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The role and production of traditional leafy vegetables in three rural communities in South Africa

by

Halina Johanna Vorster

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ABSTRACT

Traditional leafy vegetables (TLVs) have formed a part of rural household food security strategies for generations. In an effort understand their role in household food security, the role and production of TLVs (*morogo/ miroho/imifino*) were determined in three culturally and agro-ecologically diverse rural communities in South Africa. A questionnaire survey was combined with qualitative methodologies to access the indigenous knowledge associated with the utilisation and production of these crops.

TLV production is a female-oriented agricultural activity, as households mainly utilise TLVs for household consumption. Marketing of mainly dried TLVs was limited and income generated from these sales was used to complement household income. The importance of the different TLVs for household consumption varies according to the specific socio-economic situation of the household at a specific time, although they are very important in the period just before other crops are harvested.

Cultural beliefs and taboo's associated with agricultural activities were reported widely. Expenditure on agricultural inputs is low in all three villages. TLVs are commonly intercropped with maize, therefore their production and management practices are linked with maize. Uncultivated TLVs are generally harvested from maize fields and fallow lands. Variations between the villages were found for seedbed preparation, pest control management, fertilisation and irrigation practices. Interactions between crops in the production system and varieties produced had an influence on production decisions made.

The socio-economic conditions of households determined the growth stages at which TLVs were harvested. Villages differed with regard to the TLVs mixed into a dish, the proportions of the different TLVs and the plant parts harvested (seed, stalks, flowers, growth points and fruit). Differences in preparation methods of

crops existed and were reflected in the preparation method (frying, boiling), type of dish prepared (relish, incorporated into the porridge) and additions to dishes (adding of ash, peanut flour, bicarbonate of soda, mashed pumpkin seed, exotic vegetables, flowers and immature or mature fruit).

The types of TLVs dried, preservation methods utilised, storage management and length of storage varied considerably between the three villages. Most of the dried TLVs were stored for up to one year, but the bulk was used within six months. Cowpea was perceived as an ideal dried crop for drought survival strategies as the dried leaves have a long shelf life.

Villagers perceived TLVs to be nutritious, but it was not promoted amoungst vulnerable groups. The loss of indigenous knowledge (IK) was identified as a possible cause for this. The decline in utilisation of TLVs found in all three villages is mainly due to poor production systems (drought, low soil fertility, loss of IK and lack of seed). Seed systems for uncultivated plants were unstructured, although the older women had very sophisticated knowledge about seed quality.

Differences in the utilisation and production of TLVs were found between the three villages. The main contributing factors towards the utilisation differences are caused by the climate and degree of indigenous knowledge in a specific area. Production differences are influenced by the bio-physical and socio-economic elements in the area.

DECLARATION

I, Halina Johanna Vorster, hereby declare that the thesis for the MSc Agric. degree at the University of Pretoria, hereby submitted by me, has not previously been submitted for a degree at this or any other university, and it is my own work in design and execution and that all reference material contained therein has been acknowledged.

…….
Signature

Date
…….

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GLOSSARY

ALV	African leafy vegetable. Also TLV.
Amaranth	*Amaranthus* spp., thepe, cheke, imbuya
Blackjack	*Bidens pilosa*, muxidji, monyane, uqadolo
Cleome	*Cleome gynandra*, lerotho, bangala, xibangala, spider plant
Corchorus	*Corchorus* spp., guxe, thelele
Cowpea	*Vigna unguilata*, msoni, monawa
FAO	Food and Agriculture Organisation of the United Nations
GRAIN	Genetic Resources Action International
IDS	Institute of Development Studies
IIRR	International Institute for Rural Reconstruction
IK	Indigenous knowledge
Imifino	Local name for leafy vegetables
IPGRI	International Plant Genetic Resources Institute, now Bioversity International
Morogo/ marog	Local name for leafy vegetables
NRF	National Research Foundation
PRA	Participatory rural appraisal
RRA	Rapid rural appraisal
Self seeding	Natural seed distribution methods of a plant
TLV	Traditional leafy vegetable

CHAPTER 1

INTRODUCTION

About 30 000 edible plants are found throughout the world, of which 7 000 are grown or collected as food (Natarajan 2002). About 3 000 plant species have been commercialised but only about 20 are consumed on a large scale. About 80% of the world energy intake is supplied by 15 species of plants and animals. Many of these 15 are not as nutritious as many of the other available. The focus on these 15 species has, however, led to genetic erosion, loss of associated indigenous knowledge and underutilisation of many food plants (Maundu, Ngugi & Kabuye 1999). As these mainstream foods have become more popular, they have replaced many locally used crops. This has led to the loss of these crops in many communities (e.g. millet and sorghum in many African communities were replaced by maize), as well as the knowledge that was associated with these plants. Decreasing food choice and inadequate prioritisation of balanced nutrition is causing a nutritional dilemma in many countries (Mnzava 1997), including South Africa. Reliance on introduced crops that are growing at the limits of their distribution increases the risk of famine in times of drought, as they are more likely to fail than the traditional crops (FAO 1988). Informal production systems have, and still are, regularly helping overcome disasters (Mooney 1992).

In the last few decades great changes have taken place in South Africa. Urbanisation, migrant labour, greater access to health care and education, a greater effort to shift farmers from subsistence to cash cropping, increased population pressures and environmental degradation have led to changes in the socio-cultural and environmental environments of many people. These changes have severely eroded the indigenous knowledge base (Hart & Vorster 2006, Van Wyk & Gericke 2003, Vorster & Jansen van Rensburg 2005). Modi, Modi and Hendriks (2006) found in a study in Ezigeni, KwaZulu-Natal, that there was a loss

of knowledge about the plants in the younger age groups and suggested that education is very important in an attempt to prevent this loss of indigenous knowledge of these food crops. Hart and Vorster (2006) noted similar findings in the Letsitele area while Vorster and Jansen van Rensburg (2005) also noted this in the Lusikisiki and Qunu areas in the Eastern Cape. The introduction of social grants has severely affected the agricultural activities in many villages in the Eastern Cape region, with many people now preferring to buy staples, rather than to grow or harvest them (Vorster & Jansen van Rensburg 2005).

The International Plant Genetic Resources Institute (IPGRI, previously known as IBPGR and now known as Bioversity International) has, since the 1990s initiated efforts to integrate 'socio-economic and cultural aspects' of plant genetic resources into its genetic diversity program. Hodgkin and Raov (1992) state that this is in response to:

> *'… a growing concern that indigenous knowledge of cultivated and wild species is being rapidly lost. As societies change, in many cases the younger generations do not acquire the knowledge of their elders.'*

In an effort to find out what the potential of traditional leafy vegetables are to help increase food security in vulnerable groups (especially women and children), IPGRI initiated a study in five African countries (Kenya, Senegal, South Africa, Tanzania, Uganda). A situation analysis determining the use, conservation, production and sales of these crops in the rural areas was needed to determine the way forward in an effort to use the locally adapted crops to help improve food security for these vulnerable groups. The aim of this study is to determine the role and production of traditional leafy vegetables (*morogo/ miroho/imifino*) in three culturally and agro-ecologically diverse rural communities in South Africa.

In Chapter Two the role of traditional foods in Africa and South Africa is discussed. The potential of traditional foods in helping to address South Africa's nutritional needs and the linkage between traditional food crops and indigenous

knowledge highlights the vulnerability of both the crops and the indigenous knowledge associated with them. The basic concept of farming systems in Africa and the different aspects that are an integral part of theses systems are described.

Chapter Three describes the research methodology used during this study. Qualitative and quantitative methods were used to access the data on the utilisation and production of traditional leafy vegetables and these are discussed.

Chapter Four discusses the ethnic and agro-ecological background of each of the research areas in which the villages are found.

The results and discussions are split into two chapters. Due to the unfamiliarity of many of these crops, the utilisation aspects of the traditional leafy vegetables are discussed before the production systems in an effort to minimise duplication. Chapter Five reports the utilisation and sales of traditional leafy vegetables found in the three areas. Chapter Six reports the production systems in which traditional leafy vegetables are found in the three villages.

The conclusions and recommendations from this situation analysis are discussed in Chapter Seven.

CHAPTER 2

THEORETICAL RATIONALE

Morogo is a daily food, but meat is a visitor.- Pedi saying

2.1 INTRODUCTION

In this chapter a brief overview is given on several aspects of food crops and their use in Africa. The current situation of traditional food plants used in South Africa, what they are and their potential to help address the nutritional problems experienced are discussed.

2.2 TRADITIONAL FOOD PLANTS

Food plants are crops that grow wild or are cultivated and which are gathered or harvested for food within a particular ecosystem. Most of the traditional leafy vegetables (TLVs) are ruderals that commonly increase in areas with disturbed soils or agricultural activity (Cunningham 1988). Wild foods grow naturally in the bush and do not have to be tended for them to produce edible parts. Semi-wild or semi-cultivated foods are protected when they grow close to the home. Cultivated plants have originated from the previous two types and are cultivated. Plants have been essential for human existence for millennia. They are sources of food in the form of leaves, seed, berries, fruit, roots, tubers, stems, rhizomes and to a lesser degree gums. Plants also provide for the other needs of mankind in the form of shelter, fuel, medicine and fibre, to name but a few (Maundu *et al.* 1999, Van Wyk & Gericke 2003).

According to the FAO (1988), traditional vegetables are all plants whose leaves, roots or fruits are acceptable and used as vegetables by rural and urban communities through tradition, custom and habit. They were widely consumed, especially during famines or natural disasters. Traditional vegetables might not be indigenous to a country, but they can be associated with traditional production

systems, local knowledge and usually have a long history of local selection and usage (Keller, Mndiga & Maass 2004) and are described as indigenized foods (Phillips-Howard 1999). Traditional leafy vegetables (also known as African leafy vegetables or ALVs) are indigenous or traditional vegetables whose leaves, young shoots and flowers are consumed (Chweya & Eyzaguire 1999, Maundu 1997).

2.2.1 Traditional food plants in Africa

Agricultural research has been informal for thousands of years with “Third World” farmers leading agricultural research most of the time. Eastern farmers showed European farmers how to sow seed by 4000 BC, years after they had started the practice (Maundu 1997). Between the seventh and eleventh centuries Eastern farmers introduced and adapted a vast range of new crops and cropping systems that enabled them to increase their yields fourfold. Europeans then moved from sowing a field every second year to sowing winter and summer crops (Maundu 1997). The dominance of Eastern farmers has, however, shifted to European domination and has led to development of innovations and its dissemination to other continents, including Africa.

The age of discoveries and colonialism has not only influenced politics, economics and geography, but also the distribution of plants and animals. New species of crops and weeds moved with man over land and sea, with some of these crops becoming very important to local people. Exchange between communities occurred mainly during trade, famine and intermarriages. This contact increased the diversity of species and also the habit of eating vegetables. Early contact with Asian and Arabic traders has had a profound effect on what the coastal communities consumed. Latin American introductions such as potatoes, pumpkins, sweet potatoes, maize, cassava and madumbe (taro) happened during these early introductions (Maundu 1997). African farmers

acquired cassava and maize from Portuguese adventurers, and adapted them to the diverse conditions in Africa.

At the beginning of the twentieth century African food resources still came from wild, semi-cultivated and cultivated plants, thus diets were very diverse. The cultivated and semi-cultivated plants mainly provided the staples, while the wild plants provided the condiments, fruits, drinks and accessory foods. Wild and cultivated species provided the relishes that were to be eaten with the carbohydrate staples. These plants, together with the exotic crops that were introduced between the eighth and mid-twentieth century (maize, potatoes, cassava, rice, sweet potatoes, bananas and plantain), formed part of the daily diet. These crops were readily adopted where it fit in well with the local environment and food cultures (Frison, Johns, Cherfas, Eyzaguirre & Smith 2005).

In the 1970s and 1980s there was a strong tendency to replace the traditional farming systems with western farming systems that focus on a few grain crops (FAO 1988). Utilisation of traditional crops declined after the introduction of exotic species and caused a shift to growing crops that suit urban tastes or have a potential for export (FAO 1988, Mnzava 1997). This change led farmers to follow monocropping practices to ensure good yields of staples and cash crops and discouraged intercropping which subsequently led to a decrease in crop varieties (Frison *et al.* 2005) and dietary simplification.

Traditional vegetables play a role in nutrition, food security and culture and can provide employment opportunities (FAO 1985, Mnzava 1997, Mertz, Lykke & Reenberg 2001). The shift from agriculture as purely a fulfilment of the need to eat, towards an income generation activity has had severe effects on the diversity of crops and good nutrition. Crops are produced on their ability to sell, not their nutritional value. Use of wild resources for food has been an underestimated economic activity in rural communities (Turner 2004). Currently

there is a movement towards a more diversified food basket by doing research on the under-utilised crops, including the traditional foods such as leafy vegetables (Smith & Eyzaguirre 2007). The reduction or disappearance of some of these traditional vegetables have also encouraged research to be done on these under-utilised crops and wild plants that are such an important part of the livelihoods of many rural people (Chweya & Eyzaguirre 1999, Lykke, Mertz & Ganaba 2002).

Women's role in food production, water and fuel supply has been essential as they are the original food producers world wide and still play an important role in food production systems in the developing world. Local knowledge about natural resources has been transmitted from one female generation to the next. A survey of advanced agricultural systems in the world (Shiva & Dankelman 1992) shows that one quarter of the systems have male and female sharing equally, half are the exclusive domain of females and just under one fifth are the exclusive domain of men. These figures highlight the mainly subsistence farming that is the domain of women within which the production of traditional leafy vegetables are found. Due to the power structures and different gender roles, men prefer cash crops (crops produced almost exclusively for sales), whereas women look to the welfare returns for their families. The women are the target groups for discovering the utilisation and production of TLVs as they are still mainly subsistence crops (Nguni & Mwila 2007, Stokoe 2000, Maundu 1997).

Western Kenyan villages have been using TLVs for generations (Grubben & Denton, 2004). Cowpea (*Vigna unguiculata*) is one of the most important legumes mainly cultivated for seed but also very popular as a vegetable. As in South Africa they also experience lack of available fresh leaves due to seasonality (Muchoki, Imungi & Lamuka 2007). Constraints experienced by these communities in Western Kenya include pests and diseases, poor seed quality, drought, lack of transport to markets, poor marketing channels, lack of agronomic and utilization packages. Abukutsa-Onyango (2007) suggested the promotion

and improvement of cleome, cowpeas, pumpkin leaves, vegetable amaranths, slenderleaf, jute mallow, African kale and African nightshade for their potential as commercial crops. Nightshade and cleome can be found on the supermarket shelves of Tanzania and Kenya (Weinberger & Msuya 2004). The potential of these plants has, however, been recognised by policymakers in Kenya, leading to renewed interest in these crops (Abukutsa-Onyango 2007a).

2.2.2 Traditional food plants in South Africa

South Africa is very rich in plant biodiversity and culture with many people still using plants to fulfil their food, shelter, water, fuel and medicinal needs (Van Wyk & Gericke 2003). The San were the original hunter-gatherers in South Africa, with the women supplementing the hunted meat with the gathered wild plants. Early record of the use of plants for food and drink has been recorded in journals of travellers from 1822.

Cereals and cereal products have formed the staple of people since ancient times. The cycle of sowing and harvesting has led to the incorporation of many cultural rituals to ensure crop success. Seeds and nuts are almost as important as cereal crops, with many legumes having seed that are directly consumed as food (Van Wyk & Gericke 2003).

There is a wide variety of wild fruits and berries during the year (Van Wyk & Gericke 2003). Children and adults commonly eat these fruits and berries when they are doing the various chores (collecting wood, herding, etc.) in the rural areas (Vorster & Jansen van Rensburg 2005, Maundu *et al.* 1999). Some fruits have become very important in the survival of local communities (tsamma for Bushmen in the Kalahari), while others also serve other purposes such as the containers formed from the dried fruit of the calabash (*Lagenaria siceraria*).

Underground organs of wild plants (rhizomes, tubers, stems, bulbs and roots) were widely used as a source of starch, and were often processed (Van Wyk & Gericke 2003). The higher yields and popular taste of sweet potatoes (*Ipomoea batatas*) and potatoes (*Solanum tuberosum*) have replaced many indigenous vegetables previously used as starch (Vorster & Jansen van Rensburg 2005).

Green vegetables are very important in the diet as they add important nutrients. They are rich in minerals, amino acids and vitamin A and C. Over 100 different species of plants are cooked as potherb/marog with maize meal (*Zea mays*) or eaten fresh as a snack (Whitbread 1986, Wehmeyer and Rose 1983, Levy, Weintroub & Fox 1936). Another way to prepare morogo is to cook it in a minimum amount of water and then crumble maize meal over it to make a thick paste. Different types of plants are commonly cooked together (Vorster & Jansen van Rensburg 2005). The leaves of a species or mixture of species used in this way are called morogo, miroho, wild spinach, African spinach, spinach or imfino.

Many traditional leafy vegetables grow wild, thus are accessible to all, including the poor (Mőnnig 1967). Broadcasting of some popular plants in homegardens and fields takes place in some areas, but this practice seems to be confined to the older women (Vorster & Jansen van Rensburg 2005). In some fields and gardens, women will weed all plants except preferred leafy vegetables, and will then not weed again (Hart & Vorster 2006). This practice probably gives a quicker harvest of the preferred crop as the competition is lower, and enables a second harvest when seed germinate with the others after the first weeding.

Rose and Guillarmod's (1974) work with the Xhosa in Transkei, showed the effect that increasing population, declining soil fertility and changes in circumstance had on the eating habits of Xhosa men. Where men preferred meat, beer and porridge, the women would supplement the leftovers with leafy vegetables for themselves and the children. With these changes taking place in the late 1960s, men started to use the leafy vegetables more.

2.2.3 The importance of traditional leafy vegetables

Traditional leafy vegetables have several advantages over the exotic crops that are promoted extensively by research and extension. TLVs have a short growing period as they can be harvested within 3-4 weeks, they can tolerate abiotic and biotic stress and they respond well to organic fertilisers (Maundu 1997). Many traditional crops grow in marginal areas, where exotic crops struggle to survive (Abukutsa-Onyango 2007b). The bulk of this production never reaches the market as they are mainly used for household consumption, leading to an underestimation of the importance of these crops to household food security (Hart & Vorster 2006, Shackleton, Dzerefos, Shackleton & Mathabela 1998). These crops are growing under rainfed conditions as intercrops with local staples in home gardens or fields, and management thereof is relatively low (Hart & Vorster 2006, Mnzava 1997). The TLV *Crotelaria brevidens* (also known as slenderleaf), has been found to encourage seed germination of *Striga hermonthica,* a cereal crop weed. The TLV is planted to let the striga germinate which then die, as they can not use slenderleaf as a host, thus reducing the striga seed density in the soil. Farmers then plant their maize crops (Abukutsa-Onyango 2004). With amaranth reported as a host for stemborers, which is a major pest in maize (Vorster, Jansen van Rensburg, Van Zijl & Venter 2007a), it could have a negative impact. There is an indication that amaranth might suppress nematodes in soils but researchers also report that *Amaranthus cruentus* is susceptible to root knot nematodes and could have a negative allelopathic effect on tomatoes (Van den Heever & Alleman, personal communication 2004).

Kordylas (1990) reported that traditional leafy vegetables are mainly consumed when fresh, but are preserved by using their traditional drying methods or using a solar method. TLVs are often used and make up a large percentage of the food intake, even if substitute products are for sale. This leads to an increase of

diversity of the diet (Hart & Vorster 2006, Shackleton *et al*. 1998), with those used as supplements adding flavour to dishes (Maundu *et al.* 1999).

Traditional foods contribute to household food supplies on a seasonal, emergency and supplemental basis (Rubaihayo 1997, Shackleton, Dzerefos, Shackleton & Mathabela 2000). Use of wild food during drought or in marginal areas increases and represents a part of the rural safety net against poverty and disaster (Shackleton 2003). Communities often face a shortage of vegetables during the dry season. Preservation of edible leaves is one of the strategies developed to help face these times of shortage (Mnzava 2005). During periods of unemployment (between jobs, after retrenchment) these plants become very important for the affected families (Dovie, Shackleton & Witkowski 2002). During the political upheaval in Transkei (from 1960s to 1990s), many villagers left the villages and fled to the forests where they survived on food collected from the veld and forests (Vorster & Jansen van Rensburg 2005). Leafy vegetables are very important to women and children in poor rural areas, as they are more dependent on the natural resource base. Morogo tend to be traded on an opportunistic basis and are highly seasonal (Shackleton, Shackleton, Netshiluvhi, Geach, Balance & Fairbanks 2002).

According to Mnzava (1997) improving the cultural practices, processing and status of the plants can improve the cash income and status of the plants. Lev (1981) states that food sometimes competes for resources and that the distinction between food and cash crops is sometimes very indistinct. Lev (1981) also states that cash income is sometimes converted to food and that these cases need to be studied on an individual basis as there is so much variety. He warns against the generalisation of these aspects. Harnmeijer & Waters-Bayer (1993) found that the increase in cash crop and modern foods production lowers the diversity on the plate. Pagezy (1985) found that small scale cash cropping helped to overcome the seasonal fluctuation of food supply by providing the cash to buy food during this time, thus overcoming the nutritional imbalance in the lean

periods. Some crops (amaranth, nightshade) that were traditionally women's crops and have become commercially viable have been taken over by men (Abukutsa-Onyango 2007, Nguni & Mwila 2007, Moore & Raymond 2006). This phenomenon could have a negative impact on both the nutritional status of the family, and the disposable income of the women.

In an effort to develop a holistic perspective on food the nutritional culture of a society needs to be connected to a scientific study of nutrients of the same society (Khare 19804). Fleuret and Fleuret (1980) suggest that traditional food systems are rational, well-balanced adaptations to the limitations that technology and the environment place on them and that the indigenous food systems provide the appropriate nutrients needed by the population by using a wide range of non-staple foods, especially edible greens.

Several studies report on the vulnerability of women and young children (especially female children) due to the marginalisation of their nutritional needs through indigenous food distribution practices (Berg 1981, Fleuret & Fleuret 1980). Poverty and hunger are closely related. Insufficient income leads to the inability to buy food while hunger contributes to poverty by lowering the effectiveness of the immune system (less resistant to disease), lowering labour productivity and having a negative effect on educational achievements (Dixon & Gulliver & Gibbon 2001).

2.2.4 Nutritional value of traditional leafy vegetables in South Africa

Kuhnlein and Receveur (1996) state that increased nutrition related diseases of some indigenous peoples had been linked to the loss of traditional food systems in these societies. Moore and Raymond (2006) found that 'modern' crops that are commonly less nutritious and poorly adapted to the marginal growing conditions TLVs are adapted to, replaced TLVs. The higher nutritional value of the traditional crops when compared to cash crops lead to greater nutritional

vulnerability in rural areas than in urban areas where other crops can be more easily purchased (Labadarios 2000, Labadarios & Van Middelkoop 1995). Increasing the availability and consumption of, and access to nutritional plants should be an important strategy in resource poor areas. Various traditional food plants have been analysed for nutrients, and have shown high nutritional contents for especially iron, zinc, vitamin A, C and E (Mnzava 1997, Kruger, Sayed, Langenhoven & Holing 1998), as well as folic acid (Tucker 1986). They are excellent sources of proteins, carbohydrates, minerals and vitamins for poor people. Based on the high nutritional content, availability and affordability of these traditional plants, crop production systems should increase the use of underutilised crops such as traditional food crops (Modi, Modi and Hendriks 2006, Nesamvuni, Steyn & Potgieter 2001, FAO 1997). Labadarios and Steyn (2001) suggest "one should guard against the exclusive promotion of 'exotic' fruits and vegetables, which could result in indigenous plants and their produce being regarded as inferior, even when many are nutritionally superior."

2.3 INDIGENOUS KNOWLEDGE

In the 1950s and 1960s development theorists saw indigenous knowledge as inferior, inefficient and as an obstacle to development (Agrawal 1995). During the 1980s a few social scientists started working in International Agricultural Research Centres and had a disproportionate influence to their numbers (Chambers 1994). They helped development professionals to appreciate the validity and richness of rural people's knowledge better (Brokensha, Warren & Werner 1980).

2.3.1 Understanding indigenous knowledge

Indigenous knowledge (IK) is also known as local knowledge, indigenous technical knowledge (ITK), sustainable knowledge, traditional knowledge,

people's knowledge, folk science, farmers' knowledge, cultural knowledge, ethnoscience, experiential knowledge, rural people's knowledge (RPK), folk agricultural knowledge, mêtis and traditional environmental knowledge to name but a few (Antweiler 2004, Ellen & Harris 2000, Sillitoe 2000, Waters-Bayer 1994). The use of these diverse terms and abbreviations reflect the different viewpoints and political agendas that come with these different uses (Ellen & Harris 2000, Antweiler 2004). Many authors are now starting to use the term indigenous knowledge (IK) and local knowledge interchangeably. ITK is a term used by many researchers and extension personnel, with it being used in the broad sense meaning indigenous knowledge, while many refer to it as the agricultural technical knowledge farmers have (Chambers, Pacey & Thrupp 1989, Mettrick 1997), thus a very narrow knowledge system. What is today being seen as indigenous knowledge has been in contact with western knowledge since the colonisation of the Europeans and the marketing links with the oriental knowledge of the Chinese for centuries.

Several organisations working with IK have defined indigenous knowledge in different ways. UNESCO, the World Bank, NRF in South Africa and various authors (Langill 1999, Grenier 1998, IIRR 1996, Haverkort 1993, Warren & McKiernan 1993, Warren 1991) have been discussing this concept for years. However, there are several interrelated aspects that seem to be specific to IK. These aspects are:

- It is locally bound and indigenous to a specific area.
- It is closely related to subsistence and survival for many.
- It is orally transmitted, or transmitted through imitation and demonstration, usually not documented.
- It is non-formal knowledge.
- It is culture and context specific.
- It is holistic, integrative.
- It is dynamic and adaptive.
- It does not believe in individualist values.

These aspects highlight the fact that indigenous knowledge is not equally spread (Ellen & Harris 2000, Howes & Chambers 1980, Swift 1979). Knowledge differs from individual to individual, with gender accounting for a large part of these differences. Other factors such as age, kinship, religion, wealth and ethnicity also contribute to the difference in knowledge (Grenier 1998, Howes & Chambers 1980). The majority's perception reflects the community's knowledge, with the deviation showing the individual's experiences that have modified their own perception. These individuals might be the people in the community who have expertise in certain areas (Quek 1997). Cultivating specific food and cash crops, collecting wild fruits and leaves, processing, preparing, processing and preserving food and caring for livestock are activities assigned to different age and gender groups (Friis-Hansen & Sthapit, 2000; Haverkort 1993). It is generally recognised that women often play a key role in domesticating wild species, selecting, processing, storing and exchanging seed. They commonly dominate the management of food crops that are primarily grown for household food consumption (Davidson 1993, Friis-Hansen & Sthapit, 2000).

Environmental, cultural, population and historical changes are challenging the flexibility and dynamic character of IK that enables it to change from within. In areas where the strong social organisation has broken down, some IK may survive but might not be relevant to the new organisational form that has usually been formed with outside help (Farrington & Martin 1988). Communities manipulate their social and natural environment to achieve a successful livelihood (Alcorn 1995), but IK can also internalise, adapt and use external knowledge (Sillitoe 2000, Grenier 1998, Richards 1985). There is now recognition that cultures are not only systems to perpetuate values, but also embody ways of knowing, organising and interacting with the environment. In spite of this increasing acknowledgement of diversity, racial and cultural intolerance is on the rise (Norgaard 1994).

