestication (Cernansky, 2015). This is done because wild fruit trees can take up a lot of space, they grow slowly and can take years before they start to bear fruits (Cernansky, 2015). Secondly, genebanks of living trees could be established because for many wild fruit trees, storing their seeds for conservation is difficult because some seeds are large, some die when dried or cooled (Cernansky, 2015). Thirdly, farmers and gardeners can plant trees among other crops near or within their gardens, through a process called agroforestry mixtures. The idea behind this is to conserve trees by planting them near their natural habitat where they originate from (Cernansky, 2015). These challenges highlight the struggles people in rural areas face and their willingness to plant and maintain trees despite limitations caused by socio-economic and environmental factors (Thondhlana & Ruwanza, 2019).

4.4.3 Sale of home garden goods

The overwhelming majority of households in this study consume home garden produce for subsistence. This is consistent with several studies in Southern Africa which show that most households consume home garden goods for domestic use (Bvenura & Afolayan, 2015; Kalaba *et al.* 2009; Keatinge *et al.* 2015; Molebatsi *et al.* 2010; Mollee *et al.* 2017; Nemudzudzanyi *et al.* 2010; Stats-SA, 2019). Additionally, statistics show that 91% of households in Limpopo Province engage in agricultural activities as an added source of food for the household, while 4% of households do so as an extra source of income (Stats-SA, 2019). In this study, an average of 9% of households trade WEPs (dried vegetables and/or processed wild fruit) as compared to 16 % of households that trade cultivated fruits and/or vegetables. Several studies across the world have showed that households that trade home garden goods can generate income to sustain their livelihoods and improve their financial well-being (Olney *et al.* 2009; Okigbo *et al.* 1990; Trinh *et al.* 2003). Moreover, production for home consumption saves cash resources and it is also a safety against economic shocks.

Households sell surplus produce from their gardens; this is especially true for cultivated fruits since they are abundant in home gardens from this study. Fruits such as *Magnifera indica* and *Citrus x sinensis* were the most sold in this study. The sale of wild fruits is hindered by their low quantity. Wild fruit trees such as *Sclerocarya birrea* and *Vangueria infausta* in the home gardens do not yield adequate quantities (Galhena *et al.* 2013). This is perhaps why in other locations there are reports of wild fruits being processed but not for commerce (Kalaba *et al.* 2009). In this study, households that sold (processed) wild fruits had to supplement the supply by collecting more fruits in the wild. The process of collecting more fruits from the wild is deemed laborious, timeous, and daunting by some households (Haq *et al.* 2008). Additionally, processing fruits such as *Sclerocarya birrea* to make beverages is found to be even more tedious as most households would rather avoid engaging in (Kalaba *et al.* 2009; Kanungwe, 2014). Yet for a minority, trading in wild fruits, unprocessed or otherwise, can generate important cash income, such that the incidence of trade is increasing (Shackleton, *et al.* 2008). These are some of the reasons why most household would rather not engage in trading. Other studies report households sharing processed wild fruit beverages like marula beer with friends and relatives rather than selling (Shackleton & Shackleton, 2005). This is important for building social bonds, networks and reciprocal obligations (Shackleton & Shackleton, 2005). This practice of reciprocity is not only limited to marula beer but all other home garden produce. Households would rather share surplus food with friends, neighbours, and relatives in

urban areas than to engage in trading. This sharing contributes to a sense of community and social capital.

4.4.4 Value of WEPs

This study has showed that fruit and vegetable species grown in rural home gardens provide significant value for households' food consumption, cash saving and income generation needs. Cultivated species contributed 63.8% compared to 36.2% for WEPs. These values are not dissimilar to what was found by High & Shackleton (2000) with cultivated species valued at 69% compared to WEPs at 31%. The combined estimated value of fruit and vegetable produced in home gardens was R706 641, cultivated fruits accounted for over half of that value (51.7%). This was not surprising since cultivated fruits trees are the most available and abundant trees in home gardens (than wild fruits) for reasons which were earlier established. In this study, fruit trees such as *Mangifera indica* and *Persea americana* were not only highly valued fruits but highly valued species across the entire sample. The preference rural people have for such species is high as corroborated by several studies (Hall *et al.* 2022; High & Shackleton, 2000; Kanungwe, 2014; Ngcaba & Maroyi, 2021). Even though wild fruits were not abundant in home gardens, in some villages, wild fruits trees such as *Sclerocarya birrea* are common in neighbouring fields and communal lands to which households collected to supplement their fruit intake or improve their income. The estimated value of wild vegetables was higher (31.4%) compared to cultivated vegetables (12.1%). This was because cultivated vegetables faced significant production challenges as a result of poor access to consistent irrigation. The value of wild vegetables is higher because rainfall might have been favourable for that season before the study was conducted. This means that this estimated value is not fixed but may fluctuate depending favourability of weather conditions.

This study also shows that value differs by villages. Even though some villages are near each other, they portray different characteristics, as a result, this affected their values. For example, older homesteads in older villages (over 20 years) such as Mamadila and Manamela have bigger plots than newer homesteads and recent villages such as Maupye. In Goedgevonden, the poor production of cultivated fruits is attributed to pests and insects. In Juno there is a vegetable project which might have had an impact on the community's vegetable production. And there is large retention of wild fruits trees in villages such as Mamadila, Manamela, and Ramakgaphola. All these demonstrate the uniqueness of villages and how these characteristics affects the production value of fruits and vegetables in home gardens.

It is important to quantify the value of species (especially WEPs) in rural home gardens since most of the produce is consumed for subsistence and their economic value may be overlooked. High & Shackleton (2000) argue that placing value on wild foods is important “in debates relating to land use practice and change, as well as adjustments to data and indices pertaining to regional economic output”. Additionally, these valuation could also enhance debates relating to the cultivation and commercialisation of WEPs which have been previously proposed and recommended in many studies (Shackleton *et al.* 1998; Modi *et al.* 2006; Shackleton & Shackleton, 2005; Wessels *et al.* 2021). For example, the estimated monetary value of wild vegetables could be compared to other economic activities and indices. In this study, wild vegetables have an estimated value of R2 314 per household per year, this figure can be compared to other income source of rural households such as social grants and remittances. This information can be used to gauge the level of significance of wild vegetables for the rural household in terms of food consumption and its income generating potential if it was traded.

4.4.5 Store-bought fruits and vegetables

Studies show that rural household spend a significant amount of income on food (Okop *et al.* 2019). Even though this study did not focus on other food types, most households (81%) spent between R50 – R300 per month purchasing fruits and vegetables mostly at urban and rural retail stores. The value from home gardens indicates that that households would have to spend approximately double this amount without a home garden. Retail stores play a pivotal role in household food strategies and in the rural economy. Since not all fruits and vegetables consumed in rural households are from their home gardens, households have no other choice but to buy. The role the retail sector plays in this regard is that of overcoming obstacles of access by lowering travel distances and costs (Pereira *et al.* 2014). In this study, households mostly bought fruits like *Musa acuminata*, *Malus domestica* and *Pyrus communis* and vegetables like *Allium cepa* and *Brassica oleracea*. These were species that were produced less in their home garden due to their inability or incapability of the household to regularly produce the desired quality and quantity of the species for their consumption needs.

According to Pereira *et al.* (2014), most households in their study bought food from retail stores rather than to grow it in their gardens; this is because they can’t produce enough for household consumption and to generate income if they were engaged in trade. As a result, the authors argue that this situation would lead to deagrarianisation and reliance on the retail sector for food provision (Pereira *et al.* 2014). But based on observations, results from this study, and

the fact that Limpopo Province has the highest distribution of households involved in agricultural activities (Stats-SA, 2019), it could be argued that if constraints against growing fruits and vegetables (such as shortage of water and poor irrigation) in the home garden were addressed, households could intensify their agricultural production by increasing the diversity of species produced and/or by increasing the amount of land under production. This livelihood strategy was observed in several households across the study villages where access to water from community boreholes was decent or the household had its own borehole. Small vacant pieces of land near to the homestead were used as extensions of the home garden where fruit, vegetable or grain crops like maize were grown. In this case, households can spend less on food and become less reliant on retail stores if they can grow their desired fruits and vegetables in their own home gardens.

4.5 Conclusion

This study showed that a richness fruits and vegetables are available in home gardens, with cultivated fruits grown in abundance and wild vegetables showing significant economic value. These results partially supported this study's hypothesis that the abundance and value of WEPs will not be higher than that of cultivated species. However, the abundance and value of wild vegetables was higher than of cultivated vegetables. This study also showed that the availability of fruits and vegetables in the home garden is an important livelihood strategy with likely positive livelihood outcomes relating to food and nutritional security and income generation. Households grow food in their gardens for economic and socio-cultural purposes. Home garden produced fruits and vegetables supplement the households' food supply, it also assists households to save on food spending. Home garden production is also important for keeping close ties with friends, neighbours, and family relatives in urban and other rural villages through food sharing. Households do generate some income from the trade of their garden produce; however, this was minimal.

Challenges relating to production exist and persist, as issues such as water shortages coupled with other environmental and climate-related challenges such poor soil quality and poor rainfall also affect production of especially WEPs could threaten livelihoods in the long run. Opportunities for intensifying agricultural production if challenges were addressed or were minimised could prove to be important livelihood strategy to avoid future uncertain trends and shocks. The intensification of WEPs production could be done through domestication and

cultivation of more species. It was previously proposed that to achieve this, the development of WEPs seeds should be produced.

4.6 References

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Chapter 5

Traditional Knowledge and Consumption of Wild Edible Plants

5.1 Introduction

In 2004, the South African government, through the Department of Science and Technology, adopted the Indigenous Knowledge Policy. The policy aims to improve the contribution of indigenous knowledge to the social and economic development of the country through preservation and documentation of this knowledge (Department of Science and Technology, 2004). This was in anticipation that such preservation could kick-start the integration and use of this knowledge to facilitate development for the country's marginalised communities. In the face of globalisation, urbanisation and modernisation, traditional knowledge becomes increasingly threatened (Kaya & Seleti, 2014). The indigenous knowledge about medicinal plants is also at risk of bio-piracy and exploitation, especially by multinational and pharmaceutical companies (Chiwanza *et al.* 2013). Indigenous knowledge of traditional food plants is threatened directly by their declining consumption and knowledge transfer in many areas, and indirectly by climate change and habitat loss (Dweba & Mearns, 2011; Wessels *et al.* 2021). The Government's indigenous knowledge policy has objectives to address these challenges through protective laws and by recording this knowledge, to ensure the preservation of cultural identities and to curb further erosion of indigenous knowledge for future generations.

Indigenous knowledge is defined as knowledge that is held by local people of a particular geographical area and culture, which is passed from generation to generation (Chiwanza *et al.* 2013). This knowledge forms part of the culture of people in rural and urban communities and it can be applied to many aspects of their daily living, such as water resource management, disaster management, food security, agriculture, natural resource management, medicine, and ethnobotanical knowledge of food plants and many others (Dweba & Mearns, 2011). With the rising levels of malnutrition and poor intake of micronutrients in poor regions across the world (including in Africa) (FAO, 2022), the erosion of indigenous knowledge related to traditional or wild food plants would be particularly concerning. This is because several studies have shown that the intake of traditional fruits and vegetables is limited and particularly low amongst urban populations (Mncwango *et al.* 2020; Rankoana *et al.* 2015; Zobolo & Mkabela, 2006). A contribution to this decline in consumption might be the erosion of ethnobotanical

knowledge about traditional plants, especially among the youth (Dweba & Mearns, 2011; Reyes-García *et al.* 2014).

There are several factors responsible for the decline of indigenous knowledge related to wild edible plant species (Dweba and Mearns, 2011). These include the introduction of cultivated fruits and vegetables, historical policies, stigma attached to consuming WEPs, changes in lifestyles, and environmental factors. According to Fox & Norwood-Young (1982), precolonial societies in South Africa ate a diet that was mostly comprised of wild plants, wild cereals, milk, and meats, with wild vegetables consumed as a daily relish while meats were consumed occasionally. The introduction of cultivated species through colonisation and modern agriculture created a rapid dietary change, posing a threat to the local traditional food systems (Rankoana *et al.* 2015). This was aided and abetted by agricultural and health policies that promoted the cultivation and consumption of cultivated species at the expense of the indigenous ones (Dweba & Mearns, 2011; Vorster *et al.* 2007).

Negative attitudes related to the consumption of WEPs, especially by the youth, have contributed to the knowledge erosion as traditional plant foods are often regarded as unsophisticated or poverty foods (Van der Hoeven *et al.* 2013; van Rensburg *et al.* 2014). Changes in lifestyle has meant that young women today are increasingly losing knowledge on the collection and preparation of traditional plants because their participation in these activities has declined (Mncwango *et al.* 2020; Zobolo & Mkabela, 2006). Similarly, in Kenya, boys who were enrolled in formal schooling were less likely to identify and have knowledge of traditional plant species compared to boys who were livestock herders (Bruyere *et al.* 2016). Lastly, environmental problems such as climate change and deforestation threaten the existence of many traditional plant species. Habitat loss induced by deforestation and other land clearing activities, as well as climatic events such as droughts, contribute to the local decline or disappearance of WEPs (Dweba & Mearns, 2011; Wessels *et al.* 2021). These challenges need to be addressed to ensure that ethnobotanical knowledge relating to WEPs remains intact. There are several ways that indigenous knowledge challenges can be addressed, including through policy change and implementation. The indigenous knowledge policy of 2004 laid a foundation of highlighting the key issues that require attention, such as knowledge preservation and documentation (Department of Science and Technology, 2004). It also placed South Africa as one of the few countries on the continent where the government is promoting the diversification of knowledge (Green, 2008). Despite these strides, the policy has its shortcomings.

According to Green (2008), one of the challenges relates to the commercialisation of knowledge where intellectual property rights and patents related to shared knowledge need to be established. Additionally, Mhlongo (2021) bemoaned the lack of indigenous knowledge content in public libraries. Secondly, related to the first, is the issue of indigenous knowledge sharing or knowledge transfer at the household level. Since the elderly are usually more knowledgeable about traditional plants (Acquah *et al.* 2018), they can pass on the knowledge to the younger generation to promote continued future use (Dweba & Mearns, 2011). Lastly, the negative attitudes, perceptions and stigmatisation of the consumption of WEPs, especially by the youth, also needs to be attended. This could be done by integrating indigenous knowledge systems into higher education to create opportunities for students to learn about and appreciate the knowledge of elders (Battiste, 2002). This is particularly pertinent because the consumption of WEPs typically depends on whether people know the appropriate plant species (Reyes-García *et al.* 2005).

The idea of preserving indigenous knowledge is accompanied by an assumption that the more knowledge people have about WEPs is the more likely they are to consume them. For example, Ladio & Lozada (2004) in Argentina showed that people who know more edible plant species consume them more frequently. However, according to Reyes-Garcia *et al.* (2005), in Bolivia, the relationship between knowledge and consumption does not always correlate. Their study showed that the relationship between those two variables can be influenced by socio-economic factors such as location, i.e. how isolated or accessible villages are and how accessible substitute foods (cultivated crops) are (Reyes-García *et al.* 2005). Therefore, socio-economic change can create or widen the gap between people's ethnobotanical knowledge of WEPs and their use and consumption (Reyes-García *et al.* 2005).

Taking all the above issues into account it is evident that the preservation of indigenous knowledge is paramount for future use. The preservation of this knowledge is threatened by a multitude of factors, including change in lifestyles, especially by the youth. Additionally, the consumption of WEPs differs according to an individuals' level of ethnobotanical knowledge. Since an individuals' level of ethnobotanical knowledge changes throughout their lifetime (Reyes-García *et al.* 2005), this means that individuals of different ages and socio-economic background are likely to have varying levels of knowledge of WEPs. Within this context, this study assessed the relationship between ethnobotanical knowledge and consumption of WEPs.

The objectives of the study were: (1) to assess the number of wild edible fruits and vegetable species participants know; (2) How their knowledge of these species was produced and transferred; (3) Which WEPs species are consumed and how often; (4) If there is a correlation between the number of species known, the number of species consumed and how this changes with age. This study hypothesises that there would be a positive relationship between the number of species known with the number of species consumed. Additionally, the number of species known would increase with age.

5.2 Methods

5.2.1 Study Area

Refer to Chapter 1 for detailed information on study areas.

5.2.2 Data collection

A household questionnaire was used to collect data on the consumption and traditional knowledge of WEPs. A free list of species known by participants was collected as well as data on the traditional uses of those species. Participants also provided information on how this knowledge was obtained, from whom it was learnt and how it was transferred. Additionally, data of the consumption patterns of WEPs were collected, including the WEP species and the frequency of consumption. These data were gathered to assess whether having knowledge of WEPs leads to higher diversity of species consumed and if there are differences in knowledge and consumption of participants of differing age and gender groups. On top of listing species, as a way to demonstrate extent of knowledge, participants were asked to provide information about locations where the species were collected besides the home garden, the months when the species are available, the description of the taste and other uses of the species.

