

Chapter One

Introduction

1.0 Background Information

This study concerns the production of Indigenous Leafy Vegetables (ILVs) and their contribution to household food security. Points covered in this section include ILVs and food security in South Africa, and the production trends of ILVs in Southern Africa.

1.1 Indigenous Leafy Vegetables and food security in South Africa

According to Asfaw (2001:316), indigenous vegetables are described as "edible plants that are biologically indigenous to an area, while introduced vegetables are those vegetables that have been introduced into a particular area and have not physiologically adjusted to the local conditions and subsequently require many agricultural inputs". Rural communities experience a problem of harsh climatic conditions where exotic vegetable species cannot be grown, whereas indigenous leafy vegetables can withstand the harsh climatic conditions and poor soil quality (Cunningham *et al.*, 1992). However, there are many indigenous and traditionally grown plant species which can help to alleviate this situation. Indigenous leafy vegetables, of which few are grown under improved husbandry, are well suited to cultivation in the large areas of southern Africa that have low agricultural potential due to low or unreliable rainfall, poor soil and steep topography (Shackleton *et al.*, 2006).

According to Anderson (1990:18), "food security is defined as the existence of the necessary conditions for human beings to have physical and economic access, in socially acceptable ways, to food that is safe, nutritious and in keeping with their cultural preferences, so as to meet their dietary needs and live productive and healthy lives". Against this background, literature highlights that most communities affected by poverty and under nutrition in South Africa live in areas rich in biodiversity including wild and indigenous vegetables (Van den Heever, 1995; Reinten and Coetzee, 2002). It is of interest to note that ILVs have been reported to be good in nutritional qualities such as

macro and micronutrients (Mavengahama, 2013). However, there is still a high prevalence of malnutrition, especially micronutrient deficiencies, among the low income group of the South African population (Mavengahama *et al.*, 2013). Thus far, the use of indigenous vegetables has been proposed as part of the solution to the problems of micronutrients and malnutrition among these population groups (Mavengahama, 2013). Although they may be consumed in small quantities, they influence the intake of cereal staples, manage hunger and play a central role in household food security for poorer rural communities (Mavengahama, 2013). Mixing several indigenous vegetable species in one meal contributes to dietary diversity in terms of more vegetable types and in terms of choice of relish. For some very poor families, indigenous vegetables are substitutes for some food crops such as swiss chard or spinach (Flyman and Afolayan, 2006).

1.2 Production trends of ILVs in southern Africa

In southern Africa, agricultural education in both commercial and communal areas still targets cash crop production at the expense of indigenous crops (Modi *et al.*, 2006). Researchers and extension workers also promote education in cash crop production over indigenous vegetables and they still advise farmers to remove them from their fields (Shackleton, 2003; Vorster *et al.*, 2007). There is a perception that utilisation of ILVs is also unsustainable in that the benefiting farmers have no control over their availability as they do not cultivate these vegetables; thus, availability of indigenous plants is unpredictable and variable (Vorster *et al.*, 2007). Flyman and Afolayan (2006) have suggested that reliance on exotic vegetables is the primary reason for the decline in utilization of ILVs in southern Africa. Their production is more common on a small scale in rural areas, and is used primarily for subsistence purposes with a minor informal trade record [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013]. With reference to determinants of production, the following factors are suggested in literature: gender (Vorster *et al.*, 2007), education (Modi *et al.*, 2006), access to extension (Vorster *et al.*, 2007), access to markets (Mwangi and Mumbi, 2006), cultural beliefs and shared perceptions (Mavengahama, 2013).

1.3 Problem statement

Indigenous Leafy Vegetables are known as plants that are harvested while growing in their wild state and are not farmed in the conventional manner; yields thus become lower and, consequently, their nutrient contribution to the diet is also very low (Chadha and Oluoch, 2002). Forwarding arguments for the low production, Hart and Vorster (2006) noted that ILVs are still mostly treated as weeds by many researchers and extension personnel who also criticize farmers for not keeping this weed population under control, thus labelling this important food as not worthy of the space it occupies in their fields. Thus far, the South African Department of Agriculture, Forestry and Fisheries (DAFF) (2013) highlighted that there is a decline in the use of indigenous and wild vegetables by many rural communities in South Africa; this has contributed to poor diets and increased incidences of nutritional deficiencies.

Lack of knowledge about nutritional composition, cooking methods and ways of preservation have also been suggested as reasons for the low use of indigenous vegetables (Flyman and Afolayan, 2006). Despite the claim that ILVs have several benefits, the production of ILVs is still characterized by low volumes (Abugre, 2011) and is currently in decline [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013].

On a positive note, Cunningham *et al.* (1992) suggest that ILVs have the potential to provide a valuable source of nutrition in areas with hot and dry climates that are normally characterised by high levels of food insecurity, as is the case in most rural communities. Although indigenous plant species have been utilised as food for centuries (Vorster *et al.*, 2007; Adebooye and Opabode, 2004) and in spite of their noted good nutritional value, indigenous vegetables have not been widely domesticated and are not cultivated on a large commercial scale, especially in South Africa [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013]. Moreover, although ILVs have been noted to be an inexpensive source of high quality vegetables with high potential for nutritionally vulnerable communities (Odhav *et al.*, 2007), their production is still at

subsistence level and is more common in rural areas [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013]. As suggested by Frison *et al.* (2010), indigenous and traditional food systems are rarely considered a basis for a food security strategy.

Against this background, low production of ILVs may have promoted the dietary shift from ILVs to exotic plant food sources, thus seriously affecting the dietary quality and food security of underprivileged rural and urban communities because of the high prices associated with exotic vegetables.

To address these challenges, literature highlights the potential to improve micronutrient intake by increasing the production of ILVs (Modi *et al.*, 2006). With the background of high food insecurity levels in South Africa (Labadarios *et al.*, 2009), several studies call for a collaboration between agriculturalists and nutritionists to build on traditional crop production and indigenous vegetable consumption (Maunder and Meake, 2007), for purposes of improving the nutritional content of the diet in poor rural and urban households using ILVs. The need therefore arises to understand the determinants of smallholder farmers' participation in the production of ILVs and their contribution to household food security, given its claimed multiple benefits (Mavengahama, 2013) in the face of low (Abugre, 2011) to declining production (DAFF, 2013).

1.4 Objectives

The broad objective of this study was to investigate determinants of smallholder farmers' participation in the production of ILVs and their contribution to household food security. In pursuit of this objective, the study focused on the following specific objectives;

1. To assess smallholder farmers' perceptions of and most cultivated Indigenous Leafy Vegetables.
2. To investigate factors that influence smallholder farmers' participation in the production of indigenous leafy vegetables.

3. To investigate the contribution of indigenous leafy vegetables to household food security.

1.5 Justification of the study

Research has shown that production of ILVs is not popular in South Africa and contribution of ILVs to household food security has not been given much attention. Furthermore, the introduction of exotic vegetable varieties is generally believed to have impacted negatively to the production of ILVs (Smith and Eyzaguirre, 2007). Reporting on the benefits of these vegetables, ILVs are an important part of farming and consumption systems throughout rural Africa (Faber *et al.*, 2010). The indigenous vegetables shown to be more drought and heat tolerant than commonly grown exotic vegetables, generally ILVs are easier to produce and usually require less resources such as water), while being rich sources of micronutrients, such as iron and Vitamin A [Water Research Commission (WRC), 2013]. They also play a role in nutrition, food security, culture and can provide employment opportunities (Lykke and Reenberg, 2001). They are important sources of micronutrients like vitamins A and C, iron and others (Kruger *et al.*, 1998). In addition, ILVs provide more than 50% of the recommended daily allowance for Vitamin A, and they also provide varying amounts of other important nutrients, such as protein and various mineral elements, and also contained significant amounts of fibre (WRC, 2013). Indigenous leafy vegetables play an important role in the contemporary food systems of people in South Africa, particularly in poor rural areas (WRC, 2013). Indigenous Leafy Vegetables are, therefore, of extreme importance to food security, especially during times of famine and natural disasters (Habwe *et al.*, 2008). To that end, ILVs hold several advantages over the many exotic vegetables that dominate most supermarket shelves [South African Department of Agriculture, Forestry and fisheries (DAFF), 2013]. Despite all these benefits, most farmers have opted not to include ILVs in their farming systems; this is a scenario that raises questions regarding the claimed benefits of ILVs. This study therefore seeks to query the claimed food security benefits and reasons behind low to declining production as potential barriers and opportunities for farmers to participate in ILV production.

1.6 Thesis delineation and assumptions

This section focuses on the delineation of the study, in line with set specific objectives to avoid generalization. Operational assumptions are also highlighted in this section for the sake of clarity.

1.6.1 A statement of the limits to the study

This study concentrated on participation in the production of ILVs and estimated contribution of ILVs to household food security using the Household Dietary Diversity Score (HDDS) and Household Food Insecurity Access Scale (HFIAS).

1.6.2 Assumptions maintained in this Study:

- The production of ILVs within rural farming communities is on a small scale and is mainly for subsistence purposes. This is because most of the arable land is primarily used for the production of maize and other exotic crops [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013].
- The willingness of people to formally adopt ILVs as cultivated crops may be influenced by perceptions, cultural beliefs, values and social stigmas attached to their worth and understanding regarding ILVs. According to Shackelton *et al.* (2006), farmers and rural households view ILVs as 'safety nets' to be only used when there is not enough food; this is typically during drought, famine or when there is a lack of money with which to purchase exotic vegetables.
- For some people who are living in poverty these foods become such an integral part of their diets that even when circumstances change for the better, the attachment to these foods does not go away (Kepe, 2008).
- ILVs can play a huge role in addressing household food security in South Africa (Kepe, 2008; Department of Agriculture, Forestry and Fisheries (DAFF), 2013); this is worth investigating, given its low production.

1.7 Organisation of the study

Chapter 1 presents the introduction and the background to the study, by specifically looking at ILVs and food security in South Africa and the production trends of ILVs in southern Africa. **Chapter 2** reviews the relevant literature on factors that influence farmers' participation in the production of ILVs and contribution of ILVs to household food security.

Chapter 3 highlights the map of the study area from which respondents were selected. The major issues highlighted in this chapter include: an agro-ecological survey summary of the study area, rainfall, temperatures, soil and vegetation. The chapter further outlines the research design for purposes of explaining how the study was conducted. The methods and analytical tools that were used for data analysis in the study are also discussed in this chapter.

Chapter 4 initially presents and discusses the results based on descriptive statistics. The implicit goal at this stage was to ascertain whether conclusions could be made based on a descriptive analysis pertaining set operational objectives. The chapter further presents and discusses the results based on inferred findings with regard to statistical models that were used to estimate conjectured hypotheses. The absolute goal at this stage was to confer obtained relationships with some degree of confidence. **Chapter 5** wraps up the study by presenting the research summary, conclusions, and policy recommendations.

Chapter Two

Literature Review

2.0 Introduction

This chapter presents the literature reviewed on factors that influence farmers' participation in the production of ILVs and its contribution to household food security.

The literature reviewed includes issues related to:

- (a) Factors that influence farmer participation in the production of ILVs.
- (b) The contribution of ILVs to household food security.
- (c) Research insights and current gaps in literature to which this study aims to bridge.

2.1 Factors that influence smallholder farmers' participation in the production of ILVs

This section presents factors that influence smallholder farmers' participation in the production of ILVs. The factors included socio-economic, perception related and institutional factors.

2.1.1 Socio-economic factors

(a) Gender

In a study that was carried out on the role and production of ILVs in South Africa, by Vorster (2007), it was concluded that ILV production is a female orientated agricultural activity, as it was mainly utilised for household consumption. With reference to the importance of ILVs, Vorster *et al.* (2007) report that knowledge of the different groups of indigenous plants was available from both males and females. However, in most rural communities, ILVs tended to be the domain of women. Earlier, Hart and Vorster (2006) argue that under smallholder farming systems, women do most of the weeding and they often distinguish between undesirable weed species, which are hoed or pulled out, and

species that belong to the local collection of leafy vegetable species, which are harvested or left undisturbed for subsequent use. Literature also suggests that leafy vegetables tend to be regarded as a female food, but gender distinctions in terms of their consumption are much less universal than they are in terms of their collection (Whitbread, 1986; Hart and Vorster, 2006). Thus far, gender has an influence on the participation of farmers in the production of ILVs, although the direction of influence is not obvious.

(b) Age

Shackleton *et al.* (2010) note that most farmers that participate in the production of ILVs are middle-aged or elderly females. Previously, Jansen Van Rensburg *et al.* (2007) also noted that youth do not consume and participate in ILV production because they do not want to be described as old fashioned. In this respect, only middle-aged and older people participate in ILVs, which in turn influences ILV production even if the direction of influence is not obvious.

(c) Education

There is limited literature regarding education as one of the factors that influence farmers' participation in the production of ILVs. Shackleton *et al.* (2010) noted that most farmers cultivating ILVs have limited formal education. Attaining formal education, by smallholder farmers, may help them improve their cultivation knowledge of ILVs, which may lead to an increased production of these vegetables. Therefore, education may be an important factor which may perhaps help influence the production of ILVs.

(d) Income

Not much literature has been reported with reference to the level of income and its influence on ILV production. Mwaura *et al.* (2014) noted that ILVs are an important contributor to household income, as the farmers sell these vegetables to local communities in order to generate an income. Previously, Fandohan *et al.* (2010) argued that ILVs play a role as one of the primary alternative sources of income for many rural

communities. Thus far, income levels may positively influence participation in the production of ILVs by smallholder farmers.

(e) Household size

There is limited literature concerning household size and its influence on ILV production. Usually, household size would be expected to determine the labour force available to produce ILVs. Household size is therefore likely to positively influence participation in ILV production.

2.1.2 Perception related factors

(a) Competition for land

There is limited literature based on land competition of ILVs with exotic vegetables. Shackelton *et al.* (2006) argued that the production of ILVs within rural farming communities takes place on a small scale and is mainly for subsistence purposes. This is because most of the cultivated land is used for the production of maize and other exotic crops. Thus far, there is a possibility of competition for land between the cultivation of ILVs and exotic vegetables as well as other conventional crops which are normally promoted by extension. More studies are therefore necessary for the purpose of estimating the possible influence of such perceptions towards explaining the production of ILVs. This study therefore assumes a negative correlation between the competition for land perception and participation.

(b) ILVs treated as weeds

ILVs have been treated as weeds for a very long time which resulted in South African researchers and policy makers ignoring these types of leafy vegetables and promoting increased production of exotic vegetables [Department of Agriculture (DoA), 2004]. This negatively influenced the production of ILVs since farmers are advised to keep this weed population under control or remove it completely from their fields.

(c) ILVs treated as the poor man's food

In most areas, indigenous vegetables are associated with poverty and poorness. This has resulted in most people not using indigenous vegetables because they do not want to be described as old fashioned (Jansen Van Rensburg *et al.*, 2007). Thus far, perceptions that associate ILVs with old fashioned food have negatively influenced their production.

Kepe (2008) argues that, although ILVs carry a 'food for the poor' and 'famine food' tag for some groups, the fact remains that indigenous vegetables are indeed an important last resort during famine. For some rural groups, ILVs are substitutes for food crops. It is possible that for some people who are in poverty these foods become such an integral part of their diets that even when circumstances change for the better, their attachment to this food plant does not go away.

(d) Perceptions related to health benefits

The dietary intake of ILVs is said to have healing properties, which serve as a source of micronutrients and reduce the risk of cardiovascular diseases and other degenerative diseases (Frison, 2007). Also, ILVs are associated with the management of numerous diseases including HIV/AIDS, diabetes, high blood pressure and other common diseases (Irungu *et al.*, 2011). John and Sthapit (2004) noted that countries who have retained high consumption of ILVs are much less affected by cardiovascular diseases, diabetes and other complications related to the changing dietary lifestyles. With this background knowledge, ILVs as a nutritious source of food with health benefits may positively influence the production of ILVs in rural communities.

(e) Perceptions related to the nutritional benefits of ILVs

Van Jaarsveld *et al.* (2014) noted that ILVs have the potential to provide a valuable source of nutrition in many marginal areas of South Africa and they could fill a valuable niche in the production of food in rural areas where the climate is not conducive to the production of vegetables such as spinach or swiss chard.