2.3.2 Interface between traditional crops and indigenous knowledge of genetic resource conservation

Biodiversity is the source of food, shelter, medicine and industry. It is increasingly recognised that farmers play a crucial role in the conservation and management of genetic and other natural resources. Maintaining genetic diversity and species in fields is one of the best ways to create stable systems for rural farmers in marginal areas where they use low-input agriculture (Montecinos & Altieri 1992). If cultural recognition and continuous propagation favour the maintenance of that diversity, it would protect that variability (Abukutsa-Onyango 2007a, Nazarea 1998). This will ensure that the local varieties continue to evolve, thus retaining their value (Mooney 1992). The value of these plants lies in their genes as they have the potential to address agricultural, technological and medical problems (Natarajan 2002, Kiambi & Opole 1992, Mooney 1992). Weedy and wild relatives of crops often grow in wider ecological conditions than their cultivated relatives as they have a broader genetic basis that enable them to survive these harsh ecological extremes. Plant breeders and farmers have been using these genes to their advantage for generations, thus improving crops (Natarajan 2002, Montecinos & Altieri 1992).

Erosion of genetic diversity brings about loss of plant or animal species and leads to loss of associated knowledge of those species (GRAIN 1992). It also undermines food security and contributes to the powerlessness of farmers throughout the developing world (Salazar 1992). Much knowledge is being lost as the western ways are being adopted by the younger generation, thus affecting the transfer of oral traditions (Swift 1979). Maundu (1997) and Mathenge (1997) noticed that little knowledge is being passed from the more knowledgeable to the less knowledgeable in Kenya. There is an accompanying loss of landraces and other genetic diversity (sometimes species are lost), leading to a loss in associated knowledge (names, uses, etc.). Protection of indigenous knowledge, just as crop genetic resources, can not be done without protecting the agro-

ecosystem and the socio-cultural organization of the local people (Nazarea 1998, Agrawal 1995, Nabhan, House, Humberto, Hodson, Hernandez & Malda 1991).

Farmers are often losing control over their most important link in sustainable agriculture – their seeds. An important requirement for efficient crop production is good quality seed. Quality seed have the following characteristics: good germination rates, be free from soil-borne disease, and be available at the right time, affordable and available at the location where they are needed. Seed quality is affected by the agronomic practices used, the time of harvest (at what stage of maturity) and how the seeds are processed (Mnzava 1997). Farmers need to ensure that their seeds are well preserved to ensure their viability over time (Adebooye, Ajayi, Baidu-Forseon & Opabode 2005, David 2004). The relatively poor farm-level storage conditions on farms cause rapid seed deterioration, causing low germination rates and poor vigour (Schippers 2000). Losses at farmer level often lead to permanent losses as the strong regional preferences for indigenous vegetables make it uneconomical for seed companies to invest in seed production (David 2004), thus farmers are the only custodians of this seed.

In Kenya the introduction of new crops has dealt a serious blow to genetic resources. These crops undermine the traditional diets that were threatened by the erosion of cultures and traditions. Colonialists' denigration (seen as marginal, inferior and primitive) of traditional food crops led to their decreased use, especially with the 'modern' and 'educated' communities. Unique food crops are, however, still used in rural communities where women realise the nutritional value of these crops and use them to meet their family's nutritional needs (Kiambi & Opole 1992).

Traditional conservation systems have eroded due to (GRAIN 1992, Keller *et al.* 2004):

- Loss of IK associated with seed systems.

- Rural population growth leading to less land needing to produce more food.
- Increasingly lower soil fertility or soil degradation.
- Forces outside the small-scale farmers' control. These include political, economic and climatic aspects of the environment in which the farmer has to operate.
- Growing urban populations taking over agricultural land (Natarajan 2002)

2.4 FARMING SYSTEMS

Farming system research has shifted the focus of rural analysis from the farm to the household, ensuring that all aspects of farming and non-farming activities and non-agricultural objectives are taken into account (Low 1986). Research showed that male-headed households were not always informed about all aspects of the household economy. Since women had often been ignored, many activities such as food processing and minor crop production that were carried out by children and women were not captured (Babbie & Mouton 2001). This study is investigating farmer practices in terms of traditional leafy vegetables and how scientific knowledge can support indigenous knowledge in the production of some of these crops.

2.4.1 The concept of farming systems

"*A farming system … is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints*" (Dixon *et al.* 2001).

Within each farming system similar interventions and development strategies will be appropriate. The farm household as the centre of a network of resource allocation decisions is the focus of the current farming system approach (FSA). Farming systems can describe a few dozen to millions of households, depending on the scale of the analysis (Dixon *et al.* 2001).

As illustrated in Figure 2.1 a farm system collectively identifies the internal determinants of the household, its resources and resource flows and the interactions between these elements (Dixon *et al.* 2001; Haines 1982). These interactions are constantly changing, as a change in one area influences another. A farm may produce crops for generations, but the socio-economic and human elements constantly change. These interactions may have small effects or can affect the viability of such a farm (Haines 1982). Household livelihoods often consist of a range of interdependent production, post-harvest and harvesting processes. Off-farm incomes make a considerable contribution to many rural poor households (Dixon *et al.* 2001). External determinants such as policies, information, markets and so on have an influence on choices made and possibilities available to the households. The interaction between these external and internal factors determines the specific farming system a household adopts.

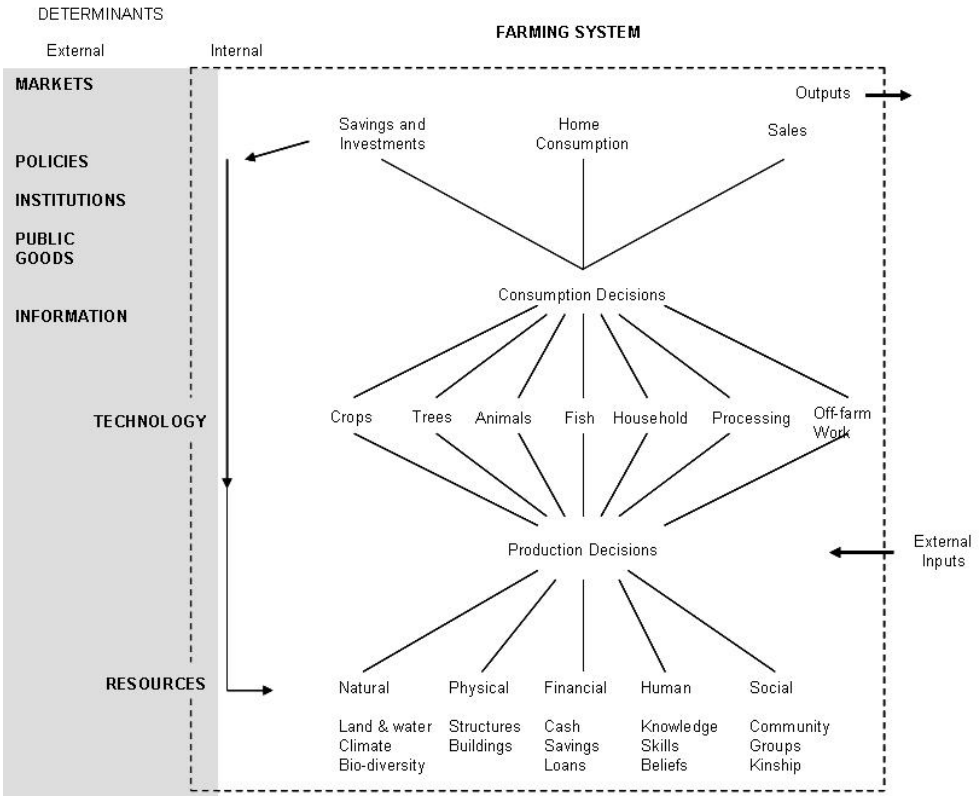


Figure 2. 1: Schematic representation of a farming system

Source: Dixon, Gulliver & Gibbon, 2001

Dixon & Gulliver (2003) state that a farming system perspective can be used to determine regional priorities, research and dissemination of best practice agendas, monitoring and impact assessment. They also suggest refining the farming systems to a lower level in an effort to help organisations make more informed development and dissemination choices. This is a powerful tool that can be used to reduce the poverty and hunger that affect so many of the rural poor (Dixon *et al.* 2001). For research to be done, the cropping system must be known in an effort to ensure that appropriate technologies are developed and adapted technologies are available to extension. The most recent work on sub-Saharan farming systems by Dixon *et al.* (2001) and Dixon & Gulliver (2003) were used as the main reference materials in an effort to discuss the recent farming systems developments.

2.4.2 Factors influencing farming systems

Agriculture has always been studied in the form of systems, with each farm existing within a complex of biophysical, socio-economic and human elements. The type of crop-animal system that has developed at a specific location is a function of the agro-ecological conditions. Climatic, biotic and edaphic factors are the deciding factors on the feasibility of crops and which crops. These will then influence the feeds that are available for animals and when (Ruthenberg 1980). As the rural population increases crop and livestock production are integrated in order to intensify output (Devendra & Thomas 2002).

2.4.2.1 Biophysical environment

The natural environment is agriculture's main resource and also its main constraint. Technologies and natural resources are mainly endogenous to the farming system. Biophysical factors tend to define the possibilities of agricultural

production that some farmers overcome by the use of socio-economic factors (such as capital and innovation in the form of technology) (Dixon & Gulliver 2003; Haines 1982). The natural factors that are important to agriculture are climate, air, soil and the genetic potential of crops and animals. Climate affects which crops can be and are grown due to the macroclimate (i.e. temperature) in a specific area, as well as the possible constraints due to the microclimate (i.e. high humidity due to close spacing) between the plants (FAO 1990; Haines 1982). Each plant has the ideal temperature at which it grows, water needs, day length (some are day length neutral) and tolerance to the effects of wind. The soil characteristics (depth, nutrient status, texture and structure), air quality (pollution, ventilation) and genetic potential (how far can the potential be adjusted by breeding) also influence the farming system (Dixon *et al.* 2001; FAO 1990; Haines 1982). Man has overcome various biological constraints (rainfall, pests and diseases, etc.) through breeding, rotation and so forth. There are, however, several non-biological constraints where the biological potential of a farm might not be reached through constraints in resources (such as labour). Different types of farming (livestock vs. crops) are sometimes not compatible due to man-made factors (no fencing around crops) (Haines 1982). Human intervention developed irrigation, planting of windbreaks, greenhouses, hydroponic techniques, ploughing, hybrids etc. to help overcome some of these problems. Land tenure and population growth will determine both the quantity and quality of the land available (Steyn 1988).

2.4.2.2 The human and social environment

These factors are mainly endogenous to the farming system. The knowledge systems used here are a mixture of both western knowledge (exotic crops) and indigenous knowledge (indigenous and naturalised crops). Labour availability can be influenced by the household size, composition and gender roles. The education level, nutritional status and health would also have an influence on the cost and quality of labour. The beliefs (norms, values, taboo's), groups and

kinships (family ties and group affiliations can increase access to resources and influence decisions at community level) within the area can affect the decisions made but also the possibilities that are available. The organisation of the community can have a vast influence on the farming systems in the community.

Farming systems' researchers have long realised that female-headed households have different priorities and resource constraints in comparison to male-headed households. Few have actually distinguished between the 'de jure' female-headed households of single, widowed or divorced women and the 'de facto' household where the husbands are absent. Within the 'de facto' female-headed household group, there are different types of decision-making processes, depending on the degree of absence and the influence the males have in decision making. These two factors are not correlated, and varies considerably (Mettrick 1997).

2.4.2.3 The socio-political and economic environment

The socio-political and economic environment is exogenous to the farming system. Prices of input costs, technology (fertiliser, mechanisation, varieties, etc.) and extension will determine what production systems are used and what levels of outputs are achieved (Steyn 1988). Agricultural training is also passed from one generation to the next, with extension (NGOs or governmental) providing many of the newer skills. Sales prices of products and markets will determine what is and what can be sold (Steyn 1988). Consumer preference plays an important part in both commercial and subsistence agriculture, as this is a major determining factor in what is planted and how much is planted. Consumer preference also influences the format in which the crop is sold, either unprocessed or in a processed form. Inflation, interest rates (on loans), labour costs, policies (land taxes, water policies, inheritance taxes, import and export taxes, subsidies, etc.), institutions, social pressure groups (anti-GM, animal rights, etc.), information, etc. have an influence on what type of farm system a

farmer opts for (Dixon *et al.* 2001; Haines 1982). Formal and informal credit will influence the capital available as running costs or fixed capital.

Dixon & Gulliver (2003) also stress the role of women in many aspects of farming systems and their contribution to the evolution of these systems. Aspects such as their role in production, processing, marketing of crops and their domestic responsibilities must not be ignored.

2.4.3 Major categories of farming systems

The farming system in which the household operates and the individual farm household's circumstances (includes the family's life cycle) accounted for most of the variation observed in farm management decisions (Dixon & Gulliver 2003; Haines 1982). Dixon & Gulliver (2003) adopted a livelihood approach in his definition of farming systems, thus they recognised multiple sources of income (cash crops, auto consumption, extractive natural resource activities, off-farm income, aquaculture) and the local institutional environment (resource sharing, credit, markets).

Dixon & Gulliver (2003) identified five important areas of rural change to develop a farming systems classification. The following key biophysical and socio-economic factors were identified:

- natural resources and climate,
- science and technology,
- trade liberalisation and market development, policies,
- institutions and public goods,
- information and human capital.

The development of the farming systems categories of developing areas have been based on (Dixon *et al.* 2001):

- available natural resource base: includes water; land; grazing areas and forest; climate; landscape; farm size; tenure and organisation;
- dominant pattern of farm activities and household livelihoods: includes field crops; livestock; trees; hunting and gathering; processing and off-farm activities; main technologies used that determine the production intensity and integration of crops, livestock and other activities.

Eight broad farming system categories were developed from these criteria (Dixon *et al.* 2001):

- Irrigated farming systems: includes a broad range of cash crop and food production
- Wetland rice-based farming systems: dependents upon monsoon rains that are supplemented by irrigation.
- Rainfed farming systems in humid areas of high resource potential: characterised by mixed crop-livestock systems or crop activity (especially root crops, cereals, industrial tree crops – smallholder and plantation; commercial horticulture).
- Rainfed farming systems in steep and highland areas: often mixed crop-livestock systems.
- Rainfed farming systems in dry or cold low potential areas: mixed crop-livestock and pastoral systems merge into often dispersed systems with very low current productivity or potential due to extreme aridity or cold.
- Dualistic (mixed large and small holder) farming systems: across a variety of ecologies and with diverse cropping patterns.
- Coastal artisanal fishing: often mixed farming systems.
- Urban based farming systems: usually focussed on livestock and horticultural production.

Dixon classified most of South Africa as dualistic, with small pockets of maize mixed systems in the Eastern Cape and a sparse (arid) system identified in the Kalahari. If the farming systems of small holder farmers should be looked at, it is

thought that the results would be very close to that described for the Eastern Cape, as maize is also a staple in these villages.

Where sufficient differences exist within a broad category sub-types can be characterised. This categorisation of farming systems by Dixon *et al.* (2000) was used in an effort to describe the predominant farming systems in the villages. The names of these categories reflect key distinguishing attributes (Dixon *et al.* 2001):

- Water resource availability: dry, irrigated, rainfed, moist.
- Climate: cold, temperate, tropical.
- Landscape relief/altitude: lowland, highland.
- Farm size: large, small holder.
- Production intensity: sparse, extensive, intensive.
- Dominant livelihood source: maize, root crop, tree crop, pastoral artisanal fishing.
- Dual crop livelihoods: cereal-root, rice-wheat (crop-livestock known as mixed).
- Location: forest based, urban, coastal.

There are generally no sharp distinctions between these different systems and they tend to merge with one another. In some cases very distinct transitional farming systems exist between two systems.

The farming systems approach is often used for global and regional strategy development. A huge potential exists for using this information at the sub-regional and national level in an effort to focus on strategy development, investment planning and in developing guidelines for the provision of services, technical assistance and technologies to rural areas. Two of the main factors affecting the strategy development based on these farming systems categories are the HIV/AIDS pandemic and migration of farmers to villages and cities. These factors affect the accuracy of future population trends and make the planning of the development of a region more difficult Dixon & Gulliver (2003).

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

Quantitative (questionnaire survey) and qualitative (RRA, PRA) methodologies were used to collect data on the utilisation and production of traditional leafy vegetables in three culturally and ecologically diverse areas.

3.2 THE RESEARCH AREAS

In an effort to look at the possible effect of culture and indigenous knowledge on the use and production of traditional leafy vegetables, ethnicity (see Appendix 2 for the distribution of the ethnic groups in South Africa) and agro-ecological zones were taken into consideration. Climate determines which crops will be found naturally in an area while ethnic preference and indigenous knowledge has an influence on if and how the plants are utilised and produced.

The following three areas were used in the study:

- Arthurstone: mild winters; frost uncommon; summer rainfall, summers very hot and humid; dominated by the Tsonga group.
- Mars and Glenroy: winters can become cold (frost not uncommon); summers dry and hot; low summer rainfall; dominated by the Sotho group. Due to the drought no observations could be made of the cropping systems as they had failed that year and limited production took place in the following three years. Descriptions of farming systems are based on descriptions provided by respondents.
- Watershed: cold to very cold winters, frost common, summer rainfall, summers very hot, dominated by the Nguni (Zulu) group.

Chapter Four has detailed descriptions of each research area. All relevant stakeholders (extension, community members, tribal authorities and political structures) were informed about the study, its objectives and how the study would be conducted. An open communication channel exists to keep all informed and copies of reports were handed to all stakeholders. The qualitative process was very extractive in the beginning, but as trust and respect between community members and the research team developed, participation grew.

3.3 THE QUANTITATIVE APPROACH

The questionnaire was used to collect relevant data from the villagers. Documentation of extractive and enriching research can increase public awareness of indigenous innovation and knowledge. Several authors warn about the warping effect of categorisation commonly associated with questionnaires and the western way of thinking on the values and interpretations of indigenous people's knowledge (Sillitoe 2000, Thrupp 1989, Howes & Chambers 1980). This can lead to misrepresentation of the knowledge as well as to overlooking important issues for local people due to our predisposition of thinking certain things are more important.

3.3.1 Validity and reliability of the quantitative survey

In an effort to increase the reliability and validity of the data the effects that researchers, participants, measuring instruments and context have on the quality of data were taken into account. Administering questionnaires in the home environment minimised unwillingness to participate (Johnson, 1992) and the effect of the environment. Having mainly women interviewing women during the questionnaires circumvented sexual differences and enabled the women to talk freely. Enumerator teams consisting of a woman and a man reported more reticence from the woman being interviewed. There were not enough women in the area who had the correct qualities needed, thus men were also included in

Watershed and Mars/Glenroy. In these mixed teams female enumerators interviewed respondents while male enumerators wrote wrote down the answers. This already made a dramatic difference as the respondents tended to 'forget' about the male enumerator as they became more involved with the questionnaire. These male enumerators left the interview when rituals and taboos were discussed. The sensitivity of the subject prevented women from discussing taboos and beliefs in a mixed sex group.

3.3.2 The questionnaire survey

Good questionnaire design and administration is critical and can affect the usefulness and value of the study when the results are interpreted.

3.3.2.1 Design of the questionnaire

The questionnaire was designed according to the problem tree methods proposed by Fink (1995), with mainly closed questions that were based on the opinions of key informants. The qualitative study had almost been completed by the time the questionnaire was developed. The information that was gathered through these activities was used to help develop the questionnaire. A problem tree was developed that addressed all of the objectives that needed to be answered by the questionnaire. These objectives were broken down into questions that needed to be answered to address these specific objectives. As Leedy and Ormrod (1993) suggested, several questions were discussed with experts (sociologist, extension personnel, researchers) to ensure that they measured the objectives accurately. Questions were very specific to minimise possible misunderstanding between enumerator and respondent (Maundu 1995). Open questions were used in areas where answers were expected to be variable. The area of study (TLVs) was new to the researcher, thus semi-structured key informant interviews, as suggested by Nazarea (1998), were used to understand the subject better and to develop the questionnaire.

The National Botanical Institute and reference books on local plants were extensively used as sources for plant identification and distribution. Census data was used to help understand the community and population better. As suggested by King (2000), information was gathered from local experts, reference book gathered from these different sources helped in the planning of the quantitative and qualitative study.

The logical flow of thinking of respondents led to the division of the questionnaire into several distinct sections (Appendix 1):

- Basic demographic information.
- Information on cropping systems.
- Cultivation practices for traditional leafy vegetables (TLVs).
- Utilisation of the five most important TLVs in a household.
- The role of gender on cultivation and use of TLVs.
- Storage practices of TLVs.
- Marketing of TLVs.
- Perceptions on utilisation, conservation and growth patterns of TLVs, use and production of TLVs and post-harvest practices.

In an effort to limit the “don’t know” answer (Webb, Campbell, Schwartz & Sechrest 1966) the importance of the respondents’ information was emphasised during the survey and discussions. The topics were kept as interesting as possible and threatening questions (income, rituals, taboos) were kept to the end of the data gathering process (Mouton and Marais 1993). As early as 1937, Sletto found that respondents would rather agree than disagree (Mouton & Marais 1993), thus such questions were avoided.

Matrix questions were included where uses, preparation and seed systems were discussed as the same types of answers were expected. This saved space (no endless turning of pages that would encourage respondent fatigue), were easier to complete and saved time. The questions asked respondents to describe

certain aspects and the enumerators ticked off what was mentioned. An example of this kind of question is where they were asked which parts they harvested and used of the five main crops important for their household. As these questions were short and asked based on the discussion group information, it did not force a set of responses to fit or foster response-set (answering in a pattern) (Babbie & Mouton 2001).

3.3.2.2 Testing of the questionnaire

Several questions were tested at the research institute (ARC-VOPI) before the testing of the complete questionnaire took place. Since several respondents found the questions about income rather threatening, thie question was also intensely discussed with a social scientist, community members and development workers. This led to the inclusion of an additional question addressing household income. The question was in an open-ended response format, and was acceptable during the pre-testing of the questionnaire. It was found that people tended not to mind giving bits of information about money, as long as they were not directly asked in which income category their income fell. By getting total average expenses for food, schooling, clothing, farming and other costs per month, as well as the savings made by the individual, a probably more accurate estimation of income could be established.

The instruments measuring for effects used in the questionnaire were addressed by doing a pilot study. After codifying of the questionnaire it was pre-tested with women of two different language groups at the institute as suggested by Babbie and Mouton (2001). Results from this pilot study led to the shortening of the questionnaire, rephrasing questions to improve effectiveness, eliminating poorly understood scales, and shifting the sensitive questions (income, rituals, taboo's) to the end of the questionnaire to enable the male enumerator counterparts (where present) to leave.

3.3.2.3 Sampling

The target population is the households in the individual villages. Many authors suggest specifying what exactly is understood by the phrase 'household', as several interpretations of the term exist (Fink 2003, McGivern 2003, Millat-e-Mustafa 2000). The use of the term 'household' (sampling unit) in this context means all the people who eat from the same pot, a description suggested by King (2000). The unit of measure is the person in the household who usually cooks (three or more times per week) for the household. The unit of measure was expected to be mainly female (generally women cook), generally of non-school going age (expect it to be mothers and grandmothers) with varying degrees of wealth and status (due to the sampling method) and possibly high illiteracy rates (McGivern 2003) within the community.

The sample was taken as large as possible, taking into account the constraints of finances, time and personnel (Murphy and Sprey 1982). Systematic sampling (Fink 2003, Leedy & Ormrod 1993, Richards 1979) was used to identify the respondents in the three villages, as sampling frames were difficult to obtain and not very complete. All the villages had rich and poor households living next to each other, thus there were no clusters of richer or poorer households in the villages. A sample size in the three areas of 80 respondents were selected based on:

- Arthurstone consists of 1300 registered households. After several discussions with villagers and extension personnel it was found that 800 households are regarded as belonging to Arthustone, while the rest are new or illegal immigrants from neighbouring countries. In an effort not to capture data of newly established households that do not know the area or where language problems (immigrants) might exist. Every tenth household was sampled. In this area the groups participating in the discussion groups were large and representative of the area.

- In Watershed the community members identified a number of about 250 households. The exact number of households was difficult to determine as the local boundaries had just been shifted and nobody could be found who knew exactly how many households were in the newly demarcated area. Relatively small groups participated in the group discussions. Group members indicated that there were differences within the community based on where in the community they lived and their kinship. The geographic difference caused by the ridge and diversity of agriculture observed due to this ridge necessitated a larger sample. It was decided to also administer 80 questionnaires and every third household was sampled.
- In Mars and Glenroy 250 households were identified for both communities. They are dominated by two ethnic groups, thus a sample of at least 20% was decided upon in an effort to capture this diversity. It was decided to administer 80 questionnaires and every third household was sampled.

The resource map drawn by the community during the PRA was used to help with the sampling of respondents. In each village there were four groups of enumerators, thus the community was divided into four equal sizes in terms of number of households. A pre-determined starting point was given to each enumerator group and the determination of the next household to be sampled was discussed in detail, thus ensuring that they understood the sampling process and could continue from there.

Absent respondents were approached during the week-end for an appointment for the interview. After three unsuccessful attempts time constraints determined that the next house would then be interviewed. This only happened once in Arthurtsone. In Mars/Glenroy a traditional healer refused to partake in the process, leading to the inclusion of the next household. No problems were experienced in Watershed.

3.3.2.4 Choice and training of enumerators

Local extension officers sourced people with the following characteristics to act enumerators as suggested by several studies (Grenier 1998, Davidson 1993, Mouton & Marais 1993, Babbie 2005):

- preferably female (since most respondents would be female),
- of the same ethnic group as the villagers,
- with good English language skills (read, write),
- late twenties and older (not too young that older ladies see them as children and thus not respond well to questions asked),
- good confidence levels (be able to interview strangers).

In each area eight enumerators were trained on all aspects of administering and finalising a questionnaire successfully. The unfamiliarity of enumerators with questionnaire administration led to training being done in five days over a two-week period, thus allowing enumerators to practice before the final training day. Misconceptions and problems were addressed during this training as the subject is quite complex and there were several unknown aspects. Enumerators were trained extensively on each question to ensure that they understood the reasoning behind the questions, thus enabling them to explain the questions further where needed. The age of many respondents were expected to be quite high, therefore this training of enumerators was thought to be important. Feedback from enumerators agreed with this viewpoint, as they had to explain many of the questions in more detail to the older respondents. In Mars and Glenroy interviewers were not very familiar with the villages and were orientated by the local extension officer of the village.

3.3.2.5 Administering the questionnaire

The questionnaires were administered between March and May 2002. The local council, extension personnel and other organisations active in the area were

informed about the survey, what the purpose of the survey was and what they could expect from the findings. The enumerator groups were well trained to answer questions about the survey, what it meant and why it was done. This helped respondents to understand and take part in the survey. The reasons for some villagers taking part and others not (sampling) were also carefully explained in an effort to enable them to answer these questions from villagers.