5.2.3 Sampling

Permission to conduct the study was obtained from the relevant authorities in all the sampled villages. A stratified purposive sampling technique was used to choose 120 individuals categorised into three age groups and two gender groups. The 120 participants were selected from villages in both the Moletjie (Mphela and Lonsdale) and the Matlala areas (Mabopane and Tibane). The 120 participants were divided into three age groups (youth 18-35; adult 36-59; and elderly > 60) of 40 participants, balanced between 20 males and 20 females. The questionnaire included both closed and open-ended questions. The interviews were conducted in the local language of Northern Sotho in which the researcher and assistants were fluent. Interviews took between 45 and 60 minutes and the responses were directly recorded on the

questionnaire as the responses were given. These data were collected between May – June 2019.

5.2.3 Data analysis

Interview data were coded and entered into a Microsoft Excel spreadsheet. Coded data was then transferred into SPSS for analysis. Data was summarised and descriptive statistical analyses, such as frequency distributions and measures of central tendency, were performed. Frequency indices (Fidelity Level) was also calculated using the following formula: $FL = (N_p/N) \times 100$ where N_p is the number of participants and N = the total number of participants. Two-way ANOVA tests were performed to determine statistical significance between age and gender groups with various variables. Correlation coefficients were also computed to determine relationships between the number of listed wild fruits and vegetable as well as the relationship between listed species and consumed species.

5.3 Results

5.3.1 Participant profile

There was a total of 120 participants stratified by age (20 participants for each group) and gender (60 participants for each group). The average age of all participants was 48.6 ± 18.9 years, ranging from 19 to 95 (Table 5.1). The average age for the youth group was 27.8 ± 5.0 years, ranging from 19 to 35, for the adult group it was 46.8 ± 6.1 years (36 to 57) and the elderly group had an average of 71.2 ± 7.5 years, ranging from 61 to 95. Half of the participants (50%) in the youth group had completed a tertiary qualification, while 47.5% had completed secondary schooling. About 37.5% of the youth are students, 12.5% are employed full-time, 15% are self-employed while 20% are unemployed. Most of the participants in the adult group (55%) had completed a secondary education and 40% of them are unemployed. Most of the elderly (45%) have completed primary schooling, 85% are retired and not working. Most of the participants (82%) grew up in a rural village, 8.3% in a township and 7.5% in farms. Most of the participants (55%) have always stayed in rural villages while 40% have lived over half of their lives in the villages.

Table 5.1: Summary profile of respondents (n=120)

Variable	Category	No.	(%)
Gender	Male	60	50.0
	Female	60	50.0
Age (Mean±SD) (Years)	Youth	27.8±5	
	Adult	46.8±6.1	
	Elder	71.2±7.5	
Occupation	Full-time employment	14	12
	Part-time employment	8	7.0
	Self-employed	16	13.0
	Unemployed	57	47.5
	Student	15	12.5
	Volunteer	10	8.0
Education	No schooling	7	6.0
	Primary	29	24.0
	Secondary	52	43.0
	Tertiary	32	27.0
Length of residence in village	Mean ± SD (Years)	40.2±20.9	
Childhood residence	Farm	9	7.5
	City	3	2.5
	Township	10	8.3
	Rural village	98	81.7

5.3.2 Traditional Knowledge of WEPs

5.3.2.1 Wild Fruits

All the participants indicated some knowledge of WEPs species. The average number of wild fruit species listed by participants was 8.4 ± 2.4 , ranging from four to sixteen species. There was a significant statistical difference between the number of species listed by age group ($F = 4.96$, $p = 0.009$). The elderly group listed a higher average number of species (9.3 ± 2.6) compared to the adult group (8.1 ± 2.5) and the youth group with the least (7.8 ± 1.7 species). Post-hoc tests showed a statistical significance was observed between the elderly group and the youth group ($p = 0.011$). There was no significant statistical difference between the number of species listed between genders ($F = 0.45$, $p = 0.503$), albeit, males listed a slightly more wild fruits (8.5 ± 2.41)

than females (8.2 ± 2.37 species). Participants free-listed a total of 24 wild edible fruit species of which 22 were identified and only two were unidentified (Table 5.2).

Table 5.2: Listed wild fruit species (in alphabetic order by local name)

Local Name	Latin Name	Voucher	Part used	Source	No of Consumers
<i>Mahlatswa</i>	Englerophytum magalismontanum		Fruit	Wild	34
<i>Makankane</i>	Cordia grandicalyx		tuber	Wild	39
<i>Matshidi</i>	Ximenia caffra		Fruit	Wild	100
<i>Mmilo</i>	Vangueria infausta		Fruit	Wild	104
<i>Mmupudu</i>	Mimusops zeyheri		Fruit	Mountain	38
<i>Mofarelatshwene</i>	Grewia caffra		Fruit	Mountain	5
<i>Mohlakauma</i>	Fleggea virosa		Fruit	Wild	1
<i>Mohlapu</i>	Ficus sansibarica		Fruit	Wild	4
<i>Mohlohlo</i>	Sersia leptodictya		Fruit	Wild	26
<i>Mohlole</i>	Ficus sycomorus		Fruit	Wild	3
<i>Mohlopi</i>	Boscia albitrunca		Fruit	Wild	2
<i>Mokgalo</i>	Ziziphus mucronata		Fruit	Wild	1
<i>Mokgampule</i>	Cyphostemma dasypleurum		Fruit	Wild	2
<i>Mokgokgothwane</i>	Lannea discolor		Fruit	Wild	21
<i>Mokgoo</i>	Cissus cornifolia		Fruit	Wild	2
<i>Mokumo</i>	Ficus burkei		Fruit	Wild	46
<i>Mokwerekwere</i>	Euclea undulata		Fruit	Wild	22
<i>Monokwane</i>	Zanthoxylum capense		Fruit	Mountain	1
<i>Monthepu</i>	*		Tuber	Wild	
<i>Moretlwa</i>	Grewia flava		Fruit	Wild	76
<i>Morobe</i>	Ehretia rigida		Fruit	Wild	10
<i>Morokolo</i>	Carissa bispinosa		Fruit	Wild	43
<i>Morula</i>	Sclerocarya birrea		Fruit	Wild	77
<i>Setlodi</i>	*		Tuber	Wild	29

*denotes unidentified species

Vangueria infausta was the most frequently listed species, mentioned by 104 participants with a frequency index of (87%), followed by *Ximenia caffra* (83%), *Sclerocarya birrea* (64%), *Grewia flava* (63%) and *Ziziphus mucronata* (48%) (Figure 5.1). The frequency index also showed that the least mentioned species were *Grewia caffra* (1%) and *Fluggea virosa*, (1%) followed by *Boscia albitruca* (2%), *Ficus sycomorus* (3%) and *Ficus sansibarica* (3%).

Participants further demonstrated knowledge about many species, for example by mentioning that *Vangueria infausta* also grows widely in the abandoned fields, it mostly harvested around February/March and the fruits also attract snakes. Similarly, *Sclerocarya birrea* also grows at the old fields and fruits between December to March, has a sweet/sour taste and can be fermented into an alcoholic beverage.

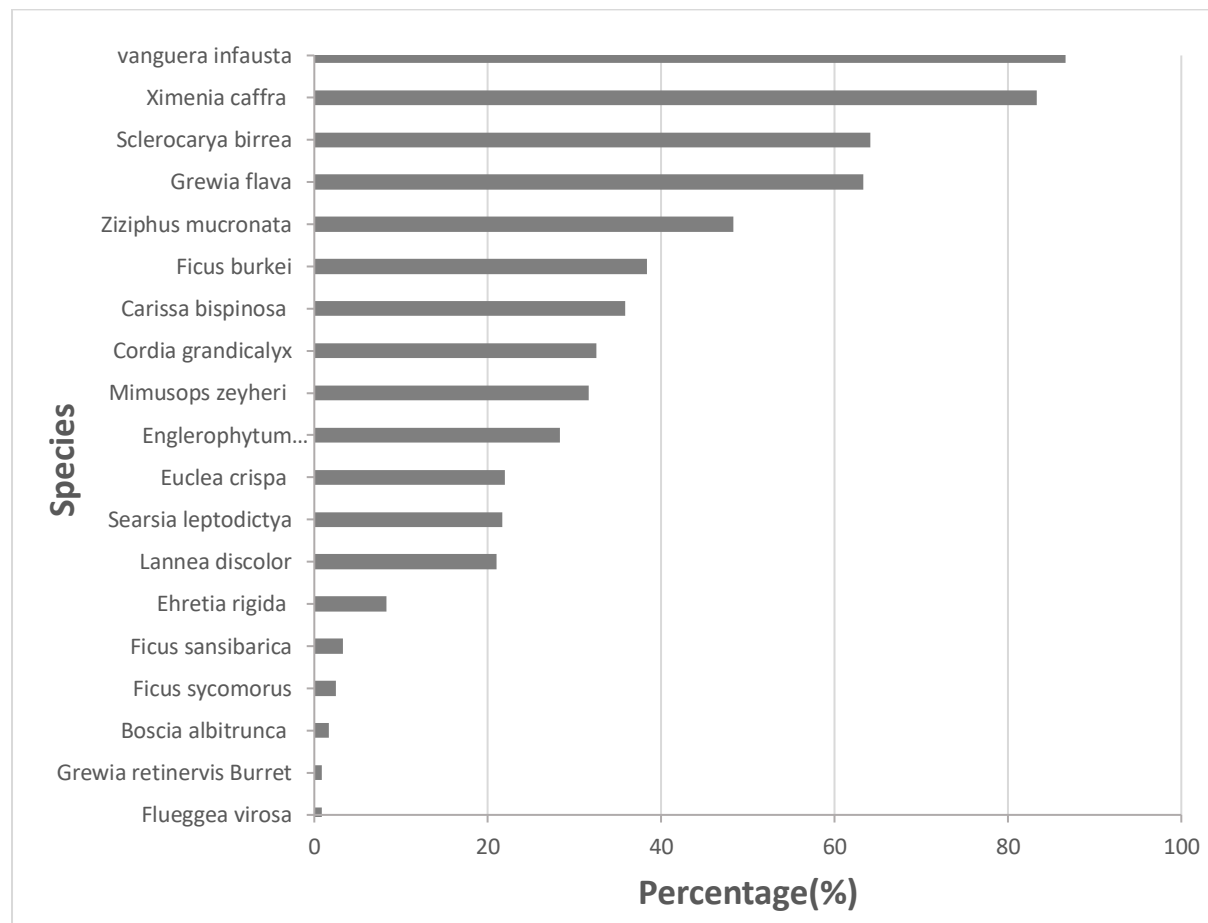


Figure 5.1: Frequently listed wild fruit species

5.3.2.2 Wild vegetables

A slightly higher average number of 9.0 ± 2.98 wild vegetable species, ranging from four to seventeen were listed per respondent as compared to wild fruits. There were no statistically significant associations between the number of listed wild vegetable species with age group ($F = 1.83$, $p = 0.165$) or gender ($p = 0.134$). In terms of age group, the elderly listed an average of 9.8 ± 3.02 species, the adult group listed 8.6 ± 3.00 species, ranging from four to fifteen, and the youth listed an average of 8.8 ± 2.86 species ranging from four to fourteen. Like wild fruits,

males recorded a slightly higher mean of 9.4 ± 2.92 species than 8.6 ± 3.01 females. A total of 18 wild vegetable species were recorded, most of the species (17) were identified while only one was unidentified (Table 5.3).

Table 5.3: Listed wild vegetable species (in alphabetic order by local name)

Local Name	Latin Name	Voucher	Part used	Source	No. of Respondents
<i>Lehlanye</i>	<i>Vernonia fastigiata</i>		Leaves	Wild	32
<i>Lerotho</i>	<i>Cleome gynandra</i>		Leaves	Home garden	84
<i>Maeteletja</i>	<i>Hibiscus trionum</i>		Leaves	Home garden	14
<i>Mantlalekgere</i>	<i>Sonchus oleraceus</i>		Leaves	Wild	1
<i>Mochacha</i>	<i>Citrullus lanatus</i>		Leaves	Home garden	92
<i>Mohutasele</i>	<i>Waltheria indica</i>		Leaves	Wild	5
<i>Monawa</i>	<i>Vigna unguiculata</i>		Leaves	Home garden	92
<i>Monyaku</i>	<i>Cucumis zeyheri</i>		Leaves	Home garden	60
<i>Mophato</i>	<i>Gymnosporia senegalensis</i>		Leaves	Wild	4
<i>Mophotse</i>	<i>Cucurbita pepo</i>		Leaves	Home garden	41
<i>Motangtang</i>	<i>Mormodica Balsamina</i>		Leaves	Wild	1
<i>Motantane</i>	<i>Convolvulus farinosus</i>		Leaves	Home garden	14
<i>Phara</i>	<i>Citrullus echinrhosus</i>		Leaves	Home garden	9
<i>Senotwanotwane</i>	<i>Cucumis hirsutus</i>		Leaves	Home garden	9
<i>Theepe</i>	<i>Amaranthus retroflexus</i>		Leaves	Home garden	76
<i>Thelele</i>	<i>Corchorus tridens</i>		Leaves	Home garden	40
<i>Tlowane</i>	*		Leaves	Home garden	14
<i>Tshehlo</i>	<i>Oxygonum alatum</i>		Leaves	Wild	14

*denotes unidentified species

Vigna unguiculata was the most frequently listed vegetable species with a frequency index of 93%, followed by *Citrillus lanatus* (92%), *Cleome gynandra* (84%), and *Amaranthus retroflexus* (76%). The frequency index also showed that the least listed species were *Mormodica balsamina* (1%) followed by *Waltheria indica* (5%), *Convolvulus farinosus* (14%) and *Oxygonum sinuatum* (14%).

There was wide agreement that *Amaranthus retroflexus* grows widely at crop fields, it is available from December to around February, and it can be cooked, dried, and stored for later consumption. *Corchorus tridens* is well known for being slimy and slippery when cooked.

Vernonia fastigiata also grows in the rainy season, it can also grow around crop fields and it is described to having a bitter taste.

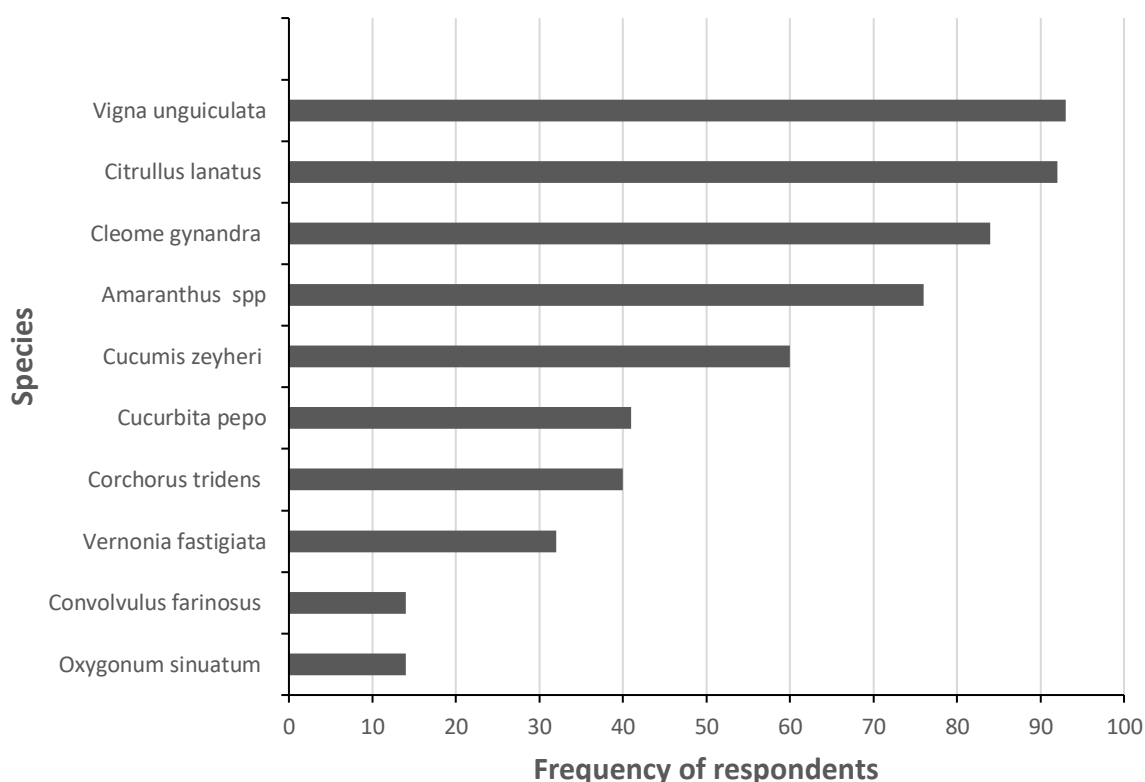


Figure 5.2: Frequently listed wild vegetable species.