Previously, Irungu *et al.* (2011) indicated that indigenous vegetables play a role in livelihoods by providing an improved diet in terms of nutritional value and diversity, and in supplementing the food needs for poorer household as well at time of food scarcity. In addition, Odhav *et al.* (2007) argued that the dietary intake of ILVs is also known to be inexpensive but it has high quality nutritional characteristics for nutritionally vulnerable communities.

A study by Nangula *et al.* (2010) on ILV consumption in Africa, with the aim of evaluating the nutritional value of ILVs and their potential impact on the nutritional status of the people, revealed that ILVs contain significant levels of micronutrients that are essential for human health. Earlier, Imungi (2002) reported that production, marketing and consumption of ILVs has enormous potential of improving social, economic and health benefits including contribution to food security, as source of livelihood and good source of essential nutrients. In addition, ILVs are known to be specially rich in micronutrients such as vitamins (especially vitamin A and C), minerals and certain essential amino acids such lysine (Imungi, 2002). Similar comparable arguments were also shared by Toledo and Burlingame (2006), who noted that there are under-utilised natural resources such as indigenous leafy vegetables which may contribute to improving food and nutrition security. Literature also argues that various ILVs have been analysed for nutrients, and have shown high nutritional content (Kruger *et al.*, 1998; Uusuku *et al.*, 2010). Based on the high nutritional content of ILVs, several studies call for the inclusion of ILVs in crop production systems in order to increase the production of these under-utilised vegetables (Modi *et al.*, 2006; Faber *et al.*, 2010).

(f) Cultural Beliefs

The production and utilization of ILVs seems to be contextualized and may be influenced by differences in cultural backgrounds which vary from one ethnic group to another, location, rural and urban dwellers, and gender, as well as differences in age (Mavengahama, 2013). Earlier, Parraga (1990) highlighted that food choices are mostly influenced by culture and people's beliefs regarding certain foods. Beliefs develop from

health or religious reasons, but some are motivated solely by religious convictions (Jansen van Rensburg and Vorster, 2005). Food is used to define a perception, which often leads to a change in food production patterns when people stop eating their ordinary food, such as indigenous foods, because it is associated with a low social status or poor people, and adopt food that is thought to be of a good social status with greater social standing (Vorster *et al.*, 2007). With this background, production may be negatively influenced by the cultural beliefs of certain people because they classify ILVs as low status food.

(g) Social disturbance

Schackleton (2003) states that during periods of drought, or when the breadwinner in the household becomes unemployed, affected rural households rely on the collection of indigenous plants for food consumption. Social disturbances can therefore lead to the increased use of wild and indigenous food. For example, during the pre-1994 political struggle in the Transkei region of the Eastern Cape people who were fleeing their houses to escape violence relied heavily on food collected from the *veld* and forest for survival (Jansen van Rensburg and Vorster, 2005).

Moreover, ILVs are faced with issues of attitudes, perceptions and priorities, especially in terms of cultivating these species as they may be competing with cash crops that already have a market (Schackleton, 2003). Thus, for the challenge of poor nutrition to be properly understood, the production of ILVs must not be viewed in isolation just as a technical challenge but as a complex social issue (McLachlan and Garrett, 2008). In this regard, social disturbance has an effect on wild and indigenous vegetable production (Bharucha and Pretty, 2010).

2.1.3 Institutional factors

(a) Access to extension

Vorster *et al.* (2007) argue that the labeling of ILVs as food for the poor, and backward knowledge by research and extension officers, has led to a shift in food use and willingness of the people to learn about the production and use of these vegetables.

Extension services may therefore have an effect on the production of and knowledge regarding ILVs. ILVs are still largely treated as weeds by many research and extension personnel who criticize farmers for not keeping this weed population under control, thus labeling this important food as unworthy of the space it occupies (Mavengahama, 2013). Extension officers have influence over farmer participation in the production of ILVs and indigenous food because farmers are always advised to keep this weed population under control (Vorster, 2007).

(b) Access to market

Several studies in Africa found that weak market chains for ILVs, poor seed systems, lack of information on best cultivation practices and the low demand of ILVs prevent farmers from producing these vegetables (Schippers, 2002; Mwangi and Mumbi 2006). Indigenous leafy vegetables are not produced in a conventional manner in South Africa, as they are only produced for subsistence consumption and not for commercial purposes (Vorster *et al.*, 2007; Department of Agriculture, Forestry and Fisheries (DAFF), 2013). The production of indigenous vegetables in rural areas, for market, may safeguard the genetic diversity of these valuable vegetables and help maintain them. It may also reintroduce already lost genetic resources while contributing to better and healthy livelihoods for rural people (Vorster *et al.*, 2007).

2.2 Contribution of ILVs to household food security

This section focuses on the contribution of ILVs to food security. The areas presented in this section include food security, dietary diversity and dietary quality with regards to ILVs.

2.2.1 Food Security

Food security is a broad term which is defined in different ways by a number of organisations around the world. The basic definition of food security is that it refers to the ability of individuals to obtain sufficient food on a day-to-day basis. Internationally, food security is defined as the ability of people to secure adequate food [South Africa

Department of Agriculture, Forestry and Fisheries (DAFF), 2011]. More especially, it has been defined by researchers as access by all people, at all times, to enough food for an active healthy life (Anderson, 1990).

Hart (2009) noted that: (a) indigenous vegetables have an ability to grow relatively well in semi-arid areas where other exotic plants fail to grow, (b) they have the ability to provide at least two food stuffs during their life cycle and (c) they have the ability of either the fruit or the leaves, or both, to be dried and stored for consumption in the winter months. Thus far, these vegetables can make a significant contribution in terms of household food security.

The literature also argues that although ILVs may be consumed in small quantities by many rural households; they influence the intake of cereal staples, manage hunger and play a central role in household food security for poor rural communities (Frison *et al.*, 2010; Mavengahama *et al.*, 2013). According to Kepe (2008), ILVs carry labels like 'food for the poor' and 'famine food' for some people as some groups in rural societies do not ordinarily eat these vegetables under circumstances of adequate food availability; they would, however, consume them under difficult conditions such as drought and food scarcity. Literature also suggests that ILVs provide variety to otherwise monotonous cereal based diets (Maholtra and Passi 2007; Michaelsen *et al.*, 2009). Providing different types of ILVs can reduce this monotony by adding different tastes and colours to the diets of rural people. On a positive note, Kalaba *et al.* (2009) suggest that increasing the production of ILVs by rural communities could be used as a strategy to improve food security and cash income for people living in rural areas and in controlling the changing climate of the country. According to Modi *et al.* (2006), the value of ILVs in food security has not been given sufficient attention in South Africa. Moreover, there are no formal interventions that seek to encourage people to produce and use ILVs as a source of essential nutrients for people who are food insecure in rural communities. Turner (2004) stated that the use of wild and indigenous resources for food has been an underestimated economic activity in rural communities which could help in improving the rural economy and alleviate poverty. The decline in the production of ILVs has encouraged research to

be done for under-utilised crops and ILVs that are such an important part of the livelihoods of many rural communities (Mertz and Ganaba, 2002).

2.2.2 Dietary Diversity (DD)

Dietary Diversity (DD) is defined as the number of individual food items or food groups consumed over a given period of time (Ruel, 2003). Dietary diversity can be measured at the household or individual level through the use of a questionnaire (Ruel, 2003). It is most often measured by counting the number of food groups rather than the food items consumed (Vakili *et al.*, 2013). The type and number of food groups included in the questionnaire and subsequent analysis may vary, depending on the intended purpose and level of measurement (Ruel, 2002). At the household level, DD is usually considered a measure of access to food; for example, the household's capacity to access costly food groups. At the individual level it reflects dietary quality, which is mainly the micronutrient adequacy of the diet (Vakili *et al.*, 2013). The reference period can vary, but is most often the previous day or week (WFP, 2009; FAO, 2011).

A study conducted by Vorster *et al.* (2007) on the importance of ILVs concluded that promoting indigenous vegetables may help diversify the food on the plate. Vorster *et al.* (2007) suggest that in order to achieve this, the 'poverty food' label needs to be addressed first and placing these vegetables in the supermarkets would help to increase the status of the crops, as they are currently primarily being sold in informal markets [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013].

A proportion of the diverse foods including indigenous vegetables that are available in South Africa have been progressively neglected in spite of modern and improved agricultural practices; this resulted in a lack of DD for many rural communities of South Africa (Frison *et al.*, 2010). Despite the strides made in reducing national hunger through increases in commercial crop productivity, the country is still hungry and the availability of cheap cereal foods has coincided with the erosion of agricultural biodiversity and a reduction in DD (Mavengahama *et al.*, 2013).

Reporting on the production and use of indigenous vegetables, Tabuti *et al.* (2004) noted that the erosion of the ecosystem diversity has affected the availability and production of some indigenous food crops. Several authors (Keller *et al.*, 2005; Flyman and Afolayan, 2006; Musinguzi *et al.*, 2006; Jansen van Rensburg *et al.*, 2007; Lwoga *et al.*, 2010) argue that the loss of indigenous knowledge resulted in the reduced production and use of indigenous vegetables, which contributes to the lack of DD. This ultimately translates into food insecurity and micronutrient deficiency, especially among poor communities (Flyman and Afolayan, 2006).

Labadarios *et al.* (2005) also explain that the diets of people in South Africa consist primarily of staple plant foods and lack DD, which results in micronutrient deficiencies. Modi *et al.* (2006) suggest that the micro-nutrient intake can be improved if the production and consumption of indigenous crops can be increased.

2.2.3 Dietary Quality

Dietary quality refers to the adequacy of nutrients in the diet (Ruel, 2003). Dietary quality has two components; namely, dietary diversity and food variety (Ruel, 2003). Dietary diversity is described as the number of foods or food groups consumed over a given period (Drewnowski *et al.*, 1997), while food variety refers to the consumption of a mixture of foods from the entire range of food groups (that is, vegetables, fruit, cereals, meat, fish and dairy products (Walker and Fisher, 1997). Interestingly, Onyango (2003) indicate that dietary diversity is directly related to dietary quality; this means that the more diverse the diet is, the higher are chances of such diets to contain more nutrients that address dietary quality.

A study conducted on the nutritional value of ILVs and their contribution to human health, by Nangula *et al.* (2010), suggested that many ILVs are good sources of micronutrients especially vitamin C, iron, zinc, calcium and magnesium. These vegetables may help to meet daily nutritional requirements, especially for rural and urban poor communities. Nangula *et al.* (2010) also reported that, in many instances, ILVs contain levels of micronutrients that are higher than those of exotic vegetables such as spinach and

cabbage. Recently, Van Jaarsveld *et al.* (2014), from a study conducted on the nutrient content of eight ILVs and their potential contribution to dietary reference intake, concluded that ILVs can potentially make a considerable contribution towards the requirements for nutrients, particularly vitamin A and iron, which are micronutrients of public health significance in South Africa.

Similar findings were earlier shared by Steyn *et al.* (2001), who argue that malnutrition could be addressed by ILVs, given their high nutritional status. Shrestha and Dhillion (2006) also highlight that the nutritional and health benefits of ILVs as well as indigenous food are well known. Similarly, Singh and Garg (2006) suggest that ILVs are important dietary supplements and sources of elements such as minerals, proteins, folic acid and vitamins for resource poor communities.

2.3 Current gaps in the Literature

In as much as literature suggested that participation in the production of ILVs may be influenced by socio-economic factors which include gender, social disturbance, competition for land, perceptions, nutrition, cultural beliefs, education, and institutional factors which include access to extension and access to market, literature also reveals that further research may be necessary in order to understand location based determinants of production given the heterogeneity of rural communities based on different cultural and ethnic backgrounds. Thus far, the observed low production of ILVs, in the face of several claimed nutritional and health benefits, may suggest several location specific barriers worth investigating for the purpose of promoting production.

Also, not much literature is available regarding the contribution of ILVs to food security. The little that is available seems to have focused on the nutritional components of ILVs and the benefits of consuming ILVs or any other indigenous foods at the expense of how production of ILVs can contribute to household food security for the rural population. The observed lack of household food security strategies and policies that include ILVs and other wild foods may suggest a lack of scientific evidence to link ILVs and other wild foods to household food security. In this respect, given the benefits that wild foods (ILVs

included) are claimed to have, the need arises for researchers to provide scientific evidence across various localities.

2.4 Summary

In summary, participation in the production of ILVs may be influenced by several socio-economic and institutional factors which include access to extension and access to the market. The literature also suggests that further research may be required in order to understand location based determinants of production, given the heterogeneity of rural communities in terms of their different cultural and ethnic backgrounds. In summary, the observed low production of ILVs in the face of several claimed nutritional and health benefits could suggest several obstacles worth investigating for the purpose of promoting the production of ILVs.

Literature further generalise the significance of ILVs towards addressing food security. This development may have contributed to the observed omission of ILVs in several recent household food security strategies and policies. Therefore, given the claimed benefits of indigenous foods, the need arises for researchers to provide unambiguous scientific evidence on the biodiversity (ILVs) household food security link across localities.

Chapter Three

Description of the Study Area, Research Method and Design

3.0 Introduction

In this chapter, a detailed review of the geographical location of the study area is presented. The chapter also outlines the research method and design in an effort to explain how the study was conducted. The chapter concludes by providing a summary of the research objectives and analytical framework of the study.

3.1 Description of the Study Area

The research was conducted in Coffee Bay, which is situated in the Eastern Cape Province of South Africa. Coffee Bay is a small coastal town of about 600 people, with some spectacular coastline nearby [Statistics South Africa (Stats SA), 2009]. Coffee Bay is located 47km away from Mqanduli City [South African Explorer (SA Explorer), 2012]. Coffee Bay is situated under King Sabatha Dalindyebo Local Municipality (KSDLM), which is one of the O. R. Tambo District's municipalities.

The area is densely populated, with gentle hills and is known to the Xhosa people as *Tshontini*, named after a dense wood that grows in the area, which also marks the traditional boundary between the Bomvana and Pondo clans of the Xhosa nation [King Sabata Dalindyebo Local Municipality Integrated Development Plan (KSDLM IDP), 2010].

The region is constituted by a Xhosa speaking majority who are largely dependent on the land and its resources to supplement their household needs. Despite an increase in national food security and relative wealth, the experience of most rural households in the Eastern Cape is that of continued poverty which is manifested in food insecurity [South African National Department of Agriculture (NDA), 1997]. Not much has been written about Coffee Bay in this regard [South African Department of Agriculture, Forestry and Fisheries (DAFF), 2013]. Ultimately, this location deserves exploring since most rural communities experience poverty [King Sabata Dalindyebo Local Municipality Integrated

3.1.1.1 Estimated Population of Coffee bay

According to Fitzpatrick and Armstrong (2006), Coffee Bay consists of 258 households with a 51.55% male population and 48.84% female population.

3.1.1.2 Main Economic Activities Pursued by Local Residents

According to the King Sabata Dalindyebo Local Municipality Integrated Development Plan (KSDLM IDP) (2012), the majority of the area is used for subsistence agriculture and most of the people in this area use their land and its resources for survival. Coffee Bay has an agricultural crop production and nursery cooperative which supports the production and utilization of indigenous vegetables; this cooperative is run by individuals from the local communities of Coffee Bay.

According to the Masande Crop Production Agricultural Cooperative brochure (2011), the cooperative produces, propagates and supplies vegetable seedlings, herbs, flowers indigenous trees, plants, and medicinal plants for the Eastern Cape market. The competitive pricing structures and large production capacity of the cooperative allows for the high supply volumes of seedlings to commercial agricultural operations. It can also supply everything from single plants, herbs, indigenous and fruit trees, to hundreds of thousands of vegetable seedlings per individual order. The Masande Crop Production Agricultural Cooperative primarily serves the Coffee Bay communities in the KSD municipal district by striving to create a market for fledgling vegetable growers (Masande Crop Production Agricultural Cooperative brochure, 2011).

In addition to the use of the area for agriculture, the land is also used for conservation and tourism [South African Department of Economic Development, Environmental Affairs and Tourism (DEDEA), 2014]. Therefore, there are other economic activities based in this area such as self-catering lodges and camping sites, which will include restaurant facilities [Eastern Cape Development Corporation (ECDC) 2004]. With the existing events, the production of ILVs from this area may attract more tourists by making these food sources available to restaurants and markets.