In South Africa the infrastructure, literacy rates and services in a target area should help determine how a questionnaire is completed, with face-to-face interviews suggested in low literacy areas (Babbie & Mouton 2001). The three study areas were found to be low-literacy areas, thus the group interview method where people complete their own questionnaires (Lategan and Düvel 1992) was not feasible.

As the person mainly responsible for cooking (usually women) was targeted for the interviews, enumerators were taught how to approach the households to enable them to get access to the right person. This was extremely important, especially where the head of the household was present when enumerators were approaching a homestead, as personal experience showed that slighting a male could lead to refusal to interviews.

Respondents decided on the time and place of the interview, thus ensuring higher willingness to participate as tasks such as keeping an eye on the children or cooking activities were not interrupted. The interview ranged from sixty to ninety minutes in length, depending on the talkativeness of the respondent and the amount of information shared. Where respondents did not have time an arrangement was made for a more convenient time.

3.3.2.6 Data analysis

Enumerators and a field supervisor checked questionnaires before they were coded. The raw data was entered into an Excel worksheet and checked. The data was cleaned by the Department of Statistics and kept in three different files, one for each village. The SAS version 8.2 statistical package was used to analyse the data. The dominant analysis of data was descriptive statistics. The X^2 test was used to test associations between various variables, including household profiles, income and area cultivated.

3.4 THE QUALITATIVE APPROACH

The same three communities participated in the questionnaire surveys and in the group discussions. Existing agricultural groups were used in the beginning, with other interested parties also joining. As time went by a new traditional leafy vegetable group formed from this conglomerate of groups. The high level of illiteracy, sensitivity of certain subjects (rituals, etc.) and difficulty to describe certain processes or reasoning made the use of qualitative techniques valuable. These techniques enabled the researchers, for whom TLVs were a new area of research, to become familiar with the various aspects of TLVs.

3.4.1 Selection of qualitative techniques

The objectives of the study were clearly stated and the questions that needed to be answered were identified and formalised in the form of a checklist that was used during the fieldwork. The questions were continually revised as new information was collected. The discussions took place from spring (August) 2001 to the beginning of winter (May) 2002, thus incorporating a whole crop cycle. Keeping the topics as close to what was happening helped women to show-and-tell when they found it difficult to describe. Methods of harvesting, preparation and seed systems were some of the difficult activities for the women to verbalise. The following RRA and PRA tools (Grenier 1998, Pretty, Guijt, Thompson &

Scoones 1995.) were used to collect and verify contextual information relating to the local production, conservation and utilisation of traditional leafy vegetables:

- In an effort to familiarise the researchers with the area of research a review of secondary data was done. Participatory mapping showed natural resources, infrastructure, land-use patterns and resource distribution and time lines (Mouton & Marais 1993) and local histories were used to look at the history of the area and historical availability of these crops over time in the area.
- Identification, utilisation, production and conservation of TLVs were triangulated with the use of direct observations, direct-matrix pair-wise ranking and scoring, key informant interviews, local resource collection (Rana, Shrestha, Rijal, Subedi & Sthapit 2000), shared presentation and analysis, seasonal calendars, focus group discussions, semi-structured interviews, pictures and self-correcting field notes.
- Rituals, taboo's and beliefs were discussed in small groups of one gender (women) in an effort to overcome sensitivities and unwillingness to talk in mixed groups.

3.4.2 Validity and reliability of the qualitative survey

Reliability and validity were improved through triangulation (Babbie & Mouton 2001, Mouton & Marais 1993). Comparing the information obtained from using different PRA and RRA tools and techniques helped to establish the quality of the information (IDS 1996). There was a constant referring back to field notes, peer reviewing of information by letting one group report back to other groups and checking the information with other participants. Information collected while men were present was always validated at a time when no men were present. This was done to ensure that the presence of the men had not prevented women from contributing or correcting information. As is appropriate with collecting of indigenous knowledge, a number of specific questions were developed beforehand to ensure that relevant information to future indigenous vegetable

research was generated and recorded using the different techniques (IIRR 1996, Langill 1999).

3.4.3 Group discussions

Qualitative studies seek to maximise the range of specific information by purposely selecting informants and locations that differ from one another (Mikkelsen 2005). Due to the nature of this study, key informants were selected on the basis of their knowledge on the traditional foods (Babbie & Mouton 2001). Selection of group participants based on their knowledge and interest increased the effectiveness of the group (Small 2004), thus the facilitators (NGO field worker or extension officer) were well briefed regarding the group composition needed. Groups consisted mainly of existing farmer group members who were interested in the study. With time a new core group working specifically on traditional leafy vegetables was formed out of these groups.

The checklist that had been developed during the planning phase was used to organise group discussions. A flexible action plan had been developed for all communities, with progress of the fieldwork leading to more focussed research. At least two researchers were involved during the discussions, with the extension personnel or NGO fieldworkers available to help with translation (where needed) and facilitation of sessions. Group discussions were held in familiar areas in the communities and the atmosphere was kept informal and relaxed (Grenier 1998, Johnson 1992). This encouraged the women to bring along plants and dishes in an effort to share information (Grenier 1998, Johnson 1992). When people did not take part in an activity due to lack of interest, conflict, change of direction or social control, activities were changed or groups were altered. In an effort to accommodate the chores of the women (Maundu 1995), group work was only done in the mornings, with key informant interviews and observations scheduled for the afternoons. As TLVs are seen as women's crops it was more practical to use groups consisting of women. Men were, however, never shown away but

they soon lost interest as they had limited contributions to make and thus left the group.

In Arthurstone discussions started with three community garden groups and some unaffiliated women. The size of the groups varied according to the day of the discussions, with a core of about twenty people attending all the discussions. The groups were dominated by women in their forties to sixties, with a few very old women (above 70 years of age). Due to the size of the group it was constantly split into smaller groups. At the end of an exercise the information of one group was presented to the other group for verification.

The Watershed group consisted of 15 women who form part of the community garden and farming interest group. The age of the group members ranged between 40 and 65, with two ladies over 70 years of age. Group work was done in different homes of the group members. The number of women per session varied and information collected was determined by the size of the group participating. When a group size unexpectedly became small, verification of information gathered at one group session was done at another meeting.

In Mars/Glenroy members of two self-help groups participated. Generally between 15 and 25 women attended these discussions. Most of the ladies were between 40 and 70 years of age, with only a few young women (between 20 and 40 years of age). When more than 20 women attended a discussion, the group was split into two groups. Where only one group was used, the information was verified at the next group meeting, but when they were divided into smaller groups, these groups presented their information to each other for verification.

3.4.4 Data analysis

Qualitative data collection is a flexible process that lends itself to iterative planning and work. There are no standard techniques of procedures to evaluate

qualitative data. The qualitative data was organised, sorted, triangulated and compared, thus establishing the quality of the information (Mikkelsen 2005, IDS 1996).

3.5 AIM, OBJECTIVES AND HYPOTHESES OF THIS STUDY

The aim of this study is to determine the role and production of traditional leafy vegetables (*morogo/ miroho/imifino*) in three culturally and agro-ecologically diverse rural communities.

The objectives of the study are as follows:

- To determine the utilisation of the five most important traditional leafy vegetables in three rural villages of South Africa.
- To determine the crop production systems of the five most important traditional leafy vegetables in three rural villages of South Africa.

The following hypotheses are set for this study:
H_1: There are differences in the utilisation of traditional leafy vegetables between the three rural villages.
H_2: There are differences in the production system of traditional leafy vegetables between the three rural villages.

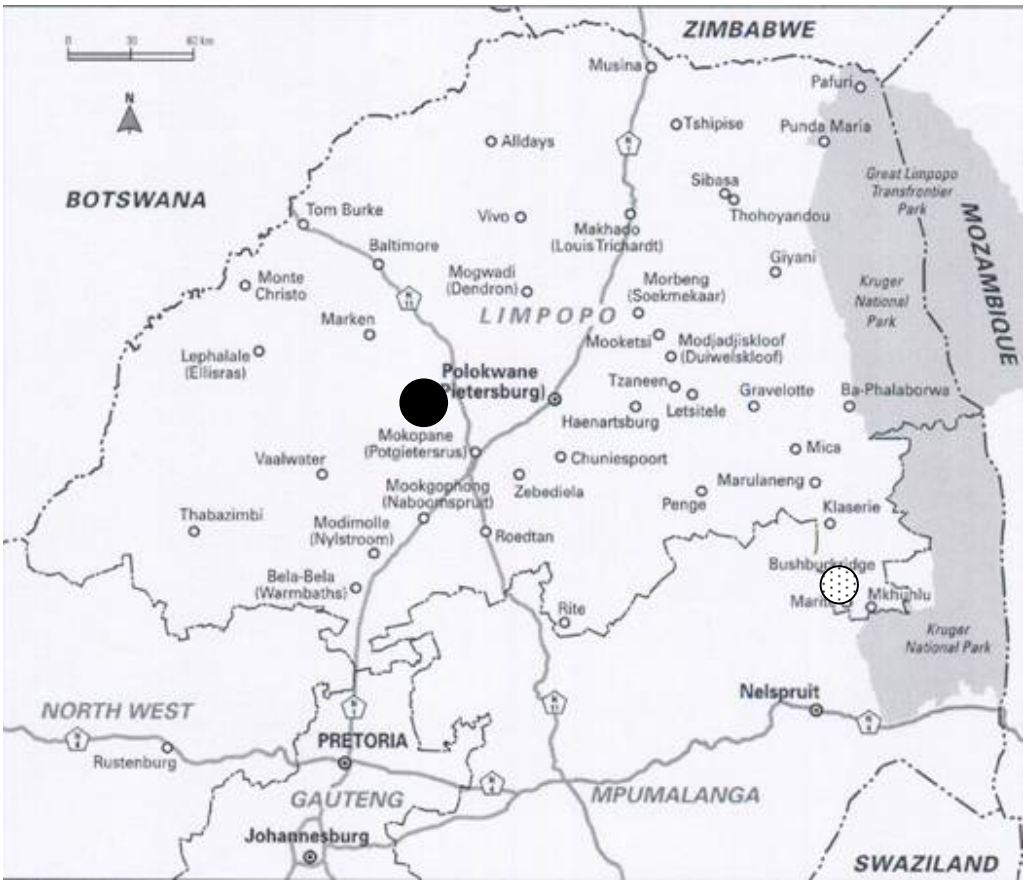
CHAPTER 4

RESEARCH AREAS

The three research areas had to represent differences in terms of ethnicity, indigenous knowledge, climate and proximity to markets within the time and budget constraints of the study. Climate has an influence on the types of plants that occur in the area and it is suspected that the ethnicity would have an influence on what is used and produced.

Discussions with the extension officers working in Limpopo identified the area of Bushbuckridge with its milder winters and mainly Shangaan ethnic group, and the area around Polokwane with the predominantly Sotho ethnic groups as study areas. Reconnaissance surveys led to the choice of Arthurstone (Figure 4.1) in Bushbuckridge and the two villages of Mars and Glenroy who would be evaluated as one as they are so close together. These villages all have relatively mild to warm winters therefore an area that experienced harsh winters was needed. Due to previous work with a very active NGO in KwaZulu-Natal, discussions with them led to the identification of Watershed, a relatively isolated village with temperature extremes that would have different types of plants available.

In many instances biophysical resources are important constraints in agricultural production, especially in subsistence agriculture where there are limited financial resources to address some of these constraints. Farmers in low rainfall areas with limited irrigation need to plant crops or varieties that are more drought tolerant. High temperatures, day length, soil types, etc. play a significant role in what farmers do and achieve within their specific environments. Access to markets and shops also determine if farmers can supplement their income with sales of produce, their access to inputs and the associated price increase due to transport costs.



Source: www.hrw.org

Figure 4. 1: The location of Arthurstone (Bushbuckridge Municipality) ⦶ and Mars/Glenroy ● in the Limpopo Province

Some of the descriptions of the climate of the areas are based on the weather information obtained from the nearest weather station to the villages. Due to the distance of the nearest weather station to the study area, the data is an approximation as no more detailed information is available.

4.1 ARTHURSTONE

Arthurstone is situated at 24º49'S and 31º04'E at an altitude of about 849m. The greater Bushbuckridge municipality is located in the northeastern side of South Africa (previously Limpopo Province, now Mpumalanga) between Graskop,

Hoedspruit and the Kruger National Park. Arthurstone, a part of Bushbuckridge, is peri-urban and provided information of what the influence of good transport and many shops have on the use and production of traditional leafy vegetables.

Before the people were forced to live together in the 1980s, the households were scattered over the area with large fields and many livestock. The drought during 1941 forced the community members to destroy most of their cattle. Since the 1980s they have limited livestock due to the available grazing. Floods destroyed huge grassland areas in the late 1990s, thus severely affecting livestock. The communal grazing field had been fenced, but the fence has been stolen. This has caused the livestock to roam everywhere, causing damage to fields and crops in the homesteads. The possibilities of successful crops are severely curtailed due to this. Livestock are usually penned at night time. The penning of the livestock enable farmers to have access to manure for fertilisation purposes.

Arthurstone is very diverse in terms of ethnicity as four groups come together in this area. The main group is the Shangaan, with small groups of Zulu, Northern Sotho and Mozambicans also living in the area (Figure 4.2).

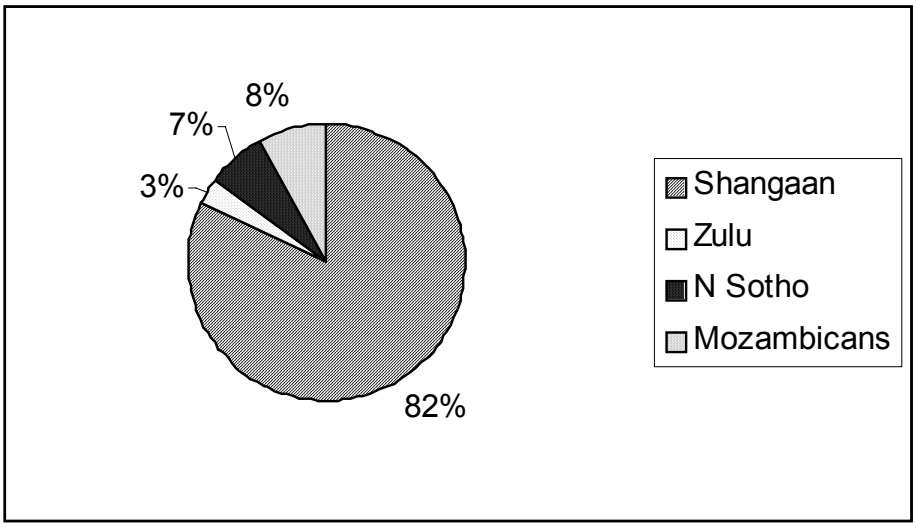


Figure 4. 2: The ethnic distribution of Arthurstone community, Limpopo Province

Arthurstone is part of the mixed lowveld sour bushveld vegetation type of the savannah grasslands biome with large, slightly undulating areas. The deeper duplex soils are underlain by potassic granites and grandiorite and are good agricultural soils. The chief grants tenancy to residents. Livestock grazes in communal areas and in winter they graze on the crop residues in fields where no winter crops are growing. The chief has prohibited the establishment of a graveyard in an effort to minimise burial of urban family members here. Burials are now done within the lands that the households have available to them.

The grocery, clothing and general shops, post office and banks of Bushbuckridge are about ten minutes by taxi from Arthurstone. The road that leads from Bushbuckridge town through Arthurstone to Tulamahashe (town where the main provincial agricultural offices are) is tarred, with all other roads being dirt roads of varying degrees of upkeep. There is an active taxi service that services the Tulamahashe road and villagers walk to this road to make use of them.

The river Sixabana separates Dwarsloop, the village where the Arthurstone pensioners receive their money, from Arthurstone. A formal grocery shop and some automatic tellers are situated at this site. During pension pay out days, an informal market selling clothes, food and other manufactured goods establishes here. Siza Motor Spares is a landmark and provides vehicle spares and also has busses for hire (the local school bus is hired here). The Department of Agriculture had built a big market here with the Drought Relief Programme money made available after the floods in South Africa and Mozambique. The influence of good transport and many shops nearby could be seen in the community as few market stalls sell fresh produce in the community. Fresh produce are mainly sold in the vicinity of the formal shops. Various spaza shops provide mainly bread and some groceries, sweets, maize and maizemeal. There is one supermarket that sells food and limited general supplies in small and bulk quantities. A bakery is part of the supermarket. The closest agricultural co-operative is 60km away in Hazyview.

The households in Arthurstone have water taps located on their household stands. A reservoir receives household water from the Sabie River at Hazyview. The Shixanba River provides water all year, but becomes a small stream in winter. The residential sites can access electricity, but not all households are connected. Due to the high cost of electricity associated with the use of a stove firewood is still used and electricity is used sparingly (mainly for appliances and lighting). Communication in Arthurstone is limited to privately owned cellphones, some Telkom phones (landlines) and a well used cellphone public phone shop in an old container. The public phones are frequently used. The post-boxes where post is delivered are located in front of Siza Motor Spares on the main road to Tulamahashe.

Winters are very mild, summers very hot and humid and rainfall is usually (when no drought conditions prevail) quite high as it lies on the escarp. The rainfall pattern was established with the use of a seasonal calendar (Table 4.1). This pattern suggests the typical drier January period followed by a wetter two months. A mean annual rainfall of about 1200 to 1000mm and mean annual temperature is 22°C.

Table 4. 1: Seasonal calendar of the rainfall intensity pattern in Arthurstone

Month	January	February	March	April	May	June	July	August	September	October	November	December
Intensity	Slight	Moderate		Dry					Moderate	Heavy		

Participants mentioned that the rainfall is starting later (October/November instead of September) than a few years ago and which is affecting the crops they can grow, how often they can plant as well as the yields they are harvesting. This shorter period of rain seems to be associated with more intense thunderstorm (same amount of rain but over a shorter period of time). These thunderstorms are causing soil erosion and the shorter rainfall period means that the grazing is now not enough for the same amount of livestock. The area experiences extreme drought on a regular basis and long periods of dry conditions are the norm rather than the exception.

Extension support is very strong with a dedicated extension officer working with all sectors (schools to pensioners) of the community. The extension officer does tend to insist on the standard best practices taught but does realise the socio-economic factors prevents many to follow these practices, thus she has learnt about alternatives to inorganic fertilisers. Extensive exposure to research due to her interest and many research projects in the area has enabled her to stay at the forefront of many low-input technologies.

4.2 MARS AND GLENROY

Mars and Glenroy are two villages about 100 (one hundred) meters apart who work well together. Mars and Glenroy are situated at approximately 23º 54'S and 29º03'E at an altitude of about 1230m with an average of about 478mm of rainfall annually. Drought or periods of water scarcity seem to be very common in the area. This has an influence on both the crops and the livestock in the area. They lie northwest of Makopane (Potgietersrus) and southwest of Polokwane (Pietersburg) in the Capricorn district (northern region) of the Limpopo province, just west of the Percy Fife nature reserve (Figure 4.1). They are situated in the tribal area of Masheshane, within the Polokwane municipal area.

The villages are part of the savannah grasslands biome with large, flat expanses. The soils are neutral sands to loams with yellow/grey being dominant and

interspersed with many rocky areas (http://eusoils.jrc.it/esbd_archive/UEDASM/africa/maps/afr_za2002_so.htm). These soils are relatively well suited for crops.

The Mars and Glenroy area was established in 1939 and in 1942-48 people started to move there from other places. In both communities the land belongs to the same chief but the villages fall under different indunas. No induna lives in Glenroy (he lives in Mashashane) but an induna lives in Mars. The predominant group in Mars/Glenroy is the Northern Sotho with smaller groups of Shangaan, Tswana and Ndebele also present (Figure 4.3).

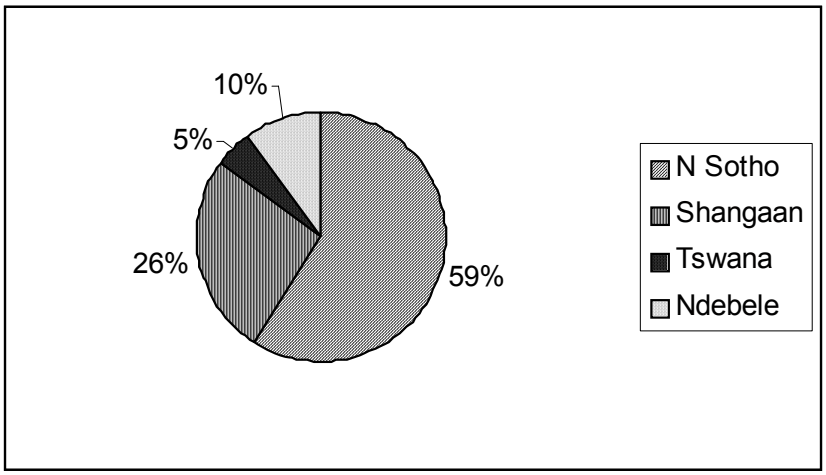


Figure 4. 3: The ethnic distribution within Mars/Glenroy in Limpopo Province

To reach Mars and Glenroy you have to turn off the main dirt road from Mashashane to Percy Fife and drive about four kilometres. This road goes through Glenroy and ends in Mars just past the small shop (sells basic groceries and cellphone airtime) that services both communities and a cellphone tower. Taxi's seldom come on this road and many villagers walk or catch a lift to the Mashashane road to catch a taxi. Any agricultural inputs must be purchased from Polokwane where the closest cooperative is situated. No landlines are available in either of the villages.

Mars consists of 135 families with each family living on a plot of 36x36m. The field is usually 1 morgen (about 0.5ha). Glenroy also has about 130 families who have variable field sizes, depending on what has been allocated. The household plots are slightly bigger than in Mars. The area is flat and due to the drought the borders of the villages can be seen from the homesteads, with a dry riverbed forming one of the borders of Mars. In both villages the majority of the homesteads lie within two blocks on either side of the road and are fenced, with the fields lying around the homesteads causing many women to walk quite far to reach the fields. Most of the homes are still traditional, well-kept homes with a few still decorated in the traditional manner. A few brick and tin roofed houses do exist. Toilets are a short distance from the house and use the long drop system.

The villages each have a women's self-help group who do crafts, sewing and agriculture to help increase their income. The primary school is in Mars and the secondary school in Glenroy. Both are strategically placed close to the border between the two villages, thus ensuring easy access for both villages.

Table 4. 2: Seasonal calendar of the rainfall intensity pattern in Mars/Glenroy

Month	January	February	March	April	May	June	July	August	September	October	November	December
Intensity	Slight	Moderate		Slight		Dry			Moderate		Heavy	

Mars/Glenroy winters can become cold and summers tend to be relatively dry and hot with occasional thundershowers (Table 4.2). The rainfall can start

supporting crops from September and can continue to March. Rainfall in April and May can not support effective crop growth. Light frost usually occurs in June/July with heavy frost not known in the area. The severe droughts experienced during and after the time of the study in Mars and Glenroy highlighted the vulnerability of the villagers to the climatic conditions. The low rainfall and tendency to drought make this area a high-risk area for agriculture.

Rivers in the Mars and Glenroy area only run when it rains heavily. Vilagers dig holes next to the river during the dry periods in an effort to access more water when the pipes are dry. There are no boreholes in the area. In Mars there is a river (has been dry for some time) and a reservoir where the municipality transports water too and people can access a set amount of water every second day. The poor water access forces producers to rely on rainfall as no irrigation is possible. Glenroy has a dam that supplies the households with water. Taps were installed in each street, but now most of the taps are not working so water needs to be conveyed to their homes. Firewood is used as the main source of energy for cooking and heating.

Livestock graze in the communal grazing area, with animals penned at night. In winter they graze on the crop residues in the fields if there are no winter crops growing. Cattle are preferred but not owned by many of the households. A few kraals exist on the outskirts of the villages, but only a few households have cattle. Chickens and goats are the predominant livestock in the area. Due to the scarcity of cattle the manure is very expensive and many use goat manure. Small pens can be seen at many homes where goats are kept overnight and then released in the morning. Chickens are common in both villages and are generally not caged and they control pests around the homesteads. The low levels of vegetation during these dry periods cause livestock to break into backyard gardens and fields.

The extension officers in this area is strongly high input oriented, with little knowledge of low input technologies. This tendency can be clearly seen in the high use of inorganic fertilisers and use of tractors.

4.3 WATERSHED

Watershed is situated at approximately 28º 22'S and 29º45'E at an altitude of about 1183m with an average of about 690mm (this is rainfall at Ladysmith who get much more rain than Watershed) of rainfall annually. It lies between Ladysmith and Newcastle in the foothills of the Drakensberg (Figure 4.4). Watershed falls under the Driefontein chieftancy in the Ladysmith Municipal area in KwaZulu-Natal. The borders of the village had been redefined just before the data collection started, leaving families and friends that used to live in the same village now suddenly living in separate villages. No induna lives in the village.

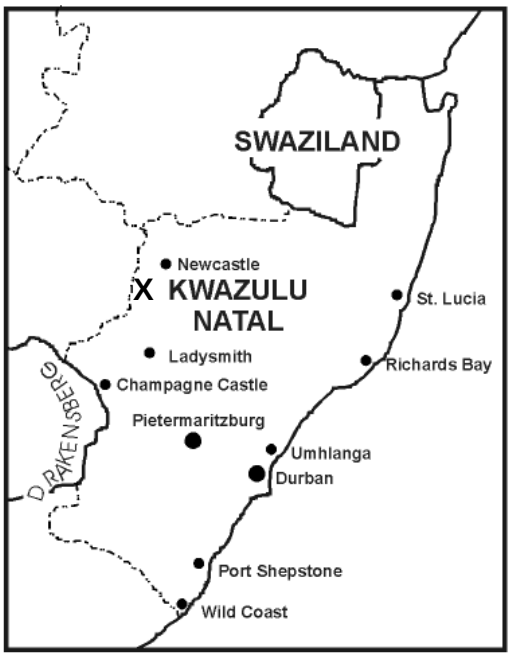


Figure 4. 4: The location of Watershed (X) within KwaZulu-Natal

Source: www.doorway.co.za

The Zulu (Nguni) are the dominant ethnic group, with a few Swazi and Xhosa women (Figure 4.5) who have married into the community. Plant knowledge between these ethnic groups was mainly transferable, but some plants, though known, do not grow in this area.