Table 5.4 shows that most of the respondents that know a high number of species are elderly and have been residing in the village all their life. They are also among the respondents that consume a high diversity of WEPs and have lower education levels. In contrast, respondents that know relatively few species are a mixture of the youth and adults who have not resided in rural villages for most of their lifetime. They also consume fewer WEPs species consumption and most of them have a tertiary qualification. However, there was no significant correlation between knowledge of WEPs and education level ($r = 0.11$, $p = 0.233$).

Table 5.4: Summary profile of the most and the least knowledgeable respondents

Top	Gender	Age	Length of village residence	No. of species known			No. of species consumed			Education
				WF	WV	T	WF	WV	T	
1	Female	62	62	14	17	31	5	5	10	Secondary
2	Female	75	75	14	15	29	6	5	11	Primary
3	Male	76	76	16	12	28	5	5	10	Primary
4	Male	67	67	11	16	27	6	8	14	Secondary
5	Male	71	71	10	15	25	6	7	13	Primary
Mode	Male	70	70	13	15	28	6	6	12	Primary
Bottom 5										
1	Female	45	45	4	5	9	4	1	5	Primary
2	Male	45	40	4	5	9	4	5	9	Tertiary
3	Female	32	32	5	4	9	3	3	6	Tertiary
4	Female	65	40	4	4	8	5	4	9	Primary
5	Male	35	20	4	4	8	3	4	7	Tertiary
Mode	Female	44	35	4	4	9	4	3	7	Tertiary

Note: WF = Wild Fruit, WV = Wild Vegetable, T = Total

5.3.2.3 Correlation between knowledge of wild fruits and vegetables

There was a strong positive correlation between the number of listed wild fruits and wild vegetables per respondent ($r = 0.67$, $p < 0.0001$) (Figure 5.3).

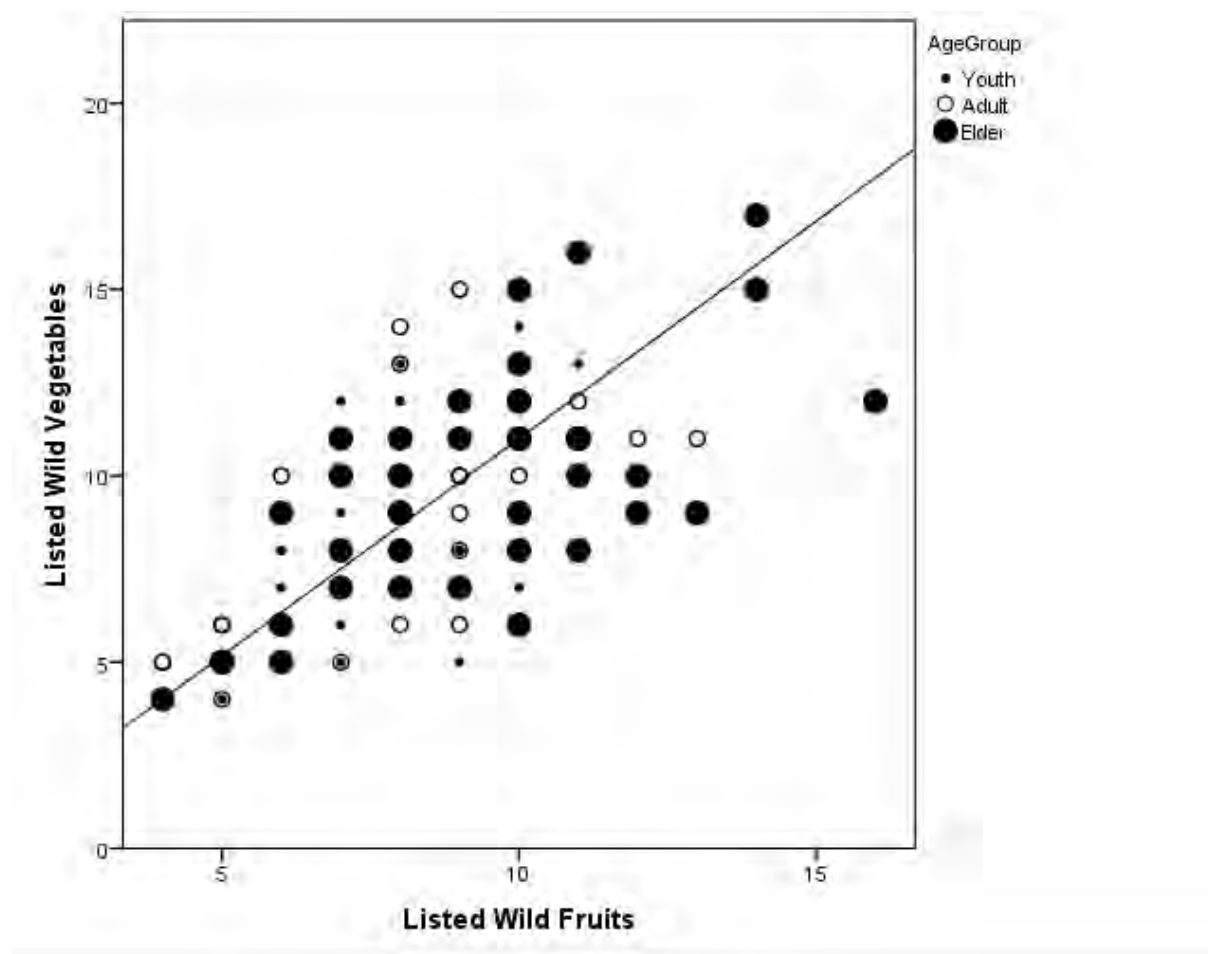
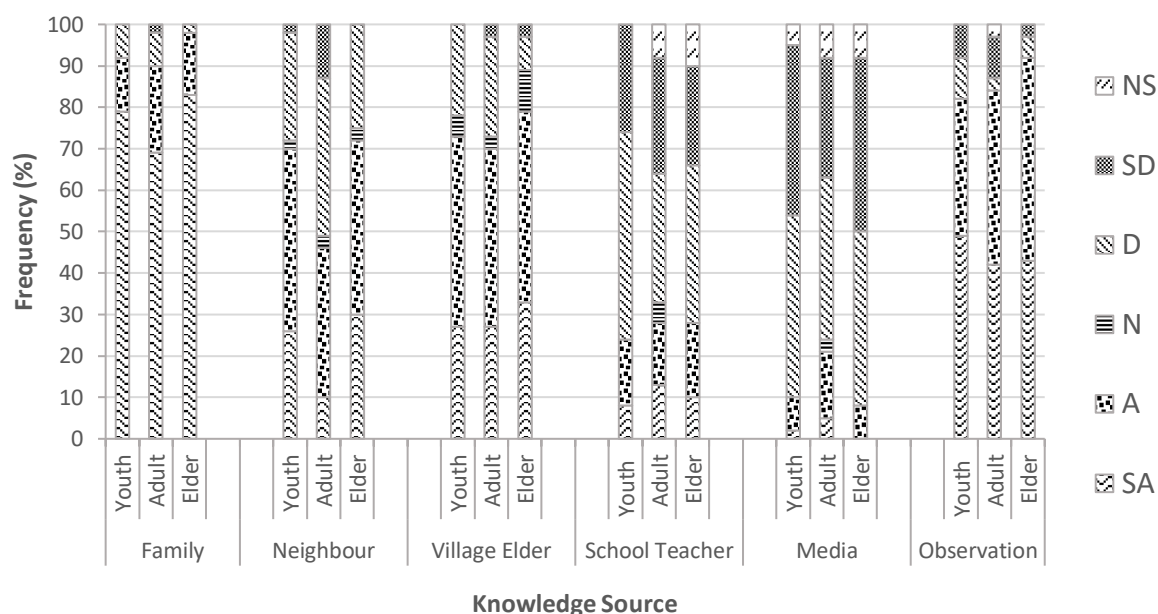


Figure 5.3: Correlation between the number of wild fruits and wild vegetables listed per respondent

5.3.4 Knowledge production and transfer of WEPs

Knowledge about the identification, use and taste of WEPs was learned and passed from different sources. Most of the participants across all age groups agreed or strongly agreed to have learned from a family member, with the level of agreement ranging from 90% for adults to 98% for the elderly (Figure 5.4). This was followed by respondents who learned from their own observations (86%) across all age groups and those who learned from a village elder (75%). Most of the participants disagreed that knowledge about WEPs was learned from the media or from school, with an average disagreement level of 79% and 66%, respectively.



*NS=Not Sure; SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree

Figure 5.4: Sources of knowledge of WEPs by age group

Most of the participants (90%) learned about WEPs during their childhood, with knowledge acquired through oral tradition (63%), followed by participation in collection (21%), through consumption (12%) and to a lesser extent, through observation (4%). The majority of participants (83%) acknowledged that they have passed this knowledge to others. Elders reported passing on the knowledge to their children (44%), friends (29%), grandchildren (18%) and siblings and other relatives (9%). Similarly, the youth pass their knowledge mostly to their friends (67%), siblings (19%) parents (11%) and relatives (3%).

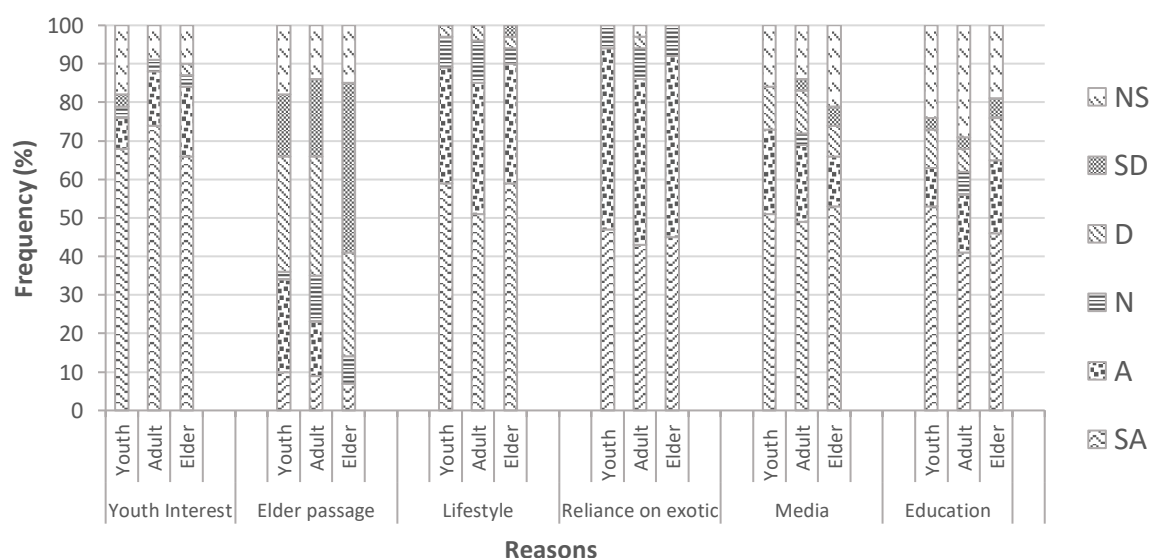
5.3.5 Relatively Recent Knowledge about WEPs

The majority of participants (88%) acknowledged to continually acquiring new knowledge relating to WEPs. New knowledge refers to the recent (past five years) acquisition of a new piece of information about a WEP species, such as discovering an unknown species, discovering a different use and value of the species. There was no statistical difference between acquiring new knowledge with age group ($F = 5.758$, $p = 0.451$) and gender ($F = 1.771$, $p = 0.621$), however, the elderly (35.8%) were slightly more likely to acquire new knowledge than the adult (33%) and youth (31%).

Participants provided a variety of newly learned knowledge that was categorised into themes. Most of the newly learned information pertains to the theme of health and nutrition (85%), followed by economy (16%), culture (4%) and the environment (1%). In terms of health and nutrition, participants reported learning how WEPs are nutritionally dense foods and species like *Ziziphus mucronata* leaves have medicinal value. Economically, participants learned that WEPs are freely available and sold in urban areas where they are most in demand. Environmentally, participants learned that some species might disappear because of poor rainfall.

5.3.6 Loss of traditional knowledge

Despite all this knowledge participants have about WEPs (including new knowledge), the majority (95%) perceive traditional knowledge of WEPs to be eroding. The most cited reasons for this were the growing dependence of people on cultivated foods (91%), change in lifestyles (88%), lack of youth interest (83%), lack of promotion of WEPs in the media (69%) and lastly, the lack of education about WEPs in schools (61%). Interestingly, even participants from the youth group conceded (68% agreed) to not being interested in WEPs and thus contributing to the loss of knowledge (Figure 5.5). Out of all the reasons provided, participants disagreed that the lack of interest from elders to pass knowledge was not a contributing factor to the loss of traditional knowledge of WEPs.



*NS=Not Sure; SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree

Figure 5.5: Reasons for loss of tradition WEPs knowledge by age group

5.3.7 Species collection

Most participants communicated that they have collected WEPs in their childhood. The majority of participants (92%) collected wild fruits more than wild vegetables (80%), although consumption rates were similar (96% for wild fruits and 94% for wild vegetables). Today, participants still collect wild fruits and vegetables. Participants (88%) indicated that they purposely left their houses to collect WEPs rather than it being an ad-hoc activity. Most of the WEPs were collected around their home gardens (45%), around the village (33%), in the fields (20%) and on mountains and riparian areas (2%).

5.3.8 Consumption of WEPs

5.3.8.1 Wild fruits

All the participants indicated that they consume WEPs species. On average, participants consumed 5.2 ± 1.19 wild fruit species, ranging from two to eight. The adult group consumed 5.0 ± 0.9 species, compared to the youth and elder group with 5.3 ± 1.3 and 5.4 ± 1.2 species, respectively. These numbers were not statistically different across age groups ($H = 3.72$, $p > 0.05$) or gender ($p > 0.05$) as females consumed an average of 5.3 ± 1.20 species and males consumed 5.2 ± 1.19 species.

5.3.8.2 Frequently consumed wild fruits

Participants listed a total of 20 wild fruit species that they have consumed in the past five years. The frequency index showed that the most consumed wild fruit species were *Vangueria infausta* (70%), followed by *Englerophytum magalismontanum* (62%), *Grewia flava* (50%), *Sclerocarya birrea* (45%), and *Ziziphus mucronata* (40%) (Figure 5.6). The frequency index also showed that the least consumed species were *Ximenia caffra* (3%) and *Ehretia rigida* (5%), along with many unidentified species such as *Lenthepu* (1%), and *Setlodi* (6%). Most of the participants (78%) perceive the abundance of wild fruits to be in decline because of indigenous trees being cut and a shortage of rainfall, while 20% do not see any changes in abundance. As a result, most participants (83%) believe consumption of wild fruits is declining.