3.2 Agro-ecological survey

This section presents a brief detail of the average rainfall, temperature, vegetation and soils of Coffee Bay.

3.2.1 Rainfall

Coffee Bay normally receives about 871mm of rain per year, with most of its rainfall occurring during summer. It receives the lowest rainfall (20mm) in June and the highest (125mm) in November [South African Department of Economic Development, Environmental Affairs and Tourism (DEDEA), 2014]. With reference to the amount of rainfall received in this area, the production of ILVs may be increased because the existing literature reports that ILVs require less water than other crops (Cunningham *et al.*, 1992). Therefore, high rainfall amounts within this area may mean increased production of these vegetables. Figure 3.2 presents average rainfall summary for Coffee Bay.

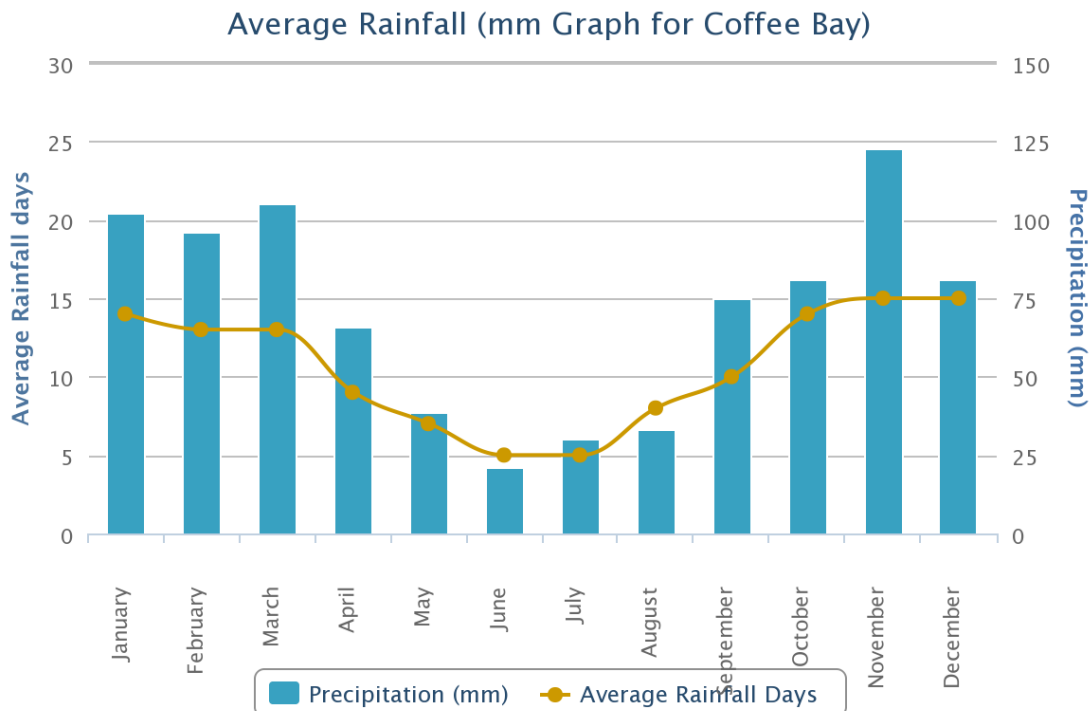


Figure 3.2: The average annual rainfall (mm) of Coffee Bay (source: DEDEA maps).

3.2.2 Temperature

The average maximum temperature for Coffee Bay ranges from 21 °C in July to 24 °C in February. The region experiences minimum temperatures during July when the mercury drops to 13°C on average during the night [South Africa Department of Economic Development, Environmental Affairs and Tourism (DEDEA), 2014]. With these temperatures, ILVs may grow well in this area since these vegetables are well-known to withstand the harsh climatic conditions where most exotic crops fail to grow (Cunningham *et al.*, 1992). Figure 3.3 presents average temperatures for Coffee Bay.

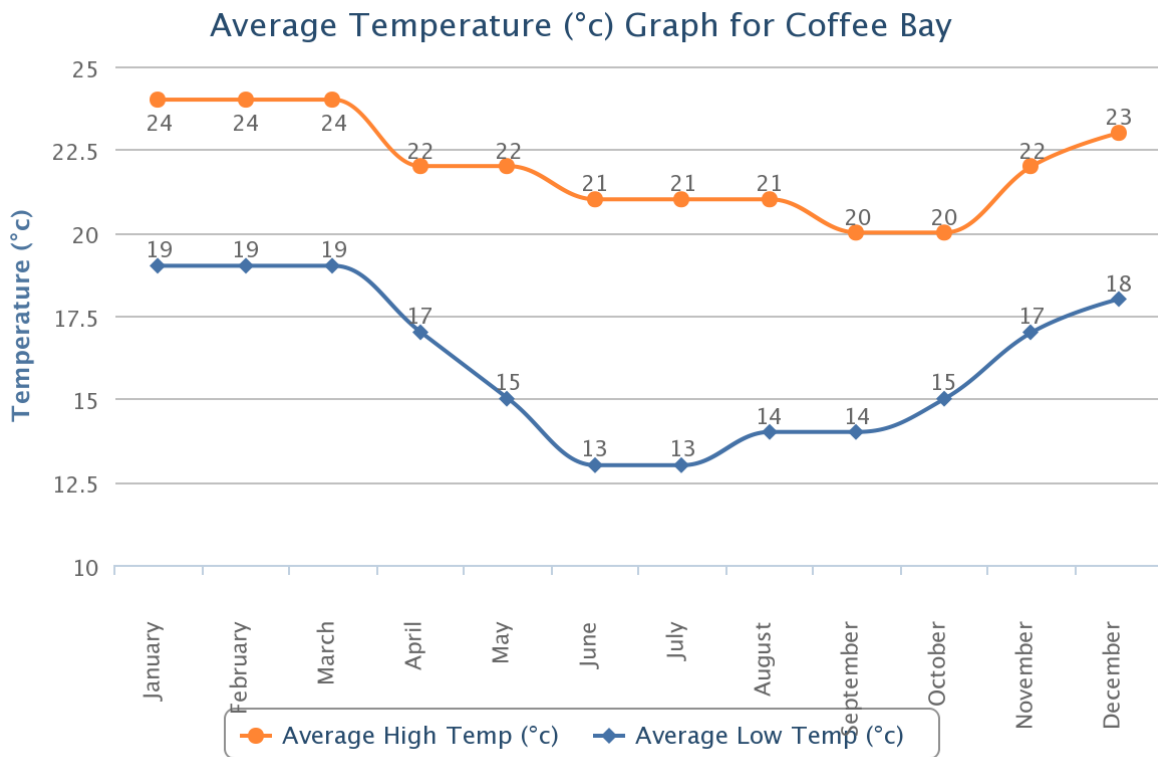


Figure 3.3: The average annual temperatures (°C) of Coffee Bay (source: DEDEA maps)

3.2.3 Vegetation

Coffee Bay has a mixture of grasslands, indigenous forests and thicket vegetation types and is rich in plant diversity (KSD IDP, 2010). In some areas of Coffee Bay, there are mixed grasslands with a number of species; however, in many other sites coastal buffalo

grass (*Stenotaphrum secundatum*) is the dominant species, usually found at the edge of rocky promontories and cliff faces. In such areas, a number of woody species are also available, such as *Cassine papillosa*, *Eugenia capensis* and *Aloe thraskii* (South Africa Coastal and Environmental Services, 2004).

According to the Eastern Cape Development Corporation (ECDC) (2004), the grasslands are an important grazing area, but in this area they are of very low nutritional value and, fortunately, the stocking rate is fairly low. The coastal buffalo grass (*Stenotaphrum secundatum*), which dominates area, forms a very short, dense turf and makes the slopes resistant to erosion.

One of the indigenous forests and vegetation thickets include a riverine forest which is dominated by *Rauvolfia caffra* and *Phoenix reclinata*. This vegetation type is observed along many of the river courses higher on the banks and overlooking slopes; it changes to the so-called scarp forest. Scarp forest occurs on steep slopes overlooking the rivers and, in some cases, towards the sea (ECDC, 2004).

This type of forest tends to be fairly short and, in some cases, consists only of shrubs that are up to 3m tall with 40-70% cover or, occasionally, trees up to 8m tall, which could have 35-70% cover [Eastern Cape Development Corporation (ECDC), 2004]. The dominant species varies from *Rapanea melanophloeos* to *Sideroxolon inerme*, *Dalbergia obovata*, *Millettia grandis*, and *Euphorbia triangularis*. The common characteristic of these forest/thicket types is the presence of the herbaceous undercover of *Isoglossa woodii* [Eastern Cape Development Corporation (ECDC), 2004].

The forests are heavily utilized for timber used in the construction of houses and kraals, and for firewood. In addition, due to the lack of fodder for goats and cattle in the short, low nutritional grasslands where there is intense grazing, livestock has also invaded and impacted upon the forest communities (South Africa Coastal and Environmental Service, 2004). The diverse vegetation from this area may mean that there is a range of options which exists in order for this community to select the types of ILVs they produce. This may, in turn, mean an increased production of ILVs from this area.

3.2.4 Soils

The soil patterns show that shallow and unstable soils dominate the landscape, with dolerite soils and alluvial terraces (Foord and Howdoft, 2005). With this, it must be noted that very few detailed soil surveys are available for this area. Given the poor soil condition of this area, ILVs may still grow well although production may not be in larger volumes. Cunningham *et al.* (1992) argue that ILVs can withstand conditions of poor soil quality.

3.2.5 Summary of agro-ecological survey

Given the agro-ecological summary of the area, the agricultural potential for commercial crop production may be limited due to some of the unfavourable climatic conditions in this area. However, the amount of rainfall is high in this area and it experiences little rainfall in winter (June), with cold temperatures in winter and high temperatures in summer. As suggested by the literature reviewed, ILVs are very easy to maintain and grow because they withstand most of the climatic conditions in which most exotic crops fail to grow and adapt. Thus far, this area may support ILV production.

The area is dominated by a mixture of vegetation which includes grasslands, indigenous forests and thicket vegetation types, and which is rich in plant diversity. The existing vegetation may be useful for grazing livestock and for the collection of ILVs for food consumption, as well as the collection of seeds and seedlings for ILVs in wild and open fields in order to produce more of these vegetables.

The hilly topography, whilst being very scenic, is a constraint in that it makes the provision of access roads difficult and costly, and limits the number of suitable developments. ILVs may adapt well under these soil conditions as they are reported to grow in any soil condition and require less input for their production.

3.4 Research Method and Design

This section presents the research method and design used in this study. This is arranged in such a way that the research design is presented first, in order to provide details of the research techniques used in the study. This is followed by a section on the methodologies and research instruments that were used to gather the different types of data that are used in this study. The chapter also offers a discussion of the sampling procedure, data sources, characteristics and the statistical analytical techniques used for this study.

3.4.1 Research Design

Cross-sectional survey is a type of research study, where either the entire population or a subset thereof is selected and, from these individuals, data are collected to help answer research questions of interest (Tourangeau *et al.*, 2000). In this study, a cross sectional approach was used to capture detailed information regarding the participation of smallholder farmers in the production of Indigenous Leafy Vegetables (ILVs) and the potential contribution of ILVs to household food security.

3.4.2 Methods and Research Instruments

The main approach used was through participatory rural appraisal surveys and interviews focusing on data regarding the following matters:

- (i) Demographics of the farmers,
- (ii) Farmers' perceptions of ILVs,
- (iii) Farmers' participation in the production of ILVs,
- (iv) Household food groups consumed by farmers and
- (v) Food insecurity access status of farmers.

A questionnaire was used as the main data collection instrument in order to gather data pertaining to the above-mentioned information.

3.4.3 Sampling frame

The study encompassed all the ILV production and non-production areas of the Coffee Bay area of the Eastern Cape Province of South Africa as its sampling frame. Primary sampling units were taken as participants and non-participants in the production of ILVs.

3.4.3.1 Sampling Procedure

The initial sample was stratified into two groups (ILVs participants and ILVs non-participants). For the ILVs participants a census was considered due to their limited numbers. Using purposive stratified convenient sampling based on the ILV participation status of the initial sample, two homogeneous mutually exclusive strata were created (stratum "A"; "**ILVs Participants**": n=88 and stratum "B"; "**ILVs Non-participants**": n=150) for independent analysis. Stratification entails dividing the population into homogeneous, mutually exclusive groups called strata where independent samples were conveniently selected from each stratum, not because such samples are necessarily easy to recruit but because the researcher uses the individuals who are available rather than selecting from the entire population.

3.4.3.2 Sampling Size

From the sampling frame, 238 farmers were randomly selected for direct questioning, using the "in-person interview" approach, as summarised in Table 3.1, below.

Table 3.1: The distribution of respondents with respect to ILV cultivation status

Study Area	Participants	Non-participants	Total
Coffee Bay	88	150	238
Total	88	150	238

From the study area, a total of two hundred and thirty eight farmers were selected comprising of eighty eight participants and one hundred and fifty non-participants farmers. In total, eighty eight participants were selected from the study area against one hundred and fifty non-participants, thus tallying two hundred and thirty eight farmers.

3.4.3.3 Enumerator Selection and Training

Four enumerators were selected, all of which had received graduate training in agriculture, applied environmental science and natural science from various universities in South Africa. All enumerators were chosen from the Eastern Cape Province and were fluent in the local language. The team was trained over three days so as to familiarize themselves with the different sections of the questionnaire. On the second day, a pre-testing exercise was conducted in the study area. Each enumerator interviewed at least five farmers per day. The third day was for brain storming and reflections on different sections of the questionnaire, based on pre-test results. Several adjustments were made to the questionnaire and skills on how to approach farmers were also highlighted.

3.4.3.4 Justification for Sample Size and Location

According to the South African Coastal and Environmental Services (2004), 67% of the Coffee Bay area is dominated by natural vegetation, which includes forests, grasslands, shrubs and indigenous plants. The obvious assumption here is that there are many ILVs in the area and that most people utilize these vegetables, especially poor people who depend quite heavily on them as their source of food. Therefore, a better representation of the value of ILV production with larger sample size could be estimated in this area. This is further supported by the fact that Coffee Bay and some surrounding agricultural cooperatives are the dominant suppliers of ILVs, including their seedlings and seeds within the Eastern Cape Province (KSD IDP, 2010).

3.5 Theoretical Framework and Empirical Analysis

This section presents the theoretical framework and data analysis procedures used in this study. Data was entered into and managed using the Statistical Package for Social Scientists (SPSS) version 22.

3.5.1 Theoretical Framework

Several studies provided a natural setting within which farmers’ decisions to produce non-conventional agricultural products can be analyzed (Damianos and Skuras, 1996; Barlas *et al.*, 2001). Assume household agricultural enterprises are “denoted” by j , where $j = 1$ for the inclusion of the ILVs to existing crop enterprises and $j = 0$ for the current crop enterprises (Mabuza *et al.*, 2012). The non-observable underlying utility function that ranks the preference of the i^{th} farmer is given by U . Although the utility function is unobserved, the relation between the utility derivable from a j^{th} enterprise is hypothesized to be a function of a number of factors, as illustrated in equation 1 below (Mabuza *et al.*, 2012).

$$U_{ij} = F(SE_{ij}, P_{ij}, I_{ij},) + \varepsilon_{ij} \quad j=1,0; \quad i= 1, \dots, n \quad U_{ij} = V_{ij} + \varepsilon_{ij} \dots \dots \dots 1$$

Where U_{ij} is the unobserved or latent utility level attained by the i^{th} farmer, V_{ij} is the explainable part of the latent utility that depends on socio-economic attributes (SE_{ij}), institutional factors (I_{ij}), farmers’ perceptions (P_{ij}), and the random error term (ε_{ij}). Following the random utility framework, the i^{th} farmer’s choice for adding ILVs to existing agricultural enterprises (L) as opposed to remaining without ILVs (O) is assumed to depend on the additional utility derived from ILV production relative to that derived from existing enterprises, which is “denoted” in this case by y_i (Mabuza *et al.*, 2012). Therefore, y_i is specified as illustrated in equation 2:

$$Y_i = (V_{Li} + \varepsilon_{Li}) - (V_{Oi} + \varepsilon_{Oi}) = (\varepsilon_{Li} - \varepsilon_{Oi}) + (V_{Li} - V_{Oi}) \dots \dots \dots 2$$

Hence, a typical farmer/household in Coffee Bay will decide to incorporate ILVs to his current enterprises if:

$$(V_{Li} + \varepsilon_{Li}) > (V_{Oi} + \varepsilon_{Oi})$$

$$U_{Li} - U_{Oi} > 0 \dots \dots \dots 3$$

Following an approach used by Mabuza *et al.* (2012), to implement the model, it was assumed that there is an unobserved or latent variable, y^* , that generates the observed

variable y , which represents a farmer's decision regarding whether or not to produce ILVs. When $y^* > 0$, the farmer produces ILVs and $y=1$ is observed. When the farmer does not produce ILVs then $y=0$ is observed. For the i^{th} farmer, the unobserved variable y_i^* was assumed to be related to observed factors that included socio-economic attributes (SE) such as gender (X_1), age (X_2), household size (X_3), level of education (X_4) and level of income (X_5); perceptual characteristics (P), which included competition for land (X_6), nutrition (X_7), cultural beliefs (X_8), health benefits (X_9), ILVs as weeds (X_{10}), palatable taste (X_{11}), food for backward people (X_{12}), food for poor people (X_{13}), food for older people (X_{14}) and food for rural people (X_{15}); and institutional factors (I), including access to market (X_{16}), distance to market (X_{17}), access to extension (X_{18}), access to credit (X_{19}), access to arable land (X_{20}) and membership of a Community Based Organization (CBO) (X_{21}).