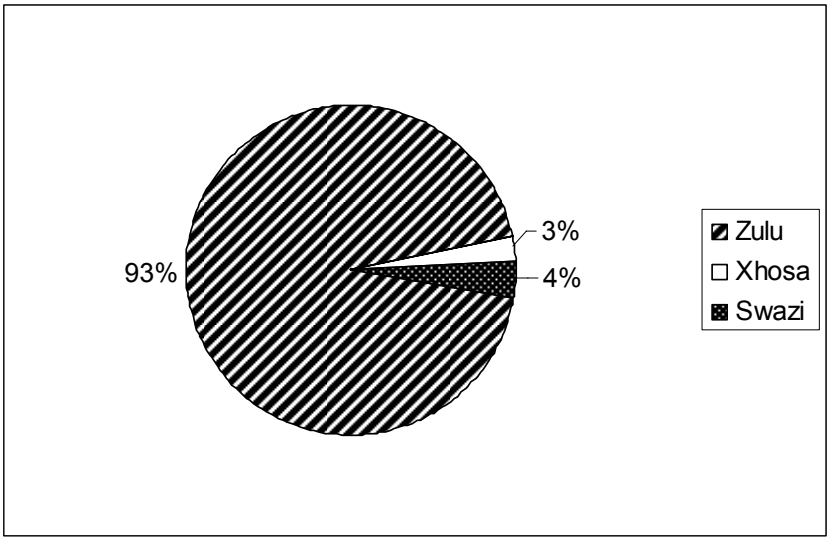


Figure 4. 5: The ethnic distribution within Watershed, KwaZulu-Natal

Watershed is part of the savannah grasslands biome with undulating hills. Black clays and solenetzic soils occur in the area which moves over to acid clays of which yellow/grey are dominant (http://eusoils.jrc.it/esbd_archive/EUDASM/africa/maps/afr_za2002_so.htm). These shallow, rocky soils are not well suited to cropping. The land belongs to the chief who grants tenancy to residents. Keeping livestock is the main agricultural activity. Livestock is grazed in communal areas and in winter they graze on the crop residues in the fields if there are no winter crops growing. Some people do own land privately. Some landowners give people permission to build on their land, but they then have to pay rent.

The women can remember back to 1962. They feel that things have stayed about the same with only minimal changes which they can not connect to any specific time. The village is effectively divided into two unequal areas by a ridge. Two

access roads enter the village across the Tatane River from the D18, a dirt road that goes past the village. One road passes over the river via a cement bridge, drives past the bottom end of the area between the ridge and the river and goes over the ridge to the largest part of the settlement. Taxis do sometimes enter the village on this road, though it is not common. About half of the homesteads and the only primary and secondary schools are in this area. At the top of the ridge before going down to this side there is a dense cluster of homesteads that have relatively large gardens and tend to be fenced. The fences at almost all the homesteads in the village are, however, old and tend to be in a state of relative disrepair. With communal grazing applied in the area farmers experience many problems with livestock breaking through fences. The road stops at the end of the village homesteads on the other side of the ridge where a dipping tank for livestock is situated. There are about 120 homesteads, with an area close to the road severely affected by erosion. In these areas the topsoil was denuded and the exposed dark clays baked hard as rock. Huge gullies occur which are annually increasing in size. Almost all the homesteads on this side are concentrated between the road and a ridge, with the crop fields and communal grazing area on the other side of the road. The size of the homestead land seems to vary and reasons for this could not be established. No telephone landlines are available, with people using cellphones (reception vary variable) to communicate.

The area between the Tatane River and the ridge has groups of scattered homesteads (clusters of 30,30,40,30 homesteads) between the communal grazing areas and the fields. The large open grasslands are interspersed by rocky areas covered by *Aloe marlothii* and *Aloe ferox*. Lack of fencing for fields have led to almost no field crops being grown, except in small fenced off areas. At the bottom of this area the first road passes through to the area over the ridge with a second smaller, deeply rutted road crossing the riverbed from the D18 and feeding into the top of the area. The roads between the homesteads tend to be impassable in the rainy season and are usually only walked upon. A few

households in the area have formed a close group and have developed a communal, fenced garden area with a small reservoir for water. Water from this small dam is used to fill buckets with which they irrigate by hand when needed. Children need to cross the ridge to go to school. There seems to be a slight separation between the two areas separated by the steep ridge. All the villagers living in this area in front of the ridge must cross the river to catch a taxi or bus on the D18 or walk down to the road that leads across the ridge for the infrequent taxi's there. Transport is expensive for families that have no additional income (R30 return to Ladysmith).

The Tatane River supplies the area with water right through the year, with the water level dropping off to an extremely small stream in winter. In summer, floods (once or twice a year) can prevent children from going to school. The river is used for drinking water for livestock, washing, brick making by individuals, washing cars and when there is a drought, water for household use. There is a public borehole that supplies the homes close by with drinking water, while the other homes source their water from small springs. Some people have private boreholes. Government helps them with boreholes but each family contributes R30 annually. Some people are far away from boreholes.

Three shops supply Watershed with groceries, beer (SAB and home-made) and maize flour. The main shopping is done in Ladysmith when the pensions are paid out. No local markets for fresh produce exist, though some informal bartering does sometimes occur. Strong social support systems ensure that family members share crops in times of need. The closest agricultural co-operative is situated in Ladysmith.

Watershed experiences hot summers and very cold winter with an environment that can be extreme (snow to heatwave). During very cold winters snow might fall in the area and frosts are common. With the help of a seasonal calendar (Table 4.3) the start of their rainfall season was determined to be in August, though frost

can still occur till middle September. Rainfall can only support crops from October and some frost might occur in late April, thus shortening their time for crop production.

Table 4. 3: Seasonal calendar of the rainfall intensity pattern in Watershed

Month	January	February	March	April	May	June	July	August	September	October	November	December
Intensity	Dry	Heavy		Slight		Dry		Slight		Moderate		Heavy

The main source of energy in Watershed is in the form of dried leaves of *Aloe marlothii*. The aloes grow extensively in the area and have become an integral part of all households. The leaves are stacked in a circle on top of each other to form large stacks that are then air-dried. These leaves are used for firewood as trees are few due to the poor soils in the area. Trees are mainly used for shade for humans and animals. Only a few households have electricity, and paraffin stoves are also relatively common.

Animals kept in the area are chickens, donkeys, goats, cattle and sheep. In the summer they do not have problems with their livestock, as there is enough food. In winter food becomes scarce, thus livestock cause problems as they jump fences and feed on the crops that the local farmers have planted. Overgrazing has led to serious erosion in some areas and the goats cause a lot of destruction to the local plants and fruit trees.

Agricultural extension support in the area is relatively limited, with the chief of the Driefontein area complaining about the lack of extension support. The provincial

department had an extension officer who rarely worked in the area and was not replaced when he left the Department. An NGO is currently providing some extension support for a few agricultural groups in the different villages in Driefontein. The same NGO is also providing ABET training and other income generating options in these villages. The NGO has a strong organic background and helps villagers to use their natural resources in a sustainable manner.

4.4. SHORT SYNTHESIS OF THE AREAS

Village	**Arthurstone**	**Mars/Glenroy**	**Watershed**
Province	**Mpumalanga**	**Limpopo**	**KwaZulu-Natal**
Main ethnic group(s)	Shangaan 82.5%	N. Sotho, 58.8% Shangaan 26.3%	Zulu 93.8%
Position	24º 49'S 31º 04'E	23º 54'S 29º 03'E	28º 22'S 29º 45'E
Elevation	849m	1230m	1183m
Biome	Savanna	Savanna	Savanna
Average rainfall	1200-1000mm	478mm *(Polokwane data which is wetter)*	690mm *(Ladysmith data which is wetter)*
Rainfall period	Sept-Febr	Sept-May	Aug-May
Mean annual temperature	22°C	19°C	17°C
Frost occurrence	Very uncommon	Relatively uncommon	Common

CHAPTER 5

UTILISATION OF TRADITIONAL LEAFY VEGETABLES

The results are discussed in Chapter 5 and 6. Chapter 5 will discuss the findings of the utilisation of traditional leafy vegetables while the results of the production of traditional leafy vegetables from a farming system perspective will be discussed in Chapter 6. The utilisation aspects of TLVs will be discussed first to familiarise the reader with the various types of TLVs before discussing the production aspects. Appendix 3 has two colourplates with photographs of some of the TLVs mentioned.

5.1 TRADITIONAL LEAFY VEGETABLES UTILISED IN THREE VILLAGES

Determining plant utilisation would help establish the diversity of use and also give an indication of the extent of IK associated with this use. A list of the most commonly known TLVs in the three different areas are listed in Table 5.1 with the species (where identified) and the local name. Amaranth, blackjack, cowpea and pumpkin are consumed in all three the villages. Cowpea (*Vigna unguilata*) is cultivated in all three the villages, though it has been lost in Watershed and has only recently been re-introduced. *Corchorus* spp. and *Cleome gynandra* grow in the hotter northern parts of South Africa (Arthurstone and Mars/Glenroy), but can not grow in Watershed due to the colder climate. In Mars/Glenroy, monyaku was not available for identification due to the drought. Motšhatšha is known as the tsamma (*Citrillus lanatus*) commonly utilised by the San (Van Wyk & Gericke 2003). Phara (*Cucumis melo*), motšhatšha, monyaku and monyane are only important in Mars/Glenroy while nkaka (*Momordica balsamina*) is only used in Arthurstone. Nightshade (*Solanum americanum*) prefers to grow in the colder climate of KwaZulu-Natal and was only found in Watershed. Though purslane

(*Portulaca* spp.) grows in all the villages, its use is restricted to Watershed, while it is perceived as pigfood in the other villages. The study by Hart and Vorster (2006) in Letsitele also found that purslane was considered and animal food. The diversity in use of plants shows that even though a plant might be present in a specific community, it is not necessarily utilised as a TLV. The influence of the climate can explain some of the differences (cleome and nightshade) between the northern villages and Watershed, but it seems as if the IK associated with a certain plant is another contributing factor.

Table 5. 1: Traditional leafy vegetables commonly utilised in the three villages

Traditional leafy vegetable specie	**Areas**		
	Arthurstone	**Mars/Glenroy**	**Watershed**
	Shangaan	***Northern Sotho***	***Zulu***
Cleome gynandra	Bangala Xibangala	Lerotho	
Amaranthus spp.	Cheke	Thepe	Imbuya
Bidens pilosa (blackjack)	Muxidji	Monyane	Uqadolo
Lagenaria spp. (calabash)		Moraka	Intshubaba
Watermelon		Mogapu	
Cucumis melo (cucurbit)		Phara	
Cucurbit		Monyaku	
Citrillus lanatus		Motšhatšha	
Vigna unguilata (cowpea)	Msoni	Monawa	Cowpea
Pumpkin	Tinwembe	Mophotse	Intanga
Momordica balsamina (cucurbit)	Nkaka		
Corchorus spp.	Guxe	Thelele	
Solanum americanum (nightshade)			Umsobo
Portulaca spp. (purslane)			Isilile

Some of the TLV plants not mentioned in Table 5.1 but also used by some residents in Arthurstone include matapi (madumbe/taro), msovo (unidentified), lipisa (unidentified), maxupini (unidentified), dledlele (unidentified), xikekechana

(unidentified), porovoro (unidentified), mquaquaza (unidentified), xikowa (unidentified), majavalatama (unidentified) and mdande (okra). The high number of unidentified plants was because many of these plants were only available for a very short time and only individuals used them. Many people used these plants more than 30 years ago, but the more readily available exotic vegetables that they are now growing have replaced them. Many of these plants have also become scarce, supporting the statements by various authors that plants need to be used for them to stay available (Nazarea 1998, Balick & Cox 1996). Further investigation found that many of the younger women involved in the group discussions did not know most of these plants mentioned above. These younger women had also lost the IK associated with these plants.

In Mars/Glenroy lehlanye, lerothwarothwane, tshehlo, lofotatane and fore were mentioned during further investigation of TLVs used in the community. The TLVs could not be identified as they were only available for a very short time, were scarce and only individuals used them. Participants in the discussions were not concerned about the scarcity of these plants as they were using exotic substitutes or did not enjoy the abovementioned TLVs' taste.

The following crops were also mentioned in Watershed (KZN): ugquzu (gooseberry), intanga and amasolozi (traditional pumkins). The use of cowpea leaves as a source of food has almost been lost as only a few of the older women still remember using the crop. The reason for this loss was difficult to establish, but the women stated that it is a labour intensive and difficult crop to grow. As many of them were quite old and their children and men were not interested in helping, the crop had vanished from the community more than a decade before. A local NGO working in the area is re-introducing the crop in an effort to increase household food security in the increasingly dry area.

The villagers stated that TLVs had been revered till the middle of the 1960s, when extension began to extensively promote the use of the 'supermarket' and

'superior' crops. In the 1970s the youth started to adhere to the 'poverty crop' and 'backward knowledge' labels and they became increasingly dissatisfied with these crops. The influence of mass media and the more acceptable foods brought back from the cities led to the young demanding modern foods. During group discussions it was clear that younger women (younger than about 35 years of age) knew fewer plants and also had less information about seed systems and sustainable harvesting techniques than the older women. Several times during discussions about TLVs, the younger women did not know that certain plants are edible. This also meant that they have lost the IK associated with aspects of the utilisation and production of these crops.

5.2 HOUSEHOLD PREFERENCES OF TRADITIONAL LEAFY VEGETABLES

The interaction between IK and TLV utilisation was studied in an effort to determine the important role TLVs play in food security. Respondents were asked to rank their household's five most preferred TLVs. All subsequent questions in the questionnaire were based on these specific preferences. Respondents in Arthurstone identified only seven different plants as part of their five most important TLVs, showing a low diversity in plant use. In Mars/Glenroy 11 plants were identified as one of the five most important crops by the different respondents, thus a greater diversity of plants are used. In Watershed twenty different crops were as one of the five most important crops for the household. Watershed respondents use the widest range of plant diversity, thus minimising the probability of nutritional deficiency.

Table 5. 2: Ranking of the six most preferred traditional leafy vegetables in the three villages (N=80)

TLV Species	Arthurstone		Mars/Glenroy		Watershed	
	n	%	n	%	n	%
Cleome gynandra	71	89	40	50	-	-
Amaranthus spp.	7	9	30	38	78	98
Bidens pilosa (blackjack)	-	-	-	-	14	18
Citrillus lanatus (tsamma)	-	-	11	14	-	-
Vigna unguilata (cowpea)	77	96	47	59	-	-
Pumpkin	78	98	64	80	64	80
Momordica balsamina (nkaka)	78	98	-	-	-	-
Corchorus spp.	79	99	-	-	-	-
Solanum americanum (nightshade)	-	-	-	-	19	24
Portulaca spp. (Purslane)	-	-	-	-	8	10
Lagenaria spp. (calabash)	-	-	31	39	13	16
Watermelon	5	6				
Total number of TLVs mentioned in top five lists	8		11		20	

Table 5.2 illustrates that the majority (at least 89%) of the respondents in Arthurstone commonly uses nkaka, cleome, pumpkin, cowpeas, corchorus. Only a few respondents were not using these abovementioned TLVs and were occasionally using amaranth or watermelon leaves instead. Amaranth is popular filler when there is not enough of a specific plant available, but due to its lower taste preference it was ranked relatively low (9%). In Mars/Glenroy, 80 percent of respondents use pumpkin while 59 percent respondents use cowpea and 50 percent respondents use cleome. Six different TLVs of which calabash (39%) and amaranth (38%) respectively are the most utilised represented the fourth and fifth position. In Mars/Glenroy the multi-purpose commercial pumpkin is enjoyed

by all, though its need for a bigger area to grow in is a problem for some respondents. In Watershed amaranth (98%) and pumpkin (80%) are the most important crops utilised by the community. Seventeen different TLVs of which nightshade (24%), blackjack (18%) and calabash (16%) are the most utilised represented the third, fourth and fifth position. Amaranth is an important TLV in Watershed where cleome does not grow, And 98% respondents use the vegetable in the house. In Mars/Glenroy amaranth is utilised where chorchorus is scarce. Pumpkin is a crop that is highly preferred in all three villages. The low importance of cowpea in Watershed is a reflection of the loss of the plant in the village.

Shackleton *et al.* (1998) found in a study of uncultivated TLVs in Bushbuckridge that *Corchorus* spp. (90%), *Cleome gynandra* (82%), *Momordica balsamina* (76%) and *Amaranthus* spp. (59%) were popular TLVs used. Pumpkin and cowpeas were cultivated and therefore not included in their study. They found that a spectrum of 21 TLV species were used, with between five and seven species commonly used. This study confirms the preferences identified in Arthurstone, with the exception for the popularity of amaranth. Weinberger and Msuya (2004), working on TLVs in Tanzania, warned that any priority setting exercise within a diverse range of crops would reflect extreme variation in preference.

Deciding on the order of preference during group discussions caused several disagreements in Arthurstone and Watershed. Further discussions clearly showed that people ranked these crops according to different criteria. The criteria could be divided into a taste or a food security preference. Included in the taste preference ranking were taste and ease of access for harvesting. The food security criteria used included aspects like how many products the plant supplied (leaves/fruit/seed), how long it is available in the fresh form and the ability to store for an extended period. In Watershed (KZN) taste and ease of preparation were identified as important criteria for selecting a specific TLV. Ease of

harvesting and availability are two important factors when plants are chosen for preparation preference in Watershed. The ranking using these criteria did not differ much and the five most important plants were the same using the different selection criteria. In cases where more TLVs need to be ranked this might, however, not be the case.

Further discussion with respondents indicated that children in Arthurstone do not like nkaka (*Momordica balsamina*) as it is too bitter. Children prefer to eat meat and fatty foods. Nkaka is easy to harvest, cook and grow with minimal management. In Mars/Glenroy phara (*Cucumis melo*) is a well-loved plant that has become very scarce. The importance of phara and corchorus in terms of taste were not identified in the quantitative methods. Mönnig's studies (1967) with the Pedi (main ethnic group in Mars/Glenroy) also described the use of wild and cultivated pumpkins, *Cucumis melo* (he records the local name of thagaraga while we recorded it as phara), amaranth, cleome and blackjack (*Bidens bipinnata*).

In Watershed the men only consume amaranth and pumpkin and therefore women must prepare something else for the men if they use any other TLV. Amaranth and pumpkin are used as the basis for their dishes, with other crops usually added to change the taste and consistency of the dishes by adding different proportions to the pot.

The variety of plants available in an area, as influenced by the agro-ecological zone, and the palatability of these plants for the local community influenced the preferences in the villages. Amaranth is a case in point. Where the popular cleome grows, amaranth is less important and is mainly utilised to add volume to other dishes (Arthurstone and Mars/Glenroy). Amaranth in Watershed is very popular, as other plants in the area are bitter or less palatable than amaranth. Knowledge of the utilisation aspects of plants (purslane and cowpea) also influences its preference. Loss of utilisation knowledge of cowpea in Watershed

has led to very limited use of the crop. The use of purslane in Watershed and not in Mars/Glenroy and Arthurstone is due to the IK associated with the food usage of this plant being available in Watershed.

5.2.1 Reasons for growing traditional leafy vegetables

In order to identify the reasons for growing TLVs by households, respondents were asked what role TLVs played in their household.

Table 5. 3: Importance of traditional leafy vegetables for household food security and sales in the three communities

Reason for growing	Arthurstone (N=77*)		Mars/Glenroy (N=80)		Watershed (N=79*)	
	n	%	n	%	n	%
Household food security	77	100	80	100	79	100
Sales	24	31	3	4	3	6

*Missing data in Arthurstone and Watershed caused less than 80 answers

Table 5.3 illustrates that all (100%) households incorporate TLVs into their food security strategies. Therefore these crops need to form part of any agricultural or food security plan for an area. Marketing potential of TLVs is limited in Mars/Glenroy (4%) and Watershed (6%) which requires further investigation. The women who sold TLV crops stated that the money was used for household needs (medical, school fees, etc.). Selling TLV produce is the easiest and sometimes the only way in which women can raise cash (Hirschmann & Vaughan 1983).

5.2.2 Consumption of traditional leafy vegetables

In all three villages participants agree that the importance of the different TLVs will vary according to the specific socio-economic situation of the household at a specific time. The following reasons were given for consuming TLVs:

- It does not need extra labour to cultivate.

- It usually grows close to the house or between the crops in the fields, and therefore it is easy to access.
- Alternative food is expensive while TLVs are free, and therefore helps to feed their families. This is perceived as a very important source of food when the income of the household is low.
- They enjoy the taste and it is healthy food. It is a good substitute for meat when income is low and no meat can be bought.
- It is part of the tradition to eat TLVs, especially amoung the older women.

Shackleton *et al.* (1998) also found similar reasons in another area in Bushbuckridge. The popularity of a specific crop was dependent on ease of finding and good taste (59%), availability (23%), good taste only (10%) or because they are free (4%). Group discussions in all three villages revealed the importance of TLVs being freely available at no cost, especially during times of crisis (unemployment, illness). Census data describe a very high unemployment rate in the Bushbuckridge area (40-60%) (StatsSA Census 2001). In the light of the high unemployment rate in the area it is possible that the importance of the crop being free might be under-reported. As Shackleton's data collection was done in the form of a questionnaire, it is possible that preferred answers were given. Other studies have listed the common complaint of not having money to buy food as one of the main reasons for using TLVs extensively (Vorster & Jansen van Rensburg 2005, Hart & Vorster 2006).

Table 5. 4: The main decision-makers of food purchases in the three villages

Decision-maker	Arthurstone (N=80)		Mars/Glenroy (N=80)		Watershed (N=80)	
	n	%	n	%	n	%
Father	30	37.5	14	17.5	22	27.5
Mother	62	77.5	49	61.3	53	67.5
Other adult family member	6	6.3	22	27.5	19	23.8

In all three villages the mother of a household is an important decision-maker (at least 61%) on how much to spend on food (Table 5.4). Therefore awareness strategies should mainly target the mothers in the household. In Mars/Glenroy (28%) and Watershed (24%) other adult members including the grandparents who were also living in the household had an influence in decision-making. The high numbers of female-headed households and absent men (migrant workers), as discussed in chapter 6, are possibly reasons for identifying women as principle decision-makers.

Arthurstone (71%), Mars/Glenroy (69%) and Watershed (51%) respondents report a decline in the use of traditional leafy vegetables.

Table 5. 5: Reasons listed by respondents for the decline in use of traditional leafy vegetables in the three villages

Reasons for decline	Arthurstone (N=78)		Mars/Glenroy (N=80)		Watershed (N=61)	
	n	%	n	%	n	%
Drought	74	94.9	2	2.5	6	9.8
Thunderstorms wash the seed away	75	96.2	1	1.3	0	0
Erosion	17	21.8	0	0	0	0
Number of people who use TLVs has decreased	0	0	38	47.5	35	57.4

Table 5.5 lists the perceived reasons for the decline in TLV use. In Arthurstone lower plant densities were ascribed to the weather while the shift from eating traditional leafy vegetables to exotic crops was seen as the main reason in Mars/Glenroy and Watershed. Observations in Arthurstone showed overgrazing and erosion to be very prominent in the area and Landcare activities in the area

in the year before the survey possibly influenced the mainly climate oriented answers.

Further investigations support the reasons given in Table 5.5. The decline in number of people consuming TLVs might be due to the westernisation of the palate, as the young prefer the fatty tastes associated with many snacks and fast foods. The general labelling TLVs as 'weeds' and the knowledge associated with it as 'backward knowledge' by both research and extension since the 1960s has led to the food being seen as low status food consumed by the poor, thus many do not want to eat TLVs. The men in many households do not want to eat TLVs and insist on eating meat, leaving the TLVs for the women and children. This relegates TLVs in the household to a low-status food. Another possible reason that the women interviewed do not experience as a problem might be the fact that they prepare a crop in only one way for weeks on end. This could possibly lead to boredom with the food. The blandness of preparation (almost no additions to the cooking pot by many households) might also be a problem. Much of the decline can be attributed to human perceptions and changing taste preferences. Though respondents in Arthurstone did not perceive the taste preferences as a problem during the questionnaire, the group discussions with children and women groups showed the importance of the lack of status of the plant and blandness of taste to be considered important factors.

Chweya (1997), as well as Nekesa and Meso (1997) reported that communities perceived a decline in use of traditional food plants. The decline was ascribed to an inability to compete with exotics and the traditional crops' reputation of low-status foods. TLVs and other traditional crops have experienced a decline in status (Moore & Raymond 2006, Weinberger & Swai 2004). Kwapata and Maliro (1997) reported a decline in the availability of traditional vegetables. The decline was linked to the habitat changes caused by the production of exotic crops, the young not realising the nutritional value of these crops and the limited research and development efforts to promote and improve these crops. Dovie *et al.* (2002)

found that over 60% of the respondents in Bushbuckridge perceived that there was a decrease in traditional leafy vegetables in the area. These results seem to agree with the villagers' perceptions about the declining utilisation of TLVs. The loss of traditional food knowledge as a result of social change has been recorded in Africa for some time (Malaisse and Parent 1985, Fox and Norwood-Young 1982).

5.2.3 Harvesting practices of traditional leafy vegetables

Traditional leafy vegetables are harvested at different stages of their growth cycle, since some are only palatable for short periods (seedling till plant starts to flower). Differences in harvesting practices due to differences in ethnicity and IK are expected between crops that are found in more than one village. The difficulty respondents experience with verbalising their harvesting practices led to the use of a combination of observations and focus group discussions to document these practices.

Table 5. 6: The harvesting practices of traditional leafy vegetables in the three villages

Village	Harvesting practices of TLVs
***Amaranthus* spp.**	
All villages	Plants must preferably be well established before harvesting is started. Plants are harvested from seedling stage up to the start of flowering. The tender tips with about 4 or 5 young leaves are harvested. Re-harvesting of a plant can take place every 4-5 days.
Arthurstone *Cheke*	Seedlings are only harvested if they grow in areas where there are too many plants or when they grow in areas that must be weeded. A few people use the stalks and the leaves.
Mars/Glenroy *Thepe*	All leaves are de-stalked.
Watershed *Imbuya*	Many villagers harvest young and older leaves. Most leaves are de-stalked.

Village	Harvesting practices of TLVs
Cleome gynandra	
Arthurstone and Mars/Glenroy	Villagers prefer to start harvesting after the plants have established themselves. Plants are harvested from seedling stage up to the start of flowering. Many villagers harvest young and older leaves. Harvesting stops when the plants start to flower because the leaves become unpalatable when the plant starts to flower.
Arthurstone *Bangala*	When plant populations are low many will still harvest when flowering has started. Re-harvesting of a plant can be done once a week.
Mars/Glenroy *Lerotho*	Re-harvest of a plant can be done after 4-5 days.
***Bidens pilosa* (blackjack)**	
Watershed	Plants are harvested from seedling stage up to the start of flowering. Harvesting stops when the plants start to flower because the leaves become unpalatable when the plant starts to flower. Re-harvesting is done when they need to harvest again.
***Portulaca* spp. (Purslane)**	
Watershed *Isilele*	All leaves are harvested. Plants are harvested when they are available.
Monyaku (traditional pumpkin)	
Mars/Glenroy	Young leaves are preferred, but some people harvest older leaves. The older leaves are not as palatable as the younger leaves. The seed is not eaten as it is bitter and can make people sick. Traditional healers use them with care, as they know the dosage that can be safely used.
Watermelon	
Mars/Glenroy *Mogapu*	The young leaves are harvested, though few harvest the growth point as well. The stalks and older leaves are not harvested. The fruit is also harvested.
***Cucumis melo* (Phara/ Mophare)**	
Mars/Glenroy	Young leaves and young (green) fruit are harvested. The flowers are not eaten.
***Citrillus lanatus* (Tsamma)**	
Mars/Glenroy *Legapu/ Motšhatšha*	The young leaves, mature fruit and seeds (ditokse) are harvested. Harvesting starts as soon as the plant starts flowering, but some do start harvesting at an earlier stage. The fruit is used for pudding and jam
***Lagenaria* spp. (calabash)**	
Watershed and Mars/Glenroy	The young leaves and immature fruit are harvested. Mature fruit are used to make containers. Leaves are commonly de-stalked and the use of growth points and flowers is uncommon.