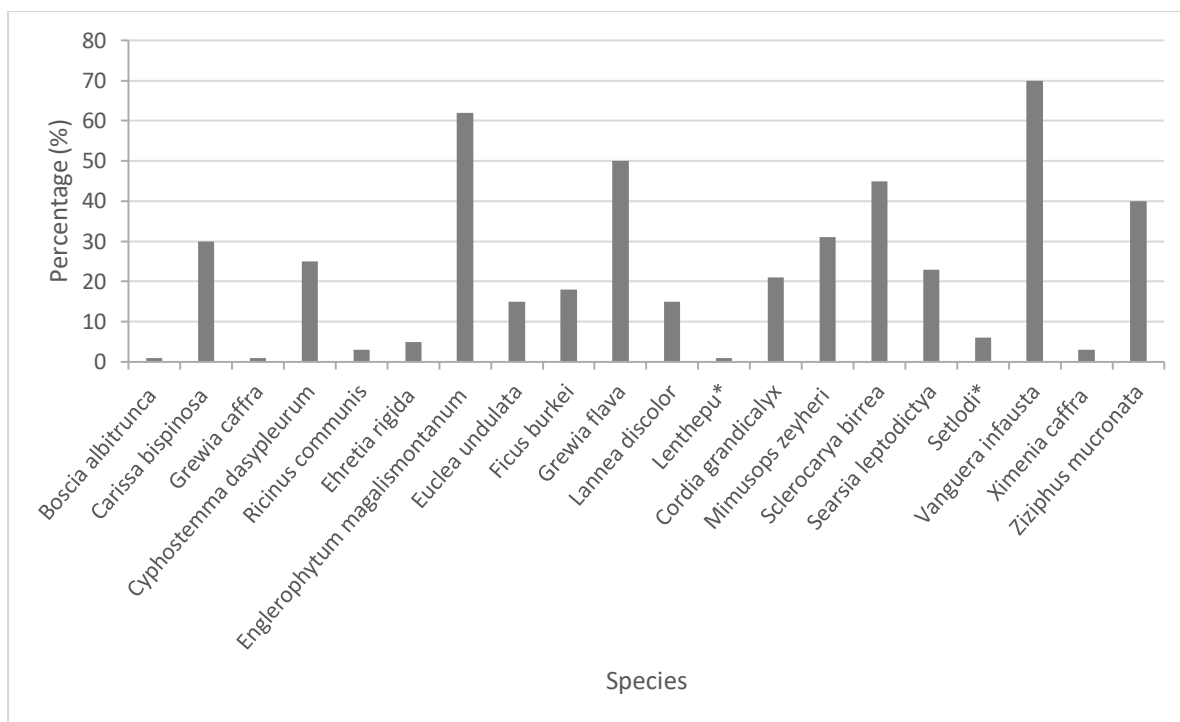


Figure 5.6: Frequently consumed wild fruit species.

5.3.8.3 Wild vegetables

A slightly higher average number of 5.42 ± 1.55 wild vegetable species were consumed, ranging from one to nine species. There was no significant statistical difference between the number of species consumed between age groups ($H = 2.58$, $p > 0.05$), being 5.7 ± 1.50 for the youth followed by the elderly group (5.5 ± 1.53) and the adult group (5.1 ± 1.59). There was also no significant difference by gender ($p > 0.05$), with males consuming 5.5 ± 1.46 species and females 5.3 ± 1.64 species.

5.3.8.4 Frequently consumed wild vegetables

On average respondents had consumed a total of 16 wild vegetable species in the past five years. Seventeen of the sixteen wild vegetable species were identified. The frequency index showed that the most consumed wild vegetables species were *Amaranthus retroflexus*, *Cleome gynandra*, and *Citrullus lanatus* leaves, all consumed by 44% of the participants (Figure 5.7). The frequency index also showed that the less frequently consumed species included unidentified species such as *Tlowane* (6%), *Gymnosporia senegalensis* (2%), and *Waltheria indica* (5%). Unlike with wild fruits, just less than half (49%) of the participants perceive the abundance of wild vegetables to be declining whilst 42% see no difference in the past five

years. However, most participants (62%) indicated that the consumption of wild vegetables is decreasing, whilst 30% believe the consumption has stayed the same.

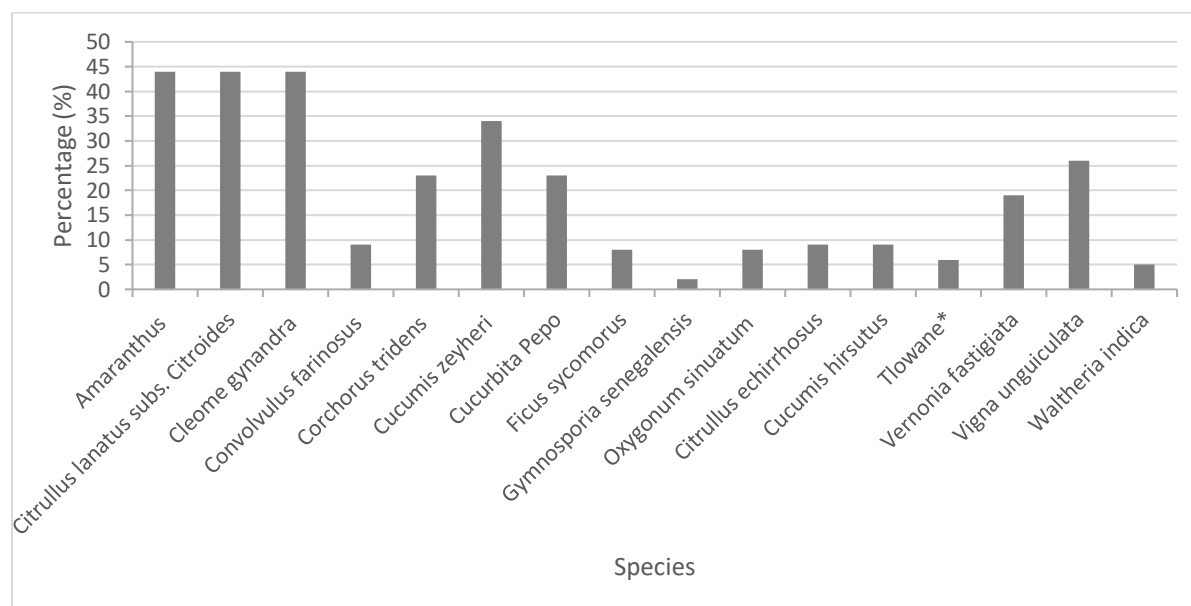


Figure 5.7: Frequently consumed wild vegetable species.

5.3.9 Knowledge and Consumption

5.3.9.1 Correlation between knowledge and consumption of WEPs

There was a positive and statistically significant correlation between participants' knowledge of WEPs and their consumption ($r = 0.42$, $p < 0.001$). In this case, the higher the number of WEPs species known, the higher the number of WEPs species consumed. Similar results were observed when wild fruits and wild vegetables were analysed separately; wild fruit species ($r = 0.31$, $p < 0.001$) and wild vegetables ($r = 0.42$, $p < 0.001$).

However, there were slight differences when the correlation was analysed based on gender and age groups. In terms of gender, the correlation between knowledge and consumption was strong, positive, and significant for both males ($r = 0.51$, $p < 0.001$, $n = 60$) and females ($r = 0.34$, $p < 0.001$, $n = 60$). In relation to age groups, there was positive and significant correlation of knowledge and consumption for the adult ($r = 0.67$, $p < 0.001$, $n = 40$) and elderly group ($r = 0.34$, $p < 0.05$, $n = 40$), but not the youth ($r = 0.28$, $p > 0.05$, $n = 40$).

5.4 Discussion

5.4.1 Traditional knowledge of WEPs

On average participants listed 17.4 ± 5.0 WEP species, which is significantly higher than similar studies such as Turreira-García *et al.* (2015) in Guatemala, where participants free-listed an average of 7.2 ± 0.7 species. However, differences in climatic conditions and vegetation types between these studies should be noted. The Guatemala study was conducted in a region characterised by subtropical forests with a higher mean annual rainfall compared to this study (Turreira-García *et al.* 2015). *Vangueria infausta*, *Ximenia caffra*, *Vigna unguiculata* and *Citrillus lanatus* were among the most commonly listed species. This might be because these species grow abundantly in people's backyards and surrounding areas hence, they are frequently recalled. This was confirmed by field observations and field walks in participants' home gardens and in the nearby fields where WEPs are available and collected.

Knowledge is not shared equally among different members of society (Chalmers & Fabricius, 2007). This study corroborated this by showing that the elderly are more knowledgeable about WEPs than the youth. This also supports the study's hypothesis that knowledge of WEPs species would increase with age. This could be attributed to factors such as modernisation that has reduced the amount of time young people spend in the natural environment (McMillen, 2012). Bruyere *et al.* (2016) noted that as more young people pursue formal education, there is a shift away from pastoralism and agrarian livelihoods which ultimately results in disinterested and unfamiliarity of the youth with some traditional knowledge. Their study found that young boys in Kenya who participated in formal education system had less knowledge of traditional plant species as compared to those practiced traditional pastoralism (Bruyere *et al.* 2016). Additionally, formal education contributes towards traditional knowledge loss because it lacks any indigenous knowledge content in the curriculum (Mhlongo, 2021).

The elderly have a higher ethnobotanical knowledge of WEP species because they have lived longer and thus have more cultural and lived experience of them. This study showed that the most knowledgeable participants were those who had resided in rural villages all their lives. Even though the majority of the youth have also lived in rural villages all their lives, the elderly have accumulated more knowledge because they lived longer and secondly, some of them have migrated from different localities to their current residence because of new opportunities or marriage. This migration might have exposed them to a new set of species that may have not been available at their village of origin which might have been in a different ecological zone.

The relationship between age and plant knowledge is corroborated by other studies such as Zent (2001) and Reyes-Garcia (2010) who found a correlation between plant knowledge acquired over time in Venezuela and Bolivia, respectively.

There was no significant statistical difference of the number of wild fruits and vegetables listed between genders. This is contrary to popular belief that women are more knowledgeable about wild vegetables than men (Vorster *et al.* 2007; Ntuli, 2013; Chakravarty *et al.* 2016). From this study, men and women listed almost equal number of wild fruits and vegetables. Ghorbani *et al.* (2012) observed similar findings where little difference in listed species between men and women were found in China. Dovie *et al.* (2008) also found no gender differences in the Bushbuckridge area of Limpopo Province.

5.4.2 Knowledge production, transmission, and loss

Knowledge about WEPs is mostly acquired and transmitted socially through relatives or community members (Turreira-García *et al.* 2015). This indeed was the case as this study showed that the majority of participants learned their knowledge of WEPs from a family member, a village elder and from their own observations. WEPs knowledge was mostly acquired during childhood through oral tradition, participating in collection and during consumption. These sources of knowledge corroborate Zarger's (2002) stages of knowledge acquisitions characterised by familiarisation, observation, and participation. As young children, participants acquired knowledge about WEPs by assisting their parents in the fields, they learned by observing and they also helped prepare meals (Turreira-García *et al.* 2015). This study also supports several studies (Bruyere *et al.* 2016; Turreira-García *et al.* 2015) that found a negative relationship between formal education and traditional knowledge as most of the participants disagreed to have acquired knowledge from school or other media sources. However, this study did not find a correlation between knowledge and education level.

Most participants affirmed passing their knowledge of WEPs to other people. Knowledge passage usually occurs from the older to the younger generations (vertical transmission) or between peers (horizontal transmission) (Adekannbi *et al.* 2014). From this study, the elderly passed knowledge mostly to their children and grandchildren, while the youth passed to their friends and siblings. The continuous transmission of knowledge across and between generations affirms that the acquisition of knowledge is a lifetime process (Reyes-García *et al.* 2019).

The learning about WEPs never stops as both the elderly and young participants reported learning new information in the last five years about species they did not know before, benefits that they were not aware of and preparation methods they were not familiar with. However, Zarger (2002) reports that knowledge fades away when one becomes too old, usually because they become frail and forgetful. This is why it's vital to transfer indigenous knowledge to the younger generation to ensure its future preservation (Dweba & Mearns, 2011).

The decline in indigenous knowledge over time is observed and confirmed by several studies (Díaz-José *et al.* 2019; Maroyi, 2017; Sujarwo *et al.* 2016; Turreira-García *et al.* 2015). Even though participants in this study have demonstrated their knowledge of local species, they perceived knowledge of WEPs, in general, to be eroding. This could be due to factors such as the dependence on cultivated foods, changes in lifestyles, lack of youth interest and lack of traditional knowledge content in formal education. Their perception of indigenous knowledge loss is not limited to their localities. Similarly, factors such as, technological change, access to new food products, and access to markets that may be caused by rural /urban migration may be perceived to contribute towards this loss in other locations (rural and urban) too (Chiwanza *et al.* 2013; Díaz-José *et al.* 2019; Reyes-García *et al.* 2019).

5.4.3 Knowledge and Consumption of WEPs

5.4.3.1 Consumption of WEPs

The most consumed wild fruits species were *Vangueria infausta*, *Englerophytum magalismontanum* and *Grewia flava*. The fruits of *Vangueria infausta* are small, round and multi-seeded; they are green when raw and brown when ripe and dried, they produce a sweet-sour taste and are available from December to April (Rankoana *et al.* 2015). In another study, *Vangueria infausta* was one of the most occurring fruit tree species in many of the home gardens in rural KwaZulu-Natal (Nemudzudzanyi *et al.* 2010). The abundance of these species is most likely the reason for its frequent consumption. The most consumed wild vegetables species were *Amaranthus retroflexus* and *Cleome gynandra*. A study from a similar location as this study (Capricorn municipality, Limpopo) found these two species to be in the top five of the most maintained and cultivated species in people's home gardens; the only two traditional vegetable species in that list alongside *Spinacia oleracea* and *Allium cepa* (Mosina & Maroyi, 2016). Indeed, various *Amaranthus spp.* are commonly consumed in rural villages throughout South Africa (Faber *et al.* 2010; Van der Hoeven *et al.* 2013; Mosina & Maroyi, 2016; Rankoana *et al.* 2015).

From a total of 24 consumed wild fruit species and 18 wild vegetable species, participants consumed an average of five species of each in the past five years. The diversity of species consumed was similar across age and gender groups. This finding contradicts several studies in South Africa that found elderly females to be the most frequent consumers of WEPs, especially wild vegetables (Mncwango *et al.* 2020; Modi *et al.* 2006; Zobolo & Mkabela, 2006). However, it is possible that the similar diversity of species consumed has little to do with differences in age and gender, but rather with the availability and accessibility of the species in a locality. Mncwango *et al.* (2020) found that the major constraint to wild vegetable consumption was the lack of availability all year-round. But in some localities, some households dry wild vegetables to ensure some supply during the dry season (Shackleton *et al.* 1998). In this study, participants (83 % and 62%) perceive wild fruits and wild vegetables consumption to be in decline, respectively. This is mainly because of shortage of rainfall (drought) which may temporarily affect the abundance of WEPs during that period. Similar findings were observed in several other studies about the impact of drought on the consumption of WEPs (Mncwango *et al.* 2020; Vorster *et al.* 2008). Not only does this challenge threaten the abundance of these species but can also ultimately contribute to the loss of knowledge and people's reduced reliance on them (Dweba & Mearns, 2011; Wessels *et al.* 2021).

5.4.3.2 The relationship between knowledge and consumption

This study found significant correlation between individuals' ethnobotanical knowledge and consumption despite some studies showing no correlation between the two variables (Ladio & Lozada, 2004). There was a correlation between knowledge and consumption of both wild fruits and vegetables; there was also positive correlation of knowledge and consumption by gender and age groups, except for the youth. This result also support the study's hypothesis that there would be a positive relation between the number of WEPs species known and species consumed. This means that the higher the level of knowledge, the higher the diversity of species consumed or vice versa. This, however, does not mean that the number of species known should be equal to the number of species consumed. Ladio & Lozada (2004) showed that people know significantly more species than they consume. Indeed, this was the case in this study as there were more species listed than were consumed. From 24 listed wild fruit species, 20 (83%) were consumed and 16 (88%) out of 18 wild vegetable species were consumed. A good example is *Ximenia caffra*, which was one of the most frequently listed species, but was among the least consumed. According to Ladio & Lozada (2004) the relationship between knowledge and consumption is linked to ecological conditions of gathering environments. If gathering

environments are depleted or eroded as a result of climatic (droughts) or environmental conditions such as intensive land use or overharvesting, consumption of species may decline or cease, even though knowledge persists for some time.

Additionally, Reyes-Garcia *et al.* (2005) attributed the relationship between consumption and knowledge to socio-economic factors such as location of the villages and how integrated the communities are to the market economy. They found that communities that were scattered and with less access to markets knew more and consumed more wild plant species (Reyes-García *et al.* 2005). They concluded that rapid socio-economic change will widen the gap between indigenous people and the use of traditional plants (Reyes-García *et al.* 2005, 2019). Villages from this current study are also undergoing socio-economic change characterised by a modernising youth and the infiltration of retail markets in to rural localities (Pereira *et al.* 2014). Effects of these changes are visible judging by the youth's low interest in consuming WEPs. One can only wonder what this disinterest would mean for future knowledge and consumption of WEPs.

5.4.3.3 Knowledge, consumption of WEP and livelihoods

Indigenous knowledge and consumption of WEPs are important contributors to the sustainability of livelihoods. Indigenous knowledge of WEPs contributes to human capital which is one of the livelihood assets important for the pursuit and attainment of livelihood objectives. Human capital is defined as the skills, knowledge, ability to labour and good health which in conjunction enables people to participate in different livelihood activities (Scoones, 1998). Indigenous knowledge includes a range of resources with which rural livelihoods are based on such as crop production, range management and wild plants (Cassidy *et al.* 2011). With this knowledge participant can identify which wild plant to consume, when plants are available for collection and how to prepare meals using those plants. Consumption of WEPs contributes to improved food security, income, reduced vulnerability to hunger and acts as a safety net for shocks. The loss of this knowledge as an asset can have negative implication for the future of rural livelihoods.