The specified structural model is illustrated in equation 4:

$$Y_i^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} + \beta_{18} X_{18} + \beta_{19} X_{19} + \beta_{20} X_{20} + \beta_{21} X_{21} + e_i \dots\dots\dots 4$$

Where the X s represent explanatory variables, β s represent coefficients to be estimated, while e_i is the random error term with a zero mean. Y_i is linked to Y_i^* , as illustrated in equation 5:

$$Y_i = 1 \text{ if } Y_i^* > 0$$

$$0 \text{ if } Y_i^* < 0 \dots\dots\dots 5$$

This implies that the production of ILVs is a dichotomous decision; hence, equation (4) can either be estimated using a logit or probit model.

3.5.2 Econometric model specifications

3.5.2.1 Binary Logistic Regression

The binary logistic regression model was used to estimate determinants of farmer participation in ILVs among the respondents. The ILV participation status of farmers was taken as dependant variables. Twenty one predictor independent variables were regressed against the binary dependent variable of the ILV participation status of farmers. Farmers' participation in ILVs was based on an assumed underlying utility function of attaining household food security from the cultivation of ILVs. In this respect, farmers were assumed more likely to participate in ILVs if the utility obtained from participation exceeds that of non-participation. The binary logistic regression model, as illustrated in equation 6, below, was used to estimate factors that influence smallholder farmers' participation in ILVs (Gujarati, 1992).

$$\ln \left(\frac{p \left(y = \frac{1}{x} \right)}{1 - p \left(y = \frac{1}{x} \right)} \right) = \alpha + \beta_1 X_1 + \dots + \beta_n X_n \dots \dots \dots 6$$

Where:

P = shall be the predicted probability of participation in ILVs.

$1 - P$ = shall be the predicted probability of non-participation in ILVs.

α = the constant of the equation.

β = the coefficient of the independent variables.

X = independent variables.

By fitting independent variables into the model, the model shall be represented as illustrated in equation 7:

$\ln (P (Y=1/X)) / (1-P (Y=1/X)) = a + \beta_1 \text{ Gender} + \beta_2 \text{ Age} + \beta_3 \text{ Household size} + \beta_4 \text{ Level of education} + \beta_5 \text{ Level of income} + \beta_6 \text{ Competition for land} + \beta_7 \text{ Nutrition} + \beta_8 \text{ Cultural}$

beliefs + β_9 Health benefits+ β_{10} ILVs as weeds+ β_{11} Palatable taste of ILVs+ β_{12} Food for backward people + β_{13} Food for poor people + β_{14} Food for older people + β_{15} Food for rural people + β_{16} Access to market + β_{17} Distance to market + β_{18} Access to extension + β_{19} Access to credit + β_{20} Access to arable land + β_{21} Membership to CBOs7

3.5.3 Food Security Index Estimates

3.5.3.1 Household Dietary Diversity Score

Through targeting the respondents’ dietary history, a 24-hour dietary recall was conducted to obtain food group information regarding the respondents’ food intake [Food Agriculture Organization (FAO), 2007]. The respondents were asked to recall all foods eaten and beverages taken in over the twenty-four hours preceding the interview. A scale of twelve food groups was used in assessing the dietary diversity of the respondents, as summarised in Table 3.2 below, following an approach taken by the FAO (2007).

Table 3.2: The categories of food groups

Food groups	Points
1. Any bread, rice, or any other foods made from millet, sorghum, maize, wheat or any other locally available grain	1
2. Any potatoes, yams, cassava or any other foods made from roots or tubers	1
3. Any vegetables	1
4. Any fruits	1
5. Any beef, pork, lamb, rabbit, chicken, duck, other birds and organ meats	1
6. Any eggs	1
7. Any fresh or dried fish, or shellfish	1
8. Any foods made from beans, peas and lentils	1
9. Any yoghurt, milk or milk products	1
10. Any food made with oil, fat or butter	1
11. Any sugar	1
12. Any food such as coffee or tea	1
Total	12

Key: if the answer is yes award 1 point and if the answer is no award 0 points

A single point was awarded to each of the food groups consumed over the reference period giving a maximum sum total dietary diversity score of 12 points for each individual in the event that his/her responses are positive to all food groups (Taruvunga, Muchenje

and Mushunje, 2013). A value of zero would therefore mean a low dietary diversity score (HDDS) and the closer the score is to 12, the higher the dietary diversity of the respondent. This approach avoids crude categorisation of dietary diversity into low, medium and high by treating dietary diversity as a continuum (Agwu *et al.*, 2012).

3.5.3.2 Household Food Insecurity Access Scale (HFIAS)

The HFIAS is a brief survey instrument developed by the Food and Nutrition Technical Assistance (FANTA) body to assess whether households have experienced problems with food access during the last 30 days (Coates *et al.*, 2006). The instrument consists of nine occurrence questions and nine frequency questions; these questions ask about the changes households made in their diet or food consumption patterns as a result of limited resources in regards to acquiring food. HFIAS measures the level of food insecurity during the past 30 days, as self-reported by the household. The measured results are then assigned categorical designations (food secure, or mildly, moderately, or severely food insecure) or given a numerical value (0-27), with higher numbers representing a greater level of food insecurity (FANTA, 2004). Table 3.3 summarises the generic HFIAS questions used in this study.

Table 3.3: The Household Food Insecurity Access Scale (HFIAS) Generic Questions.

Questions	Response options: 0= Never 1= Rarely (once or twice in the past 30 days) 2= Sometimes (three to ten times in the past 30 days) 3= Often (more than ten times in the past 30 days).
1. Did you worry that your household would not have enough food?	
2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	
3. Did you or any household member eat just a few kinds of food day after day due to a lack of resources?	
4. Did you or any household member eat food that you preferred not to eat because a lack of resources to obtain other types of food?	
5. Did you or any household member eat a smaller meal than you felt you needed because there was not enough food?	

6. Did you or any other household member eat fewer meals in a day because there was not enough food?	
7. Was there ever no food at all in your household because there were no resources to get more?	
8. Did you or any household member go to sleep at night hungry because there was not enough food?	
9. Did you or any household member go a whole day without eating anything because there was not enough food?	

For each of the above questions, a respondent considered what has happened in the past 30 days. The respondent also indicated whether this never happened, rarely (once or twice), sometimes (3-10 times), or often (more than 10 times) in the past 30 days.

To measure HFIAS, the HFIAS score was used as it measures the degree of food access in the household over the past 30 days. A HFIAS score variable is calculated for each household by totaling the codes for each frequency of occurrence question. The maximum score for a household is 27 (if the household response to all 9 questions was “often”, coded with a response code of 3); the minimum score is 0 (Coates *et al.*, 2007). The higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experienced.

The HFIAS Score is between 0-27 and the sum of the frequency of experience during the past 30 days for the 9 food insecurity-related conditions: Sum frequency code (Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9) (FANTA, 2004).

For the purpose of estimating the contribution of ILVs to HDDS and HFIAS, two linear regression models were used. The generated HDDS and HFIAS scores were treated as the dependent variables with the implicit form of the regression expressed as illustrated in equation 8 (Agwu *et al.*, 2012);

$$Y = f(X_S, X_I, X_D, e) \dots \dots \dots 8$$

Where:

Y = HDDS (Household Dietary Diversity Score): First linear equation

Y = HFIAS (Household Food Insecurity Access Scale score): Second linear equation

X_S = Socio-economic factors

X_I = Institutional factors

X_D = Participation dummy (participation in ILV production)

e = Error term

By regressing the independent predictor variables (X) against the HDDS and HFIAS (Y), factors that condition (and the direction of influence) household dietary diversity and household food insecurity access were therefore estimated respectively. The participation dummy was used to estimate the potential influence of ILVs on household dietary diversity and household food insecurity access, which were taken as proxy measures of household food security.

3.6 Review of models and approaches for this study

This section presents models and approaches that were used in addressing the objectives of this study. Binary logistic regression and linear regression models were used to determine factors that influence participation in ILV production and household food security (HDDS and HFIAS) respectively. In addition, the Household Dietary Diversity Score (HDDS) and Household Food Insecurity Access Scale (HFIAS) were used as approaches to estimate food security for households.

3.3.1 Models for Determinants of Participation and Household Food Security

This section presents a brief review of models that can be used to estimate determinants of participation and household food security.

3.6.1.1 Binary Logistic Regression Model

Logistic regression is a statistical method for analyzing a data set in which there are one or more independent variables that determine an outcome (William, 2011). The outcome is measured with a dichotomous variable (in which there are only two possible outcomes). In logistic regression, the dependent variable is binary or dichotomous (Gujarati, 1992;

Greene, 2008; Hosmer and Lemeshew 1989). In terms of the dichotomous analysis outcome variable, Hosmer and Lemeshew (1989) point out that the logistic distribution (binary logistic regression model) has an advantage over the other models because of its extreme flexibility and ease of use from a mathematical point of view, and results in a meaningful interpretation. One of the advantages of the binary logit model is that a binary logistic model can include more than one explanatory variable (independent variable), and these variables can be dichotomous, ordinal or continuous (Williams, 2011).

Binary regression techniques allow estimating the effects of the Xs on the underlying Y. They can also be used to see how Xs affect the probability of being in one category of the observed Y as opposed to another (Williams, 2011). In regards to this study, the dependent variable was coded as 1 if the farmer is a participant in the production of ILVs and coded as 0 if the farmer is not a participant in the production of ILVs.

To estimate the determinants of participation in the production of ILVs, the study used the binary logit model. The farmers' ILV participation status (Y) was taken as dependant variables while all the reviewed factors that influence participation in the production of ILVs were taken as predictor independent variables (X). The independent variables were regressed against the binary dependant variable of the ILV participation status of farmers.

3.6.1.2 Linear Regression Model

The generated HDDS (Household Dietary Diversity Score) and the HFIAS (Household Food Insecurity Access Scale score) were treated as the dependent variables in the two equations.

From this study, regressing the independent variables (X) against HDDS (Y), factors that condition HDD (Household Dietary Diversity) were estimated and regressing the independent variables (X) against HFIAS score (Y); factors that condition HFIA (Household Food Insecurity Access) were also estimated.

3.6.2 Approaches for Estimation of Food Security

This section presents a brief review of household food security proxy measures as suggested by literature.

3.6.2.1 Household Dietary Diversity Score (HDDS)

Household Dietary Diversity (HDD) is usually measured by summing the number of foods or more often by counting the number of food groups consumed over a reference period (Ruel, 2002; Vakili *et al.*, 2013). At household level, Vakili *et al.* (2013) suggest that dietary diversity can be used as a proxy measure for food access, while at the individual level it acts as a reflection of dietary quality. For the purpose of this study, the respondents were asked to recall all foods eaten and beverages taken in the twenty-four hours preceding the interview. A scale of twelve food groups was used to assess the dietary diversity of the respondents. A single point is awarded to each of the food groups consumed over the reference period, giving a maximum sum total dietary diversity score of 12 points for each individual in the event that his/her responses are positive to all food groups (Taruvunga, Muchenje and Mushunje, 2013). A value of zero would therefore mean a low Household Dietary Diversity Score (HDDS) and the closer the score is to 12, the higher the dietary diversity. This approach avoids crude categorisation of dietary diversity into low, medium and high by treating dietary diversity as a continuum (Agwu *et al.*, 2012).

3.6.2.2 Household Food Insecurity Access Scale (HFIAS)

Household Food Insecurity Access Scale (HFIAS) is an adaptation of the approach used to generate the annual number of food insecure and hungry people in the world (Coates *et al.*, 2006). This method is based on the idea that the experience of food insecurity (access) causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale [Food and Nutrition Technical Assistance (FANTA), 2004].

Four types of indicators can be calculated to help understand the characteristics of and changes in household food insecurity (access) in the surveyed population (Coates *et al.*, 2006). For the purpose of this study, a Household Food Insecurity Access Scale score indicator was used.

According to Coates *et al.* (2006), the HFIAS score is a continuous measure of the degree of food insecurity (access) in the household (in the past 30 days). Firstly, a HFIAS score variable is calculated for each household by summing the coded frequency of experience for each question. The maximum score for a household is 27 (the household response to all 9 questions was "often", coded with a response code of 3); the minimum score is 0. The higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) the household experienced.

3.7 Description of Variables Specified in the Binary Regression Model

This section focuses on a description of the variables specified in the binary logistic regression model. Using conclusions inferred from other studies, the *a priori* influence of various farmers' characteristics was estimated.

Table 3.4: Variables specified in the binary logistic model and their expected signs

Variable	Variable description	Anticipated Sign
Gender	1= male; 2= female	+
Age	1=<25; 2=26-35; 3=36-46; 4= 47-56; 5= >56	+
Household size	Number of household members	+
Education	1=no education; 2=primary education; 3= secondary education	+
Level of Income	1= <R1000; 2=R1000-R3000; 3= >R3000	-
Competition for land	ILVs compete for land (No=0; Yes=1)	+
Nutrition	Nutrition benefits (No=0; Yes=1)	+
Cultural beliefs (CB)	CB influence farmers participation in ILVs (no=0; yes=1,)	+
Health benefits	ILVs have health benefits (No=0, Yes=1)	+
ILVs treated as weeds	ILVs are weeds (No=0, Yes=1)	-
Palatable taste of ILVs	ILVs have a palatable taste (No=0, Yes=1)	+
Food for backward people	No=0, Yes=1	-
Food for poor people	No=0, Yes=1	-
Food for older people	No=0, Yes=1	-
Food for rural people	No=0, Yes=1	-

Access to market	No access=1; access=2	+
Distance to market	1=<5km; 2=>5km	-
Access to extension	No access=1; access=2	-
Access to credit	No access=1; access=2	+
Access to arable land	No access=1; access=2	+
Membership of CBOs	Non membership to a CBO =1; 2= membership to CBO	+

3.7.1 Socio-economic factors

(a) Gender

Women and men engage in different activities in rural communities; as it is explained in African culture, there are activities that are performed only by men or only by women. A dummy variable was used to code this variable, as follows: 0 = males, 1=females.

Hart and Vorster (2006) noted that in most rural areas women tend to make a greater contribution to the production of ILVs because they are able to differentiate between indigenous plants that are good as food sources which are harvested or left undisturbed for later consumption, and those that belong to the weed population that needs to be removed from the fields. Females were therefore expected to participate more in the production of ILVs compared to their male counterparts. To this end, a positive correlation was expected from this variable.

(b) Age

Age was measured by the actual number of years of the respondent. Older respondents were expected to have better knowledge of ILV production than younger people because ILVs are reported to be the food that was consumed mostly in the olden days. Jansen Van Rensburg *et al.* (2007) confirmed that in most areas ILVs are associated with poverty and poorness and that this has resulted in most people, especially the youth, not using ILVs because they do not want to be labelled 'backward' people. Age is therefore likely to have an effect on the production and utilization of ILVs. Therefore, a positive correlation was expected for this variable.