Village	Harvesting practices of TLVs
	***Momordica* spp. (Nkaka)**
Arthurstone	Villagers prefer to start harvesting after the plants have established themselves. Plants are harvested from seedling stage up to the start of flowering. The young leaves are preferentially harvested, but older leaves are also harvested if they want to spice up a dish. Care should be taken that the growth points are not damaged. When they harvest destructively they remove the whole branch from the base of the plant, roll the branch up and transport it in a bundle. Most de-stalk the leaves. Growth points are commonly included in the dish. The unripe green fruit can be harvested and added to the dish. The taste of the ripening and ripe fruit is not acceptable so these fruits are not harvested. Plants are re-harvested once a week, till they start to die down.
	***Corchorus* spp.**
Arthurstone *Guxe*	Villagers prefer to start harvesting after the plants have established themselves, as this will increase the yield. Plants are harvested from seedling stage up to the start of flowering. The three youngest leaves and growth point are harvested. The stalks are usually removed. Harvesting is continued until the plant starts to flower as leaves then become fibrous and unpalatable. When yields are low harvesting of leaves will continue after the plant starts to flower. Plants can be re-harvest after one week.
	***Solanum americanum* (nightshade)**
Watershed *Umsobo*	Younger leaves are commonly harvested because they taste better than the older leaves. Leaves are harvested from the seedling stage until the plants start to flower. The dark red fruit are used to make jam.
	Cowpea
All three villages	Only the young leaves are harvested (generally the youngest three leaves on the growing point) because leaves become fibrous when the plant starts to flower. The seed are also harvested by removing the dried pods.
Arthurstone *Mnsoni*	Flowers are not commonly harvested. Most women de-stalk the leaves before cooking. Two methods of harvesting leaves were described: 1. Harvesting of leaves starts after the plant starts to creep. Harvesting is halted when the plant starts to flower to ensure a good seed yield. 2. Leaves are only harvested in February/ March. This allows the plant to flower and form the seedpods. Plants can be re-harvested after 2 days.

Village	Harvesting practices of TLVs
Mars/Glenroy *Dinawa/Monawa*	Leaves are harvested on the day before they want to cook it. Leaves are placed in the sun to help shorten the cooking time. Two leaf harvesting methods were described: 1. Harvesting of leaves starts after the plant starts to creep. Harvesting is halted when the plant starts to flower to ensure a good seed yield. 2. Leaves are only harvested in February/ March. This allows the plant to flower and form the seedpods. Plants can be re-harvested every 4-5 days.
Pumpkin	
Arthurstone	Young leaves are harvested at the growth point. Immature and mature fruit, flowers and seed are also harvested. The plants can be harvested at any time during their growth cycle. To ensure a good harvest leaves are harvested selectively. Only a few leaves are harvested from each plant in an effort not to influence the fruit yield. During the thinning out of flowers these flowers are cleaned (reproductive parts are removed) and added to the dish. Thinning out of immature, sweet fruits is also done. These fruits are also added to the leaves to enhance the taste. Plants can be re-harvest after two days.
Mars/Glenroy *Mophotse/ Monyaku*	Mophotse (pumpkin) Three types are used for leaves, but only cultivar 1 and 3 (see below) fruit is used. Only the young leaves are harvested but care is taken to ensure that the growth points are not damaged. Plants can be re-harvest after 4-5 days. Reproductive parts of flowers are removed before it is added to a dish. 1. *Mophotse, cultivar 1* (pumpkin, boerpampoen) Available from February till June. Young leaves are harvested. Growth points, stalks and older leaves are occasionally utilised. Some flowers (leave for fruit), fruit (lerotse) and seed (ditokse) are harvested. 2. *Mophotse, cultivar 3* (pumpkin, possibly Hubbard squash) Commonly young leaves and mature fruit are harvested. Available from February till May. 3. *Mophotse, cultivar 2* (wild cucurbit) Available from February to June. Only the leaves are harvested because the fruit is very watery and fibrous.

Village	Harvesting practices of TLVs
Watershed *Intanga*	The last 10 –20 cm (max 30cm) of the growing tip is removed with the leaves. Only growth tips that break off easily are harvested. Tips that do not break off easily are left, as they are too hard to use. Mainly the young leaves are harvested but stalks can also be harvested. Flowers are harvested selectively. Plants can be re-harvested as soon as the re-growth is big enough. Harvesting can be done at any stage of the plants' growth cycle. The constant harvesting has an effect on the yield of pumpkin fruit, thus harvest is done selectively. Some vines are not harvested to ensure they bear fruit.

In general, plants will be left to establish themselves before harvesting is started (Table 5.6). Uncultivated plants are harvested when still young and succulent (seedling stage) but as the plants approach maturity, only the apical rosettes of leaves of the stems and branches are harvested. Destructive harvesting (removal of the whole plant) of uncultivated seedlings (seedlings of 'wild' TLVs that sow themselves) usually occurs when there is a shortage of food, the plant population is too high or it is seen as a 'weed' (grows where it is not wanted). In all three villages, preference for young, tender leaves were found with regard to the uncultivated crops. Harvesting of older leaves or harvesting leaves after the plant starts to flower is, however, not uncommon, especially when there is a shortage of fresh crops. Though there are many practices that overlap, there are still several small differences between the villages. This is especially evident in the described pumpkin practices in the three villages where the harvesting practices are quite different. Time to re-harvesting and time of harvesting differ between Arthurstone and Mars/Glenroy. The loss and re-introduction of cowpea into Watershed can be seen in the few practices listed that are common to all three villages. There are no locality differences and only general information is known. No details such as days to re-harvesting and optimal times for harvesting the leaves exist in Watershed. This lack of additional information illustrates the loss of indigenous knowledge that enabled a longer time of harvesting. This example supports the statement made by Nazarea (1998) that conservation of biodiversity needs to be combined with the use of the plant to ensure that the associated indigenous knowledge is not lost.

Gathering of TLVs usually starts in September to November and ends in February or March. Very little gathering of TLVs is done after April, as the leaves of the mature plants are too fibrous to be palatable. Whitbread (1986) also reported limited gathering of mature TLV plants as they tend to have tough, fibrous leaves that made them unpalatable.

Table 5.6 illustrates the differences in the utilisation of TLVs between the villages due to the level of IK that exist in the three villages. The use of plant parts (seed, stalks, flowers, fruit) and the plants used are different, even though some plants are found in all the villages. The re-introduction of cowpea into Watershed illustrates the value of IK with the utilisation of TLVs. The basic production and utilisation information was re-introduced with the crop, but the detailed knowledge that ensured good seed and leaf yields in that area was not known anymore.

Women in various parts of Africa reportedly harvest some TLV species from cultivated fields and uncultivated areas (Dovie, Shackleton & Witkowski 2007, Modi *et al*. 2006, Musinguzi, Kikafunda & Kiremire 2006). Modi *et al*. (2006) reported that TLVs are more available and occur in greater variety in cultivated fields than in uncultivated areas. These findings reflect the harvesting areas of the three villages.

5.2.4 Preparation practices of traditional leafy vegetables

Preparation times and how plants are prepared have an influence on both food safety (minimising contaminants) and retention of nutritional value. Table 5.7 describes the preparation practices of each of the TLVs as found in the villages that identified the specific TLV as one of the five most important TLVs utilised in the household. Where overlap between villages was found, the practices are reported together.

Table 5. 7: Preparation methods used for the different traditional leafy vegetable crops in the three villages

Traditional leafy vegetable	Preparation practices of TLVs
***Portulaca* spp. (purslane)**	
Watershed *Isilele*	This plant is usually added to amaranth to increase the volume of the dish (bulk up the amaranth in a 1 part Isilele: 5 parts amaranth proportion). Dishes are prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - De-stalking the leaves and then boiling with a lid. - Water used during the cooking process is not re-used. - Reported cooking time varies from 5 to 30 minutes. Women must prepare something else for the men as they refuse to eat this dish. The leaves are consumed as a relish with porridge.
***Amaranthus* spp.**	
Arthurstone *Cheke*	Amaranth is usually mixed with cleome, pumpkin and cowpea leaves. Common practices include: - Washing of leaves. - Boiling the leaves with a lid. - Few re-use the water used during the cooking process. - Reported cooking time varies from 5-20 minutes. The leaves are consumed as a relish with porridge.
Mars/Glenroy *Thepe*	Amaranth is usually mixed with Cleome (lerotho), pumpkin and cowpea leaves. The cleome amaranth mix is popular and used to enhance the taste (2 parts lerotho to 1 part thepe). Common practices include: - Washing of leaves. - De-stalking the leaves and then boiling with a lid. - Few re-use the water used during the cooking process. - Reported cooking time varies from 10-120 minutes. The leaves are consumed as a relish with porridge.

Traditional leafy vegetable	Preparation practices of TLVs
Watershed *Imbuya*	Collected stems and leaves are not chopped. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid till tender. Onion, potato, chillies or tomato can be added to taste. - Few re-use the water used during the cooking process. - Reported cooking time varies from 5-60 minutes. A few women fry the leaves. The leaves are consumed as a relish with porridge.
***Cucumis melo* (phara/ mophare)**	
Mars/Glenroy	The dish is prepared within two hours of harvesting. Common practices include: - Leaves are washed and boiled with a lid. - The immature green fruit can be added to change the taste. The leaves are consumed as a relish with porridge.
Cleome gynandra	
Arthurstone and Mars/Glenroy	Cleome is mixed with amaranth to enhance taste. Dishes are prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid. - Few re-use the water used during the cooking process. The leaves are consumed as a relish with porridge.
Arthurstone *Bangala*	Common practices include: - Reported cooking time varies from 1 to 240 minutes, with the average boiling time at 120 minutes.
Mars/Glenroy *Lerotho*	Common practices include: - Reported cooking time varies from 25 to 240 minutes.
***Bidens pilosa* (blackjack)**	
Watershed	Dishes are prepared within two hours of harvesting. Common practices include: - Washing of leaves. - De-stalking the leaves and then boiling with a lid. - Few re-use the water used during the cooking process. Women must prepare something else for the men as they refuse to eat this dish. The leaves are consumed as a relish with porridge.

Traditional leafy vegetable	Preparation practices of TLVs
***Momordica* spp. (nkaka)**	
Arthurstone	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid. - Few re-use the water used during the cooking process. - Reported cooking time varies from 3-10 minutes. The leaves are consumed as a relish with porridge.
Monyaku (traditional pumpkin)	
Mars/Glenroy	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid till tender. Onion, potato, chillies or tomato can be added to taste. - Many re-use the water used during the cooking process. - Reported cooking time varies from 15-120 minutes. The leaves are consumed as a relish with porridge.
***Citrillus lanatus* (tsamma)**	
Mars/Glenroy *Motšhatšha*	Common practices used: - Leaves, mature fruit and seeds (ditokse) are used. - Fruit are used for pudding & jam. - Leaves are washed and de-stalking is done according to preference. - The dish is boiled and covered with a lid. - Water used for boiling is seldom re-used. - Reported cooking time varies from 3-40 minutes. - The dish is prepared within two hours of harvesting.
***Solanum americanum* (nightshade)**	
Watershed *Umsobo*	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Leaves and stems are not chopped. - Boiling the leaves with a lid till tender. Onion and tomato can be added to taste. - Few re-use the water used during the cooking process. - Reported cooking time varies from 10-30 minutes. Women must prepare something else for the men as they refuse to eat this dish. The leaves are consumed as a relish with porridge.

Traditional leafy vegetable	Preparation practices of TLVs
Cowpeas	
All three villages	Dishes are prepared one day after harvesting. Leaves are placed in the sun on the day of harvest and then prepared the next day. This breaks down some of the fibres in the leaves and they become softer and cook faster. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid till tender. - Few re-use the water used during the cooking process. The leaves are consumed as a relish with porridge.
Arthurstone	Common practices include: - Reported cooking time varies from 5 to 240 minutes.
Mars/Glenroy *Dinawa/Monawa*	Common practices include: - Reported cooking time varies from 60 to 240 minutes. - Cooking oil is not added to fresh leaves but can be added to dried leaves.
Watershed	Common practices include: - Reported cooking time varies from 30 to 90 minutes.
***Corchorus* spp.**	
Arthurstone *Guxe*	The dish is prepared within two hours of harvesting. Fresh leaves are very popular, but the dried leaves tend to be less palatable. Common practices include: - Washing and de-stalking of leaves. - Boil the leaves with bicarbonate of soda or ash from a specific tree and cover with a lid. - Water used in the cooking process is not re-used. - Reported cooking time varies from 5-15 minutes. The leaves are consumed as a relish with porridge.
Mars/Glenroy *Thelele*	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boil the leaves with a lid. - Water used in the cooking process is not re-used. The leaves are consumed as a relish with porridge.

Traditional leafy vegetable	Preparation practices of TLVs
***Lagenaria* spp. (calabash)**	
Watershed and Mars/Glenroy	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boil the leaves with a lid till tender. - Few re-use the water used during the cooking process. The leaves are consumed as a relish with porridge
Watershed *Intshubaba*	Common practices include: - Leaves and stems are not chopped. - Mix the boiled leaves with pap because it is bitter. - Few re-use the water used during the cooking process. - Reported cooking time varies from 5-30 minutes. - Some fry the leaves. - An infusion can be made from the leaves. It helps to control high blood pressure and diabetes. Women must prepare something else for the men as they refuse to eat this dish.
Watermelon	
Mars/Glenroy *Mogapu/Legapu*	The dish is prepared within two hours of harvesting. Common practices include: - Washing and de-stalking of leaves. - Boiling the leaves with a lid till tender. - Few re-use the water used during the cooking process. - Reported cooking time varies from 3-90 minutes. The leaves are consumed as a relish with porridge.
Mars/Glenroy *Moraka*	Common practices include: - Reported cooking time varies from 3 to 60 minutes.
Pumpkin	
All three villages	The dish is prepared within two hours of harvesting. Common practices include: - Washing the leaves. - Removing the hairs from the stalks and leaves by pulling the dermal layer off. - Boiling the leaves with a lid till tender. The leaves are consumed as a relish with porridge.

Traditional leafy vegetable	Preparation practices of TLVs
Arthurstone	Common practices include: - Few re-use the water used during the cooking process. - Seed are mashed into a powder, sifted and added to fresh vegetables. - Reported cooking time varies from 5-27 minutes. Everybody enjoys it as the taste is good, it looks attractive and it is very nutritious.
Watershed *Intanga*	Common practices include: - No stems or leaves are chopped. - Many fry the leaves. - Onion and tomato can be added to the boiled leaves. - Reported cooking time varies from 7 and 90 minutes. - Seeds are often roasted (Imbece)
Mars/Glenroy *Mophotse/ Monyaku*	Common practices include: - Flowers are occasionally used. The reproductive parts are removed before adding to the pot to prevent a bitter taste. 1. Mophotse, cultivar 1 (pumpkin, boerpampoen.) and cultivar 3 (pumpkin, possibly Hubbard squash). - The fruit is boiled, mashed and served with rice. - Young leaves, onion or tomato can be added to the dish. No cooking oil must be added. Mophotse, cultivar 2 (wild cucurbit) - Only the leaves are consumed because the fruit is very watery and fibrous. - Commonly re-use the water used during the cooking process. - Reported cooking time varies from 3 to 120 minutes.
***Citrillus lanatus* (tsamma)**	
Mars/Glenroy *Motšhatšha*	Common practices used: - Leaves, mature fruit and seeds (ditokse) are used. - Fruit are used for pudding & jam. - Leaves are washed and de-stalking is done according to preference. - The dish is boiled and covered with a lid. - Water used for boiling is seldom re-used. - Reported cooking time varies from 3-40 minutes. - The dish is prepared within two hours of harvesting.

Table 5.7 illustrates that all crops except cowpea is prepared within two hours of harvesting in all the villages. These crops are mainly eaten as a relish with maize

porridge. Mixing of crops is common, and the least preferred crop is usually used to add volume to the preferred crop. De-stalking is done according to personal preference. Corchorus is cooked with bicarbonate of soda or ash from a specific tree to lessen the mucilaginous consistency of the dish. This practice was not identified in Mars/Glenroy. Cucurbits need to have the hairs on the leaves and stalks removed and sweet, immature fruits are added as a special treat. Different TLVs, mashed pumpkinseed, exotic vegetables, flowers and immature fruit are added to dishes to enhance the taste. Frying of TLVs was only reported in Watershed. In Watershed men only eat intanga (pumpkin leaves) and imbuya (amaranth) and women have to prepare something else for the men if they cook umsobo (nightshade), isilele (purslane) or uqadolo (blackjack). The preparation times reported for the crops vary substantially between villages. The long periods of cooking reported for certain crops are a concern, as their nutritional value can be severely affected.

Further investigation with women in Watershed (KZN) illustrated that almost all the crops are prepared with oil since the household members prefer it. Mathenge (1997:77) found that some of the communities in Kenya eat the leafy vegetables for their bitterness. Where these bitter crops were not preferred, they were mixed with other crops to lessen the bitterness. Group discussion with women in the three villages support these findings, as some plants which have strong tastes are added as a spice to the food to enhance the taste. This was found in Arthurstone where older leaves of nkaka (*Momordica balsamina*) were used to flavour dishes. The different tastes and consistencies the women wanted to achieve determined the specific mixes used for each dish. Plants such as blackjack, nightshade and nkaka are all used in the different villages to enhance the flavour and appearance of a dish.

Mönnig's (1967) studies with the Pedi (found in Mars/Glenroy) illustrated that blackjack was used to enhance the flavour of a dish. The strong taste of these leaves enable the addition of only a few leaves to the dish to change the taste.

This investigation established that blackjack was no longer popular and only used occasionally to enhance the taste of a dish. This could be due to the bitterness of the plant and the changing tastes of the community.

The following findings of Shackleton *et al.* (1998) are supported:

- TLVs are boiled until the water has evaporated.
- *Momordica balsamina* was boiled for some time, after which the water is drained to remove some of the bitter taste.
- *Corchorus* spp. are prepared with bicarbonate of soda which forms a mucilaginous mass that is eaten with stiff maize porridge.

Pumpkin is preferably eaten 'pure', while Shackleton *et al.* (1998) indicated that the shoots and flowers are boiled with other TLVs. Kgaphola and Viljoen (2000) found that all TLVs are cooked in salted water. Where the bitter taste is not appreciated, the cooking water of the more bitter ALV species is decanted to reduce the bitter taste. Bicarbonate of soda is commonly used to reduce the mucilaginous consistency of corchorus and okra and toughness of leaves such as cowpea (Kimiywe, Waudo, Mbithe & Maundu 2007, Kgaphola and Viljoen 2000). Bicarbonate of soda does, however, destroy most of the nutrients of the crop and enhance the colour (Kimiywe *et al*. 2007) and flavour (Nguni and Mwila 2007).

The identification of different methods of preparation can be used to help promote the consumption of TLVs. Disseminating these different methods of preparation will counteract the bland way in which many of the respondents prepare the crops. During discussions held with children at school, they mentioned that dishes tended to be very bland.

The variety in additives, mixes of plants and parts of TLV plants (leaves, stalks, immature and mature fruit, flowers and seed) used between the villages reflect the differences in the preparation methods. Large differences in cooking times of

crops such as pumpkin exist between Arthurstone (5-27 minutes), Mars/Glenroy (7-90 minutes) and Watershed (3-120 minutes).

5.2.5 Perceived nutritional value of traditional leafy vegetables

The perceived nutritional value of specific TLVs can lead to the utilisation of that TLV for certain groups such as pregnant and lactating women, the elderly, the ill and children. Such practices had been noted in earlier studies (Fox & Norwood-Young 1982), where some of the plants were singled out for pregnant women, the ill and those who need to build their strength (i.e. after a birth).

In Arthurstone women don't perceive one plant as more nutritious than the other. To help preserve nutrients for winter periods they will either dry uncooked leaves (cleome, corchorus) or first blanch for a few minutes and then dry (the other crops). They add mashed peanuts to the dish when dried leaves are used to make up for any nutrient loss experienced during the drying and storage process. There is no belief that any of the TLV's is particularly good for pregnant women, the elderly or the ill. *Momordica balsamina* is believed to have medicinal value as the leaves are used in the form of an infusion to help control high blood pressure. This practice was also found in predominantly Shangaan villages in Limpopo Province (Hart & Vorster 2006).

In Mars/Glenroy the women perceive the TLVs to be very nutritious as their ancestors have been surviving on them for generations, though this was seen in the light of any other nutritious plant. No specific TLV is singled out as very advantageous for a vulnerable group. They state that using these plants in their daily diet will ensure a long and healthy life.

In Watershed the women perceive the imbuya (amaranth) and pumpkin leaves to be highly nutritious, just as other crops are nutritious. No specific TLV was

identified as valuable for vulnerable groups such as the sick, children or pregnant women.

The fact that no specific TLVs are given to vulnerable groups, demonstrates that this part of the IK has probably been lost. This loss of knowledge could have an effect on the resilience and recovery rate of these vulnerable groups. Similar results had been found in studies done in the Eastern Cape (Vorster & Jansen van Rensburg 2005). In some parts of Africa people perceive that TLVs have a high nutritional value and that these crops make them strong (Abukutsa-Onyango 2007b, Raschke, Oltersdorf, Elmadfa, Wahlqvist, Kouris-Blazos & Cheema 2007). During studies done with the Swazi, Kgaphola and Viljoen (2004) found that some believed that TLVs and porridge are good for women.

5.3 ROLE OF TRADITIONAL LEAFY VEGETABLES IN FOOD SECURITY

Food security of the households tends to fall into two distinct phases: when fresh crops are available (usually summer and autumn) and when limited fresh crops are available (usually winter and spring). It is expected that rainfall has an effect on the availability patterns of fresh, uncultivated TLVs.

5.3.1 Availability of fresh traditional leafy vegetables

The availability of TLVs is important for the food security strategies of households. A seasonal calendar was used to determine the availability of fresh TLVs during the year which is reflected in Tables 5.8 (Arthurstone), Table 5.9 (Mars/Glenroy) and Table 5.10 (Watershed). N is the number of respondents who reported using the crops as one of the five most important crops for the household. In the questionnaire only the five most important TLVs were identified per household. Respondents perceived that months with percentages above

50% represent months where sufficient amounts of the specific TLV is available for household use in the whole village.

Table 5. 8: Harvesting frequency (%) of the six most important fresh leafy vegetables in Arthurstone

Crop	N	August	September	October	November	December	January	February	March	April	May	June	July
Amaranth	7	14	***57***	***86***	***100***	***100***	***100***	***100***	***100***	***86***	***86***	43	14
Cleome	71	1	30	48	***96***	***100***	***100***	***89***	***72***	32			
Cowpea	77	1	26	31	***79***	***97***	***100***	***99***	***81***	***64***	4	1	
Corchorus	79		33	***75***	***99***	***100***	***100***	***100***	***97***	***90***	20	1	
Nkaka	78	23	***60***	***92***	***100***	***100***	***100***	***100***	***100***	***97***	***77***	42	22
Pumpkin	78	1	26	***59***	***86***	***100***	***99***	***99***	***94***	***86***	12		

Table 5.8 illustrates the importance of fresh TLVs in Arthurstone. TLVs are available fresh for eight to ten months of the year. From October to April there is enough fresh TLVs to supply the households, but May to September are characterised by low volumes available. During these months dried food is used. The period in which abundant fresh TLVs are available, should be the time when preservation must be done. The festive season traditionally found in rural communities in December and the beginning of January, when migrant workers spend at home, severely limits the time available to dry TLVs. These are also the times when weeding is an important aspect of the women's lives (further discussed in chapter 6), thus limiting time available to preserve TLVs.

Further research illustrated that drying TLVs helps to extend the availability of food, even though associated with lowering of nutritional value caused by processing. The Shangaan add groundnuts (*Arachis hypogaea*) to increase the nutritional value of the dish. If the soil stays moist enough (rainfall, irrigation) nkaka (*Momordica balsamina*) can be available the whole year. Cleome is a popular summer crop (November to March) but is only available for a short time.

Table 5. 9: Harvesting frequency (%) of the eight most important fresh leafy vegetables in Mars/Glenroy

Crop	N	August	September	October	November	December	January	February	March	April	May	June	July
Amaranth	30				23	***93***	***100***	***97***	***80***	***63***	***60***		
Cleome	40		3	5	25	***93***	***100***	***100***	***83***	***58***	***55***		
Cowpea	47						43	***100***	***81***	45	11		
Monyaku	21				24	***90***	***100***	***95***	***71***	***57***	48		
Moraka	31					26	29	***58***	***68***	***97***	***100***	29	
Motšhatšha	11			9	18	36	***91***	***100***	***73***	***73***	45	9	
Pumpkin	64	2	2	2	2	33	***57***	***95***	***100***	***94***	***69***	3	2
Watermelon	13					8	38	***69***	***92***	***100***	***85***	15	

In Mars/Glenroy the potential exists that fresh TLVs can be available for the whole year, but as indicated in Table 5.9 they are only available in sufficient quantities for two to five months. Usually from December onwards, there are sufficient fresh leaves available from three TLVs namely amaranth, cleome and monyaku which supply the households. June to November are the months when fresh TLV volumes are relatively low and dried food is used to supplement the daily diet. The festive season and weeding responsibilities of women also influence the effective processing of abundant TLVs during December till April.

Discussions with women of Mars/Glenroy determined that September to November were times of extreme food shortages, due to the late start of summer rainfalls. Water scarcity in Mars/Glenroy forces them to optimise the growth period during the rainfall period.

Table 5. 10: Harvesting frequency (%) of the six most important fresh leafy vegetables in Watershed

Crop	N	August	September	October	November	December	January	February	March	April	May	June	July
Amaranth	78		3	46	***85***	***94***	***88***	***100***	***100***	3			
Black jack	14			21	43	***79***	***79***	***100***	***71***	14	14		
Intshubaba	13			38	***77***	***100***	***100***	***85***	46	15			
Nightshade	19		5	37	***68***	***84***	***100***	***89***	47	5	5	5	5
Pumpkin	64		5	47	***72***	***92***	***98***	***100***	***70***	44	16	8	
Purslane	8			13	***63***	***100***	***100***	***88***	***88***	13			

In Watershed the potential for fresh TLVs exists for up to eleven months of the year, as indicated in Table 5.10. TLVs are, however, only available in sufficient quantities for four to five months. From November to March there are enough fresh TLVs to supply the households, though low volumes are available from April to October. During these months dried foods are used. The harsh winters and late frost in the area lead to a shorter abundant period from December to February in Watershed. The festive period from December to middle of January and the short growing season tends to limit time for TLV preservation as the other crops need intense management to optimise yields and weeding in this community becomes a very important activity.

Women in Watershed identified August and September as months of extreme food shortages. The occurrence of early and late frosts force them to grow as much as they can from October to March, and these months must be optimised to help ensure enough plants for processing to address shortages during the lean months. Whitbread (1986) found that villages in KwaZulu-Natal started gathering TLVs in September after the first rains and ended in February or March. Limited TLV gathering took place during April.