5.5 Conclusion

This study has shown that people in the study area still know a significant number of wild fruit and vegetable species and these foods still form an important part of the rural diet, as it was hypothesised. Participants still have access to some of the species from their home gardens and in the surrounding fields. This study also found that knowledge about WEPs is produced and

transmitted across and between people of different ages and genders in a variety of ways. This continuing transmission demonstrates how knowledge about WEPs is ongoing as both the young and old have reported to have learned something new about WEPs recently. Even though that is the case, there continues to be concerns regarding the youth and their lack of interest in knowing and consuming WEPs. This disinterest could ultimately lead to the future loss of traditional plant knowledge and livelihoods. If, indeed, knowledge of WEPs is a lifelong process that changes in levels overtime (Reyes-García *et al.* 2005), perhaps the youth are in their early stages of knowledge acquisition. However, to ensure future preservation of WEPs knowledge, certain measures could be considered. Firstly, WEPs could be incorporated into modern recipes and meals; secondly, there should be formalisation of indigenous knowledge by increasing content in local libraries and in the school curriculum (Bruyere *et al.* 2016; Mhlongo, 2021). Youth development can focus on establishing an industry of eco-entrepreneurs who specialise in selling products made from WEPs (Ham *et al.* 2007). Finally, the presence of WEPs needs to be increased in the media (social media, print media, televisions programmes) and through development of indigenous plant identification applications. These measures could ensure future conservation of WEPs especially in the youth. Longitudinal studies are required to investigate changes in levels of knowledge in the youth to evaluate the impact of biophysical, socio-economic factors or intervention measures on knowledge and consumption of WEPs.

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Chapter 6

Synthesis and Recommendations

6.1 Introduction

The number of people experiencing hunger and malnutrition has been steadily increasing in the world over the past two decades (UN, 2021). This number was further exacerbated by the COVID-19 pandemic which plunged millions more into hunger as a result of damaged economies and high food prices (FAO *et al.* 2022). These challenges are particularly prevalent in Africa and are estimated to become worse in this region already affected by conflict, poor healthcare, and natural disasters such as floods and droughts (FAO *et al.* 2022)., Agricultural production has played an important role in the provision of food for societies for thousands of years. However, Since the inception of the green revolution in the 1960's food production approaches focused mainly on the cultivation of a small number of staples mostly cereals, rice, wheat, and maize (Tanamonure *et al.* 2021). From 150 actively cultivated plant species only 20% make up most of human consumed calories and protein (Fuleky, 2002). The reliance on these crops is contributing to 'hidden hunger' caused by the lack of micronutrient intake and the consumption of non-diverse diets (Keatinge *et al.* 2015). WEPs, which previously formed a significant part of indigenous people's diet, have been regarded as an important food source crucial for the alleviation of malnutrition and micronutrient deficiencies (Bvenura & Afolaya, 2015; Jimoh *et al.* 2018). Despite their nutritional qualities, they are often ignored, overlooked, and undermined by agricultural programmes and food security interventions (Uprety *et al.* 2012). Additionally, WEPs are largely absent in modern urban diets, they are often surrounded by negative perceptions, they are economically undervalued, and thus the indigenous knowledge of these species is under threat.

This study regards WEPs as important resources that can significantly contribute to improved livelihood outcomes such as income, food security, culture and good health (Bvenura & Afolayan, 2015; Faber *et al.* 2010; Galhena *et al.* 2013; Lulekal *et al.* 2011; Neudeck *et al.* 2012). WEPs have been part of rural people's diets for millenia. However, traditional food consumption practices have undergone major shifts over the past century and accelerated over the last three decades (Viljoen *et al.* 2005). The changing economic and political landscapes which resulted in deagrarianisation, urban migration and a shift to a cash-based economy, is largely liable for changes in food choices and consumption (Pereira *et al.* 2014). It is also

evident that people's perceptions and attitudes play a crucial role in determining the rate and frequency of WEP consumption and the level of importance they accredit WEPs in their daily lives. Most studies examine perceptions such as health, taste, and tradition (Maseko *et al.* 2017; Seyoum *et al.* 2015; Sōukand, 2016), but very few have studied perceptions around trade and commercialisation by individuals from different socioeconomic backgrounds. With most dietary changes reported to be prominent in urban areas, it begs the question of to what extent have the consumption of WEPs changed amongst modern rural households. In the face of increasing urbanisation, westernisation, and increasing reliance of food from retail stores; this study assessed changes of WEPs consumption and use in rural households framed using the Sustainable Livelihoods Framework. The objectives of the study were to (1) assess changes of WEPs consumption and use in rural households; (2) Explore perceptions relating to the use and consumption of WEPs; (3) Examine the extent of WEPs availability, abundance, and economic value in rural home gardens and; (4) Explore the relationship between indigenous knowledge and WEPs use. To address the study aim and objectives, a mixed method approach was employed. A total of 356 participant were interviewed for this research using a combination of qualitative and quantitative methods such as household surveys, field surveys, freelists, semi-structured interviews, observations, and in-depth interviews. This chapter provides a synthesis and integrate key findings from the study as well as propose recommendations for future research and policy interventions.

6.2 Key findings

6.2.1 Availability, richness, and abundance of WEPs in rural home gardens

The study showed that WEPs are widely available in rural home gardens, with wild vegetables available in 97% of home gardens and wild fruits available in 58% of the home gardens. There were no significant difference of wild fruit tree and wild vegetable availability among villages. However, villages such as Maupye and Mamadila had the highest proportion (75%) of home gardens with wild fruit trees, while Ramakgaphola (81%) and Juno (80%) had the highest proportion of households with wild vegetables. The availability of WEPs in rural home gardens is complemented by results in Chapter 2 where participants gave accounts of species which are available in their home gardens. The results in Chapter 2 also showed that WEPs were kept and maintained in home gardens in the past as well. Therefore, the availability of WEPs in rural home gardens today is indicative of a continuation and persistence of traditional food practices. WEPs are an important livelihood asset and are still relevant to the rural diet. However, overall

cultivated species dominate rural home gardens, suggesting that despite the persistence of WEPs, there is a transition in progress.

From a total of 23 fruit tree species found in home gardens, six (26%) were wild species and from a total of 999 fruit trees recorded only 14% were wild. Wild fruit tree species averaged 2.5 ± 0.78 trees per home garden across all villages as compared to 9.7 ± 12.05 for cultivated fruit trees. These findings are, firstly, indicative of how appreciative rural people are over the value trees provide for them (Paumgarten *et al.* 2005; Thondhlana & Ruwanza, 2019). Trees provide ecosystem services such as aesthetic, spiritual, provisioning, regulating and cultural benefits (Shackleton *et al.* 2008). Secondly, the results show that households prefer cultivated fruits over wild fruits; a preference also noted in urban gardens in Southern Africa (Kaoma & Shackleton, 2014; Mosina & Maroyi, 2016; Paumgarten *et al.* 2005; Thondhlana & Ruwanza, 2019). Preference of cultivated species over WEPs was also shown in Chapter 3 where participants expressed their preference for cultivated crops for consumption and trade of WEPs. This preference is influenced by the suitable conditions that allow for cultivated trees to thrive in home gardens. This is because cultivated trees are actively planted, found to be easier to grow, and they yield faster (and often larger fruits) than wild fruit trees (Thondhlana & Ruwanza, 2019). Wild fruit trees lacked availability of seeds for people to actively propagate them; even when there are attempts to do so (by transplanting seedlings), in most cases they are unsuccessful. As a result, rural home gardens are dominated by cultivated fruit trees like *Prunus persica*, *Mangifera indica*, *Punica gratum* and *Psidium guajava*. This is consistent with other Limpopo Province studies which also found the same species alongside *Carica papaya* among the most prevalent species in home gardens (Mosina & Maroyi, 2016; Paumgarten *et al.* 2005). Because of the lack of availability of wild fruit seeds, and other challenges such as limited rainfall, lack of water supply, and poor soil quality; the richness and abundance of wild fruits is affected. This is perhaps why only a few species, such as *Sclerocarya birrea* and *Vangueria infausta*, are particularly prevalent species, however, with poor abundance and richness, unlike wild vegetable species.

The findings show that wild vegetables are more available, diverse, and abundant than cultivated vegetables in rural home gardens. Wild vegetables were found in 97% of the home gardens as compared to cultivated vegetables which were available in 78%. There was an average of 3.7 ± 1.5 wild vegetables species per home gardens compared to 2.2 ± 2 for cultivated species. From a total of 24 vegetable species recorded in home gardens, 54% were wild. Wild

vegetables in home gardens also provide ecosystem services such as cultural, provisioning, and regulating services (Maroyi, 2022). Wild vegetables are also an important livelihood asset and they provide livelihood outcomes such as improved food security, income, better health, cultural identity, and reduced vulnerability (Dop *et al.* 2019; Tata Ngome *et al.* 2017; Mukaila *et al.* 2022; Neudeck *et al.* 2012). In Chapter 3, most participants expressed their preference of wild vegetables over wild fruits. This preference was age-dependent as the adult and elderly preferred to consume wild vegetables as a relish, more than the youth. The preference of wild vegetables may also be the reason why species such as *Amaranthus retroflexus* ., *Cleome gynandra* and *Bidens pilosa* are identified as having the highest potential to alleviate food insecurity in the province (Bvenura & Afolayan, 2015). Even though cultivated vegetable species like *Spinacia oleracea* and *Beta vulgaris* were prevalent in all study villages and available in both rural and urban home gardens as reported in other studies (Maroyi, 2017; Mosina *et al.* 2014; Mosina & Maroyi, 2016; Ngcaba & Maroyi, 2021), wild vegetables were still more preferred. This is because wild vegetables are regarded to be nutritionally superior to cultivated vegetables such as *Spinacia oleracea* and *Brassica oleracea* (Jimoh *et al.* 2018; Lewu & Mavengahama, 2011). Cultivated vegetables face several challenges which may affect their availability in home gardens, such as, shortage of water, rain, and poor soil quality were mentioned to affect both wild and cultivated vegetables but not to the same degree. This is because some studies show wild vegetables to be tolerant to dry conditions as many species have adapted to limited water supply and high temperatures, unlike cultivated vegetables which are sensitive to such conditions (Chivenge *et al.* 2015; Stöber *et al.* 2017). As a result, some households in several villages like Ramakgaphola avoid planting cultivated vegetables in their home gardens precisely because of such challenges. This is perhaps the reason why the availability, richness, and abundance of cultivated vegetables is low. The availability of wild vegetables on the other hand depends on the suitability of natural conditions. In Chapter 2, participants recalled times in the past where rainfall was more favourable for WEPs to thrive; others recalled periods of droughts where the availability of WEPs was hampered. This demonstrates that the availability, abundance, and richness of WEPs fluctuates depending on the suitability of weather and environmental conditions.

Table 6.1: List of all species mentioned in this study

Scientific name	Local name	Wild/Exotic	Scientific name	Wild/Exotic	Local name
Vegetables			Fruits		
<i>Allium cepa</i> L.	Eiye	E	<i>Carica papaya</i> L.	E	Phopho
<i>Allium sativum</i> L.	garlic	E	<i>Citrus limon</i> L.	E	Swiri
<i>Amaranthus retroflexus</i> L.	Theepe	W	<i>Citrus unshiu</i> Marcow.	E	Nariki
<i>Beta vulgaris</i> L.	beetroot	E	<i>Citrus x sinensis</i> L.	E	Namune
<i>Bidens Pilosa</i> L.	Mokolonyane	W	<i>Ficus burkei</i> Blume.	W	Mokumo
<i>Brassica oleracea</i> L.	Khabetshe	E	<i>Ficus carica</i> L.	E	Feiye
<i>Brassica rapa</i> L.		E	<i>Ficus sansibarica</i> Warb.	W	Mohlupu
<i>Citrullus lanatus</i> Thunb.	Mochacha	W	<i>Grewia flava</i> DC.	W	Moretlwa
<i>Cleome gynandra</i> L.	Lerotho	W	<i>Litchi chinensis</i> Sonn.	E	
<i>Convolvulus farinosus</i> L.	Motantane	W	<i>Malus domestica</i> Mill.	E	Apola
<i>Corchorus tridens</i> L.	Thelele	W	<i>Mangifera indica</i> L.	E	mango
<i>Cucumis zeyheri</i> Sond.	Monyaku	W	<i>Morus nigra</i> L.	E	Morompeila
<i>Cucurbita moschata</i> Duchesne.		E	<i>Musa acuminata</i> Colla.	E	Panana
<i>Cucurbita pepo</i> L.	Mophotse	W	<i>Persea americana</i> Mill.	E	avocado
<i>Daucus carota</i> L.	kherote	E	<i>Prunus domestica</i> L.	E	plum
<i>Ipomoea batatas</i> L.	potata	E	<i>Prunus persica</i> L.	E	Perekisi
*	<i>Lerotwarotwane</i> *	W	<i>Psidium guajava</i> L.	E	kwebere
<i>Moringa oleifera</i> Lam.	moringa	E	<i>Punica granatum</i> L.	E	garenate
<i>Oxygonum sinuatum</i> Hochst.	Tshehlo	W	<i>Pyrus communis</i> L.	E	Piere
<i>Solanum tuberosum</i> L.	Letsapane	E	<i>Sclerocarya birrea</i> A. Rich.	W	Marula
<i>Spinacia oleracea</i> L.	Sepenatshe	E	<i>Vangueria infausta</i> Burch	W	Mmilo
<i>Splantana</i> *		W	<i>Vitis vinifera</i> L.	E	Terebe
<i>Vernonia fastigiata</i> Oliv. & Hiern.	Lehlanye	W	<i>Ziziphus mucronata</i> Willd.	W	Mokgalo
<i>Vigna unguiculata</i> L.	Monawa	W	<i>Mimusops zeyheri</i> Sond.	W	Mobupudu
<i>Hibiscus trionum</i> L.	Maeteletja	W	<i>Grewia caffra</i> Meisn.	W	Mofarelatschwene
<i>Sonchus oleraceus</i> L.	Mantlalekgere	W	<i>Flueggea virosa</i> Willd.	W	Mohlakauma
<i>Waltheria indica</i> L.	Mohutasele	W	<i>Englerophytum magalismontanum</i> Sond.	W	Mohlatswa
<i>Momordica balsamina</i> L.	Motangtang	W	<i>Searsia lancea</i> L.f.	W	Mohlohlo
*	Mmamotinti	W	<i>Ficus sycomorus</i> L.	W	Mohlole
<i>Gymnosporia senegalensis</i>	Mophato	W	<i>Boscia albitrunca</i> Burch	W	Mohlopi
<i>Citrullus echirrhosus</i>	Phara	W	<i>Cordia grandicalyx</i>	W	Mokankane
<i>Cucumis hirsutus</i>	Senotwanotwane	W	<i>Cyphostemma dasypleurum</i> C.A.Sm.	W	Mokgampule
	Tlowane	W	<i>Euclea undulata</i> Thunb.	W	Mokwerekwere
			<i>Ehretia rigida</i> Thunb.	W	Morobe
			<i>Carissa bispinosa</i> L.	W	Morokolo
			<i>Ximenia caffra</i> Sond.	W	Motshidi
			<i>Cissus cornofoia</i>	W	Mokgoo
			<i>Zanthoxylum capense</i>	W	Monokwane
			*	W	Monthepu
			*	W	Setlodi

6.2.2 Economic value and contribution of WEPs to livelihoods

The study showed that home gardens provide significant economic value to rural households. WEPs and cultivated fruits and vegetables in home gardens contribute to household food supply, cash savings and income generation needs. The total estimated value of fruits and vegetables in home gardens was R706 641 with cultivated species contributing 63.8% compared to R255 360 (36.2.%) for WEPs. These results are complemented by High & Shackleton (2000) who valued cultivated species at 69% compared to WEPs at 31%. The high value of cultivated species was due to the dominance of cultivated fruits accounting for just over half (51.7%) of the estimated value of fruits and vegetables. Based on the low availability, richness, and abundance of wild fruit trees (Chapter 4) in home gardens, the estimated value of 4.7% for wild fruits was anticipated. However, households still benefitted greatly from wild fruits growing in the surrounding landscapes. Participants reported collecting fruits from *Sclerocarya birrea* and *Vangueria infausta* trees around neighbouring fields and communal lands to supplement their wild fruit intake and generate more income. Most of the estimated value of WEPs (87%) comes from wild vegetables. As shown in Chapter 4, wild vegetables were widely available and more abundant in home gardens than cultivated vegetables. There are several important reasons why placing economic value on home garden produce is necessary. Firstly, rural households mostly consume home gardens goods for subsistence, thus, the economic value of produce is usually unknown and thus overlooked. Arguments that placing a value on WEPs foods is important “in debates relating to land use practice and change, as well as adjustments to data and indices pertaining to regional economic output” were also previously made (High & Shackleton, 2000). Placing a value on WEPs can also provide a clearer picture of how WEPs contribute to livelihood outcomes such as income generation and saving on food spending.