(c) Household size

Household size was measured by the number of family members in the household. Households with a larger number of members are likely to participate in the production of ILVs as they may share farming activities which include the production of ILVs. This may increase the production of ILVs which may, in the end, address the problem of food insecurity for households. To this end, a positive correlation was expected from this variable.

(d) Level of education

Level of education was measured in terms of whether the participant in ILV production is educated or uneducated. The variable was coded as follows: 1=no education; 2=primary education; 3= secondary. Faber and Wenhold (2007) argued that education has an effect regarding the participation of farmers in the production of ILVs because, in both commercial and communal farming, education promotes the increased cultivation of exotic crops than ILVs. A positive correlation was therefore expected between education and ILV production.

(e) Level of income

The level of income was measured based on the amount of the money the participant receives per month. The variable was coded as follows: 1=<R1000; 2=R1000-R3000; 3=>R3000. Naturally, households with a high income may not consider production or consumption of ILVs since they have the financial means to purchase exotic crops that dominate the market shelves and are always available on the market. To this end, a negative correlation was expected for this variable.

3.7.2 Perception related factors

(a) Competition for land

There is competition for land in rural communities, between ILV production and exotic vegetable production. This may be caused by the fact that most of the cultivated land is

used for the production of maize and commercial crops. Based on this information, a negative correlation was expected from this variable.

(b) Nutrition

Toledo and Burlingame (2006) noted that ILVs are under-utilised natural resources although they have the potential to contribute to the improvement of food and nutrition security. Various ILVs have been analysed for nutrients, and they have shown high nutritional content (Kruger *et al.*, 1998). In this respect, rural households have also developed different perceptions regarding the nutritional status of ILVs. In communities where they are perceived to be nutritious, their production and consumption may be promoted, but in communities where the perception is otherwise, production and consumption may be low. Based on these arguments, the influence could not be established *a priori*.

(c) Cultural beliefs

Certain people or cultures have different beliefs regarding the utilization and production of ILVs. The production and utilization of ILVs appears to be contextualized and may be influenced by changes in cultural experiences which vary from one cultural group to another, as well as from location, rural and urban dwellers, gender and variances in age (Mavengahama, 2013). Cultural views may therefore have an effect on the production and utilization of ILVs. Based on this information, the influence could not be established *a priori*.

d) Health benefits

The consumption of ILVs has been reported to have healing properties that maintain good health. These healing properties serve as a source of micronutrients and reduce the risk of cardiovascular diseases and other degenerative diseases (Frison, 2007). With this background information, a positive influence on ILV production was expected from this variable.

(e) ILVs treated as weeds

According to Vorster *et al.* (2007), ILVs are still largely treated as weeds by many research and extension personnel who criticize farmers for not keeping this weed population under control, thus labelling this important food as unworthy of the space it occupies. Thus far, a negative correlation was therefore expected for this variable.

(f) Palatable taste of ILVs

Taruvinga and Nengovhela (2015) argue that most households believe that ILVs have a pleasant taste and are easy to prepare which makes them a favorite dish in most rural daily meals. Generally, as long as households believe that ILVs have palatable taste, the more likely they are to support the production of ILVs. In light of this, a positive influence of palatable taste on ILVs was estimated.

(g) ILVs treated as food for backward people

There is a perception that ILVs are food for backward people. Modi *et al.* (2006) reported a decline in the utilization and cultivation of ILVs because people believe that ILVs were only consumed in the olden days. Jansen Van Rensburg *et al.* (2007) argue that people stopped consuming their ordinary food which included ILVs because they did not want to be described as backward people or as old fashioned. Based on these arguments, a negative correlation was expected from this variable.

(h) ILVs treated as food for poor people

There is a perception that ILVs are food consumed by poor people. Jansen Van Rensburg *et al.* (2007) noted that, in most areas, ILVs are associated with poverty and poorness; discourages the production and consumption of these vegetables. Thus far, a negative association was predicted from this variable.

(i) ILVs treated as food for older people

Jansen Van Rensburg *et al.* (2007) stated that most people, especially youth, do not use ILVs because they do not want to be described as old fashioned. Based on this

information, only older people are likely to consume ILVs which may discourage their production. To this end, a negative correlation was expected for this variable.

(j) ILVs treated as food for rural people

Typically, it is very rare to see urban dwellers visiting fields or places where they can get ILVs. In most circumstances, only rural people are found using these vegetables because they live in areas that are convenient for them to obtain these vegetables. In light of this, a negative association was anticipated from this variable.

3.7.3 Institutional factors

(a) Access to market

Access to market was measured as a dummy variable taking a value of 0 if the participant does not have access to market and a value of 1 if the participant has access to market. Schippers (2002) reveals that several studies in Africa found that weak market chains for ILVs, poor seed systems, lack of information on best cultivation practices and low demand of ILVs prevent farmers from producing these vegetables. Similar findings were later revealed by Mwangi and Mumbi (2006). Therefore, a positive correlation between market access and production of ILVs was expected.

(b) Distance to market

Distance to market was anticipated to influence the production of ILVs. Distance to market was estimated to influence participation in the production of ILVs, taking a value of 1 if the distance to market is less than 20km, a value of 2 if the distance to market is less than 40km and a value of 3 if the distance to market is more than 50km. A negative association was predicted from this variable.

(c) Access to extension

Access to extension was assumed by asking whether farmers have access to extension services or not. A value of 0 was taken if the farmer has no access to extension services and a value of 1 was taken if the farmer has access to extension services. According to

Vorster (2007), extension officers have influence over farmers' participation in the production of ILVs and indigenous food because farmers are always advised to keep this weed population under control. Smallholder farmers may have access to extension services related to the production of commercial crops but services relating to ILV production are at times limited or not available. Therefore, a negative relationship between ILV production and access to extension was probable.

(d) Access to credit

Farmers were asked if they have access to credit; a value of 0 was given to farmers who have no access to credit and a value of 1 to farmers who have access to credit. Credit support in the form of capital loans and funding to smallholder farmers who are willing to participate in ILV production may encourage them to produce these vegetables not only for household consumption but also for commercial purposes. Therefore, a positive correlation was expected from this variable.

(e) Access to arable land

A value of 0 was given to farmers who had no access to arable land and a value of 1 was given to farmers who had access to arable land. The majority of the rural communities own arable land, although most of the land is under-utilized. Providing resources to willing farmers in order that they produce ILVs may increase their production and food choices. To this end, a positive correlation between access to arable land and ILV production was expected.

(f) Membership of CBOs

Membership of CBOs was measured as a dummy variable that influences participation in the production of ILVs. The variable was coded as follows: non-member to a CBO=0; member to a CBO=1. A membership to a CBO such as projects and social clubs may help encourage the production of ILVs as they may be sharing benefits associated with ILVs. To this end, a positive correlation was expected from this variable.

3.8 Summary of research objectives and analytical tools

Table 3.5 Research objectives and analytical framework

Objectives	Analytical Tools
1. To assess smallholder farmers' perceptions of and most cultivated Indigenous Leafy Vegetables.	Descriptive analysis
2. To investigate factors that influence smallholder farmers' participation in the production of indigenous leafy vegetables.	Binary regression model
3. To investigate the contribution of indigenous leafy vegetables to household food security.	Linear regression model

Chapter Four

Descriptive Statistics, Empirical Findings and Discussion

4.0 Introduction

This chapter presents the research findings of this study, based on descriptive and econometric results. Initially the chapter presents the basic sample statistics of the two groups (ILVs participants and ILVs non-participants). To address Objective One, the chapter first presents the smallholder farmers' perceptions of and most cultivated Indigenous Leafy Vegetables from the study area. To address Objective Two, the chapter presents the results of determinants of participation in the production of ILVs. To address Objective Three, the chapter further presents the observed food groups consumed by respondents from the study area, estimated Household Dietary Diversity Scores of the two groups, HFIAS for the two groups and the regression estimates for determinants of household food security.

4.1 Basic sample statistics of the two groups (ILVs participants and ILVs non-participants)

Table 4.1 provides the basic sample characteristics from the study area for non-participants. A total of 150 non-participants in ILV production respondents were considered for this study, with a mean household-head age range of 36-46 years. The median education level was 2; this implies that, on average, respondents were educated up to the level of primary schooling. Basic sample statistics also suggest that the considered sample had more females than males with an average monthly income between R1000 and R3000. The sample results further reveal an average household size of 7 family members with a minimum of 2 and a maximum of 14. A majority of the respondents did not have access to extension, market and credit services. With reference to arable land and membership to CBOs sample statistics reveal that a majority had access and were members respectively. The asymmetry of distribution was both positively and negatively skewed, as shown in Table 4.1 below. Most of the variables had skewness

values below and close to 1 (with the exception of access to land); this suggests that the distribution did not differ significantly from a normal symmetric distribution.

Table 4.1 Basic sample statistics of non-participants in ILV production

	GENDER	AGE	EDUCATION	INCOME	HH. SIZE	ATM	DTM	ATE	ATC	ATL	ORG
Valid	150	150	150	150	150	150	150	150	150	150	150
Mean	1.69	3.49	2.05	2.01	6.97	1.45	1.45	1.16	1.23	1.93	1.82
Std. Deviation	.465	1.145	.907	.825	2.385	.499	.499	.368	.424	.250	.385
Skewness	-.813	-.225	.836	.312	.832	.217	.217	1.874	1.274	-3.510	-1.683
Minimum	1	1	1	1	2	1	1	1	1	1	1
Maximum	2	5	4	3	14	2	2	2	2	2	2

Key: GEND: Gender (0=male; 1=female), **AGE:** Age (1=<25; 2=26-35; 3=36-46; 4=47-56; 5=>56), **EDUC:** Education (1=no education; 2=primary education; 3=secondary education), **INCO:** Income per month (1=<R1000; 2=R1000-R3000; 3>R3000), **HHS:** Household size, **ATM:** Access to market (0=no access; 1=access), **DTM:** Distance to market (0=<5km; 1=>5km;), **ATE:** Access to extension (0=no access; 1=access), **ATC:** Access to credit (0=no access; 1=access), **ATL:** Access to arable land (0=no access; 1=access), **ORG:** Membership of CBOs (0=non membership to CBO; 1=membership to CBO).

Table 4.2 provides the basic sample characteristics from the study area for participants. A total of 88 participants in ILV production were considered for this study, with a mean household-head age range of 36-46 years which was also similar with non-participants. The mean education level was 2; this implies that, on average, respondents were educated up to primary level similar to the non-participant group. Basic sample statistics also indicate that the considered sample had more females than males with an average monthly income between R1000 and R3000. The sample results further reveal an average household size of 7 family members with a minimum of 2 and a maximum of 15. A majority of the respondents did not have access to extension, market and credit services. The statistics further reveal that respondents had access to arable land and

were also members to local CBOs. The asymmetry of distribution was both positively and negatively skewed, as shown in Table 4.2 below. Most of the variables had skewness values below and close to 1 (with the exception of access to land); this suggests that the distribution did not differ significantly from a normal symmetric distribution.

Table 4.2: Basic sample statistics of participants in ILV production

	GENDER	AGE	EDUCATION	INCOME	HH. SIZE	ATM	DTM	ATE	ATC	ATL	ORG
Valid	88	88	88	88	88	88	88	88	88	88	88
Mean	1.58	3.41	1.85	2.23	7.25	1.19	1.17	1.24	1.22	1.91	1.58
Std. Deviation	.496	1.319	.598	.784	2.801	.397	.378	.429	.414	.289	.496
Skewness	-.328	-.368	.058	.159	.611	1.581	1.783	1.248	1.405	-2.896	-.328
Minimum	1	1	1	1	2	1	1	1	1	1	1
Maximum	2	5	3	3	15	2	2	2	2	2	2

Key: GEND: Gender (0=male; 1=female), **AGE:** Age (1=<25; 2=26-35; 3=36-46; 4=47-56; 5=>56), **EDUC:** Education (1=no education; 2=primary education; 3=secondary education), **INCO:** Income per month (1=<R1000; 2=R1000-R3000; 3>R3000), **HHS:** Household size, **ATM:** Access to market (0=no access; 1=access), **DTM:** Distance to market (1=<5km; 2=>5km;), **ATE:** Access to extension (0=no access; 1=access), **ATC:** Access to credit (0=no access; 1=access), **ATL:** Access to arable land (0=no access; 1=access), **ORG:** Membership of CBOs (0=non membership to CBO; 1=membership to CBO).

4.2 The most cultivated ILVs from the study area

The results from the study area indicate that different types of ILVs were commonly grown, as summarized in Figure 4.1 below. The major ILVs grown in the study area include the following vegetables: Group 1; amaranth, black jack, spider plant and chinese cabbage (55%), Group 2; pumpkin leaves and pigweed (28%), Group 3; chenopodium album (9%) and Group 4; night shade and goose foot (8%). Previous studies report the production and consumption of wild foods from the same area [King Sabata Dalindyebo Local Municipality Integrated Development Plan (KSDLM IDP), 2012].

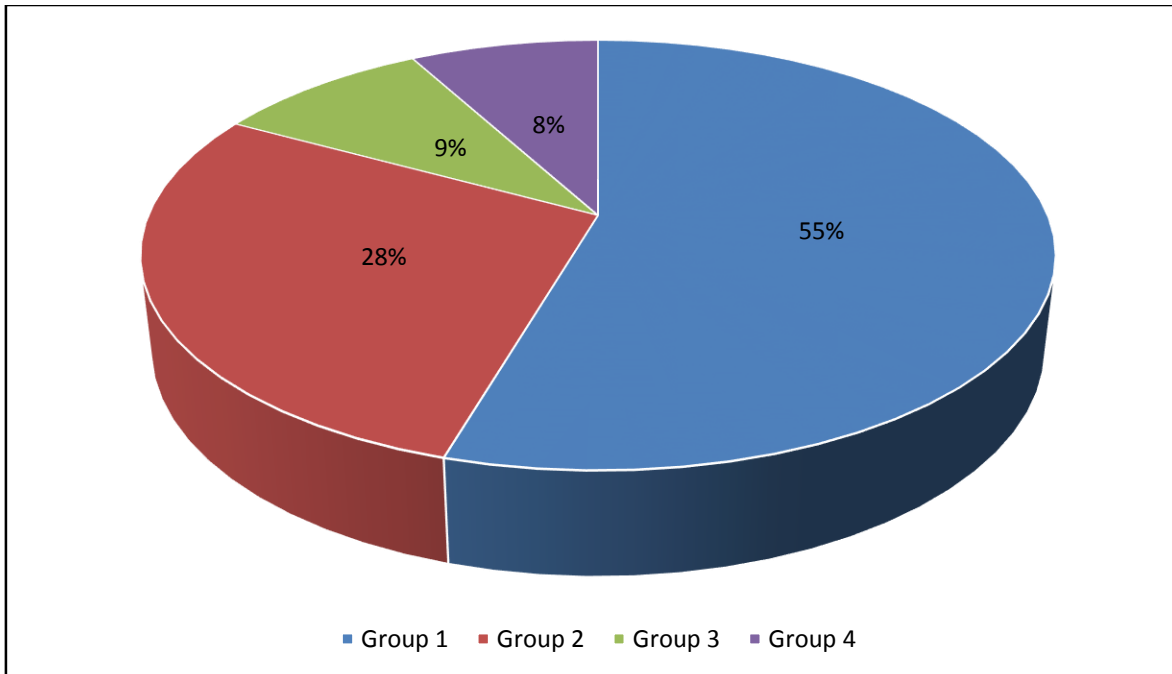


Figure: 4.1: Cultivated ILVs from the study area (source: research data, 2015)

The next section presents shared perceptions of ILVs from the study area

4.3 Shared perceptions of ILVs from the study area

This section presents the results of shared perceptions of ILVs from the study area. Figure 4.2 presents a summary of the reported perceptions from the study area.