Similar patterns of availability of fresh TLVs occur for Watershed and Mars/Glenroy, while Arthurstone differs significantly. The winter climate (cold, occasional frost, dry) in Mars/Glenroy is similar to Watershed, though the frost in Watershed starts earlier and continues later. Arthurstone experiences no frost and mild winters. In all three villages uncultivated TLVs appear shortly after the first rains, a finding supported by those of Levy *et al.* (1936), Whitbread (1986), Kgaphola and Viljoen (2000) and Modi *et al*. (2006). Several studies show that there is a perception in communities that the availability of morogo during drought is low (Shackleton *et al.* 1998, Vorster & Jansen van Rensburg 2005, Hart & Vorster 2006). A few plants seem to be available in limited quantities during the year, but the reason for this limited availability has not been determined.

5.3.2 Utilisation of dried traditional leafy vegetables

The survey went further and assessed the type of food consumed when limited fresh TLVs are available (Table 5.11).

Table 5. 11: Food types consumed when no fresh traditional leafyvegetables are available in the three villages (N=80)

Type of food	Arthurstone		Mars/Glenroy		Watershed	
	n	%	n	%	n	%
Winter vegetables	38	48	78	98	61	76
Animal protein	49	61	39	49	1	1
Soup	47	59	5	6	1	1
Buy food	6	8	3	4	9	11
Pasta	19	24	0	0	0	0
Dried TLV	39	49	78	98	47	59

The animal protein is usually bought in the form of chicken heads and feet. This is an affordable source of protein that is readily available in all three the villages. This protein originates from the poultry abbatoirs close to Polokwane and

Bushbuckridge. Pasta is used as an alternative for maize porridge and is readily available in the various shops in and around Arthurstone. Soup stretches the food available in the household. Table 5.11 illustrates that the food types consumed in Arthurstone when limited fresh TLVs are available, are in order of priority: animal protein, soup, dried TLVs and other winter vegetables. In Mars/Glenroy dried TLVs (98%) and winter vegetables (98%) are the main food types consumed when TLVs become limited. Forty-nine percent of respondents buy animal protein during this period. In Watershed respondents depended on winter vegetables (76%) and dried TLVs (59%). Dried TLVs in Mars/Glenroy (98%) and Watershed (59%) are an important food source for households during periods when fresh TLVs are limited. In Arthurstone TLVs are less important but still provide a source of food for 49% of respondents. The rural villages (Mars/Glenroy and Watershed) are more dependent on dried TLVs than the peri-urban Arthurstone.

Watershed and Mars/Glenroy women reported that the harsh climatic conditions force many villagers to buy food, although it is seen as a last resort. The relative high number of respondents using winter vegetables in Mars/Glenroy can be attributed to drought conditions and harsh winter conditions. In Watershed the increase of respondents who buy winter vegetables can be ascribed to the harsh winters that prevent production of winter vegetables. Mild winters in Arthurstone enable producers to grow winter crops, which lowers their dependency on dried TLVs for food security during winter periods. It might also be due to easier access to shops where food can be bought.

Numerous researchers in Africa have found that TLVs are available in dried form during periods of drought (Mertz, Lykke & Reenberg 2001, Campbell 1987, Mallaisse & Parent 1985). The indigenous knowledge associated with the utilisation of preserved plants help to increase food security during winter and spring before the rain starts. The level of IK (how many crops are dried and how long they can be stored) is a determining factor for household's food security

during the months when fresh crops are limited. Hart, Azubuike, Barimalaa & Achinewhu (2005) found that TLVs in West Africa are generally consumed as an ingredient in soups, stews and as a relish.

In Table 5.12 the number of respondents drying a crop was determined through the number of respondents who had reported using (N) the crop fresh. Storage of TLVs reported below is for periods of longer than one month as it then requires containers and management of the dried leaves to help ensure an extended shelf life. The crops stored and preserved as included in Table 5.12 refer to the five priority crops identified by a household.

Table 5. 12: Distribution of respondents who preserve and store traditional leafy vegetables used for household food security in the three villages

Villages	Dry TLVs			Store TLVs		
	N	n	%	N	n	%
Pumpkin						
Arthurstone	78	78	100	78	74	95
Mars/Glenroy	76	75	99	76	67	88
Watershed	79	41	52	79	24	30
Cowpea						
Arthurstone	77	77	100	77	74	96
Mars/Glenroy	54	54	100	54	36	67
Watershed	7	2	29	7	1	15
***Amaranthus* spp.**						
Arthurstone	8	7	88	8	1	13
Mars/Glenroy	33	31	94	33	13	39
Watershed	77	31	40	77	13	17
Cleome						
Arthurstone	77	77	100	77	68	88
Mars/Glenroy	38	38	100	38	19	50

Villages	Dry TLVs			Store TLVs		
	N	n	%	N	n	%
***Corchorus* spp**						
Arthurstone	79	79	100	79	76	96
***Momordica balsamina* (nkaka)**						
Arthurstone	78	75	96	78	69	88
***Solanum* spp. (nightshade)**						
Watershed	18	5	28	18	0	0
Lagenaria spp. (calabash)						
Mars/Glenroy	39	20	51	39	0	0
Watershed	10	4	40	10	0	0
***Citrillus lanatus* (motšhatšha/ tsamma)**						
Mars/Glenroy	22	18	82	22	0	0
Watermelon						
Mars/Glenroy	20	14	70	20	0	0
Monyaku						
Mars/Glenroy	24	24	100	24	0	0

Pumpkins and cowpeas are very important sources of dried food for Arthurstone as all respondents (100%) dry and the majority (95-96%) store them for longer than one month. In Mars/Glenroy the majority of respondents (99-100%) dry pumpkin and cowpea though the storage of pumpkin (88%) and cowpea (67%) for longer than one month is much lower. The other large pumpkin types (watermelon, monyaku, tsamma and calabash) grown in Mars/Glenroy and Watershed are dried and used within one month. *Momordica balsamina* (nkaka) and *Corchorus* spp. (guxe) are very popular in Arthurstone and therefore extensively dried and stored. All households in Arthurstone and Mars/Glenroy dry cleome, while 88% of respondents in Arthurstone and 50% of respondents in Mars/Glenroy store cleome. The majority of respondents in Arthurstone (88%) and Mars/Glenroy (94%) dried amaranth, although few stored it for longer than one month. Despite fresh amaranth's popularity in Watershed, only 40% of

respondents dry and 17% store it for longer than one month. Respondents in Arthurstone preserve six different TLVs, while Mars/Glenroy respondents preserve four types of TLVs and Watershed respondents preserve only amaranth and pumpkin. The limited variety of TLVs available for winter could lead to bland winter and spring diets.

The volume of leaves dried varies both within and between the villages and was mainly determined by the prevailing circumstances of the household, especially in terms of income, health and number of members in the household.

These findings on storage practices agree with other studies. Storage of TLVs for winter was found in the Transkei and provided the bulk of the food intake in winter (Nguni & Mwila 2007, Vorster & Jansen van Rensburg 2005, Rose & Guillarmod 1974). *Corchorus* spp., amaranth, cowpea, cleome and pumpkins were reported being dried (Hart & Vorster 2006, Whitbread 1986, Rose & Guillarmod 1974, Levy *et al.* 1936) in various villages in South Africa.

In all three villages harvesting of semi-cultivated and uncultivated crops are mainly done by the farmers themselves. Mars/Glenroy respondents bought cultivated pumpkins (1%) and cowpeas (4%) due to the drought experienced at the time of the survey. In Watershed individuals buy TLVs such as amaranth (16%) and pumpkin (16%). This may be an effect derived from the food buying culture that had developed when households had someone sending remittances home from the cities.

In Arthurstone and Mars/Glenroy cowpea is seen as the ideal dried crop in times of drought. The long storage life of these leaves makes them ideal for local drought survival strategies and they are used as such in both villages.

The availability and the easiness of growing of *Momordica balsamina* (nkaka) in Arthurstone make this crop very popular among older people who enjoy the

taste. The leaves are mainly used to enhance the taste of dishes and can also be used to control high blood pressure. This multipurpose crop is therefore dried by 96% of the respondents.

Cleome, amaranth and corchorus use seems to be interconnected. Corchorus has become very scarce in Mars/Glenroy, even though the taste is enjoyed. Where cleome and corchorus are available, the importance of amaranth is lower and it is mainly used to bulk up (add volume to) a dish. This was clearly illustrated in Arthurstone, and to a lesser degree Mars/Glenroy where limited corchorus was found.In these two villages respondents reported that they prefer these two crops to amaranth which is more bitter. In Watershed where cleome and corchorus can not grow, amaranth is popular amoungst respondents.

Watershed respondents are of the opinion that many members of the village do not know how to dry and store pumpkin leaves and had lost the IK associated with the production and utilisation of cowpea. Drying and storage of TLVs are important aspects that show the role of indigenous knowledge in the food security strategies of many rural households. The efficiency and impact of these practices were determined and is revealed in Table 5.13. Where drying and storage practices are similar, these practices are reported in one line and the differences between the villages are then discussed per village. Each crop is discussed individually to facilitate comparisons between the three villages.

Table 5. 13: The traditional drying and storage practices for the most important traditional leafy vegetables of the three villages

Traditional leafy vegetable	Drying practices of crops
***Amaranthus* spp.**	
All three villages	Common practices include: - Washing of leaves in clean water.
Arthurstone	Amaranth leaves deteriorate into powder quite quickly. This powder is thrown away and not used in other dishes. Common practices include: - Fresh leaves are dried in the shade. - Blanched leaves are placed in the sun on a tin sheet.
Mars/Glenroy *Thepe*	Common practices include: - Leaves are not chopped. - Water is brought to the boil, leaves are added and boiled for at least one hour. - Blanched leaves are placed on a tray in the sun or shade.
Watershed *Imbuya*	Common practices include: - Fresh leaves are placed on a clean surface in the sun or the shade.
Cleome gynandra	
Arthurstone and Mars/Glenroy	Common practices include: - Washing of leaves in clean water. - Leaves are not chopped. - Boil the water (can add salt) and add leaves.
Arthurstone *Bangala*	Cleome has problems with worms attacking the leaves, even when dried. If the dried product is stored airtight, it is still destroyed by worms. Respondents try to circumvent this by blanching the leaves, as it does seem to reduce the problem. Common practices used: - Leaves are boiled at a high temperature for 2-3 hours till tender (leaves turn brown). - Fresh leaves are usually dried in the sun. - Blanched leaves are placed in the sun on a tin sheet.
Mars/Glenroy *Lerotho*	Common practices used: - Water is brought to the boil, leaves are added and boiled for at least one hour. - Blanched leaves are placed on a tray in the sun or shade.

Traditional leafy vegetable	Drying practices of crops
Watermelon	
Mars/Glenroy	Common practices used: - Leaves are washed in clean water. - Leaves are not chopped. - Fresh leaves are placed on a clean surface in the sun or shade.
Lagenaria spp. (calabash)	
Mars/Glenroy and Watershed	Common practices used: - Young leaves are harvested. - The hairs on the leaves are removed by pulling off the dermal layer. - The leaves are washed in clean water. - Fresh leaves are placed on a clean surface in the sun or shade.
Mars/Glenroy	Common practices used: - A small amount of water is brought to the boil and leaves are added. - Leaves are boiled for five minutes, turned once and then drained. - Blanched leaves are spread on corrugated iron and left in the sun for 3-4 days.
***Momordica* spp. (Nkaka)**	
Arthurstone	Dried nkaka leaves can be stored for two to three years if blanched. *Leaf preparation*: - Young leaves are harvested. - Foreign material is removed and the leaves are washed. *To dry fresh leaves:* - Cleaned leaves are placed on empty sacks and dried in the shade. This ensures that the leaves stay green and keep their nutrients. - Some dry the fresh leaves on sacks in the sun. *To dry blanched leaves:* - Water is brought to the boil, leaves are added and boiled for two minutes. - Blanched leaves are placed on empty bags or corrugated iron to dry in the sun for 1 day.
Cowpeas	
Arthurstone and Mars/Glenroy	Common practices used: - Young leaves are harvested, de-stalked and washed. - Leaves are not chopped. - Fresh leaves are placed in the sun to dry (this reduces cooking time dramatically).

Traditional leafy vegetable	**Drying practices of crops**
Arthurstone *Msoni*	Dried cowpea leaves can be stored for up to three years if blanched. *To dry fresh leaves:* - Cleaned leaves are usually placed on a clean surface in the sun. *To dry blanched leaves:* - Salt is added to water and then the water is brought to the boil. Leaves are added and boiled till tender (2-3 hours). - Blanched leaves are placed on empty bags or corrugated iron to dry in the sun for 2-3 days.
Mars/Glenroy *Dinawa/Monawa*	Common practices used: - Bring water to the boil and add the leaves. Boil for at least one hour. - Place the leaves on a tray in the sun till dry.
Pumpkin	
Arthurstone and Mars/Glenroy	Common practices used: - Young leaves are washed. - The hairs on the leaves are removed by pulling off the dermal layer.
Mars/Glenroy *Mophotse*	Common practices used: - Leaves are washed but not chopped. - Fresh leaves are placed on a clean surface in the sun or the shade.
Arthurstone *Tinwembe*	Dried pumpkin leaves cannot be kept for the whole year as the leaves disintegrate. *To dry blanched leaves:* Common practices used: - A small amount of water is brought to the boil and leaves are added. - Leaves are boiled for five minutes, turned once and then drained. - Blanched leaves are spread on corrugated iron and left in the sun for 3-4 days. *To dry fresh leaves:* Common practices used: - Young leaves are washed and chopped. - Chopped leaves are spread on a clean surface in the shade or the sun.
Watershed *Intanga*	Common practices used: - Young leaves are washed but not chopped. - Fresh leaves are placed on a clean surface in the sun or the shade.

Traditional leafy vegetable	Drying practices of crops
Monyaku (cucurbit)	
Mars/Glenroy	Common practices used: - Leaves are not chopped but are washed in clean water. - The fresh leaves on a clean surface in the sun or shade.
***Citrillus lanatus* (Motšhatšha)**	
Mars/Glenroy	Common practices used: - Leaves are harvested and washed in clean water. - Leaves are not chopped. - Fresh leaves are placed on a clean surface in the sun or shade.
***Solanum americanum* (nightshade)**	
Watershed	Common practices used: - Leaves are not chopped but are washed in clean water. - The fresh leaves are placed on a clean surface in the sun till dry.
***Corchorus* spp.**	
Arthurstone *Guxe*	*To dry fresh leaves*: Common practices used: - Foreign material and big stalks are removed. - Leaves are not chopped. - Leaves are washed. - The fresh leaves are placed on bags in the sun or shade till dry. *To dry blanched leaves:* Common practices used: - Add leaves to boiling water and boil for two minutes. - Place blanched leaves on bags in the sun or shade. The dried corchorus leaves can be stored for up to three years if blanched. Fresh leaves are very popular, but the dried leaves tend to be less palatable. Start drying in November through to March.

Several uncultivated TLVs (blackjack, purslane, nightshade) are usually not dried. TLVs that are dried are generally not chopped. Drying practices used for amaranth, cleome and pumpkin vary between the three villages, while respondents use similar practices for drying cucurbit types as they use for drying commercial pumpkins. The blanching times of cleome, amaranth and cowpea are in general very long and therefore raises some concern regarding the amount of

nutrients lost during the process. The practice of drying blanched leaves in the sun contributes to the loss of vitamin C in the plants (Keller *et al.* 2004). Cowpea in Arthurstone and Mars/Glenroy are dried with long blanching times as well as long exposure to the sun to help break down the fibres in the leaves. In Watershed the few TLVs (pumpkin, amaranth, nightshade and calabash) that are dried illustrate the loss of IK associated with drying of TLVs amoungst village members. The four TLVs are dried in the same way. Limited blanching is used to help extend shelf life. The one month period that many cucurbits and uncultivated TLVs are stored (see Table 5.12), is probably due to the fact that they are dried fresh.

The importance of dried products in the household food security has been discussed previously (see Table 5.11) and drying and storage practices help villages to survive critical food security periods. The main drying methods utilised for TLVs in the three villages are listed in Table 5.14.

Table 5. 14: Methods used for the drying of traditional leafy vegetables in the three rural villages

Village	Dry fresh leaves				Dry blanched leaves			
	Sun		Shade		Sun		Shade	
	n	%	n	%	n	%	n	%
Amaranth								
Arthurstone (N=8)	0	0	1	14	6	86	0	0
Mars/Glenroy (N=33)	28	85	16	48	26	79	1	3
Watershed (N=77)	22	29	10	13	7	9	1	1
Cleome								
Arthurstone (N=77)	20	26	2	3	68	88	0	0
Mars/Glenroy (N=38)	33	87	20	53	34	89	2	5
Cowpea								

Village	Dry fresh leaves				Dry blanched leaves			
	Sun		Shade		Sun		Shade	
	n	%	n	%	n	%	n	%
Arthurstone (N=77)	21	27	4	5	73	95	0	0
Mars/Glenroy (N=54)	19	35	9	17	52	94	3	6
Corchorus								
Arthurstone (N=79)	44	56	55	70	30	38	2	3
***Momordica balsamina* (nkaka)**								
Arthurstone (N=78)	27	35	26	33	65	83	1	1
Pumpkin								
Arthurstone (N=78)	22	28	20	26	61	78	0	0
Mars/Glenroy (N=76)	43	57	45	59	35	46	4	5
Watershed (N=79)	31	39	9	11	9	11	3	4
Monyaku								
Mars/Glenroy (N=24)	21	88	12	50	18	75	2	8
***Lagenaria* spp. (calabash)**								
Mars/Glenroy *Moraka* (N=39)	17	44	18	46	15	38	3	8
Watershed *Intshubaba* (N=10)	3	30	3	30	1	10	1	10
***Citrillus lanatus* (Motšhatšha)**								
Mars/Glenroy (N=22)	7	32	7	32	9	41	1	5
Watermelon								
Mars/Glenroy (N=20)	9	45	4	20	4	20	1	5
Nightshade (umsobo)								
Watershed (N=18)	5	28	0	0	3	17	0	0

Table 5.14 illustrates that the same respondent can utilise different methods to dry a specific TLV. In all the villages drying of blanched leaves in the sun was identified as an important method, except for corchorus that is predominantly dried fresh in the sun. Sun drying might shorten the drying process of the wet

leaves. In Mars/Glenroy a preference for drying leaves of watermelon, monyaku, cowpea, cleome and amaranth in the sun, was found. In Watershed leaves of nightshade and amaranth are preferably dried in the sun. Arthurstone respondents, however, prefer to blanch amaranth leaves. The relative low number of respondents utilising amaranth as one of their five most important crops in Arthurstone make the interpretation of this specific data more difficult. Watershed respondents prefer to dry pumpkin leaves in the sun. The preference for drying fresh leaves in the sun is causing the loss of important vitamin C in these plants (Keller *et al.* 2004). As dried crops form an important source of nutrition during the winter and spring months, the nutrient losses should be minimised.

Focus group discussions with women revealed that time available for drying would influence the decision between blanching and not blanching before drying. Both time and fuel materials had to be available for blanching to be done. In various areas it has been reported that leaves are either dried fresh in the sun or cooked and pressed into balls before they are dried and stored for the winter. Studies with the Shangaan near Letsitele showed that they blanch leaves and dry the leaves spread out on a clean surface and not made into balls (Hart & Vorster 2006). Discussions in all three communities documented both these practices, though spreading of the leaves after blanching is preferred as it dries faster. The shelf life of dried TLVs reported during group discussions varied extensively and was influenced by the type of drying method, quality of plants and management of stored leaves. Blanched leaves could be stored longer, did not disintegrate easily and was damaged less by insects. Storage of dried leaves in sealed, inflexible containers also extended shelf life. Observation of drying of leaves in the different villages raised concern about possible contamination from the environment. Fresh leaves are placed on a clean surface in the sun or shade, but are not protected from insects, animals or human contamination. Leaves are commonly placed in an open access area that tends to have a high flow of vehicular, animal or human traffic. This concern is supported by the findings of

Mpuchane and Gashe (1995) who found coliform contaminants in some samples sold in markets and stores in Botswana.

Several studies reflected differing results on the preservation of TLVs. Some studies report a reluctance to dry due to the loss of colour and taste (Ogle & Grivetti 1985; Kgaphola and Viljoen, 2000). Musinguzi *et al*. (2006) reported preservation to be very rare while Nguni and Mwila (2007) reported that preservation of ALVs was quite common. Vorster & Jansen van Rensburg (2005) found that ALVs in South Africa were dried either fresh or blanched, with sun or shade drying being used.

The type of containers used for storage will have an influence on the shelf life and possible contamination of the product. In Table 5.15 the use of containers for storing TLVs is revealed. Clay pots and polypropylene bags (used for maize flour at the mill) are some of the containers described under 'Other'. The polypropylene bags are more susceptible to contamination and crushing of leaves, which then lead to loss of food as the crushed leaves are discarded.

Table 5.15 reflects the predominance of use of buckets (59-74%) to store dried TLVs in Arthurstone. Large plastic bags are also used (20%). In Mars/Glenroy respondents mainly use buckets to store dried cleome, pumpkin and cowpea. Dried amaranth is also commonly stored in plastic bags. Watershed respondents mainly store dried amaranth in plastic bags (100%) and buckets (85%) while dried pumpkin leaves are stored in buckets (33%), plastic bags (13%), clay pots and polypropylene flour bags (58%). The storage of a variety of dried TLVs in Watershed is relatively low. The relatively low storage reported is probably because many respondents have indicated that they have lost the necessary knowledge to dry these leaves. Use of more than one type of container for the same dried product is common in all the villages.

Table 5. 15: Containers used for storage of preserved traditional leafy vegetables in the three villages

Village	N	Container used					
		n	Bucket	n	Plastic bag	n	Other
Pumpkin							
Arthurstone	78	56	72	34	44	17	22
Mars/Glenroy	76	65	86	0	0	2	3
Watershed	79	8	10	3	4	14	18
Cowpea							
Arthurstone	77	57	74	29	38	16	21
Mars/Glenroy	54	36	67	0	0	0	0
***Amaranthus* spp.**							
Mars/Glenroy	33	13	39	0	0	2	6
Watershed	77	11	14	13	17	7	9
Cleome							
Arthurstone	77	54	70	30	39	15	19
Mars/Glenroy	38	18	47	1	3	1	3
***Corchorus* spp.**							
Arthurstone	79	55	70	35	44	15	19
***Momordica balsamina* (nkaka)**							
Arthurstone	78	46	59	31	40	15	19

Women reported during group discussions that they have a specific order in which stored dried leaves are utilised if more than one type of container was used. Dried products stored in airtight containers (buckets and sealed clay pots) are used last, while dried leaves stored in polypropylene sacks and plastic bags are usually being used first. This practice ensures that the containers with the highest possibility of loss are consumed first and minimises losses due to crushing as well as contamination.

Promoting the use of more inflexible containers that can seal well would help to lengthen shelf life of the more delicate dried TLVs. As buckets are stackable, they are easy to store, do not take up much space, prevent contamination from outside sources and rodent and other pest damage is prevented. Respondents seal the containers used, either by knotting, placing lids on them or sealing with wet mud or cow dung.

In years when enough food is available, storing TLVs for longer than about nine months is not necessary. However, with the highly fluctuating rainfall, villagers need to store their produce for a longer time to ensure food availability when rainfall is late or low. To help increase food security during these periods, knowledge about the storage life of products is imperative. In Table 5.16 respondents gave an indication of the average time that the dried product can be stored and still be acceptable for household use.

Table 5.16 illustrates that most of the TLVs are utilised within six months, during the winter and spring following the summer when the crops were dried. The reported storage time, however, could also be influenced by the amount of leaves stored. For instance the storage of pumpkin in Arthurstone continues for a longer period than reported in Watershed and Mars/Glenroy. In Arthurstone and Mars/Glenroy cowpea is seen as a drought relief crop. In Arthurstone and Mars/Glenroy amaranth is seen as a plant used to bulk up other dishes, so is used extensively to help stretch the storage of the other dried TLVs. Amaranth is used for a longer period in Mars/Glenroy than in the other villages. Corchorus is a popular plant in Arthurstone and is mixed with amaranth to extend the storage period.

Table 5. 16: The duration of storage of the most important traditional leafy vegetables used for household food security in the three villages.

Village	< 6 months		6-12 months		1-2 years		+2 years	
	n	%	n	%	n	%	n	%
Pumpkin								
Arthurstone (N=78)	33	42	23	29	15	19	4	5
Mars/Glenroy (N=76)	41	54	28	37	1	1	1	1
Watershed (N=79)	9	11	29	37	5	6	2	3
Cowpea								
Arthurstone (N=77)	23	30	26	34	24	31	4	5
Mars/Glenroy (N=54)	17	31	33	61	2	4	1	2
Cleome								
Arthurstone (N=77)	28	36	22	29	17	22	3	4
Mars/Glenroy (N=38)	20	53	17	45	1	3	1	3
***Amaranthus* spp.**								
Arthurstone (N=8)	5	63	0	0	0	0	0	0
Mars/Glenroy (N=33)	18	55	12	36	1	3	1	3
Watershed (N=77)	20	26	7	9	3	4	2	3
***Corchorus* spp.**								
Arthurstone (N=79)	27	34	31	39	17	22	2	3
***Momordica balsamina* (Nkaka)**								
Arthurstone (N=78)	44	56	18	23	0	0	5	6

Further investigation with women groups about duration of storage found that the softer plants such as cleome, amaranth and corchorus are very brittle and easily

disintegrates into powder if stored in a flexible container. The powder is seen as a storage loss and discarded.

The importance of TLVs for the food security of especially the more isolated communities has been illustrated in the sections above. TLVs are important in both the fresh and processed form for the food security of many households in these communities. Increasing yields or extending fresh crop availability could increase food security even more, as higher yields make more TLVs available for drying. In Watershed women at the group discussions were asking for information on the utilisation of TLVs back in an effort to help them improve their food security in the winter and spring months. The women admitted to having lost most of this information. IK associated with ensuring greater bulk during a short time (seed systems and processing) has been mainly eroded. It is possible that this happened during a time when the men were working as migrant workers and the food was than mainly bought from remittances sent home. The closure of many mines and mechanisation/ containerisation of ports has led to many job losses. By the time the knowledge was needed again, the custodians of the knowledge had died and had not passed it on, as there was nobody interested at the time.

The varying degrees of preservation and storage, drying practices (blanching or fresh), storage management (container use) and duration of storage illustrated the variation in preservation practices between the villages. The differences can be ascribed to the level of IK in the villages, access to resources (time and fuel materials) and the climate that restrict growth periods and the types of plants that can grow in an area.

5.3.3 Traditional leafy vegetable seed systems and biodiversity

Seed systems, use of plants and biodiversity in an area are interrelated. Nazarea (1998) and Balick & Cox (1996) found that as soon as plants were not used in an

area anymore, it become scarce and in some cases became locally extinct. The IK associated with the use of those plants were then also lost. Poor seed systems can result in the loss of a specific crop or depletion in plant populations. Phara for instance, had vanished from Mars/Glenroy when the livestock broke into the yard and consumed the last plants. The community was assisted to get access to seed from family members about 60km away to help restore the plant back into the community and an *in situ* (on location) conservation plan was developed with them.

5.3.3.1 Traditional leafy vegetable seed systems

A 'seed system' is "an interrelated set of components including breeding, management, replacement and distribution of seed" (Thiele 1999).