Results from this study show that WEPs contribute to livelihoods in a variety of ways. The most important way WEPs contribute to livelihoods is through the provision of food for household subsistence. Most of the households in this study produced food in their home gardens primarily for subsistence. This is consistent with many studies in Southern Africa which show that households consume home garden goods for domestic use (Bvenura & Afolayan, 2015; Kalaba *et al.* 2009; Keatinge *et al.* 2015; Molebatsi *et al.* 2010; Mollee *et al.* 2017; Nemudzudzanyi & Siebert, 2015). All the result chapters of this study show that home gardens provide households with WEPs as a food source. Chapter 3 and 5 showed that WEPs provide meals for household members a few times a week, while for some elderly members

the provision is daily. Chapter 5 showed that a diversity of WEPs has been consumed in the past five years. The addition of WEPs as a regular part of meals for households enhances dietary diversity (Keatinge *et al.* 2015; Vorster *et al.* 2007), improves micronutrient intake (Jimoh *et al.* 2018), and can lead to better health (Guissou *et al.* 2015). Similarly in Chapter 2, WEPs were consumed to diversify diets and used as safety nets for vulnerable households to purchase foods when running low on cash income. Therefore, WEPs contribute to reduced vulnerability to hunger and food insecurity. Results in Chapter 4 revealed that 9% of the households trade WEPs (dried vegetables and/or processed wild fruit) to generate income. Income generation is important for the sustainability of livelihoods and to improve household financial well-being. Additionally, food produced from home gardens relieves the household from some of its food spending, thus saving household cash income (Chapter 4). Since most households consume home garden produce for subsistence, surplus produce is not traded but shared with friends and relatives in urban and other rural areas. This builds bonds, networks, and reciprocal obligations; thus contributing to social capital (Shackleton & Shackleton, 2005).

6.2.3 Perceptions of WEPs

The research revealed that almost two-thirds (65.6%) of participants hold positive attitudes regarding WEPs. This is corroborated by some studies which show that rural communities generally harbour favourable perceptions about WEPs because they are frequently consumed and seen as a valuable food source (Taruvunga & Nengovhela, 2015). Overall, participants perceived WEPs to be healthy, nutritious, tasty traditional foods. These perceptions however, differed with age as adults and the elderly were more likely to perceive WEPs as healthy, nutritious, tasty, and traditional, than were the youth. There was significant association between age and perceptions relating to taste and tradition. This may be the reason why adults and the elderly value WEPs more because of traditions, knowledge, and experience; hence they hold more positive attitudes about them than the youth.

The relationship between the youth and WEPs was prominent in Chapters 2, 3, and 5. In Chapter 2, the elderly participants discussed how the youth were reluctant and disliked consuming wild vegetables; Chapter 5 showed that the youth knew fewer WEPs and consumed slightly less and Chapter 3 showed that the youth were less likely to perceive wild vegetables as tasty, traditional foods. The youth presented interesting results in this study. On the one hand they agree with other age groups relating to perceptions that WEPs are healthy, nutritious, and not poverty foods; they consume WEPs at almost similar rates with adults and the elderly.

However, from their own admission, they do not like consuming wild vegetables because they have little knowledge about them, they lack interest and they dislike the taste. As a result, they prefer to consume “modern foods”. According to Vorster *et al* (2007) the youth lack awareness about nutritional content of WEPs, while the elderly knew their benefits because the previous generation survived on them. Additionally, other studies have showed that the youth have little knowledge and skills for preparing WEPs, and nutritional information about WEPs or lack thereof was considered a hindrance to consuming them (Matenge *et al.*2012).

Similar results extend to the perception of WEPs commercialisation. Most of the participants (especially the youth) would buy more cultivated crops in the market than WEPs. This may be because dietary choice depends on food availability, affordability, convenience, desirability and culture (Herfoth & Ahmed, 2015; Guissou *et al.* 2015). The youth might prefer consuming cultivated crops because of similar reasons. Mncwango *et al.* (2020) showed that most young people frowned on harvesting WEPs because they considered the activity to be degrading their dignity even though they participated in their consumption. Therefore, buying WEPs might be convenient to the youth because they find the process of harvesting and preparing WEPs to be unsuitable for their busy lifestyle (Matenge *et al.* 2012). Additionally, rural residents might not see the need to buy WEPs because they are available in their home gardens. However, if they were to buy WEPs, they were less likely to buy from road side or in the informal market but would be open to buying them from retail stores. This could be attributed to them perceiving food from retail stores to be of higher quality than food bought from informal markets (Ngugi *et al.* 2007). Chapter 4 showed that the retail sector is increasingly playing an important role in the rural economy and food system. Results in Chapter 4 showed that almost all households purchase fruits and vegetables from retail stores due to the incapacity of their home gardens to produce desired quality and quantity all-year round. WEPs could be purchased the same way, especially if they are limited in the home garden or during the off-season when WEPs are not available. Perhaps if WEPs are sold in retail stores could change how they are perceived as old-fashioned foods, especially by the youth.

6.2.4 Knowledge and consumption of WEPs

The findings show that all the participants in this study consumed WEPs. Results in Chapter 2 showed that WEPs were consumed on average 2.7 times per week, with most participants consuming them two to three times per week. This finding corroborates some studies which came to similar findings (Mncwango *et al.* 2020). Participants reported consuming wild

vegetables such as *Vigna subterranean*, which was consumed by 16% of the participants, *Cleome gynandra* (8%) and *Amaranthus retroflexus*. (8%) and wild fruits such as *Vangueria infausta* (35%), *Grewia flava* (11%) and *Sclerocarya birrea* (8%). There was no significant statistical difference between consumption with age, gender, or income groups. Chapter 5 revealed that on average, participants consumed 5.2 ± 1.19 wild fruit species, ranging from two to eight and 5.4 ± 1.55 wild vegetable species were consumed, ranging from one to nine species. Results in Chapter 5 also show that in the past five years wild vegetables like *Amaranthus retroflexus*. and *Cleome gynandra* were among the most consumed and *Vangueria infausta* and *Grewia flava* were the most consumed wild fruits. Studies shows that these species are mostly consumed because of their availability and abundance in rural home gardens (Faber *et al.* 2010; Van der Hoeven *et al.* 2013; Mosina & Maroyi, 2016; Rankoana *et al.* 2015). *Vangueria infausta* was one of the most common fruit species in many of the home gardens in rural KwaZulu-Natal (Nemudzudzanyi *et al.* 2010) and various *Amaranthus retroflexus*. are commonly consumed in rural villages throughout South Africa (Faber *et al.* 2010; Van der Hoeven *et al.* 2013; Mosina & Maroyi, 2016; Rankoana *et al.* 2015).

The study shows that participants have vast knowledge of WEPs. Freelist results reveal that participants listed a total of 24 wild fruit species and 18 wild vegetable species. Participants listed an average of 8.4 ± 2.4 wild fruits species ranging from four to sixteen species. The most frequently listed species were *Vangueria infausta*, *Ximenia caffra*, *Sclerocarya birrea*, *Grewia flava*, and *Ziziphus mucronata*. There was no significant statistical difference between listed wild fruits with gender, however, there was a significant difference with age, i.e., between the elderly and the youth. The elderly listed an average of (9.3 ± 2.6) wild fruit species compared to (7.8 ± 1.7) for the youth. This result corroborates assertions and perceptions made in Chapter 2 and 3 that the youth have lower knowledge about WEPs. McMillen (2012) argued that this could be due to factors related to modernisation that have resulted in the youth spending less time in the natural environment. Another factor is formal education which created a shift away from pastoralism and agrarian livelihoods, which ultimately resulted in disinterested and unfamiliarity of the youth with some traditional knowledge (Bruyere *et al.* 2016). In Chapter 2 male participants gave accounts of how they used to collect wild fruits as children when herding livestock, and a practice that has faded because of formal education that is contributing to indigenous knowledge loss. This was also corroborated by a study in Kenya which showed that young boys who participated in the formal education system had less knowledge of traditional plant species as compared to those who practiced traditional pastoralism (Bruyere *et al.* 2016).

Participants listed an average of 9.0 ± 2.98 wild vegetable species ranging from four to seventeen. There was no statistically significant difference between species listed with age and gender. The most frequently listed wild vegetable species were *Vigna unguiculata*, *Citrillus lanatus*, *Cleome gynandra*, and *Amaranthus retroflexus*. There was a positive correlation between knowledge of wild fruit listed and wild vegetables, meaning, if one knows more wild fruits species, they are likely to know more wild vegetables species too. Knowledge about WEPs was acquired during childhood, through oral traditions, collection and from a family member. This was confirmed by accounts in Chapter 2 where participants as children learned about WEPs through collection (boys; mostly fruits) and through participation and oral traditions (girls). This also confirms Zarger's (2002) stages of knowledge acquisition characterised by familiarisation, observation, and participation where knowledge is acquired by children assisting their parents in the fields, they learned by observing and they also helped prepare meals (Turreira-García *et al.* 2015).

From the interesting findings related to knowledge and consumption, this study further investigated if there was a relationship between the two variables. The study found a significant correlation between individuals' ethnobotanical knowledge of wild fruits and vegetables and consumption even though some studies (Ladio & Lozada, 2004) showed the opposite. This means that the more species known would translate to a higher diversity of species consumed or vice versa. This relationship was significant between gender and age groups except the youth. The youth knew slightly higher number of species than species they consumed but the consumption was less and not significant. According to Ladio & Lozada (2004) people generally know more species than they consume. This is corroborated by results in Chapter 5 showing that people on average know 8.4 ± 2.4 wild fruits species but consumed 5.2 ± 1.19 wild fruit species. This is linked to ecological conditions of gathering environments; if gathering environments are depleted (due to land use change or climatic conditions) consumption of species may decline or cease, even though knowledge persists for some time. Additionally, based on participants' accounts in Chapter 2, this could also be attributed to migration; when people move to different ecological environments, they may have a recollection of WEPs from their previous location but may not be currently consuming them because of non-availability in their current location. Location of the village is also an important socio-economic factor affecting the relationship between knowledge and consumption. According to Reyes-Garcia *et al.* (2005) communities that are scattered and have less access to markets know more and consume more wild plant species. Villages in this current study are also undergoing socio-

economic change characterised by a modernising youth and the rise of the retail sector in rural areas (Pereira *et al.* 2014). The impact of this on knowledge and consumption of WEPs would require long-term studies.

6.2.5 Changes in consumption and use of WEPs

The use and consumption of WEPs has been changing over the past few decades. Results show that there has been a shift in WEPs consumption in terms of meal composition and frequency. In Chapter 2, participants provided a list of foods from different food groups that they consumed in the past. The list corroborates Quin (1964) who provided a list that was comprised of six categories of food, namely cultivated plants, indigenous plants, indigenous fruits, insects, domestic animals, and indigenous fauna. Sorghum, millet, and maize were consumed as soft and hard porridges (Fox & Norwood-Young, 1982) while indigenous vegetables were consumed as relishes alongside these porridges for most meals. Roasted seeds, bean gravies, insect dishes, milk, salt, fruit sauces and meat were other types of relishes consumed. The consumption of meat was described as minimal, relegated to mostly celebrations or for traditional ceremonies (Fox & Norwood-Young, 1982; Quin, 1964). This composition of meals was the norm for daily meals and for meals consumed during traditional ceremonies. The frequency of meals was only twice a day; in the late mornings and after sunset. Both meals comprised of a stiff porridge (from either sorghum, millet, or maize) served with a wild vegetable of choice as a relish. Different species of wild vegetables could be consumed interchangeably throughout the week (Viljoen *et al.* 2005).

The findings in Chapter 2 corroborate studies such as Ronquest-Ross *et al.* (2015) and Walker (1996) that found an increase in consumption of foods like white flour, bread, sugar, sweets, and maize products like samp, mielie rice, maize meal, and meats. The consumption of these foods contributed to dietary changes. The consumption of wild vegetables has declined from being consumed daily to only a few times a week because cultivated vegetables and meats are consumed as relishes. The consumption of meat has increased (Ronquest-Ross *et al.* 2015) and meat has replaced wild vegetables as the primary relish. Different meats are now consumed interchangeably throughout the week. Consuming three meals a day is now the norm (Viljoen *et al.* 2005). During traditional ceremonies and other celebrations, modern foods are served side-by-side with traditional foods and beverages; this demonstrates that traditional foods still play an important role in diets and to maintain traditional practices.

There are several factors responsible for the change in the use and consumption of WEPs. Chapter 2 provided a historical overview and traces socio-economic and political changes of segregation as the probable triggers of change. The subsequent urbanisation and tenancy on white-owned farms introduced new food items in their home gardens and in their diets. Urban trading stores played a role in the increased consumption of foods like bread, milk, tea, and soft drinks that became popular in urban and to some extent in rural areas too (Viljoen *et al.* 2005). This influence has today extended to rural areas in a form of shopping centres and an increased number of retail stores. Modern technology has also played a part in changing the way people store, preserve, and prepare their food. Food such as meats and dairy could be bought in bulk and stored for longer and WEPs such as traditional beers and wild vegetables are also stored this way to preserve their freshness. Participants also expressed how preparation methods for wild vegetables have modernised as they are cooked using oils while adding tomatoes, onions, and spices to improve their taste. In Chapter 3 and 5 participants perceived WEPs availability, abundance, and richness to be in decline; they largely attributed this to droughts and poor soil. As a result, most of the agricultural lands lie fallow and underutilised, with most food purchased in retail stores and supplemented with home gardens produce (Pereira *et al.* 2014).

6.3 Reflections of WEPs and the SLF

One of the strengths of the SLF is that it can be applied to different development and academic research projects. This study is one of the few to apply SLF to analyse the contribution of WEPs to sustaining livelihoods. The application of SLF to studying the impact of WEPs to livelihoods was informed by livelihood research which made it clear that rural livelihoods especially in the developing world are diverse and complex often requiring interdisciplinary understanding of links between different fields and activities that form part of a livelihood (Lowder *et al.* 2021). The SLF captures these links through different components which depict how livelihood assets are influenced by structures and processes, affected by trends and shocks and how these linkages ultimately lead to the achievement of livelihood outcomes. It is through the interconnectedness of these livelihood components that made the SLF useful, valuable, and suitable tool to analyse the diverse nature and contribution of WEPs to sustain livelihoods. In this study, WEPs are seen as a form of a natural capital; the indigenous knowledge and perceptions people have about WEPs as well as their participation in collecting and preparing WEPs meals is human capital; the sharing of WEPs foods with relatives, friends and neighbours is a social capital. These assets are influenced by institutions, structures and processes that are

in place and results from this study demonstrates how these allows for the detection of restrictions or barriers and opportunities to sustain livelihoods. For example, results in Chapter 2 and 4 showed how globalisation through socio-economic change has created a shift to a cash-based economy characterised by the infiltration of the retail sector in rural areas having implications for WEPs consumption and local livelihoods. Another value of using the SLF for this study was because of its vulnerability context analysis which applies well to WEPs. Firstly, WEPs are seasonal resources whose availability and abundance is subject to seasonal variations dictated primarily by climatic conditions. In this study, WEPs are widely collected, consumed, and traded in the rainy summer season where their availability and abundance are optimum. The SLF also captures the effect of trends and shocks that can have a negative impact on livelihoods such as natural disaster, political instability, and economic crisis. This study showed how the contribution of WEPs was able to minimises shocks such as food shortage caused by lack of income. Additionally, several studies have show how WEPs can be used as safety nets during periods of uncertainty and hardship such as droughts, famine, conflict, or disease outbreak.

The use and consumption of WEPs especially in the home garden setting forms part of two types of livelihood strategies namely agricultural intensification and livelihood diversification. Firstly, rural home gardens contain a diversity of agricultural and other food plant species such as fruit trees, cultivated vegetable species and other crops such as maize. The addition of the maintenance and management of WEPs on the same land intensifies agricultural production output which could be vital for household food security and income. Secondly, in addition to income generating livelihood activities such as employment, remittances, other business ventures, for some households the trading of WEPs or their products creates an additional source of income for the household. On top of these livelihood outcomes, this study has showed that WEPs contribute to more livelihood outcomes such as food security, nutrition and dietary diversity, health, and reduced vulnerability.