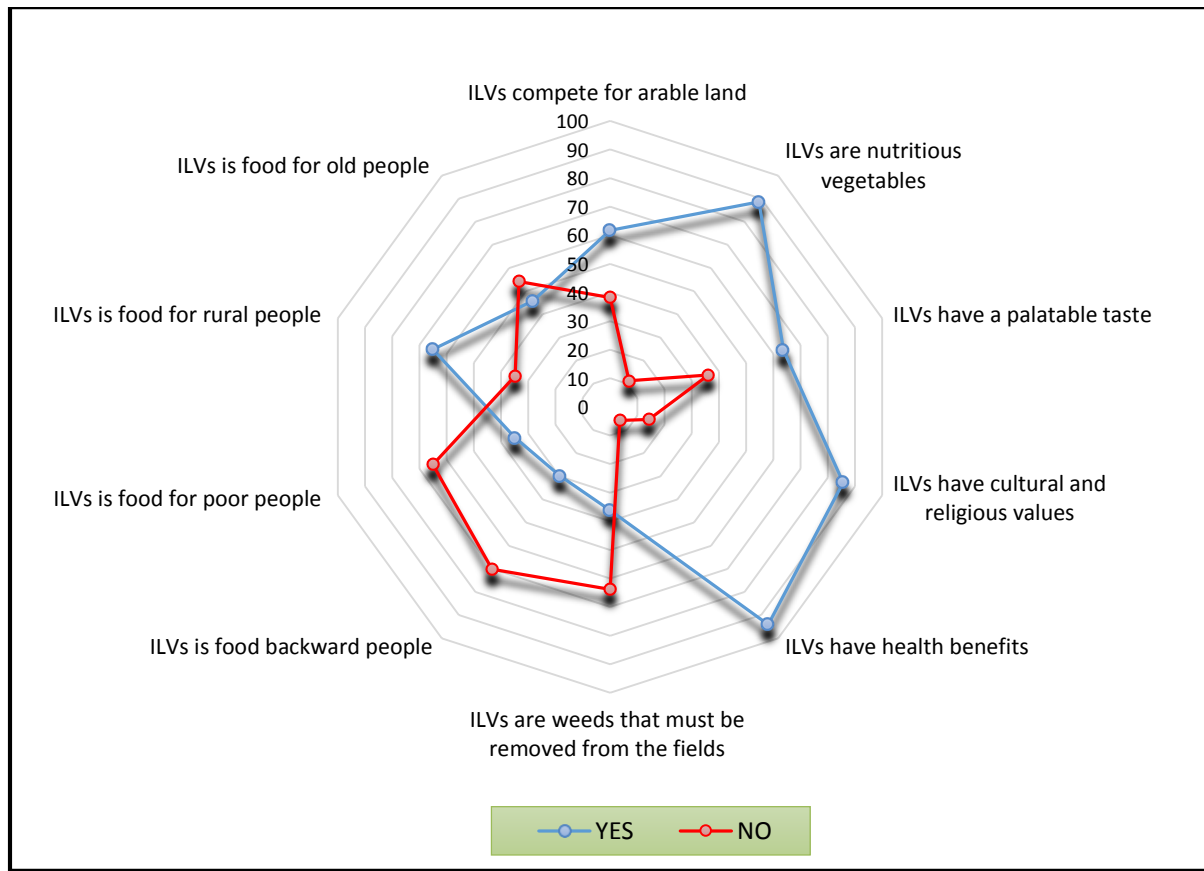


Figure: 4.2 Shared perceptions of ILVs from the study area (source: research data, 2015).

Figure 4.2 indicates that 62% of the respondents believed that ILVs compete for arable land while 38% of the respondents did not believe that ILVs compete for arable land. Most of the respondents believed that ILVs compete for land and this may suggest a low production of ILVs due to competition for land with commercial and other field crops, such as maize. Similar comparable observations were previously noted by Shackelton *et al.* (2006) who argue that the production of ILVs within rural farming communities is on small scale and is primarily for subsistence purposes. This is because most of the cultivated land is used for the production of maize and other exotic crops.

With reference to perceptions related to nutrition, the results of this study indicate that 89% of the respondents believed that ILVs are nutritious vegetables and 11% of the respondents did not believe that ILVs are nutritious vegetables. These findings suggest that the majority of the respondents from the area associate ILVs with nutritious

vegetables; this is a significant belief that may have a positive influence on the production of ILVs.

Figure 4.2 further indicates that 64% of the respondents believed that ILVs are a palatable source of food, while 36% of the respondents did not believe that ILVs are a palatable source of food. These findings suggest that most of the respondents from the study area share a positive perception regarding ILVs as a palatable source of food. Based on these findings, rural communities may be encouraged to produce and utilize more of these vegetables.

The results also reveal that 86% of the respondents believed that ILVs have cultural and religious values, while 14% of the respondents did not believe that ILVs have cultural and religious values. The results suggest that the majority of the people believe that there are cultural beliefs associated with ILVs; this may, in turn, encourage them to further participate in the production of ILVs. Similar findings were earlier noted by Parraga (1990) who argued that food choices are primarily influenced by culture and people's beliefs about certain food.

Figure 4.2 further indicates that 94% of the respondents from the study area believed that ILVs have health benefits and very few (6%) of the respondents did not believe that ILVs have health benefits. These findings suggest that the majority of the respondents from the study area share positive perceptions of ILVs in terms of the health benefits of these vegetables; this may trigger their interest in participating in the production of ILVs.

With reference to the perception of ILVs as weeds, 36% of the respondents believed that ILVs are weeds that should be removed from the fields and about 64% of the respondents did not believe that ILVs are weeds. These results suggest a positive influence of this perception, in the study area, on participation in the production of ILVs.

The results reveal that 70% of the respondents did not believe that ILVs are food for backward people and 30% of the respondents believed that ILVs are food for backward

people. These findings suggest a positive influence on participation in the production of ILVs, which may cause individuals in the study area participate in the production thereof.

With reference to the perception of ILVs as food for poor people, 65% of the respondents did not believe that ILVs are food for poor people and 35% of the respondents believed that ILVs are food for poor people. These findings suggest that most of the respondents share a positive perception in this regard. The results also reveal that 54% of all the respondents did not believe that ILVs are food for older people while 46% of the respondents believed that ILVs are food for older people. These results suggest positive perceptions from the study area.

With reference to ILVs as food for rural people, 65% of all the respondents from the study area believed that ILVs are food for rural people while 35% of the respondents did not believe that ILVs are food for rural people. These findings suggest that most of the respondents share a negative perception of ILVs as food for rural people.

4.4 Summary

The majority of the people from the study area share positive perceptions regarding ILVs; this is in contrast to the suggestions forwarded in the literature on the subject. The two negative perceptions that are suggested from the study area are: (a) ILVs are food for rural people, and (b) ILVs compete for arable land. Thus far, these findings suggest that ILVs are very popular and positively perceived in rural areas.

4.5 Factors that influence participation in the production of ILVs

This section presents the econometric results of the determinants of participation in the production of ILVs. With regard to the model fit, the Lemeshow Godness-of-Fit test statistics was 1.00 implying that the model's estimates fit the data at an acceptable level. A pseudo R^2 was computed as a proxy estimate to R^2 in OLS regression which, according to Norusis (2004), measures the proportion of the variation in the response that is explained by the model. In this study, *Nagelkerke* R^2 of 0.611 was obtained; this indicates that more of the variation was explained by the model with an overall prediction percentage of 84.5, as shown in Table 4.3 below.

Table 4.3: Determinants of participation in the production of ILVs

Independent Variables		β	SE	Sig.
Constant	β_0	1.674	2.268	0.460
Perception related factors				
a) CFL (ILVs compete for land)	β_1	.155	.272	.568
b) NUT (ILVs are nutritious)	β_2	2.222	.745	.003*
c) CUL (ILVs are influenced by cultural beliefs)	β_3	-.767	.374	.040*
d) HEA (ILVs have health benefits)	β_4	2.111	1.047	.044*
e) WED (ILVs are weeds)	β_5	-3.259	.537	.000**
f) PAL (ILVs have a palatable taste)	β_6	2.555	.427	.000**
g) F4BP (ILVs are food for backward people)	β_7	-2.153	.427	.000**
h) F4PP (ILVs are food for poor people)	β_8	-2.001	.374	.000**
i) F4OP (ILVs are food for older people)	β_9	-1.791	.313	.000**
j) F4RP (ILVs are food for rural people)	β_{10}	-1.455	.290	.000**
Socio-economic factors				
a) GENDER	β_{11}	-.464	.279	.096
b) AGE	β_{12}			.164
AGE (<25)	β_{12a}	.727	.570	.202
AGE (26-35)	β_{12b}	.139	.430	.747
AGE (36-46)	β_{12c}	-.566	.382	.138
AGE (>47 years)	β_{12d}	.085	.379	.823
c) EDUCATION	β_{13}			.904
EDUCATION (no education)	β_{13a}	20.625	9748.321	.998
EDUCATION (primary education)	β_{13b}	20.854	9748.321	.998
EDUCATION (secondary education)	β_{13c}	20.866	9748.321	.998
d) INCOME	β_{14}			.024*
INCOME (<R1000)	β_{14a}	2.185	.727	.003*
INCOME (R1000-R3000)	β_{14b}	1.358	.649	.036*
INCOME (>R3000)	β_{14c}	1.364	.665	.040*
e) HHS (House hold size)	β_{15}	.043	.053	.418
Institutional related factors				
a) ATM (Access to market)	β_{16}	1.111	.308	.000**
b) DTM (Distance to market)	β_{17}	-1.466	.332	.000**
c) ATE (Access to extension)	β_{18}	-.283	.329	.391

d) ATC (Access to credit)	β_{19}	.023	.318	.943
e) ATL (Access to arable land)	β_{20}	.528	.447	.238
f) ORG (Membership of CBOs)	β_{21}	.949	.287	.001*
Model Summary				
1) Chi-Square (df = 21)				141.115
2) (-2) Log Likelihood				172.484
3) Accuracy of prediction: Overall (%)				84.5
4) Nagelkerke R ²				0.611

Note: ** and * indicate significance at 0.01 and 0.05 probability levels, respectively.

From the twenty one predictor variables fitted in the binary logistic regression model, thirteen variables had a significant impact on influencing households' participation in the production of ILVs, while eight variables were not significant.

Of the thirteen significant predictor variables, six variables had positive signs, implying an increase in either of these variables would be associated with an increase in households' participation level in the production of ILVs and the other seven (ILVs are influenced by cultural beliefs, ILVs are weeds, ILVs are food for backward people, ILVs are for poor people, ILVs are for older people, ILVs are for rural people and distance to market) had negative signs meaning an increase in either of these variables would be associated with a decrease in participation level as shown in Table 4.3.

4.5.1 Perception related factors

(a) Nutrition

Perceptions related to the nutritional value of ILVs were considered to influence participation in the production of ILVs. The model results confirmed a positive significant association between the perception that ILVs are nutritious vegetables and participation in their production. These results reveal that households are likely to consider ILV production if they believe that ILVs have nutritional benefits. These findings, therefore, suggest that there may be sufficient evidence to claim that ILV production may be positively supported as long as rural households continue to share positive nutritional beliefs regarding ILVs. In light of this, the observed association may be based on the assumption that production is driven by the desire to address nutritional deficiency.

(b) Cultural and religious merits

With reference to cultural beliefs and religious merits, the model results confirmed a negative association between the perception that ILVs have cultural and religious merits and their production. The implied message is that, as long as communities believe that ILVs are connected to cultural issues, this may discourage them from participation in the production of ILVs. Previous studies support these findings (Parranga, 1990) by arguing that food choices are mostly influenced by culture and people's beliefs about certain food.

(c) Health benefits

The model results reveal a positive significant association between health perceptions and participation in the production of ILVs. These results suggest that households are more likely to consider ILV production when associated with health benefits. Thus far, ILV production may be positively supported if rural households continue to share the positive health beliefs of ILVs. In this regard, production may be driven by the desire to maintain a healthy living.

(d) ILVs as weeds

With reference to the perception that ILVs are weeds, the model results indicate a negative association. These findings suggest that, if communities continue to believe that ILVs are weeds that need to be removed from the fields, they are likely to be discouraged in their production. Several previous studies support these findings (South African National Department of Agriculture (DoA), 2004; Janseen Van Rensburg *et al.*, 2007) by arguing that the fact that ILVs are being treated as weeds resulted in South African researchers and policy makers ignoring these types of leafy vegetables and promoting the increased production of exotic vegetables.

(e) Palatability

The study confirmed a positive significant association between the perception that ILVs have a palatable taste and participation in ILV production. These results reveal that households are likely to consider ILV production as long as they believe that ILVs have a palatable taste. These findings, therefore, suggest that there may be sufficient

evidence to claim that ILV production may be positively supported if rural households continue to share positive palatable taste beliefs regarding ILVs.

(f) ILVs as food for backward people

The model results also confirm a negative association between the perception that ILVs are food for backward people and the production of ILVs. These findings suggest that, as long as communities believe that ILVs are food for backward people, this may discourage them from participation in the production of ILVs. Similar comparable findings were noted by Jansen Van Rensburg *et al.* (2007) who argued that, in most areas, indigenous vegetables are associated with poverty. This has resulted in most people not using indigenous vegetables because they do not want to be described as old fashioned.

(g) ILVs as poor man's food

With reference to the perception that ILVs are food for poor people, the model results confirm a negative association as summarized in Table 4.3. The implication here is that the continued existence of this perception in our communities may further discourage the production of ILVs.

(h) ILVs as food for older people

The model results further confirm a negative association between the perception that ILVs are food for older people and production of ILVs. These findings suggest negative implications of such perceptions for the production of ILVs.

(i) ILVs as food for rural people

Lastly, with reference to perceptual factors, the model results confirm a negative association between the perception that ILVs are food for rural people and the production of ILVs. These findings suggest that, as long as communities perceive ILVs as food for rural people, they may be discouraged from participation in their production. This may lead to low participation in the production of ILVs which may increase food insecurity in these communities.

4.5.2 Socio-economic factors

(a) Income

The model results confirm a positive association between income and participation in the production of ILVs at all levels of income, as summarised in Table 4.3 below. These results suggest that as income increases, the production of ILVs also increases. Based on these results, and the consumption of ILVs in the area, one may assume that farmers produce more of these vegetables for both subsistence consumption and for local markets and, thus, generate an income through the high demand response from consumers. This may encourage these farmers to produce more of these vegetables as they may earn an extra income from them.

4.5.3 Institutional related factors

(a) Access to market

The results confirm a positive significant association between access to market and participation in ILV production. The results suggest that communities are likely to consider ILV production, as long as they have access to market for such products. These findings, therefore, suggest that ILV production may be market driven, where production is motivated by producing more of these vegetables for subsistence use and for commercial purposes.

(b) Distance to market for ILVs

The model results confirm a negative significant association between distance to market and participation in ILV production. These findings further reinforce the notion that ILV production may be more market driven where farmers are likely to consider ILV production, if they have closer markets for selling their ILVs.

(c) Membership of Community Based Organisations (CBOs)

A positive significant association was confirmed between membership of community based organisations and participation in ILV production. These results reveal that communities are likely to consider ILV production as long as they belong to community based organizations (CBOs) like farming clubs or projects. The observed association

may be based on the assumption that production may be driven by forces behind social networks as local club members share more benefits associated with ILVs.

4.5.4 Summary

In summary, from the descriptive and econometric results presented here, several messages emerge from the study. Firstly, the production of ILVs is primarily conditioned by perceptions and institutional factors rather than the socio-economic attributes of farmers. Since ILVs are non-conventional crops, farmers are more likely to have mixed perceptions that may condition their participation in producing these kinds of crops. Secondly, descriptive results reveal that rural farmers generally share positive perceptions regarding ILVs. Furthermore, the model results indicate that positive perceptions positively influence production while negative perceptions have the potential to discourage production. Thirdly, institutional support in the form of market access, distance to market and membership to local farming social networks are also crucial production drivers. Thus, the promotion of ILV production may require a supportive market platform and increased educational awareness campaigns on the benefits of ILVs in order to create positive attitudes and dispel fears and myths surrounding ILVs as potential complementary vegetables to the current existing conventional list.

4.6 Contribution of indigenous leafy vegetables to household food security

This section presents the results regarding the contribution of indigenous leafy vegetables to household food security. Two food security proxy measures, Household Dietary Diversity Score (HDDS) and Household Food Insecurity Access Score (HFIAS), were used in this study, as explained in the methodology section of Chapter 3 of this study.

4.6.1 Food groups consumed in the study area

This section focuses on reported food groups from the study area, based on a 24-hour dietary recall. Figure 4.3, below, presents the results of the reported food groups from the study area by participation status. The distribution reveals that the following food

groups were common for both categories: food group 1 (100%), food group 11 (90%), food group 12 (91%).