“A local seed system is basically what the formal seed system is not. Activities tend to be integrated and locally organized, and the local system embraces most of the other ways in which farmers themselves produce, disseminate, and access seed: directly from their own harvest; through exchange and barter among friends, neighbors and relatives; and through local grain markets. Encompassing a wider range of seed system variations, what characterizes the local seed system most is its flexibility. Varieties may be landraces or mixed races and may be heterogeneous (modified through breeding and use)…The same general steps or processes take place in the local systems as in the formal sector (variety choice, variety testing, introduction, seed multiplication, selection, dissemination, and storage) but they take place as integral parts of farmers' production systems rather than as discrete activities. (…) The steps do not flow in a linear sequence, and they are not monitored or controlled by government policies and regulations. Rather, they are guided by local technical knowledge and standards and by local social structures and norms. Despite, or perhaps because, of their variability and local specificity to needs and preferences, local channels (e.g. household stocks, markets, social exchange networks) provide most of the seed that most small

farmers use. Common figures suggest that somewhere between 80-90% of the seed farmers access comes from the local seed system" (Sperling & Cooper 2003).

Uncultivated crops usually self-seed (distribute their own seed) and are very vulnerable to external forces that can limit the number of plants that reach seed formation. These plants can be severely affected by over-harvesting and poor growing conditions due to drought or soil erosion. Seed systems can make the difference between enough to store for winter or just having enough for summer as broadcasting of seed can increase plant populations and thus increase the number of plants available for drying.

Seed systems in the three villages were described during focus groups and observations were made. The descriptions for the various TLVs are presented in Table 5.17.

Table 5. 17: Descriptions of the various seed systems of traditional leafy vegetables found in the three rural communities

Village	Seed systems of crops
***Amaranthus* spp.**	
Arthurstone Mars/Glenroy	No seed is stored, the plant self-seeds.
Watershed *Imbuya*	Two systems exist: - The plant self-seeds. - Seed from more than one plant is collected and stored in a container.
Cleome gynandra	
Arthurstone Mars/Glenroy	No seed is stored, the plant self-seeds
***Corchorus* spp.**	
Arthurstone Mars/Glenroy	No seed system, the plant seeds itself.

Village	Seed systems of crops
Pumpkin	
Arthurstone *Tinwembe*	Common practice: - Seed is collected from mature fruit that will be cooked. - Seed is cleaned, dried in the sun and stored in bottles. - Sometimes ash from cooking fires is added. - No seed is bought. Own seed is used or seed is shared. - Only enough seed is kept for one planting, with some extra if neighbours might need seed. The system is very vulnerable to crop failures. No problems are experienced with germination. A good variety of pumpkinseed is available.
Mars/Glenroy *Mophotse*	Common practice: - Seed is collected from mature fruit that will be cooked. - Seed is cleaned, dried in the sun and stored in bottles. - Sometimes ash from cooking fires is added for protection against pests.. - No seed is bought. Own seed is used or seed is shared. A wide variety of pumpkins are used.
Watershed *Intanga*	Common practice: - The biggest pumpkin fruit are left on the vines to mature. - Seed is collected from mature fruit that will be cooked. - Seed is cleaned, dried in the sun and stored in bottles. - Sometimes aloe ash is added for protection against pests. - No seed is bought. Own seed is used or seed is shared. A wide variety of pumpkins are used
Monyaku (cucurbit)	
Mars/Glenroy	Common practice: - Seed are rarely stored. - If seeds are collected they are harvested when the green pods have turned yellow-brown. - Seeds are not eaten because they are bitter and they claim it makes people sick. Traditional healers use the seed, as they know the dosage.
***Bidens pilosa* (blackjack)**	
All three villages	No seed is stored, the plant self-seeds
***Solanum americanum* (nightshade)**	
Watershed	No seed is stored, the plant self-seeds

Village	Seed systems of crops
Cowpeas	
Arthurstone *Msoni*	Common practice: - Some keep their own seed, others buy seed and others give seed away. Seeds sold for consumption at R2 a mug (about 300ml) is often planted. - Seedpods are dried and threshed. Seed is removed and stored in bottles with ash from cooking fires to help control grain weevils.
Mars/Glenroy *Dinawa/Monawa*	Common practice: - Aloe ash is added to stored seed. - All the seed colours are planted. The seeds can be separated by colour before planting, but women claim that the seed colour makes no difference to the taste. - If there are no seed, they buy from the co-operative.
Watershed	Common practice: - Some keep their own seed, or exhange with neighbours or friends. Seedpods are dried and threshed. Seed is removed and stored in bottles with ash of *Aloe marlothii* or *A. ferox*.
***Portulaca* spp. (Purslane)**	
Watershed	No seed is stored, the plant self-seeds
Monyaku (cucurbit)	
Mars/Glenroy	Common practice: - Seed are rarely stored. - If seeds are collected they are harvested when the green pods have turned yellow-brown. - Seeds are not eaten because they are bitter and they claim it makes people sick. Traditional healers use the seed, as they know the dosage.
***Cucumis melo* (Phara/ Mophare)**	
Mars/Glenroy	There are two practices: 1. Ripe fruit is halved and turned inside out to dry. When the fruit halves are dry the seed is removed and cleaned and stored. 2. Ripe fruit is harvested, opened and the seed is spread along the area where the plants are desired.
***Lagenaria* spp. (Moraka)**	
Mars/Glenroy	Common practice: - Seed is collected from mature fruit that will be cooked. - Seed is cleaned, dried in the sun and stored in bottles. - Sometimes ash from cooking fires is added. - No seed is bought. Own seed is used or shared.

Village	Seed systems of crops
***Momordica* spp. (Nkaka)**	
Arthurstone	There are two practices: 1. Seed is harvested from mature fruit. Seed is cleaned, dried in the sun and stored. 2. Ripe fruit is harvested, opened and the seed is spread along the area where the plants are desired.

Table 5.15 describes the complex seed systems that are found in the three villages. The pumpkin seed systems are relatively simple and well sorted out. The same types of systems are used with all cucurbits where seed systems are in place. In general little seed storage of uncultivated TLVs is found and only a few of the older women occasionally store some of the seed. Three seed management systems were found for the semi-cultivated cucurbits (*Momordica balsamina* known as nkaka and *Cucumis melo* known as phara). Some seed are collected and stored, some fruit are left to ripen and drop seeds when the fruit disintegrates or ripe fruit are opened and the seed spread in areas where the plants are required. Cultivated traditional leafy vegetables (cucurbits and cowpeas) are usually harvested and stored. They are often kept for own use, shared with family and neighbours and infrequently bought. Cowpea seed are generally bought more often than those of cucurbits. Selection of a specific, healthy plant to supply seed for the next season was only found in Watershed, where the biggest commercial pumpkin type fruit was selected for their seed. This fruit was selected and cared for from an early age, with additional irrigation sometimes done to ensure good quality seed. The fruit was commonly protected against the sun and possible pests by covering it with grass. This was, however, not found in any of the other crops in Watershed or for any cucurbits in Arthurstone or Mars/Glenroy.

The seed support systems for TLVs in Africa are mainly informal and are farmer-kept or bought at the village market (Abukutsa-Onyango 2007a, Nguni and Mwila, 2007, Diouf, Gueye, Faye, Dieme & Lo 2007). In Kenya seed support system initiatives are providing more formal seed systems (Mwangi and Mumbi

2006; Abukutsa-Onyango, 2007a). In the villages the role of seed custodian, usually assigned to an eldery woman of high status, has been lost due to various social and economic reasons. Generally, seed systems are informal, unorganized and seed exchange between family and neighbours occur regularly.

Selection of seed before and after storage is very important to ensure viability and quality seedlings. The criteria used for seed selection are reported in Table 5.18.

Table 5. 18: Criteria used for seed selection in the three villages

Criteria	Arthurstone *N=80*		Mars and Glenroy *N=80*		Watershed *N=80*	
	n	%	n	%	n	%
No criteria	5	6	3	4	10	13
Big seed	9	11	32	40	24	30
Correct colour	5	6	6	8	20	25
Not hollow	0	0	9	11	1	1
Taste of seed	0	0	2	3	0	0
Strongest seed	63	79	40	50	36	45
No pest damage	27	34	11	14	4	5
Hard seed	20	25	3	4	25	31

All three villages reported using the strongest seed for planting or broadcasting. Big (large) seed was therefore important in Mars/Glenroy (40%) and Watershed (30%). Hard seed (seed that is not dehydrated is 'hard') was important in Arthurstone (25%) and Watershed (31%). 'Hard' seed is also an age indicator, as older seed stored in the same conditions will have lost more moisture than fresher seed. Arthurstone respondents (34%) reported seed undamaged by pests as one of their important criteria. The criteria used are generally very good indicators of seed viability and ensure the viability of the local seed systems.

During a focus group discussion a strong seed was described as large, correct colour for the specific crop (white for pumpkin, red for *Momordica balsamina*), not damaged by insects and was hard (not dehydrated). These criteria are used in commercial seed quality control activities to ensure a quality product and shows the sophisticated knowledge that still exists among some of the women.

5.3.3.2 Biodiversity of traditional leafy vegetables

No beliefs, taboos or mechanisms to ensure sustainable harvesting of wild TLVs were found in any of the villages. Many plants are destructively harvested (the whole plant is harvested) at seedling stage. Plants not harvested at seedling stage are usually harvested till flowering starts. Harvesting generally stops when the plants start to flower, as the leaves become fibrous and less palatable. In general only the leaves are harvested and the flowers and stems are left to let the plants seed themselves. In cases of crop loss or food insecurity this harvesting will, however, continue.

Several discussions were held and observations were made in the three villages and the following trends were identified:

5.3.3.2.1 Arthurstone

In Arthurstone there is a limited *in situ* (on location) conservation system of uncultivated TLVs within the community. Should some of the older women see that the plant is becoming scarce they will harvest seed from another area and spread it where required. This practice seems to be limited to the older women. Only a few of the younger women (under 45) reported such actions and many were surprised to hear of them. The *in situ* conservation of cultivated (pumpkin, cowpeas) and semi-cultivated (*Momordica balsamina, Cucumis melo*) plants was relatively well established, though there is need for concern as the younger

members of the group do not seem to know the principles of seed storage and only keep pumpkin seed.

Declining TLV populations in Arthurstone were reported by 66% of respondents. Many are worried about the scarcity of cleome (92%) as all gender and age groups enjoy the taste. The quantity of cleome has decreased during the past two years, but they feel that it is still available in sufficient amounts. They feel there is no apparent reason for the decline. A purple flowering cleome (xibangala) was reported as no longer available. *Momordica balsamina* (nkaka) was reported as unavailable by 31% of these respondents who also want it back again because it helps to control high blood pressure. Concern was also expressed for cowpea (18%) and *Bidens pilosa* (black jack). The following plants have been reported as no longer available: umsovo (grows in water and mud, unidentified), nhlawa (unidentified) and inanga (unidentified). These plants could not be found anywhere in the community. In Arthurstone the drought (87%), thunderstorms (44%) and low soil fertility (54%) were seen as important reasons for the decline in TLV populations. Further discussions with the community members on the possible reasons for this decline raised the following:

- Heavy thunderstorms wash seed away. This is possible as there are areas that are overgrazed and plant cover is sparse. In these areas there are few places where seeds can be retained.
- The number of people in the area is increasing dramatically, which contributes to the over harvesting of TLVs. When harvesting is mainly done at seedling stage, the seed production of TLVs is severely affected.

5.3.3.2.2 Mars/Glenroy

In Mars/Glenroy no broadcasting of scarce plant seed was reported. The *in situ* (on location) conservation of cultivated (pumpkin, cowpeas) and semi-cultivated (*Momordica balsamina, Cucumis melo*) plants was relatively well established.

In Mars/Glenroy the decline of TLV populations was reported by 19% of the respondents. Important reasons for the scarcity of some TLVs were ascribed to low soil fertility (53%), drought (23%) and unavailability of seed (7%). A high number of respondents did not know why plant populations are becoming scarce (23%). Cowpea and corchorus were reported as scarce while cleome and amaranth were mentioned as becoming scarce. During the time of the investigation phara had completely vanished and seed was collected in a village 60km away to re-introduce the crop.

5.3.3.2.3 Watershed

In Watershed no broadcasting of scarce plant seed was reported. The *in situ* (on location) conservation of cultivated (pumpkin, cowpea) plants was relatively well established. The younger members of the group do not seem to know the principles of seed storage, thus the future of crops of which seed is not available, is a concern.

In Watershed all traditional leafy vegetables, except pumpkins and cowpea, are uncultivated. There are no beliefs or taboos that govern harvesting practices. Only 18% of respondents reported a decline of TLV populations and of some concern is the high number of people who do not know why these TLV populations are declining (32%). Lack of seed (21%) and drought (16%) were two reasons mentioned as possible cause for the decline in TLV population. The rest of the respondents (42%) reported individual, unrelated perceptions. Of the 18% of respondents who reported the scarcity of some TLVs the following crops were mentioned: cowpea, nightshade and lethanye, of which the latter two are both bitter and being used occasionally. The tasty amaranth was also reported as becoming scarce.

According to Musinguzi *et al*. (2006) TLVs have become scarce due to the deterioration of the habitat caused by factors such as overgrazing, erosion and

deforestation. Nguni and Mwila (2007) found that overharvesting of uncultivated TLVs was avoided in Zambia, thus ensuring regrowth and conservation of utilised TLVs. Prain and Piniero (1999), as well as Nazarea (1998) urged scientists to realise that local crop diversity is maintained for particular reasons. These reasons ensure that local conservation of genetic diversity remain dynamic (Mooney 1992). New cultivars (introduced or self developed) should be tested for 'fit' into the local systems, and would either vanish (poor 'fit') or take the place of another less suited cultivar already in use. This is the process that has replaced many of the wild crops as the planting process tends to give people a more reliable way to food security (Prain and Piniero 1999). It has been observed throughout this study that spinach and cabbage has replaced many of the TLVs. The yields of spinach and cabbage are high and the plants are popular with all household members. Furthermore, the status of these crops is high as they are seen as modern and not poor man's food. Destruction of habitat, especially overgrazing and the resulting erosion, was observed in all the villages and reported as a cause for declining TLV populations in Arthurstone.

The loss of TLV crops in all the villages is of particular concern, as many people do not know why this is happening. If the reason for the declining populations is unknown, it can lead to the permanent loss of crops in a particular area since people do not know which problems to address. The loss of these plants also contributes to the loss of the IK concerning TLV production and utilisation.

5.4 MARKETING OF TRADITIONAL LEAFY VEGETABLES

The selling of traditional leafy vegetables varies between the different communities. The low number of traders in Mars/ Glenroy (4%) and Watershed (6%) is possibly due to the high cost of transport to the nearest market area as both villages are quite remote. Local markets, on the other hand, are limited since TLVs can be harvested in the veld and few people commute.

Arthurstone, due to its proximity to a ready market and the fact that several households have at least one parent working, has the potential to access a market. Almost a third (31%) of community members market some TLVs.

Table 5. 19: Marketing practices of the different traditional leafy vegetable crops in Arthurstone

Traditional leafy vegetable	Marketing of crops
Cleome gynandra (N=25)	Sell dried products. Dried: R2 / mug (250-300 ml) in plastic bag, June to September.
Cowpea Msoni (N=23)	Sell dried products. Dried: R2 / mug (250-300 ml) in plastic bag, June to September.
Pumpkin Tinwembe (N=23)	Sell fresh and dried products. Fresh: small plastic grocery bag (about 4l) @ R2/R3. The communities with irrigation sell at R2, the dryland communities sell at R3. They prefer to sell the dried product because of this price descrepancy. Dried: R2 / mug (250-300 ml) in plastic bag.
***Corchorus* spp.** Guxe (N=25)	Sell fresh and dried products. Fresh: small plastic bag (about 1l) @ R3 from November to January. Dried: R2 / mug (250-300 ml) in plastic bag, June to September.
***Momordica* sp.** Nkaka (N=25)	Sell fresh and dried products. Fresh: small plastic bag (about 1l) @ R3 from November to January. Dried: R2 / mug (250-300 ml) in plastic bag, June to September. The women do not work together when selling.

Table 5.19 shows the marketing practices of cleome, pumpkin, cowpea, corchorus and *Momordica balsamina* as reported by Arthurstone respondents. TLVs are mainly traded in dried form, though *Momordica balsamina* (nkaka), *Corchorus* spp. (guxe) and pumpkin are also marketed fresh. Most products are sold at R2 per mug. The competition experienced with the irrigation farmers who can trade at lower prices has led to the trading of mainly dried pumpkin, as the fresh pumpkin can stay unsold due to their own higher prices. The uncertainty of the market and the competition experienced with the irrigation farmers make the

marketing of dried products a safer option. TLVs are known for their short fresh shelf life (traders at markets, pers. comm.) and any unsold produce can generally not be sold two days later. Fresh pumpkins can only be sold on the day of harvest as they wilt very fast. Market conditions make the keeping fresh of produce difficult as access to water and shade is limited.

Several studies in Africa also found that weak market chains for TLVs, poor processing strategies, poor seed systems, lack of high quality seed, lack of information on best cultivation practices and low demand prevent farmers from commercialising (Mwangi and Mumbi 2006, Schippers 2002, Mnzava 1997). Schippers (2002) found other constraints not often mentioned by farmers to be lack of awareness of the nutritional value of TLVs and short shelf life of fresh TLVs. These factors generally agree with the constraints reported in the study.

Focus group discussions with traders ranked the importance of crops traded as: (1) pumpkin, (2) corchorus (guxe), (3) cleome (bangala), (4) *Momordica balsamina* (nkaka) and (5) cowpea. The crops that are traded are also the crops that were identified as the most preferred in Arthurstone (see Table 5.2). The traders are using their knowledge of the taste preferences in the area to help boost their sales.

The people involved with marketing TLVs, the areas where the marketing is done and packaging in which the TLVs are presented for sale, are discussed for Arthurstone. Each of the sections is presented for the TLVs marketed in Arthurstone.

Table 5. 20: People responsible for TLV sales, areas where sales take place and in what packaging TLVs are sold

Crop	*Cleome gynandra* (N=25)		Cowpea (N=23)		Pumpkin (N=23)		*Corchorus* spp. (N=25)		*Momordica balsamina* (N=25)	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Who sells TLVs										
Children	17	68	16	70	17	74	20	80	17	68
Women	21	84	20	87	20	87	22	88	22	88
Other family	3	12	3	13	4	17	3	12	3	12
Places of trade										
Home	2	8	7	30	12	52	8	32	8	32
Gathering places	0	0	1	4	7	30	0	0	1	4
Markets	22	88	21	91	20	87	22	88	22	88
Door-to-door	1	4	6	26	7	30	6	24	4	16
Packaging										
In plastic bag	25	100	23	100	23	100	25	100	25	100
Loose	5	20	5	22	5	22	5	20	5	20
Bunches	0	0	0	0	9	39	0	0	0	0

Table 5.20 shows women (84-88%) and children (68-80%) are the main TLV marketers. The main area of trade for TLVs is at the markets (87-91%), though other trade options namely sales from home, at gathering places and door-to-door trading are also used. Pumpkin is mainly sold at markets (20%) and from home (52%). All TLVs are traded in plastic bags (100%), though they are occasionally sold loose (20-22%). Pumpkin is mainly sold in plastic bags (100%) but many (39%) are also sold in bunches. All opportunities for trading are

extensively used as the diversity of places of trade reflects. The mainly dried form of TLV that is sold lends itself to being pre-packed in plastic bags and giving the freedom of selling the product loose. Observations have shown that the trading of loose dried leaves enable flexibility in volume per unit sold. When competition is high, the volumes can be slightly increased to make their product more appealing.

Respondents in Arthurstone mentioned that they tend to sell from door-to-door and at gathering places (hospitals, pension payout points, meetings, etc.). Women tend to do their own selling, but children are often sent to sell produce from door-to-door in the area close to home. In a few cases customers would come to the house to buy TLVs. This was usually done in combination with the selling of other vegetables or foodstuff.

In Tanzania TLVs consumed were mainly from own homegardens and wild collection, while the wealthier consumers purchased them in the market. The consumption of TLVs was higher amoungst the poorer population than in the wealthier sector, with the variety of TLVs consumed declining as wealth increased (Weinberger & Swai 2004). South Africa (Twine, Moshe, Netshiluvhi & Siphugu 2003) and Uganda (Musinguzi *et al.* 2006) also reported this trend. Dovie *et al.* (2007) found no correlation between the dependency on TLVs and wealth in rural Bushbuckridge. The data from this study is not detailed enough to determine this trend.

In Arthurstone 40% of the traders mentioned the following constraints:

- Traders cannot compete with the prices of their competitors (23%).
- TLVs have a short shelf life (14%).
- The market is far (26%).
- Potential customers do not have money to buy TLVs (29%).
- Potential customers think TLVs are too expensive (8%).

During the focus group discussions in all three the villages a strong tendency not to enter the market place was identified. The prices are too low for them to

retrieve their transport costs and make a profit. Traders perceive that potential customers cannot afford to buy TLVs or perceive TLVs as being too expensive.

The distance to the point of sale and the mode of transport can affect the quantity and quality of the produce sold. Where time between harvest and trade is long, or exposure to high temperatures is extended, the shelf life and quality of the product is affected. Poor transport conditions can lead to produce that are perceived as of poor quality. Table 5.21 categorises the distance to markets and mode of travel used to access them.

Table 5. 21: The distances travelled and the mode of travel of traders of the three villages during their marketing activities

	Arthurstone (N=25)		Mars and Glenroy (N=3)		Watershed (N=5)	
	n	%	n	%	n	%
Distance to point of sale						
0.1-1.9	15	60	2	66.7	5	100
2-3.9	9	36	0	0	0	0
> 3.9	1	4	1	33.3	0	0
Total	25	100	3	100	5	100
Mode of transport						
Walk	23	92	2	66.7	4	80
Taxi	9	36	1	33.3	0	-
Bicycle	1	4	0	-	0	-
Other	0	-	0	-	1	20

Table 5.21 illustrates that areas TLVs are traded were close by (usually less than 2km). Produce was mainly carried to the place of sale. Traders also use other modes of transport and will travel by taxi if they have large quantities to sell. Trading is strongly localised in all the villages with only a few people selling outside their village. In Watershed all TLV traders sell within less than 2 km from their homes and they mainly walk. In Mars/Glenroy traders who sell TLVs in the

village mainly walk. The one trader who sells outside the village (>3.9km) needs to take a taxi as they are far from other villages. The mode of travel and distance to the area of trade can not explain the poor quality of TLVs seen in the markets. The problems are possibly due to the poor access to water (to keep TLVs fresh) and lack of shade (placing TLVs in the sun reduces shelf life drastically). To improve the quality at the markets, markets should be evaluated and upgraded where necessary. The marketing of mainly dried produce, however, helps to limit problems experienced at the markets. The only male respondent in Arthurstone who sells TLVs does it for his own benefit and spends the money on himself. All the other traders are female who might occasionally use the children to sell from door-to-door. Many of these traders only sell when they need money for expenses (school fees, medical costs, unexpected costs, etc.).

In Kenya Farm Concern International consumer studies found that the key inhibiting factors in TLV marketing were a poor product image and lack of consumer awareness. Production of TLVs with wastewater in the urban environments led to concern about the source of the TLVs. Other constraints include lack of awareness of TLVs' nutritional value, poor handling and quality of TLVs in especially street markets and lack of TLVs in formal markets (Mwangi and Mumbi 2006). Maundu *et al.* (1999) and Abukutsa-Onyango (2007b) find that TLVs have to compete with exotic crops, a situation also found in the three villages. A study by Kimiywe *et al.* (2007) in urban and peri-urban Nairobi found ignorance of cooking methods and high cost a constraint in marketing, a finding also reflected by Vorster, Pichop, Maro & Marealle (2007b) on the marketing of traditional vegetables in Soshanguve in Gauteng.

The ability to determine product prices is an important component for any successful marketing venture.

Table 5. 22: Ability of respondents to determine prices successfully

Market information	Arthurstone (N=80)		Mars and Glenroy (N=80)		Watershed (N=80)	
	n	%	n	%	n	%
Ability to price correctly	58	72.5	54	67.5	20	25

In Table 5.22 reflect that 75% of women in Watershed report that they do not know how to determine their prices as few of them are involved with marketing. The women in Arthurstone (73%) and Mars/Glenroy (68%) have experience in selling activities and know how to determine prices. Marketing of TLVs are mainly done on an *ad hoc* basis, with traders selling when the opportunity arises or when money is needed for unexpected expenses. Determining a price where the product is already sold at low prices is a problem, as labour is generally not considered as an opportunity cost due to the high unemployment rates in the areas. Marketing of TLVs in Watershed and Mars/Glenroy is limited by the remoteness of markets and low prices realised by TLVs.

Traders need to know what the prices for their produce are before they set off to the markets. Table 5.23 reflects the sources of information utilised by traders to access marketing information of TLVs. When competition is high, prices tend to be low and many traders can not recoup their investment at these prices. TLVs that are harvested in these times can best be dried for selling at a later stage when the fresh TLVs are limited. Marketing when fewer traders are selling improves the possibility of profits. The informal marketing of TLVs does not enable traders to access media for prevailing prices. Informal networks need to play an important role in their market information access strategies.

Table 5. 23: Sources of information used by traders to determine the prices of TLVs in the markets

Market information	Arthurstone (N=25)		Mars/Glenroy (N=3)		Watershed (N=5)	
	n	%	n	%	n	%
Know TLV price before go to market	23	92	2	66.7	1	20
Neighbours provide information	4	16	2	66.7	1	20
Friends provide information	7	28	0	0	0	0
Other sources provide information	13	52	0	0	0	0

Table 5.23 illustrates that the majority (92%) of Arthurstone traders know the prices of TLVs before they leave for the market. They receive this information from neighbours (16%), friends (28%) and various other (52%) sources (taxi drivers, passers by, etc.). In Mars and Glenroy the two local traders know what the prices in the village are and they receive this information from their neighbours (100%). The one trader selling in the closest town does not have any information beforehand. The five traders in Watershed all know how well the TLVs are selling but only one obtained this information from the neighbours (20%).

Local networks have proved important in the marketing of TLVs. These networks are used to determine where, how and for how much the produce will be sold. Traders that compete outside villages find marketing in these areas very demanding and need to build networks. Competition for TLV buyers is high in summer, but the sales of dried products in winter seem to be less of a problem as the product is not so freely available in the villages. Local social networks assist traders in the more isolated villages (Watershed, Mars/Glenroy) to access

information, while the more peri-urban Arthurstone rely on passer-by and taxi intelligence.

5.5 SUMMARY

Urbanisation and the extensive promotion of 'modern' crops led to the youth perceiving TLVs as a poverty crop with low status. TLVs are being replaced by less adapted exotic crops in many gardens. At the community and household level the IK associated with the production and utilisation of TLVs in the group of women 35 years and younger, tended to be lower than in the older age group. Women from the younger age group utilised fewer of the plants and had less information about seed systems and sustainable harvesting techniques.