Despite the usefulness of the applicability of SLF to the use and consumption of WEPs, there are some shortfalls to consider to which some authors have called for its reformulation, justifiably so (Natarajan *et al.* 2022). Firstly, the SLF tends to focus on the here-and-now overlooking the role of historical processes such as colonialism and land dispossession which have implications for the nature of livelihoods today (Natarajan *et al.* 2022). Results in Chapter 2 showed how WEPs played a crucial role in the sustaining of livelihoods in the past and how

that has changed largely driven by past policies and institutions. Therefore, the SLF requires an analysis of historical processes and their effects of how they shape our understanding and existence of current livelihoods (Natarajan *et al.* 2022; Scoones, 2015). Secondly, related to the first is the insufficient analysis of political and economic factors in relation to place-based livelihoods strategies (Scoones, 2015). Since the SLF is underpinned by the broader definition of poverty, which includes empowerment, social justice, security, health etc, it is however not reflected on the framework because livelihood assets are viewed in economic or capitalistic terms (Natarajan *et al.* 2022). Thus, in a world going through globalisation, the SLF should analyse the effects of capitalism on livelihoods. In their reformulation of the SLF, Natarajan *et al.* (2022) propose replacing human, social and natural capital with relational power and climate and environment relations. Relational power refers to class, gender, ethnicity, caste, and other power relations which build, shape, and sustain livelihoods. These are important for addressing gender insensitivities, other power relations, or shortfalls that are overlooked or inadequately addressed by the SLF. The climatic and environmental factors address the relations between local-level climatic and environmental factors; how these are shaped at the macro level and how they shape rural livelihoods (Olsson *et al.* 2014).

The SLF has provided great insight for the analysis of how WEPs contribute to sustaining rural livelihoods. The SLF can still provide value to future related academic research, however, there can always be room for improvement. With livelihoods undergoing change in the 21 century, the SLF could be revitalise to improve the understanding of the changing nature of livelihoods in rural and urban areas as well as in developed and developing countries.

6.4 Conclusion and recommendations

The study examined the economic value of WEPs in rural home gardens, their potential contribution on sustaining livelihoods and how perceptions and indigenous knowledge affect their use and consumption. This study showed that WEPs (especially wild vegetables) are available and abundant in rural home gardens. WEPs are still appreciated and valued by some members of rural communities such as the elderly. Not only do they provide ecosystem services, they also have economic value and they contribute significantly to sustaining livelihoods leading to improved food security, reduced vulnerability, culture, and increased income for some households. Rural inhabitants generally view WEPs in a positive light. They regard them as healthy, nutritious, traditional foods with a potential for commercial success if sold in markets. WEPs are well known in rural areas and still form a significant part of rural

people's diets. Even with reported declines in availability and consumption as a result of socio-economic change and modernisation, traditional foods in general and WEPs in particular still have a place in modern diets. This was demonstrated by their consumption several times a week, their consumption side-by-side with cultivated foods during traditional ceremonies and other celebrations and new preparation methods that ensure that WEPs are enjoyed better and still form part of modern meals. With their reported benefits for health, nutrition, culture, and contribution to livelihoods, WEPs could play a bigger role in the fight against (hidden) hunger, malnutrition and food security in the country and the continent at large. This could firstly be done by affirming WEPs use and consumption in rural and urban areas by encouraging more consumption in households, local competition of the best WEPs dishes could be established. Look for ways for incorporating WEPs in modern recipes and dishes, this could be important for improving acceptability and preference, especially for the youth (Matenge *et al.* 2012). WEPs could form part of the meals served for school feeding programmes, they could be part of the diet served and recommended at clinics and hospitals. Secondly, food programs and interventions should involve WEPs as part of their strategies to mitigate household food insecurity. Youth entrepreneurial programs in rural areas should encourage the youth to establish businesses that sell WEPs or products made from WEPs. This would ensure continued use of WEPs and their commercial availability especially in urban markets. The commercial success of WEPs would require an intensification of production through domestication and cultivation. More research is required on how more WEPs plants species could be cultivated, in this case more wild fruit species could be planted in home gardens and more land could be used to plant more wild vegetable species actively under a management system. Finally, to promote the preservation of WEPs knowledge, there should be formalisation of indigenous knowledge content in the school curriculum and in libraries (Bruyere *et al.* 2016; Mhlongo, 2021). For the general public, there needs to be an increased presence of WEPs in the media space, this should include newspaper articles sharing the latest or interesting research about WEPs, discussions about WEPs in radio talk shows, television programmes, social media posts sharing WEPs recipes and development of WEP identification applications. These measures would ensure the future use and preservation of WEPs for the continued contribution to sustaining livelihoods for households in rural areas.

6.5 References

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Appendices

Appendix 1: Interview Schedule Chapter 2

Assessing Changes in WEPs use

Interview no: _____ Date: _____ Start time: _____ End Time: _____
_____ Village Area: _____ Village: _____

Childhood Background

1. Place of Birth: _____
2. Parents place of birth: _____
3. Parents Occupation: _____
4. Where did you grow up?
5. Describe the place (environment, community)
6. What was it like growing up there?
7. Describe the house you lived in?
8. Describe the sort of food you ate.
9. Did you have a food garden in your home?
10. If so, what crops and WEPs were found there?
11. Did you collect any foods from the wild as a child?
12. If so, what were they?
13. When did you collect them? (probe, during playtime, on way to or from schools, etc.)
14. What were some of your favourite WEPs and why?
15. Describe the games you played?
16. Do you remember any songs, games or stories in which WEPs were mentioned?
17. Were you told any stories/folklore about WEPs? If so, what were they?
18. Were there any rules or taboos you were told of relating to the collection or consumption of WEPs?

Family Activities

19. How many were you in your family?
20. Did the family participate in traditional ceremonies? If so which ones?
21. What kinds of foods were eaten during those occasions? Probe different occasions.

22. Were there meals which contained WEPs? If so which meals and what WEPs were contained?
23. Who in the family was responsible for collection of WEPs
24. Who was responsible for preparation of meals?
25. What were some of your favourite meals which contained WEPs?
26. Were there any WEPs eaten as snacks for past time? If so which ones?
27. Which ones were you favourite WEPs snacks?
28. Were any WEPs used for other things e.g fermentation? Or other uses?
29. If so, which WEPs?

Current use

30. Describe a typical family gathering?
31. Does the family participate in any traditional ceremonies today? If so which ones?
32. What kinds of foods do you eat during those ceremonies?
33. What are some of the meals you eat during an ordinary week day?
34. On average, how many of those meals contain WEPs?
35. Who in the family is responsible for collecting/managing WEPs
36. Who is responsible for preparation of meals with WEPs? What are some of your favorite meals which contain WEPs?
37. Are there any other uses of WEPs besides preparation of meals e.g fermentation? Or any other uses?

Culture and WEPs

38. Are there any WEPs which are important for culture? Why?
39. Do you see Home gardening as a cultural practice? If so, in what way?
40. What are some of the meals that are prepared using culturally identified WEPs?
41. According to culture who is responsible for collecting and preparation of meals?
42. Which methods of WEPs preparation makes meals culturally unique?
43. Are there any taboos of consuming WEPs?
44. Are there specific rules of collection/preparation / consumption for men/women or children?
45. Which WEPs are mostly preferred and consumed by men? Why?
46. Which WEPs are preferred by women? Why?
47. Which WEPs are mostly preferred by children and youth? Why?

Changes

48. Have cultural practices relating to WEPs changed?
49. Are the traditions, ceremonies, rules and taboos relating to WEPs consumption still practiced?
50. Do you think the frequency of WEPs consumption is the same as in the past (i.e your childhood)?
51. Do you see any similarities or differences between the experiences of your childhood to that of children of today?
52. Are there any WEPs that were consumed in the past which are no longer being consumed today? If so, which ones and why?
53. Have methods of preparation of WEPs changed in any way?
54. Have meals containing WEPs changed (improved or worsened?)
55. Do you still enjoy WEPs just as much as you did in the past?
56. Do you think WEP are still important and relevant to rural household diets?

Individual/Household Profile

Gender: M ☐ F ☐

Age: _____

Occupation: Employed ☐ Unemployed ☐ Self-employed ☐ Retired ☐

Highest Education Level: _____

Household Size: Adults (> 18) ☐ Children (< 18) ☐

Household head: M ☐ F ☐

Social Grants: Child grants ☐ Disability ☐ Pension ☐

Household income p/m: R0 – R1000 ☐ R1000 – R5000 ☐ R5000 – 10 000 ☐ R10 000 – 15 000 ☐ over R15 000 ☐

Other sources of income: remittances ☐ Grants ☐ farming ☐ other business ☐

Income spent on food p/m: R0 – 500 ☐ R501 – 1000 ☐ R1001 – 1500 ☐ over R1500 ☐

How often does your household eat meat? Everyday [] 4 – 6 times p/w [] less than 3 times p/w [] never []

How many of these does your household have:

Cattle: _____ Goats: _____ Cars: _____ Tv: _____ Radio/ hifi: _____ Fridge: _____

Computer: _____

Appendix 2: Interview Schedule Chapter 3

Perceptions of WEPs Use

Interview no: _____ Date: _____ Start time: _____ End Time: _____
Village Area: _____ Village: _____

1. Have you/ do you consume WEPs? _____
2. How often per week/month? _____
3. Which WEP have you consumed recently?

4. Which WEP type do you mostly prefer? Wild vegetables or wild fruits? Why?

5. How important are WEPs for you? Why/why not?

6. How much do you agree with the following statements:

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
WEPs are tasty					
WEPs are good for health					
Eating WEPs is our tradition					
WEPs are poverty foods					
WEPs are more nutritious than cultivated crops					

WEPs are children's food					
WEP are part of our culture					

7. How would you describe the taste of some WEPs you know?

8. Do you think that WEPs tasted better at childhood? Yes or no and why?

Perceptions of Commercialisation

9. Do you know if people sell WEPs? _____

10. If so, do you think one can make a living from selling WEPs?

11. Do you think if WEPs were available and sold at supermarkets/ in town people would buy them?

12. Do you think WEPs would sell more than cultivated foods?

13. If so, why do you think WEPs would sell more? If not why not?

14. Do you think more WEPs are consumed in the absence of cultivated foods or the consumption would not change even in their presence?

15. Do you think there is a demand for WEPs in rural/urban households? _____

16. Do you think WEPs can replace cultivated foods? Why/why not?

Perceptions of health

17. Do you think WEPs have health benefits? _____

18. If so, what are some of those health benefits?

19. Are there any WEPs that have negative health benefits?

20. Do you think WEPs are healthier than cultivated crops?

21. Are there any WEPs that are not consumed as one gets older? Why?

Perceptions of future use

22. Do you think the youth are interested in consuming WEPs? Why/ why not?

23. Do you think WEPs consumption is declining? If so, what is causing the decline?

24. What role do you think culture plays in the consumption of WEPs?

25. Do you think some people eat WEPs because they see them as cultural foods?

26. What do you think should be done to encourage more people eat WEPs? If yes what? If no why?

Individual/Household Profile

Gender: M [] F []

Age: _____

Occupation: Employed [] Unemployed [] Self-employed [] Retired []

Highest Education Level: _____

Household Size: Adults (> 18) [] Children (< 18) []

Household head: M [] F []

Social Grants: Child grants [] Disability [] Pension []

Household income p/m: R0 – R1000 [] R1000 – R5000 [] R5000 – 10 000 [] R10 000 – 15 000 [] over R15 000 []

Other sources of income: remittances [] Grants [] farming [] other business []

Income spent on food p/m: R0 – 500 [] R501 – 1000 [] R1001 – 1500 [] over R1500 []

How often does your household eat meat? Everyday [] 4 – 6 times p/w [] less than 3 times p/w [] never []

How many of these does your household have:

Cattle: _____ Goats: _____ Cars: _____ Tv: _____ Radio/ hifi: _____ Fridge: _____

Computer: _____

Appendix 3: Household Survey Chapter 4

WEPs Availability and Use in Home Gardens

Interview no: _____ Date: _____ Start time: _____ End
Time: _____ Village Area: _____ Village: _____
House no: _____

Section A: Wild Edible Plants

Wild Vegetables

1. Do you have Wild vegetables in your Home Garden? [☐] Yes [☐] No

If no, why not? [Proceed to question 8]

2. If yes, why do you have Wild vegetables in your Home Garden?

3. Please rank the importance of having Wild vegetables in your household (1= not important and 5 = very important)

1 [☐] 2 [☐] 3 [☐] 4 [☐] 5 [☐]

4. Which Wild vegetables are available in your Home garden?

Local Name	Part Used (Code A)	Used For (Code B)	Months (Code C)	Quantity	Frequency (Code D)	Purpose (Code E)	Period of Availability in HG (Code F)

Code A	Code B	Code C	Code D	Code E	Code F
1 Leaves	1 Food	1 January	1 Daily	1 Personal (subsistence)	1 (1 – 3 years)
2 Stem	2 Seeding	2 February	2 (4 – 6 times)	2 Household (Subsistence)	2 (3 – 5)
3 Fruit	3 Medicinal	3 March	3 (1 – 3 times)	3 Household (Commercial)	3 (5 – 10)
4 Seed	4 Firewood	4 April	4 (less than 5 times p/y)	4 Other	4 (over 10 years)
5 Roots	5 Beverages	5 May	5 Never		
6 Bark	6 Spiritual	6 June			
7 Branch	7 Shade	7 July			
	8 Wind break	8 August			
	9 Fencing	9 September			
	10 other	10 October			
		11 November			
		12 December			

5. What are some of the reasons for having Wild vegetables in your home garden?

Reasons	Level of agreement					
	SA	A	N	D	SD	NS
1 They are healthy foods						
2 Important for household subsistence						
3 Its our tradition						
4 They contribute to household income						
5 They are delicious (tasty)						

6 Saves money						
---------------	--	--	--	--	--	--

Note: SA- strongly agree; A- Agree; N- Neutral; D – Disagree; SD- Strongly disagree; NS- Not sure

6. Has the number of Wild vegetables type in your home garden in the past five years: increased [] decreased [] or stayed the same []?

7. Why do you think this is so?

8. Would you like to have a variety of more wild fruits in your home garden? Yes []
No []

9. If yes, what do you think will be some of the constraints/challenges of having more wild vegetables available in your home garden?

	Level of Agreement					
	SA	A	N	D	SD	NS
Shortage of land						
Seedlings scarce						
Poor soil quality						
Poor rainfall						
Livestock browsing						
Lack of fence						
Water shortages						
Other (specify)						

Wild Edible Plants: Fruits

10. Do you have Wild fruits in your Home Garden? [] Yes [] No

If no, why not? [Proceed to question 17]

11. If yes, why do you have Wild fruits in your Home Garden?

12. Please rank the importance of having Wild fruits in your household (1= not important and 5 = very important)

1 [] 2 [] 3 [] 4 [] 5 []

13. Which Wild fruits are available in your Home garden?

Local Name	Part Used (Code A)	Used For (Code B)	Months (Code C)	Quantity	Frequency (Code D)	Purpose (Code E)	Period of Availability In HG (Code F)

Code A	Code B	Code C	Code D	Code E	Code F
1 Leaves	1 Food	1 January	1 Daily	1 Personal (subsistence)	1 (1 – 3 years)
2 Stem	2 Seeding	2 February	2 (4 – 6 times)	2 Household (Subsistence)	2 (3 – 5)
3 Fruit	3 Medicinal	3 March	3 (1 – 3 times)	3 Household (Commercial)	3 (5 – 10)
4 Seed	4 Firewood	4 April	4 (less than 5 times p/y)	4 Other	4 (over 10 years)
5 Roots	5 Beverages	5 May	5 Never		
6 Bark	6 Spiritual	6 June			
7 Branch	7 Shade	7 July			
	8 Wind break	8 August			
		9 September			
		10 October			
		11 November			
		12 December			

	9 Fencing				
	10 other				

14. What are some of the reasons for having Wild fruits in your home garden?

Reasons	Level of agreement					
	SA	A	N	D	SD	NS
1 They are healthy foods						
2 Important for household subsistence						
3 Its our tradition						
4 They contribute to household income						
5 They are delicious (tasty)						
6 Saves money						

Note: SA- strongly agree; A- Agree; N- Neutral; D – Disagree; SD- Strongly disagree; NS- Not sure

15. Has the number of wild fruits types in your home garden in the past five years:

increased [] decreased [] or stayed the same []?

16. Why do you think this is so?

17. Would you like to have a variety of more wild fruits in your home garden? Yes []

No []

18. If yes, what do you think will be some of the constraints/challenges of having more wild fruits available in your home garden?