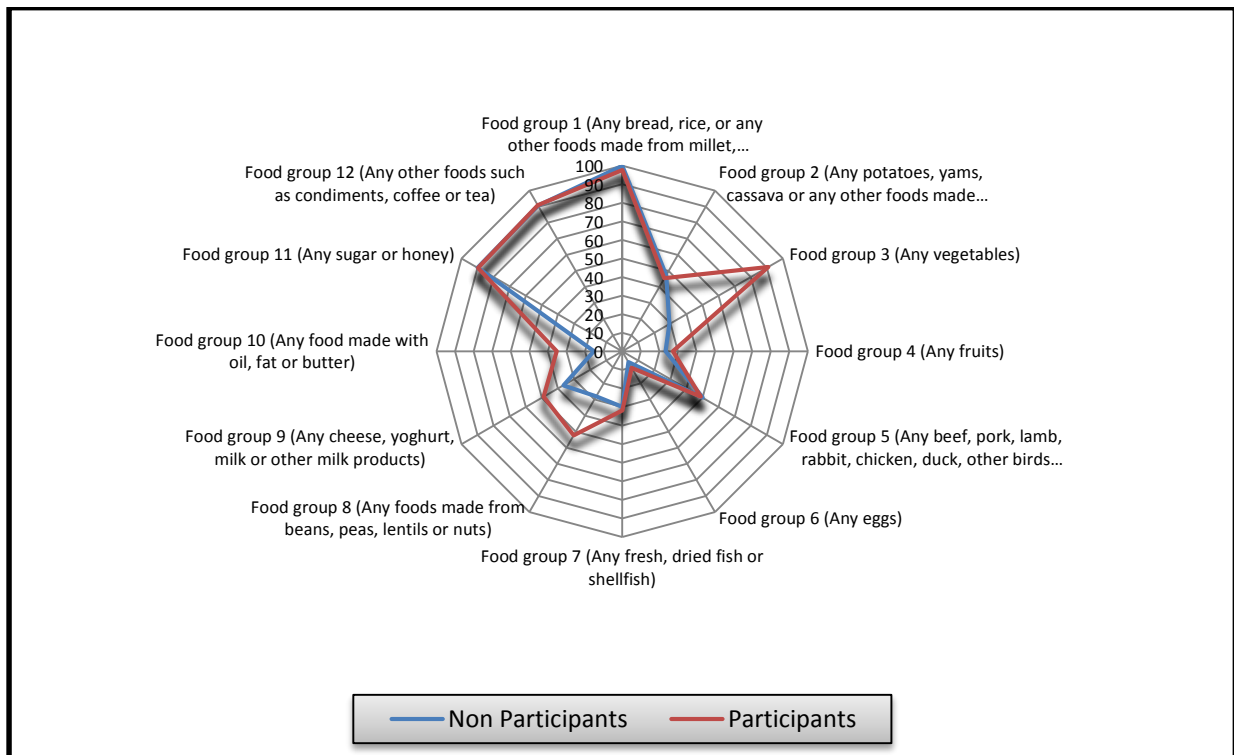


Figure 4.3: Food groups consumed from the study area

Food group 3 (vegetables) is of particular interest here as a huge difference was noted between the two groups, where vegetables were very popular among participants (91%) and not popular for non-participants (30%). This distribution suggests that rural diets are dominated by food groups which are rich in starch, sugar and condiments. Similar comparable observations were also noted by several authors (Ruel *et al.*, 2004; Taruvinga *et al.*, 2013). These results further suggest that participation in ILV production may improve rural household diets in the following food groups: group 3 (vegetables), group 8 (food made from beans, peas, lentil or nuts) and group 10 (food made of oils, fat or butter).

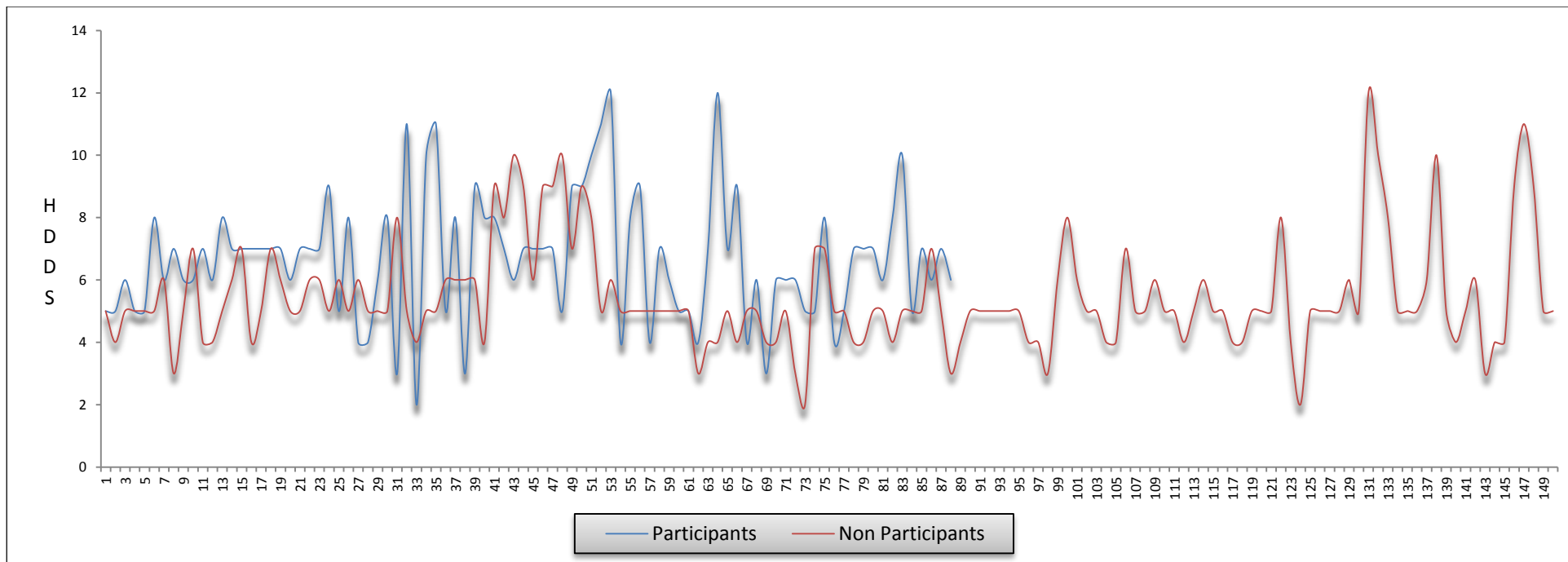
The next section presents the results on the contribution of indigenous leafy vegetables to Household Dietary Diversity Score (HDDS) from the study area.

4.6.2 Contribution of indigenous leafy vegetables to food security using HHDS measure

In this section, the study paired participants to non-participants in terms of their HDDS. Figure 4.4, below, presents a consolidated summary of the calculated HDDS for both categories. The results from the upper panel graph reveal that, on average, participants (7) had a higher HDD score compared to their non-participant counterparts (5). On the lower panel table, the study estimated the food security status of the two groups using HDDS as a proxy measure of food security.

Although the results are not conclusive, they indicate that the two groups were classified in the moderately food secure category. These findings suggest that both groups had a medium dietary diversity. Although the two groups were classified in the same category (medium dietary diversity), the results further reveal that participants had a higher HDDS of 7 compared to an HDDS of 5 for non-participants. Participation in the production of ILVs may, therefore, positively contribute to household food security. Similar comparable findings were previously noted by Modi *et al.* (2006) who suggest that micro-nutrient intake can be improved if the production and consumption of indigenous crops is increased.

The following section presents the results on the contribution of Indigenous Leafy Vegetables to HFIAS from the study area.



	Low Dietary Diversity	Medium Dietary Diversity	High Dietary Diversity
Dietary Diversity Score	0 - 4	5 - 8	9 - 12
Participants		7	
Non-Participants		5	
Food security proxy	Insecure	Moderately secure	Secure

Figure 4.4: Observed Household Dietary Diversity Score (HDDS) by participation status of respondents

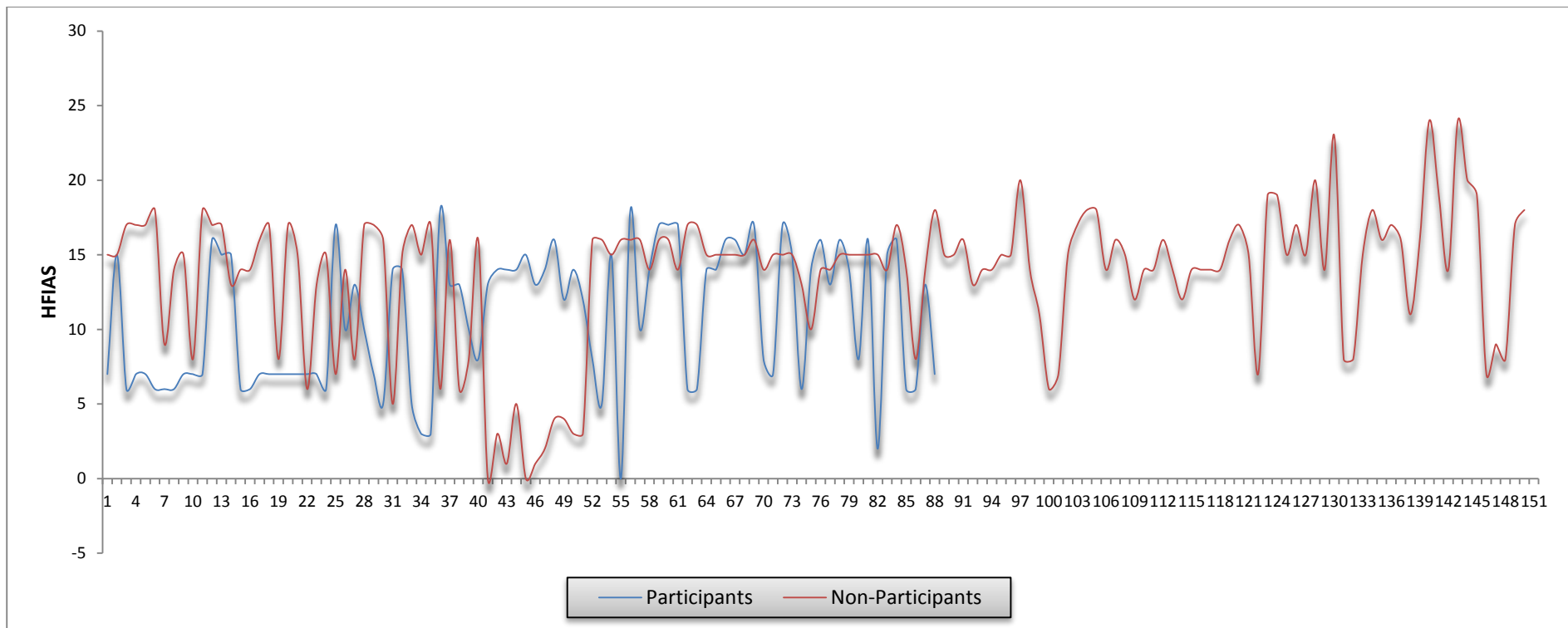
4.6.3 Contribution of indigenous leafy vegetables to food security using HFIAS measure

In this section, the study provides the results regarding the estimated contribution of ILVs towards addressing household food insecurity. As highlighted in the methodology chapter: the higher the HFIAS, the more food insecurity a household would have experienced and the lower the score, the less food insecurity a household would have experienced (Coates *et al.*, 2006). Figure 4.5 presents the observed Household Food Insecurity Access Score (HFIAS) by participation status of respondents.

The results displayed in the upper panel of Figure 4.5 indicate a lower HFIAS for participants compared to non-participants. The lower panel table results endorse the upper panel results (participants HFIAS = 10.7; non-participants HFIAS = 13.6). By classification, these results suggest that both groups can be classified as moderately food insecure. Although not conclusive, these findings suggest that participation in ILV production may positively contribute to a lower HFIAS that may mean household food security. Similar comparable findings were noted by Vorster *et al.* (2007), who argue that promoting production and the use of indigenous vegetables may help diversify the food on the plate and encourage food security.

Descriptive results suggest that there may be a difference between the food security status of participants and non-participants which is worth further probing, using econometric estimation. In the next section, two linear regression model results are presented for the purpose of estimating the significance and direction of influence of participation in ILV production and household food security, using HDDS and HFIAS as proxy measures of food security. In other words, the two models estimated the determinants of household food security where participation in ILV production was considered a dummy predictor variable, together with other socio-economic and institutional factors.

The next section presents the results on the determinants of household food security among ILV participants and non-participants from the study area.



HFIAS score	Low	Medium	High
	0 - 9	10 - 18	19 - 27
a) Participants		10.7	
b) Non-Participants		13.6	
Food security Proxy	Less food insecure	Moderately food insecure	More food insecure

Figure 4.5: Observed Household Food Insecurity Scale (HFIAS) score by participation status of respondents

4.6.4 Determinants of household food security among ILV participants and non-participants

The results, as presented in Table 4.4 below, were estimated using OLS in SPSS version 22. With reference to the overall fit of the models, it obtained R²; this suggests that the weighted combination of predictor variables was jointly significant in explaining each of the dependent variables in both models. The R² test statistic for HDDS and HFIAS were 0.621 and 0.573, respectively, as shown in Table 4.4.

Table 4.4: Determinants of household food security (HDDS & HFIAS)

Variables	Dependent Variable HDDS (Score)			Dependent Variable HFIAS (Score)		
	B	t	Sig.	B	t	Sig.
(Constant)	1.386	1.366	.173	14.961	5.977	.000
1) Part Dummy	1.727	7.956**	.000	-2.758	-4.574**	.000
2) Age	-.012	-1.467	.144	.004	.176	.861
3) Gender	-.072	-.347	.729	.507	.988	.324
4) Income	.940	6.318**	.000	-1.198	-3.021*	.003
5) Education	.443	3.002*	.003	-1.021	-2.760*	.006
6) Household Size	.012	.301	.764	.414	4.269	.000
7) Access to Market	.668	2.475*	.014	-.811	-1.206	.229
8) Access to Extension	.003	.009	.993	.552	.609	.543
9) Access to Credit	.251	.689	.491	.744	.831	.407
10) Access to land	.042	.108	.914	2.368	2.501*	.013
11) HDDS				-.807	-4.949**	.000
a) Number of Observations			238			238
b) F			16.476			16.995
c) Sig. F			.000			.000
d) R ²			.621			.573

Notes: ** and * indicates significance at 0.01 and 0.05 probability levels, respectively

From the eleven predictor variables fitted in the first linear regression model for HDDS, four variables (Part dummy, level of income, education and market access) had a significant impact on influencing households' food security. For the second linear regression model for HFIAS, five variables (Part dummy, income, education, access to land and HDDS) had a significant impact on influencing household food security.

Of the four significant predictor variables in the first model (HDDS), all variables (part dummy, income, education and access to market) had positive signs, implying an increase in either of these variables would be associated with an increase in Household

food security Of the five significant independent variables in the second model (HFIAS) one variable (access to land) had a positive sign, meaning an increase in this variable is associated with household food insecurity (food insecure) and the other four variables (part dummy, income, education and HDDS) had negative signs implying that an increase in either of these variables is associated with a decrease in household food insecurity (food secure).

4.6.4.1 Part dummy (participation in ILVs production)

Participation in ILVs was estimated to have an influence on HDDS and HFIAS proxy measures of household food security in this study. Model results confirmed that the participation in ILV production is positively associated to HDDS. These findings imply that increased household participation in ILVs is likely to lead to their food security, based on the HDDS standards. Similar comparable results were previously noted by Kalaba *et al.* (2009) who suggest that increasing the production of ILVs by rural communities could be used as a strategy to improve food security for people living in rural areas.

With reference to HFIAS, a negative association was confirmed. This implies that the increased household participation in ILV production is more likely to reduce their food insecurity, based on the HFIAS standards. The observed association may be based on the notion that participation in the production of ILVs is driven by the need to address nutritional balance which may contribute to household food security. Similar comparable findings were earlier noted by Frison *et al.* (2010) and Mavengahama *et al.* (2013) who state that although ILVs may be consumed in small quantities by many rural households; they influence the intake of cereal staples, manage hunger and play a central role in household food security for the poorer rural communities.