	Level of Agreement					
	SA	A	N	D	SD	NS
Shortage of land/space						
Seedlings scarce						
Poor soil quality						
Poor rainfall						

Livestock browsing						
Lack of fence						
Water shortages						
Other (specify)						

Section B: Cultivated Crops

Cultivated Vegetables

19. Are there cultivated vegetables available in your home garden? Yes [] No []

If no, why not? (proceed to question 27).

20. If yes, why do you have cultivated vegetables in your home garden?

21. Please rank the importance of having cultivated vegetables in your household (1= not important and 5 = very important)

1 [] 2 [] 3 [] 4 [] 5 []

22. How long have you been cultivating cultivated crops in your home garden?

_____ (years)

23. Which cultivated vegetables are available in your home garden?

Crop Name	Part Used (Code A)	Used For (Code B)	Frequency (Code C)	Quantity	Season (Code D)	Purpose (Code E)	Period of Availability in HG (Code F)

Code A	Code B	Code C	Code D	Code E	Code F
1 Leaves	1 Food	1 Daily	1 Summer	1 Personal (subsistence)	1 (1 – 3 years)
2 Stem	2 Seeding	2 (4 – 6 times)	2 Autumn	2 Household (Subsistence)	2 (3 – 5)
3 Fruit	3 Medicinal	3 (1 – 3 times)	3 Winter	3 Household (Commercial)	3 (5 – 10)
4 Seed	4 Firewood	4 (less than 5 times p/y)	4 Winter	4 Other	4 (over 10 years)
5 Roots	5 Beverages	5 Never	5 All the above		
6 Bark	6 Spiritual				
7 Branch	7 Shade				
	8 Wind break				
	9 Fencing				
	10 other				

24. What are some of the reasons for having cultivated vegetables in your home garden?

Reasons	Level of agreement					
	SA	A	N	D	SD	NS
1 They are healthy foods						

2 Important for household subsistence						
3 Times have changed						
4 They contribute to household income						
5 They are delicious (tasty)						
6 Saves money						
7 Safer and better than buying at the store						
8 Prefer growing my own foods						

Note: SA- strongly agree; A- Agree; N- Neutral; D – Disagree; SD- Strongly disagree; NS- Not sure

25. Has the number of cultivated vegetable types in your home garden in the past five years: increased [] decreased [] or stayed the same []?

26. Why do you think this is so?

27. Would you like to have a variety of more cultivated vegetables in your home garden?
Yes [] No []

28. If yes, what do you think will be some of the constraints/challenges of having more cultivated vegetables available in your home garden?

	Level of Agreement					
	SA	A	N	D	SD	NS
Shortage of land						
Shortage of water						
Poor soil quality						
Seedlings expensive						
Inputs costly						
Poor rainfall						
No labour						
Insect damage						
Livestock browsing						
Lack of fence						
Other (specify)						

Cultivated Fruits

29. Are there cultivated fruits available in your home garden? Yes [] No []

If no, why not? (proceed to question 37).

30. If yes, why do you have Cultivated fruits in your home garden?

31. Please rank the importance of having cultivated fruits in your household (1= not important and 5 = very important)

1 [] 2 [] 3 [] 4 [] 5 []

32. How long have you been cultivating cultivated fruits in your Home Garden?

_____ (years)

33. Which cultivated fruits are available in your home garden?

Crop Name	Part Used (Code A)	Used For (Code B)	Frequency (Code C)	Quantity	Season (Code D)	Purpose (Code E)	Period of Availability in HG (Code F)

Code A	Code B	Code C	Code D	Code E	Code F
1 Leaves	1 Food	1 Daily	1 Summer	1 Personal (subsistence)	1 (1 – 3 years)
2 Stem	2 Seeding	2 (4 – 6 times)	2 Autumn	2 Household (Subsistence)	2 (3 – 5)
3 Fruit	3 Medicinal	3 (1 – 3 times)	3 Winter	3 Household (Commercial)	3 (5 – 10)
4 Seed	4 Firewood	4 (less than 5 times p/y)	4 Winter	4 Other	4 (over 10 years)
5 Roots	5 Beverages	5 Never	5 All the above		
6 Bark	6 Spiritual				
7 Branch	7 Shade				
	8 Wind break				
	9 Fencing				
	10 other				

34. What are some of the reasons for having cultivated fruits in your home garden?

Reasons	Level of agreement					
	SA	A	N	D	SD	NS
1 They are healthy foods						
2 Important for household subsistence						
3 Times have changed						
4 They contribute to household income						
5 They are delicious (tasty)						
6 Saves money						
7 Safer and better than buying at the store						
8 Prefer growing my own foods						

Note: SA- strongly agree; A- Agree; N- Neutral; D – Disagree; SD- Strongly disagree; NS- Not sure

35. Has the number of cultivated fruit types in your home garden in the past five years:
increased [] decreased [] or stayed the same []?

36. Why do you think this is so?

37. Would you like to have a variety of more wild fruits in your home garden? Yes []
No []

38. If yes, what do you think will be some of the constraints/challenges of having more cultivated fruits available in your home garden?

	Level of Agreement					
	SA	A	N	D	SD	NS
Shortage of land						
Shortage of water						
Poor soil quality						
Seedlings expensive						
Inputs costly						
Poor rainfall						
No labour						
Insect damage						
Livestock browsing						
Lack of fence						
Other (specify)						

Section B: Sale of Home garden goods

Wild Vegetables

39. Do you sell wild vegetables from your home garden? Yes [] No []

If no, why not? (proceed to question 44).

40. If yes, why do you sell them?

41. Where do you sell them? From your home [] In your village [] Pension markets [] In town [] Other [] _____

42. What do you sell? In what quantities and for how much do you sell them for?

Species	Product	Quantity	Price per Unit	No of Units per Week	Month Selling

43. What are some of the constraints/challenges of selling wild vegetables?

	Level of Agreement					
	SA	A	N	D	SD	NS
Lack of markets						
People not interested in buying						
Less profitable						
They are low in quantity						
Other (specify)						

Wild Fruits

44. Do you sell wild fruits from your home garden? Yes [] No []

If no, why not? (proceed to question 49)

45. If yes, why do you sell them?

46. Where do you sell them? From your home [☐] In your village [☐] Pension markets [☐] In town [☐] Other [☐] _____

47. What do you sell? In what quantities and for how much do you sell them for?

Species	Product Preparation (Code A)	Product	Quantity	Price per Unit	No of Units per Week	Months Selling

Code A

- 1 Raw
- 2 Cooked
- 3 Fried
- 4 Dried
- 5 Boiled
- 6 Fermented
- 7 Juiced
- 8 Other

48. What are some of the constraints/challenges of selling wild fruits?

	Level of Agreement					
	SA	A	N	D	SD	NS
Lack of markets						
People not interested in buying						
Less profitable						
They are low in quantity						
Other (specify)						

Cultivated species

49. Do you sell cultivated species from your home garden? Yes [] No []

If no, why not? (proceed to question 55)

50. If yes, why do you sell them?

51. Where do you sell them? From your home [] In your village [] Pension markets [] In town [] Other [] _____ -

52. What do you sell? In what quantities and for how much do you sell them for?

53. Species	Product Preparation (Code A)	Product	Quantity	Price per Unit	No of Units per Week	Months Selling

Code A

- 1 Raw
- 2 Cooked
- 3 Fried
- 4 Dried
- 5 Boiled
- 6 Fermented

- 7 Juiced
8 Other

54. What are some of the constraints/challenges of selling WEPs?

	Level of Agreement					
	SA	A	N	D	SD	NS
More competition						
Transport						
Less profitable						
They are low in quantity						
Poor quality						
Other (specify)						

Section C: Store/market fruits and vegetables

55. Do you buy fruits & vegetables from the store? Yes [] No []

If no, why not? (proceed to question 63)

56. If yes, what are some of the important fruits & vegetables you buy:

Product	Product type (Code A)	Quantity	Purpose (Code B)	Months (Code C)	Meal (Code D)

Code A	Code B	Code C	Code D
1 Cultivated Fruits	1 Cooking	1 January	1 Breakfast
2 Cultivated	2 Baking	2 February	2 Lunch
Vegetables	3 Frying	3 March	3 Supper
		4 April	
		5 May	

3 Wild fruits 4 Wild vegetables	4 Boiling 5 Eat as is 6 Drying 7 Other	6 June 7 July 8 August 9 September 10 October 11 November 12 December	4 Anytime
------------------------------------	---	---	-----------

57. In your estimation, how much do you spend per month buying these fruits & vegetables?

R1 – R50 []

R51 – R150 []

R151 – R300 []

R301 – R600 []

R601 – R1000 []

R1000 – R1500 []

Over R1500

58. Do you buy fruits & vegetables that you have and already growing in your home garden? If so why, if not, why not?

59. From which stores do you buy these fruits & vegetables from?

Local stores []

Rural Malls []

Tonwship Malls []

Stores in town []

Informal market []

Other [] _____

60. Please rank the source of fresh fruits & vegetables (1 = most and 3 = least)

		WEP	Cultivated	Store/Market
RAINY SEASON	Fruits			
	Vegetable			

	Crops			
DRY SEASON	Fruits			
	Vegetables			
	Crops			

61. What are the reasons for buying fruits & vegetables from the store/markets ?

	Level of Agreement					
	SA	A	N	D	SD	NS
Saves labour time						
Shopping centres close						
Can't produce food myself						
Affordable						
More choice on where to buy from						
Saves money as compared to growing in HG						
Home garden foods not adequate						
To diversify diet						
Other (specify)						

62. What are some of the challenges of buying fruits & vegetables from the store/market?

	Level of Agreement					
	SA	A	N	D	SD	NS
Its far to travel to the store						
Transport Costs						
Food expensive						
No other choice than to buy						
Other (specify)						

Section D: Other sources of food

63. Are you or anyone in the household part of a farming project in the village? Yes []

No []

64. If yes, what is the project about?

65. How many people are involved in the project? _____

66. Which crops are cultivated?

67. On what size of the land? _____

68. What is the quantity of the produce?

69. How is the quantity shared?

70. Is the produce for sale or for household consumption?

71. What are the benefits of forming part of such a project?

72. What are the challenges of being part of the project?

Individual/Household Profile

Gender: M [] F []

Age: _____

Occupation: Employed full-time [] Employed Part-time [] Volunteer [] Unemployed []
 Self-employed [] Retired [] Student []

Highest Education Level: _____

Household Size:

Sex	Younger than 6	7 -17 years	Over 18 years
Male			
Female			

Household head: M [] F []

Number of Social Grants: Child grants [] Disability [] Pension []

Household income p/m: R0 – R1000 [] R1000 – R5000 [] R5000 – 10 000 [] R10 000 – 15 000 [] over R15 000 []

Other sources of income: remittances [] Grants [] farming [] other business []

Which is the largest contributor to household income: Salary [] Remittances [] Grants []
 farming [] other businesses []

How often does your household eat meat? Everyday [] 4 – 6 times p/w [] less than 3 times
 p/w [] 1-4 times p/m [] never []

What is the size of your home garden? _____

Is the home garden fenced? Yes [] No []

Type of fencing? _____

What is the water source for the household? _____

How many of these does your household have:

Cattle: _____ Goats: _____ Cars: _____ Tractor: _____ Bicycle: _____ Motorbike:
 _____ Tv: _____ Radio/ hifi: _____ Fridge: _____

Computer: _____ Cellphone: _____

Appendix 4: Interview Schedule Chapter 5

Knowledge and of Consumption of WEPs

Interview no: _____ Date: _____ Start time: _____ End
Time: _____ Village Area: _____ Village: _____

Knowledge of WEPs

1. Do you know any WEPs? Yes [] No []
2. If yes, please list all WEPs fruits and wild vegetables that you know in the table below:

Wild fruits	Wild vegetables

3. Please tell us more about what you know the plants you listed

Species	Location of collection besides HG (code A)	Months (Code B)	Part used (Code C)	Cultivated or not (Y / N)	Method of preparation (Code D)	Taste (Code E)	Other use (Code F)	Animal species that like the plant

[illegible]

Code A	Code B	Code C	Code D	Code E	Code F
1 Crop fields	1 January	1 Leaves	1 Boil	1 Sweet	1 Seeding
2 wild fields	2 February	2 Stem	2 Fry	2 Sour	2 Medicinal
3 Mountains	3 March	3 Fruit	3 Dry	3Bitter	3 Firewood
4 riparian area	4 April	4 Seed	4 Raw/ no	4 Salty	4 Beverages
5 Other	5 May	5 Roots	preparation	5 Other	5 Spiritual
	6 June	6 Bark	5 Bake		6 Shade
	7 July	7 Branch	6 Ferment		7 Wind break
	8 August	8 Other	7 Other		8 Fencing
	9 September				9 Other
	10 October				
	11 November				
	12 December				

4. From whom did you learn about this knowledge from?

	Level of Agreement					
	SA	A	N	D	SD	NS
Family member						
Neighbour						
Village elder						
School teacher						
Media (TV, radio, newspapers, internet)						
Own observation						
Other						

5. When did you learn this knowledge? Childhood (6 -12 years) [☐] Teenager (13 – 19 years) [☐] Adulthood [☐]
6. In what way was the knowledge of WEP acquired? Oral history [☐] Participation through collection [☐] Observation [☐] Through consumption [☐] Other (specify) [☐]
7. Have you passed on or taught somebody else this knowledge about WEPs?
Yes [☐] No [☐]
8. If so, to whom have you passed this knowledge to?

Elders: My Children [] My Grandchildren [] My friends [] Family members/relatives []

Youth: My younger siblings [] My friends [] My children [] My parents [] My grand parents []

9. Is there anything new that you have learned in the past years about WEPs? Yes [] No []
If so, what is it?

10. Do you think indigenous knowledge about WEPs is getting lost? Yes [] No []
If yes, what do you think is contributing to this loss?

	Level of Agreement					
	SA	A	N	D	SD	NS
Lack of interest from youth to learn						
Lack of interest from elders to pass knowledge						
lifestyle						
Over reliance on cultivated foods						
Westernisation						
WEPs ignored by media						
Lack of education about WEPs at schools						
Other						

Consumption of WEPs

11. Have you ever consumed WEPs? Yes [] No []
12. If yes, please list some of the WEPs you have consumed in the past 5 years.

Wild fruits	Wild leafy vegetables

13. Did you eat wild fruits as a child? Yes [] No []

14. Did you eat wild vegetables as a child? Yes [] No []

15. Did you collect wild fruits as a child? Yes [] No []

16. Did you collect wild fruits as a child? Yes [] No []

17. Were there any WEPs that you ate as a child that you no longer eat? Yes [] No []

If so, which ones and why?

18. Are there any WEPs that you eat today that you did not eat as a child? Yes [] No []. If so, which ones and why?

19. Please list WEPs that you have consumed in the past year:

Species	Months (Code A)	Part used (Code B)	Method of preparation (Code C)	Taste (Code D)	Method of consumption (Code E)	Frequency of consumption

Code A	Code B	Code C	Code D	Code E
1 January	1 Leaves	1 Boil	1 Sweet	1 Eat with a meal
2 February	2 Stem	2 Fry	2 Sour	2 Eat solely
3 March	3 Fruit	3 Dry	3 Bitter	
4 April	4 Seed		4 Salty	

5 May	5 Roots	4 Raw/ no preparation	5 Other	3 Eat as a snack
6 June	6 Bark	5 Cook		4 Drink
7 July	7 Branch	6 Ferment		Other
8 August	8 Other	7 Other		
9 September				
10 October				
11 November				
12 December				

20. Which ones do you like the best? Why?

21. Which ones did you like the least? Why?

22. Do you think the abundance of wild fruits in the past 5 – 10 years has: increased []
decreased [] or stayed the same []?

Why is it so?

23. Do you think the abundance of wild vegetables in the past 5 – 10 years has: increased
[] decreased [] or stayed the same []?

Why is it so?

24. Has your consumption of wild fruits in the past five years: increased [] decreased [] or stayed the same []?

Why is it so?

25. Has your consumption of wild vegetables in the past five years: increased [] decreased [] or stayed the same []?

Why is it so?

26. Do you collect wild fruits yourself? Yes [] No []

27. Do you collect wild vegetables yourself? Yes [] No []

28. If yes, do you leave your house with the purpose of collecting WEPs? Yes [] No []

29. Where do you collect them mostly? My home garden [] around the village [] in the fields [] mountains [] riparian areas []

Participant Individual Profile

Age: _____

Sex: Male [] Female []

Employment status: Student [] Unemployed [] Volunteer [] Part-time [] Full-time []

Self-employed []

Highest Education Level: _____

Where did you grow up? A rural village [] Township [] City [] Farm []

How long have you lived in this village? _____

Appendix 5: Unidentified Species



Species 1: Lenthepu



Species 2: Setlodi



Species 3: Tlowane