4.6.4.2 Level of income

The results reveal a positive association between level of income and HDDS. These results suggest that the higher a household's income the more likely it is to have a more diversified diet, which may translate to food security. The assumption may be that the higher the income of households the higher their chances of getting resources which may improve their daily nutrient intake and diversify the food on their table.

Several comparable studies suggest a positive association between income and dietary diversity (Theile and Finke, 1983; Pollack, 2001; Regmi, 2001; Ruel, 2002; Rashid *et al.*, 2006; Taruvinga *et al.*, 2013).

The model results also confirmed that level of income is negatively correlated to HFIAS, which means that a higher household income the lower their likelihood of food insecurity. These results suggest that a high income level may mean food security amongst households. This may be based on the assumption that households with a high income may have the means to acquire food sources that may help in improving their daily diets and diversifying food groups, which will eventually lead to food security.

4.6.4.3 Level of education

Level of education was also estimated as a critical factor that may influence household food security. The model results confirmed that education is positively associated to HDDS, which means that the more educated households are, the more likely they are to be food secure. These findings suggest that educated households are more likely to have a high HDDS compared to their uneducated counterparts. This may be influenced by the fact that educated households normally have better job skills which lead them to getting better job opportunities with a fair income. In addition, educated households normally make informed decisions when it comes to their food choices and diversity. This eventually broadens their food choices and diversity as well as their purchasing power. Previous studies support these findings (Thiele and Weiss, 2003; Taruvinga *et al.*, 2013).

With reference to HFIAS, a negative association was confirmed between level of education and HFIAS, suggesting that households which have a higher level of education are less likely to be food insecure. The reason for this may be that educated people, unlike uneducated people, have a better understanding of food groups to consume in order to have a balanced nutritional diet and they may also have the means to obtain such varieties of food. This results in food diversity and better food security for households.

4.6.4.4 Access to market

Access to market is positively associated to HDDS which means that households which have access to food markets are more likely to have a wider choice of food groups. These findings suggest that households who have access to food markets are in a better position to obtain a variety of food groups that would help them increase their dietary diversity and improve their household food security.

4.6.4.5 Access to land

The model results reveal that access to land is positively associated to HFIAS; this means that households which have access to are more likely to be food insecure. These results unmask the unproductive nature of rural arable land and its diminishing role in addressing rural household food security in its current state. This may also imply that food security issues in rural areas are, of late, more defined by other off-farm activities. Several authors acknowledge that, while many households in rural areas are involved in farm activities, many get the bulk of their incomes from non-farm activities and, recently, the latter has been viewed as an important pathway out of rural poverty (Reardon, 1997; Bryceson and Jamal, 1997; Rosenzweig, 1988; Kimhi, 2000; Ellis, 2000; Barrett *et al.*, 2001; Lanjouw, 2001; Ruben and Van den Berg, 2001; de Janvry and Sadoulet, 2001; Haggblade *et al.*, 2007; World Bank, 2008; Chikwama, 2010; Zahonogo, 2011). (f) Household Dietary Diversity Score (HDDS)

Lastly, the study estimated a possible link between the two proxy measures of food security used (HDDS and HFIAS). The model results reveal a negative significant correlation between HDDS and HFIAS. These findings uncover the positive contribution of a diversified diet towards addressing household food insecurity. These results suggest that households that have diverse diets are more likely to be less food insecure. The implication of this is that the two proxy measures of food security complement one another in such a way that by addressing household dietary diversity, households will also address household food insecurity.

4.7 Summary

The following messages emerge from the results: firstly, rural diets are dominated by staple starch food groups which seriously affect the dietary diversity of rural communities. Participation in the production of ILVs may have the potential to improve the diversity of rural diets in the following food groups; 3 (vegetables), 8 (beans, peas, lentils and nuts), and 10 (oils, fat and butter), possibly because of their influence on the higher intake of other food groups. As they promote higher intake of other food groups, ILVs ultimately reduce the level of household food insecurity. Secondly, HDDS and HFIAS seem to be more conditioned by participation in ILV production, income, education and institutional factors like access to food markets. Therefore, a food security strategy that targets the promotion of ILV production and is supported by markets, education and improvement of rural household income may go a long way towards addressing rural household food security. Thirdly, the observed positive influence of access to land and food insecurity suggests the diminishing role of rural arable land and the emerging role of other off-farm activities towards addressing rural household food security; this is worth understanding and promoting to complete on-farm activities. Fourthly, policy and investment strategies that promote HDD are more likely to address household food security.

Chapter 5

Research Summary, Conclusions and Policy Recommendations

5.0 Introduction

This chapter summarizes and concludes this study. The chapter is organized in such a way that it first presents a one-on-one mapping of the major objectives outlined in the first chapter to the major findings inferred from the analytical chapters. This will lead to the general conclusion of the study and highlight policy recommendations.

5.1 Research Summary

This section summarizes the major findings from the analytical chapter in order to make inferences regarding the major hypotheses and thesis of the study. The broad objective of this study was to investigate factors that influence participation in the production of Indigenous Leafy Vegetables (ILVs) and its contribution to household food security. In pursuit of this objective, the study focused on the following specific objectives:

The first specific objective was to assess smallholder farmers' perceptions of and most cultivated indigenous leafy vegetables. The fundamental hypothesis to this objective was that smallholder farmers have positive perceptions of, and commonly cultivate the following ILVs; amaranth and black jack. Major findings drawn from the analytical chapters were that the majority of the people from the study area share positive perceptions of, and cultivate the following ILVs; amaranth, black jack, spider plant, chinese cabbage, pumpkin leaves, pigweed, chenopodium album, night shade and goose foot. These findings therefore suggest that ILVs are very popular and positively perceived in rural areas.

The second specific objective was to investigate the factors that influence smallholder farmers' participation in the production of indigenous leafy vegetables. The fundamental hypothesis to this objective was that socio-economic factors such as level of education, gender, level of income and age are some of the factors that influence smallholder farmers' participation in the production of ILVs. Major findings drawn from the analytical chapters were that the production of ILVs is significantly conditioned by

perceptions and institutional factors rather than socio-economic characteristics. The major conclusion inferred was that positive perceptions, if promoted and widely shared in communities, may have a positive influence on production while negative perceptions may have the potential to discourage production. Moreover, institutional support in the form of market access, distance to market and membership of local farming social networks may be crucial production drivers worth promoting.

Thirdly, the study focused on investigating the contribution of indigenous leafy vegetables to household food security through assessing its link to the Household Dietary Diversity Score (HDDS) and Household Food Insecurity Access Score (HFIAS). The principal hypothesis to this objective was that participation in the production of ILVs will positively contribute to household food security. Descriptive results indicated that participation in the production of ILVs leads to a higher HDDS and a lower HFIAS. The Regression estimates further revealed that participation positively contributes to a higher HDDS and a lower HFIAS; which suggests that households that participate in ILV production are more likely to be food secure than those that do not. The main conclusion, therefore, was that participation in the production of ILVs has significant potential to address household food security.

5.2 Conclusions

The study concludes that ILVs are very popular in rural areas and people share positive perceptions with regard to ILVs. The study also concludes that production of ILVs is primarily conditioned by perceptions and institutional factors rather than the socio-economic characteristics of farmers. With reference to institutional and economic factors that condition farmers' participation, the study concludes that the following factors positively influence production: membership of community based organizations (CBOs), access to market and income. It has also been concluded that distance to market negatively conditions participation in the production of ILVs. Perceptions related to palatability, health benefits and nutrition also positively influence participation, while perceptions related to ILVs as food for rural people, food for older people, food for poor people, food for backward people, ILVs as weeds that must be removed from farmers' fields and the association of ILVs with cultural beliefs all negatively influence production. With regard to the contribution of ILV production to

household food security, the study concludes that participation leads to a higher Household Dietary Diversity Score (HDDS) and a lower Household Food Insecurity Access Scale (HFIAS). Thus far, the study concludes that farmers who participate in ILV production are more likely to be food secure than non-participants.

The study, therefore, calls for the promotion of ILV production as a household food security strategy.

5.3 Policy Recommendations

From the literature reviewed and the study results, it is evident that ILVs have the potential to play a major role in improving the diversity of diets of communities while ensuring household food security. To achieve this, existing perceptions and institutional influences need to be addressed to create a supportive environment to drive production. This is summarized in the ensuing discussion.

Given that production seems to be positively conditioned by perceptions related to nutrition and health, more scientific research on the nutritional and health benefits of ILVs may be required to substantiate and support current nutritional and health perceptions if these perceptions are to be shared with the wider community as an awareness strategy to garner support. In the same vein, more research may be required to improve ILVs' palatability for purposes of backing-up claimed palatability perceptions.

Several negative perceptions were identified in this study as capable of discouraging production. In light of this, awareness campaigns targeting such perceptions should be part of the content of current and future extension messages to be shared with farmers for the purpose of dispelling fears and myths.

Production is also driven by availability and distance to markets, as revealed by this study. Public policies that promote the creation of rural food markets that accommodate ILVs are more likely to enhance the production and availability of such vegetables in markets for consumer access.

Lastly, the model results revealed the power of social networks in promoting participation as farmers share benefits, production and market information. In this

respect, to complement extension services, public policies and investments that promote the creation and operations of Community Based Organizations (CBOs) may go a long way towards promoting the production of ILVs.

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Appendix A: Questionnaire

Research Title: The production of Indigenous Leafy Vegetables (ILVs) and their contribution to household food security: Evidence from Coffee Bay, Eastern Cape Province of South Africa.

Background Information:

Anele Mayekiso is a postgraduate student from University of Fort Hare currently conducting research on "*The production of Indigenous Leafy Vegetables (ILVs) and its contribution to household food security*". Your responses will be treated as confidential information and within the ethics of research for purposes of research and only for research.

General Information

Enumerator's name.....

Name of the village.....

Date.....

Section A: demographics of the farmers/households

1. Gender

Male	Female
------	--------

2. Age

1. ≤ 25	2. 26-35	3. 36-46	4. 47-56	5. > 56
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3. Level of education

1. Never went to school	
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2.Primary education	
3. Secondary education	

4. Level of Income (per month)

1.<R1000	2.R1000-R3000	3.>R3000
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5. Household size.....

Section B: participation in the production of ILVs

1. Do you participate in the production of ILVs?

Yes	No
-----	----

2. If No, what are the reasons for not cultivating ILVs?

1. There is no need since they occur natural	
2. Do not know how to cultivate them	
3. Lack of seeds	
4. Never thought of it	
5. They are not easy to cultivate	
6. Do not eat them	

3. If yes, how long you have been participating?

1. Less than a year	
2. One year	
3. 3years	
4. Over 5years	

4. How big is the area that you cultivate ILVs on?

<input type="checkbox"/> ≤0.5 ha	<input type="checkbox"/> 1ha	<input type="checkbox"/> >1.5ha
----------------------------------	------------------------------	---------------------------------

5. What are the most cultivated ILVs in this area? List them

.....

.....

.....

.....

6. Are there special tools used in production of ILVs?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

7. Are there certain soils or places that ILVs grow?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

If yes, please describe.....

8. Do you feed your ILVs?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

If yes, with what?

1. Cattle Manure	<input type="checkbox"/>
2. Fertilizer	<input type="checkbox"/>
3. Compost	<input type="checkbox"/>
4. Other (specify)	<input type="checkbox"/>

9. Do you irrigate your ILVs?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

10. What time of the year are ILVs cultivated?

1. Summer	
2. Winter	
3. Spring	
4. Autumn	

11. Where do you get seeds or seedlings for ILVs?

1. Collect ILVs from own field	
2. From NGO's	
3. From friends	
4. Purchase	
5. Department Of Agriculture	
6. Others (specify)	

12. Do you have access to the following institutional factors? Mark with an X

Factors	No	Yes
a. Access to market for ILVs		
b. Access to extension services related to ILVs		
c. Access to credit		
d. Access to arable land		

f. Ownership status of arable land

Own	lease	borrowed
-----	-------	----------

g. Size of owned arable land

< 0.5 ha	1ha	1.5ha	>2ha
----------	-----	-------	------

h. Distance to nearby market/town

1. <20km	2. <40km	3. <50km
----------	----------	----------

i. Are you a member of any farmer organisation?

Yes	No
-----	----

13. Do the following perception factors affect your participation in the production of ILVs? Mark with an X a Yes or No for an answer.

Factors	No	Yes
a. Do you believe ILVs Compete for land?		
b. Do you believe ILVs are Nutritious?		
c. Do you believe ILVs have cultural / religious merits?		
d. Do you believe ILVs have health benefits?		
e. Do you believe ILVs are weeds that must be removed from the fields?		
f. Do you believe ILVs have a palatable taste?		
g. Do you believe ILVs is food for backward people?		
h. Do you believe ILVs is food for the poor?		
i. Do you believe ILVs is food for the old people?		
j. Do you believe ILVs is food for rural people?		

Section C: Contribution of ILVs to household food security.

1. Recall all foods eaten and beverages taken in the previous twenty-four hours.

Food groups	Points
13. Any bread, rice, or any other foods made from millet, sorghum, maize, wheat or any other locally available grain	
14. Any potatoes, yams, cassava or any other foods made from roots or tubers	
15. Any vegetables	

16. Any fruits	
17. Any beef, pork, lamb, rabbit, chicken, duck, other birds and organ meats	
18. Any eggs	
19. Any fresh, dried fish or shellfish	
20. Any foods made from beans, peas and lentils	
21. Any yoghurt, milk or milk product	
22. Any food made with oil, fat or butter	
23. Any sugar	
24. Any food such as coffee or tea	
Total	

Key: if the answer is yes award 1 point and if the answer is no award 0 point.

2. Household Food Insecurity Access Scale (HFIAS).

Questions	Response options: 0=Never 1=Rarely (once or twice in the past 30 days) 2=Sometimes (three to ten times in the past 30 days) 3=Often (more than 10 times in the past 30 days).
1. Did you worry that your household would not have enough food?	
2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	
3. Did you or any household member eat just a few kinds of food day after day due to a lack of resources?	
4. Did you or any household member eat food that you preferred not to eat because a lack of resources to obtain other types of food?	
5. Did you or any household member eat a smaller meal than you felt you needed because there was not enough food?	
6. Did you or any other household member eat fewer meals in a day because there was not enough food?	

7. Was there ever no food at all in your household because there were not resources to get more?	
8. Did you or any household member go to sleep at night hungry because there was not enough food?	
9. Did you or any household member go a whole day without eating anything because there was not enough food?	

THANK YOU FOR PARTICIPATING IN THIS STUDY!!!!!!!!!!!!

Appendix B: Ethical clearance certificate



University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE REC-270710-028-RA Level 01

Certificate Reference Number: MUS131SMAY01

Project title: **Factors that influence smallholder farmers participation in the production of Indigenous Leafy Vegetables (ILVs) and its contribution to household food security: Evidence from Mapuzi village, Coffee Bay, Eastern Cape**

Nature of Project: Masters

Principal Researcher: Anele Mayekiso

Supervisor: Prof A Mushunje

Co-supervisor:

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

The Principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

Special conditions: Research that includes children as per the official regulations of the act must take the following into account:

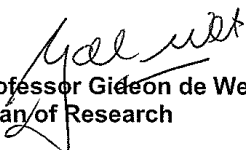
Note: The UREC is aware of the provisions of s71 of the National Health Act 61 of 2003 and that matters pertaining to obtaining the Minister's consent are under discussion and remain unresolved. Nonetheless, as was decided at a meeting between the National Health Research Ethics Committee and stakeholders on 6 June 2013, university ethics committees may continue to grant ethical clearance for research involving children without the Minister's consent, provided that the prescripts of the previous rules have been met. This certificate is granted in terms of this agreement.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
 - Any unethical principal or practices are revealed or suspected
 - Relevant information has been withheld or misrepresented
 - Regulatory changes of whatsoever nature so require
 - The conditions contained in the Certificate have not been adhered to
- Request access to any information or data at any time during the course or after completion of the project.
- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office

The Ethics Committee wished you well in your research.

Yours sincerely


Professor Gideon de Wet
Dean of Research

13 March 2015