Use of TLVs was largely restricted to household consumption, and therefore was important for household food security. Food security of households tended to fall into two distinct phases namely when fresh crops are abundant (usually summer and autumn) and when fresh crops are limited (usually winter and spring). As fresh TLVs are available from two weeks after the first rains, they are an important source of food for households in the pre-harvesting period of cultivated crops (spring). Watershed (KwaZulu-Natal) was the only village reporting on gender differences in consumption patterns, as the men would only consume amaranth and pumpkin. Women were the main decision-makers on how much of the household income was spent on food. The importance of the different TLVs for household consumption varies according to the specific socio-economic situation of the household at a specific time.

The socio-economic conditions of households determined the growth stages at which TLVs are harvested. Time elapsed between harvesting periods of the same plant differed between the three villages. Consumers preferred harvesting young leaves before the plant started to flower. Harvesting of older leaves only occurred when a shortage of fresh crops existed. Though many harvesting

practices overlapped, several differences occurred between the villages. Villages differed with regards to the plant parts (seed, stalks, flowers and fruit) used, types of TLV mixes and their proportions within the mix. Almost all TLVs were prepared within two hours of harvesting. The TLVs were mainly prepared as a relish for maize porridge, though limited variation was found. Differences in preparation methods of crops existed and were reflected in the type of dish prepared (relish, incorporated into the porridge), additives to dishes (adding of ash, peanut flour, bicarbonate of soda, mashed pumpkin seed, exotic vegetables, flowers and immature or mature fruit) and preparation method (frying, boiling). The cooking times varied considerably between and within villages.

During periods of low volume fresh TLVs, dried TLVs and winter vegetables formed very important food sources in all three villages. The rural villages of Mars/Glenroy and Watershed were more dependent on dried TLVs for their winter and spring food security when fresh TLVs were limited than the peri-urban village of Arthurstone. The types of TLVs that are dried, the methods used to dry them, their storage management and length of storage vary considerable between the three villages. Blanching times tended to be very long and most of the leaves were dried in the sun. Most of the dried TLVs in all three the villages were stored for up to one year, but the bulk seemed to be used within six months. Pumpkins are very important sources of food for winter in all villages as most respondents dried and stored them. Cowpea was perceived as an ideal dried crop for drought survival strategies as the dried leaves have a long shelf life. Most of the dried TLVs were stored in plastic bags (short-term storage), buckets and clay pots. The softer plants such as cleome, amaranth and corchorus are very brittle and if they are not correctly stored, will easily disintegrate into powder that is currently discarded.

Villagers perceived TLVs to be nutritious, but it was not promoted for use by vulnerable groups like the ill, children, elderly, pregnant or lactating women. The loss of IK was identified as a possible cause for this.

A decline in utilisation of TLVs was found in all three villages. In Arthurstone relatively poor weather conditions, low soil fertility and lack of seed restricted the availability of TLVs and therefore also its consumption. In Watershed and Mars/Glenroy the decline in utilisation is due to poor production systems (drought, low soil fertility and lack of seed). Seed systems for uncultivated plants were unstructured. The older women in the three villages had very sophisticated knowledge about seed quality, although selection of a healthy plant or fruit for seed collection was only found for pumpkin in Watershed. In Arthurstone spreading of scarce TLV seed was not practised by the younger generation.

Marketing of TLVs was limited in Mars/Glenroy and Watershed but more frequent in Arthurstone. Income generated from these sales was used to complement household income. TLVs were mainly sold in dried form as the shelf life of fresh TLVs is very short. In Arthurstone women and children are the main marketers and most of the produce was sold in an informal market set-up. Traders were using their knowledge of the taste preferences in the area to help boost their sales and local social networks assisted traders in accessing TLV market information.

CHAPTER 6

PRODUCTION OF TRADITIONAL LEAFY VEGETABLES

Dixon & Gulliver (2003) suggested using the farming systems perspective at the sub-regional and national level to develop guidelines for the provision of services, technical assistance and technologies to rural areas. In South Africa not enough is known about TLV production systems to develop these guidelines.

6.1 THE HUMAN AND SOCIAL RESOURCES

6.1.1 Social institutions

In Arthurstone a pre-school takes care of children from three up to six years old, thus enabling women to work. One of the three primary schools in the area incorporates grade R (pre-school) and all of them include grades one to seven and take part in the government feeding scheme. Two secondary schools cater for grade eight to twelve. The large number of schools shows the youthfulness of the population. The majority of the working villagers either commute or move as opportunities for employment within the community is limited.

Arthurstone has one clinic that is open daily and is intensively used by the community. There are five nurses who provide good services, and even work overtime. The members of the community raised their concern about the state of repair of the building, but the government addressed this in the the year following the survey.

Several community groups were found in Arthurstone and these included: savings, sewing, religious, funeral, agricultural, youth, crafts and political groups.

The agricultural group had access to a communal garden, extension services and loans.

Within the Mars and Glenroy boundaries there is a pre-school, primary school and a high school where the children of both communities attend. The primary school in Mars takes part in the school feeding scheme where children receive additional food at school to help address the malnutrition problems.

A mobile clinic visits Mars/Glenroy once a month to treat ill patients and to administer vaccinations to babies and children. The following types of groups were found in the community: savings, funeral, sewing, crafts, agricultural, political and religious groups. The agricultural and sewing self-help groups have access to extension services, tractors, loans and entrepeneurship training.

In Watershed there is one primary school for grades one to seven with about 400 children and one secondary school with about 300 pupils for grade eight to twelve.

Since November 2001, a mobile clinic comes to Watershed once a month to see to all ailments. A daily clinic is available at Driefontein (about 10km from there). No growth and nutrition information is available, as these clinics treat the ill and supply the vaccinations where needed.

Several community groups in Watershed influence various aspects of community life and form social networks between households that are not due to kinship. This broadens the possibilities to access available to households. The following types of groups were found: savings, funeral, agricultural, religious and political groups. The influence of these groups on households can be substantial as they can affect the status of the household, as well as access to resources. An example of this is the agricultural group that has access to a communal garden, agricultural training and help with access to resources.

6.1.2 The household demography

The household-head (male or female) as illustrated in Table 6.1 and age group composition of the household (Table 6.2) influences the resources available to the household, it's access to land, ability to provide labour for agricultural activities and chores and the general potential of the household. In general female heads of households have less access to resources and tend to be poorer (Mettrick 1997). Households with more children and fewer adults are also more vulnerable to shocks.

Table 6. 1: The household-head gender profile of the three villages

Community	Arthurstone (%) (N=72)		Mars/Glenroy (%) (N=80)		Watershed (%) (N=72)	
	n	%	n	%	n	%
Male-headed households	33	46	36	45	33	46
Female-headed households	39	54	44	55	39	54

No significant differences were found for the household-head distribution between the villages. Slightly more households are female-headed (Table 6.1). In all the villages it was found that households where the men have migrated to the cities for work, the households are still considered male-headed and the women still have to function under the decisions made by the men during their short periods of residence in the village. These *de facto* female-headed households are not reported as such, but are seen as male-headed households. The number of households where females have to do the day-to-day decision-making is thus under-reported. From an agricultural development point of view the large number of *de facto* and *de jure* female-headed households is a constraint, as households that are female-headed tend to have less access to resources (Mettrick 1997). Agricultural support services need to take the high incidence of households

where females are the day-to-day decision-makers, into consideration and should be gender sensitive when planning interventions (time, labour, access to land, income). The circumstances of these female-headed households need to be studied to help ensure the maximum impact when any interventions are planned in a specific village.

Table 6. 2: The household composition in the three villages

Household composition	Arthurstone	Mars/Glenroy	Watershed
Average number children under 7 years of age	1.05	0.95	1.15
Average number of children 7-12 years of age	1.32	0.99	0.99
Average number of children 13-18 years of age	1.44	1.06	1.13
Average number of people 19-60 years of age	2.7	2.15	2.8
Average number of pensioners per household	0.47	0.7	0.66
Average number of people per household	7	5.85	6.75
Average number of people who contribute to household income	1.25	1.45	1.68

Table 6.2 indicates that Mars/Glenroy reported less children (3) and adults under pensionable age (2.15) per household, though more pensioners (0.7) were reported. The average household size is smaller than found in Arthurstone and Watershed. The smaller household size, seen in combination with the higher number of pensioners can lead to a shortage of labour for agricultural needs. Larger areas would force farmers to make use of hired labour or mechanised processes (use of tractors). In spite of its larger average household (7), fewer people contribute to household income (1.25) in Arthurstone. This could be a

combination of less pensioners and more children under 19 years of age when compared to Watershed and Mars/Glenroy. Watershed households have more children under the age of seven (average 1.15), more adults between 19 and 60 years of age (average 2.8) and more people contributing (average 1.68) to the household income. The larger number of people between 18 and 60 years of age in Arthurstone and Watershed could lessen the need for mechanised processes or hired labour in the smaller cultivated areas.

Further investigation revealed that Watershed has significantly more families with more than one child under the age of seven (X^2=10.5817, df=4, p<0.0317) than Arthurstone and Mars/Glenroy. General group discussions have shown that many grandchildren stay in the community till they have to go to school, when they are sent to their urban parents for schooling. No significant differences were found for the children of school going age (7-12 years, 13-18 years) or adults (19-60 years) between the different villages. In Arthurstone there is a tendency for fewer households to have pensioners (X^2=5.3443, df=2, p<0.0691) than in Watershed and Mars/Glenroy, thus reflecting a more youthful household composition and less people who can substantially contribute to household income through some kind of employment. There were no statistical differences between the average number of people per household and the average number of people who contribute towards the household income between the different villages. The lower number of pensioners per household in Arthurstone has probably influenced the lower number of people contributing to household income. Further analysis on household composition has shown that Mars/Glenroy tends to have fewer households with eight or more members (X^2=8.8208, df=4, p<0.0657) than Arthurstone and Watershed.

6.1.3 Household income and expenditure

Household incomes and expenditures are an important factor in the production decisions that households take. A lower household income lowers the ability of

households to influence the biophysical conditions in which they have to farm, as they can afford less external inputs for their production system (Dixon & Gulliver 2003).

Table 6. 3: Household ranking of importance of income sources in the three villages

Income source	Arthurstone	Mars/Glenroy	Watershed
	Rank	Rank	Rank
Pension	**2**	**1**	**1**
Formal employment	**1**	**3**	**2**
Self employment	**3**	5	5
Seasonal labour	5	4	4
Farming	4	**2**	**3**

Table 6.3 reflects the perceived importance of sources of income to a household. Reported incomes varied, with the households where salaries for formal employment are received, skewing the average income. Pensions and formal employment are under the top three income sources for households in all villages. Farming is perceived as one of the three most important income sources in Mars/Glenroy and Watershed. The importance of pensions in the villages can be seen by the high ranking that it received in the rural villages (Watershed and Mars/Glenroy). Arthurstone's peri-urban environment gives more opportunities for people to be self-employed and therefore pensions and farming were perceived to be a less important source of household income. The constant flow of traffic between Bushbuckridge and the surrounding areas enable villagers to be involved in transport and associated enterprises.

The non-parametric Kruskal-Wallis test showed no statistically significant differences between the average income of the three villages (Kruskal-Wallis statistic = 3.33, df=2, p=0.1895). Group discussions in all the villages showed the

perceived high unemployment of the youth. According to the women many unemployed young adults and their children are living with their parents. This places a huge demand on the finances of the household as many households might only have one employed member. Some households might have migrant workers contributing to household incomes, while others supplement income with income generating projects established in the villages (sewing, crafts).

Household expenses tend to provide a reflection of household income. Relatively poor households spend proportionately more on food than wealthier households (Vernon 2004, Maliwichi, Bourne & Mokoena 2003).

Table 6. 4: The proportional spending of household income for different categories in the three villages.

Community	Arthurstone (N=80)		Mars/Glenroy (N=80)		Watershed (N=80)	
	n	%	n	%	n	%
Food	50	62	52	65	53	67
Farming	2	3	6	8	4	5
Savings	4	5	4	5	2	3
Other	24	30	18	22	21	25
Total	80	100	80	100	80	100

Table 6.4 illustrates that a high percentage of income (more than 60%) is spent on food, agreeing with the relatively low incomes in the villages. Group discussions stated that buying of fresh or processed food is done in winter. Many consumables that they are not able to produce (sugar, tea, oil, etc.) make up the bulk of the food purchases throughout the year. Farmers buy very few or no inputs and try to use their local resources instead. Savings tend to be informal with the local funeral clubs and stokvel. These savings are used to help families with their funerary needs. Discussions have shown that this has become an

important aspect of household expenditures due to the high rate of adults mortality. The low incomes in the three villages invariably lower the savings opportunities in households. All other expenses were grouped under 'Other' and include expenses associated with transport, clothing and education. In all households there are an average of about two children of school going age (see Table 6.2), thus school costs attribute largely to this category of expenses. Expenditure on farming varies from 3 to 8% of household income. Households can not afford the expensive inputs needed by the commercially oriented agriculture promoted by many agricultural support services. Farmers usually buy little or no inputs, and try to use their local resources instead. No statistical differences were found within any of the expenditure categories between the three villages.

6.1.4 Rituals, taboos and beliefs associated with traditional leafy vegetables

As traditional leafy vegetables fall mainly in the domain of women, they also know about the taboos, rituals and beliefs regarding TLVs and agricultural issues. These beliefs influence the use, access, production and promotion of traditional leafy vegetables.

In Arthurstone 15% of respondents reported that there were crops that only men or only women could plant. These respondents state that only women can plant bambara groundnut. In Mars and Glenroy no such division was reported. Only 5% in Watershed reported this gender oriented crop restriction. The respondents reported that men do not cultivate cowpea as cultivation causes infertility in men.

Eighty-nine percent of respondents in Arthurstone, 40% of respondents in Mars/Glenroy and 46% of respondents in Watershed reported beliefs associated with agricultural activities.

Table 6. 5 Beliefs associated with agricultural activities in the three villages

Belief	Arthurstone N=71		Mars/Glenroy N=32		Watershed N=37	
	n	%	n	%	n	%
Beliefs associated with the female fertility cycle						
A woman may not work in the field if she had sex with her husband the previous day	23	32	0	0	0	0
Women may not work in the field when they are menstruating.	58	82	*	*	11	30
Women are not allowed to do any agricultural work during the early stages of pregnancy	47	66	0	0	0	0
Women may not work in the fields when you have a small baby	*	*	6	19	1	3
Beliefs associated with death						
There is a restriction on working in the fields on the day before and on the day of a funeral	*	*	10	31	6	16
Women who have recently lost a husband may not do any work in their fields	0	0	5	18	0	0
Beliefs associated with the weather						
They may not work in the fields when it has hailed the previous day	0	0	13	41	0	0
When lightning has struck someone	0	0	2	6	0	0
When there is lightning in the area	0	0	2	6	0	0

* Was reported by at least half of the participants at the group discussions but was not quantified

About double the respondents in Arthurstone reported beliefs associated with agricultural activities when compared to the other villages (Table 6.5). Quite a few of the taboo's and beliefs are connected to the female fertility cycle (menstruation, pregnancy) and some are possibly for the protection of mother and child (stages of pregnancy, lactating women with small babies). All three villages reported taboo's on menstruating women and women with small babies working in the fields, and no agricultural work the day before and on the day of

the funeral. Beliefs associated with the weather (hail and lightning) were just reported in Mars/Glenroy.

In Arthurstone several women also mentioned the following beliefs during the group discussions:

- Menstruating women are not allowed to go in to the fields where pumpkins are, since it will cause the loss of fruit.
- Young women (females 16-18 years of age) may not handle seeds.

Group discussions in Mars/Glenroy also identified the following beliefs:

- No children are allowed to jump over any pumpkin type plants or fruit, as these children will then never marry and any fruit will abort.
- Menstruating women are not allowed to work in the fields.
- A maize field may not be entered for two days after a hailstorm, or the hailstorm will come back.

During the group discussions in Watershed, several women also mentioned the following beliefs:

- No bedwetting child may be in the fields.
- Men and menstruating women may not walk through bambara fields.

The group discussions in Mars/Glenroy and Watershed show the influence of the church on these beliefs and taboo's, as they are seen as pagan beliefs that are not acceptable in a Christian household. This might be one of the reasons for the low reporting of beliefs and taboo's, especially with the younger women who expressed surprise at some of the beliefs and taboo's mentioned during group discussions.

The taboo's and beliefs (human factors) can severely affect the labour availability and possibility for agricultural activities of especially households with many adult women (adult women are more affected by the beliefs). The number of

households who reported beliefs associated with agricultural activities is higher in Arthurstone than Watershed and Mars/Glenroy. Arthurstone households' options in terms of labour are therefore more severely affected. Combined with the relative low income in Arthurstone it limits the use of hired labour to overcome the effect of these beliefs on their production decision-making.

6.2 THE LIVESTOCK

The livestock were not evaluated in the farming systems of the study. The length of the questionnaire did not make the inclusion of livestock data possible.

Group discussions in Arthurstone and Mars/Glenroy showed the important role of animals as either draught animals for land preparation or as source of savings (cattle) or food (mainly the small livestock such as goats and poultry). Poultry generally served as a pest control mechanism and a source of protein. Goats and cattle could have a very negative impact on farming activities, especially where farmers were not able to fence their fields. In the drier areas livestock regularly broke through fences or slipped through holes or open gates. In Mars/Glenroy this led to the loss of a TLV in both the villages (see 5.3.4), as cattle had eaten the last plants and fruits.

6.3 TRADITIONAL LEAFY VEGETABLE CROPPING SYSTEM

Farmers usually refer to their maize field or groundnut field, causing many outsiders to miss the secondary crops (such as TLVs) that are growing in these fields and are essential to the household's nutrition and economy. These secondary crops can be cultivated or semi-cultivated between or beneath starch crops, or can include TLVs or trees that have been left in the field. The bulk of this production never reaches the market as they are mainly used for household consumption, leading to an underestimation of the relative importance of these

crops to household food security (Lykke, Mertz & Ganaba 2002, Mertz *et al.* 2001).

6.3.1 Cultivated areas in the three villages

The field sizes that farmers cultivate in the three communities are very diverse. The cultivated areas have been divided into three groups (Table 6.6). Generally farmers with just a backyard garden cultivate an area of less than 500m^2. Farmers with more than 5000m^2 cropping fields need some type of mechanisation (African Co-operative Action Trust, NGO in KwaZulu-Natal, personal communication).

Table 6. 6: The distribution of respondents according to their cultivated area in the three villages

Village	0-499m^2		500-4999m^2		> 5000m^2	
	n	%	n	%	n	%
Arthurstone N=80	20	25	45	56	15	19
Mars/Glenroy N=78	5	6	34	44	39	50
Watershed N=75	46	61	18	24	11	15

Table 6.6 indicates that at least 80% of the respondents in Arthurstone and Watershed cultivate areas smaller than 5000m^2. Sixtyone percent of Watershed respondents cultivate small areas less than 500m^2, thus their main cultivation is done in home gardens and small communal garden plots. In Mars/Glenroy a few respondents (6%) cultivate only their home gardens (<500 m^2). The increased access to a tractor in the village enables Mars/Glenroy respondents, even with smaller households, to cultivate areas larger than 5000 m^2. In spite of the larger average household size and more adults (19-60 years of age) per household, Watershed households mainly cultivate small areas of less than 500m^2. In all three villages the lack of fencing of fields and roaming livestock are preventing

many households with fields to cultivate these areas. Agricultural support services should recognise the different needs (extra food, food security, sales) and constraints (lack of access to land, poor fencing) of the different groups and adjust their activities according to the situation.

Informal discussions in the villages have shown that access to fields is quite restricted. Many of the families who have moved there in the last ten years have no access to cropping fields. The local NGO has taken the areas available for cropping into consideration and is helping farmers to optimise their small areas. This is, however, not always the case with agricultural support services and should be taken into consideration. Group discussions in Mars/Glenroy found that households usually have at least one field cultivated, with farming and pensions supplying the bulk of the income. Only a few individuals, who are generally employed, cultivate only at their home garden.

Household income and composition influence the area that a household cultivates. These factors influence the household labour available and the ability of a household to buy inputs or hire services. In Arthurstone households who indicated their main sources of income as a combination of employment and pensions, plus two or more adults in the household, tended to cultivate areas smaller than 500m^2. The higher number of adults influence the number of workforce who could increase household income. Higher external incomes enable many households to buy food, thus making them less dependent on farming to secure their food needs. Discussions with Arthurstone respondents suggested that larger areas (larger than 5000m^2) tended to be planted when external income needed to be replaced or supplemented with income from farming. Watershed households with more than two adults per household (X^2=4.7916, df=2, p<0.0911), tended to cultivate areas larger than 5000m^2. The low degree of mechanisation (tractors and animal traction) in Watershed increases the need for more labourers to cultivate these larger areas. The interaction between household income (financial factors), household composition

(human factors) and area cultivated (natural factors) differs between the villages. These factors affect each other and also affect the production decisions that are made.

6.3.2 Crops grown and constraints experienced in the three villages

In Arthurstone maize, pumpkins, spinach, tomatoes, onions, chillies, sweet potatoes, dry beans, cabbage, green pepper, beetroot, cowpeas, bambara groundnuts, groundnuts and fruit trees (especially mangoes and marula) are common. A stream is feeding a dam in the area, and some local households have established a communal garden where summer crops are grown. A privately owned mango orchard is situated in the community. At the end of the year sales of marula beer is common along the roadside. Each homestead tends to have at least one mango tree, as they thrive in this area. Most of the mango yields are used for fresh fruit and atchar.

In Mars/Glenroy men and women tend to work in the fields together if both live there. Due to the poor water situation they have to rely on rain and can not irrigate. They tend to have small home gardens and use their fields for field crops. They sow whatever they prefer but the crops must be able to grow without irrigation. Maize (Mmidi) is the most important crop as everything is eaten with it. All households plant maize using the seeds that they have selected from their previous crop. Mars/Glenroy is very dry and the livestock devour the tender crops that they can reach. The fields tend to be scattered and unfenced and many of the villagers risk planting cowpeas in the field in spite of the threat of livestock. Generally these leaves are not as tender and by planting them between the maize they hope to keep livestock out. Livestock roam freely and are not attended. Women will chase livestock if they see them entering a field. In this area exotic crops are very popular and will probably replace TLV production as the older people who plant it because of tradition, stop cultivating due to illness or

old age. These women complain that their children are not interested in the TLVs.

In Watershed the following crops are grown: potatoes, Mbila (maize), sorghum (mabele) for beer, dry beans, cabbage, onion, beetroot, green pepper, cauliflower, spinach, cowpeas, bambara groundnuts, soybeans (new in the area), pumkin, watermelon and butternuts. Farmers have to guard their gardens from livestock in winter, as there are no fences. A local NGO has started experimenting with living fences (planting plants that serve as fences, ie agave). Theft is a problem with crops, especially green maize. The fields are rainfed and maize is usually intercropped with pumpkins. A community garden with 13 families involved (about 100 people benefit) uses a small self-built dam as water source. If it is very dry, they will start using water from the river. Vegetables such as spinach, tomatoes, eggplant, beetroot, green peppers and onions are cultivated.

6.3.3 Ranking of the five most important crops in the three villages

Determining the most important crops in an area give an indication of the types of crops produced and the possible crops that are intercropped with each other. Experience has shown that pumpkins, cowpea and maize are commonly intercropped. The types of crops that are important can give an indication of the water situation in a village. Maize is usually not irrigated while exotic crops tend to be irrigated. Where non-irrigated and irrigated crops are important, the irrigated crops are usually produced in an area where water is relatively easy to access and close to home. Field crops such as maize, cowpeas and many types of pumpkin crops are generally grown in fields where no irrigation is done.

Table 6. 7: Five most important cultivated crops listed by respondents in each of the three villages

Crop	Arthurstone (N=80)		Mars/Glenroy (N=80)		Watershed (N=80)	
	n	%	n	%	n	%
Maize	77	96	80	100	71	89
Pumpkin	74	93	76	95	71	89
Spinach	60	75	0	0	64	80
Tomato	0	0	0	0	62	78
Onion	0	0	0	0	46	58
Cowpea	77	96	54	68	0	0
Momordica balsamina	45	56	0	0	0	0
Calabash	0	0	41	51	0	0
Watermelon	0	0	33	41	0	0

Note: this is an open question and the percentages reflect the respondents who chose the crop as one of their five most important.

In Arthurstone the most important crops (Table 6.7) are: (1) maize and cowpea, (2) pumpkin, (3) spinach and (4) *Momordica balsamina* (nkaka). In Mars/Glenroy the most cultivated crops are: (1) maize, (2) pumpkin, (3) cowpea, (4) calabash and (5) watermelon. The most planted crops in Watershed are: (1) pumpkin and maize, (2) spinach, (3) tomato and (4) onions. In all three villages pumpkin and maize are very important crops to the community, with cowpea an important crop in Arthurstone and Mars/Glenroy while exotic vegetables are important in Watershed.

In all three villages the majority of respondents grow pumpkin (89-95%) and maize (89-100%), with cowpea also important in Arthurstone (96%) and Mars/Glenroy (68%) (Table 6.7). In Mars/Glenroy the importance of pumpkin types is seen in the choice of three pumpkin types in the list of five most important crops. This could also, however, be a reflection of the drought that they were experiencing during the study, as some pumpkins were reported to grow in home gardens and can be irrigated occasionally with grey water. Pumpkin types are multi-purpose as they produce edible leaves, seed and fruit. This is an

important aspect for women who have to provide food for the household (Hart & Vorser 2006). The mention of exotic crops in the list of most important crops in Watershed and Arthurstone suggest an area where limited irrigation practices can be followed. Spinach is important in Arthurstone and Watershed, where both villages tend to irrigate them. Mars/Glenroy crops tend to depict a production system where irrigation is limited. Mars/Glenroy does not have water to irrigate, thus no exotic crops are currently grown. This highlights the importance of TLVs in communities during times of drought.

6.3.4 Production status of traditional leafy vegetables

During the group discussions respondents in the three communities suggested a link between the variation in production of TLVs to the socio-economic situation of the individual household and the amount of rainfall experienced. Many participants were of the opinion that TLVs grow better than 'new' crops (mainly exotic vegetables) in times of low rainfall and marginal conditions. Several reasons were given for some of the types of TLVs not growing in their fields or gardens anymore, of which the loss of seed and bitter taste seem to be the most important factors.

Table 6. 8: Traditional leafy vegetable production information of the three villages

Production information	Arthurstone (N=78)		Mars/Glenroy (N=80)		Watershed (N=76)	
	n	%	n	%	n	%
Perceived increase in TLV production during the last 5 years	12	15.4	19	23.8	32	42.1
Frequency of TLV production per village	76	97.5	80	100	67	88.2
Produce TLVs in home garden	74	94.9	74	92.5	63	82.9

In Table 6.8 Watershed respondents report the highest increase in TLV production in the last five years (the local NGO has entered the area about five

years before the survey and promotes the production of traditional crops), though all have reported an increase. The number of TLV growers in all the villages is high (more than 88%). In spite of half the respondents (50%) in Mars/Glenroy cultivating more than 5000m^2 (see Table 6.5), the majority of the respondents (93%) only grow TLVs in home gardens. This might be explained by the fact that the home gardens are fenced and the drought is causing many of the livestock to enter areas where growing crops are not fenced. The unfenced fields and associated livestock damage in Watershed and Arthurstone are probably also contributing factors for TLV production in home gardens. This is a limiting factor for expansion of TLV production.

6.3.5 Preferred production sites for traditional leafy vegetables

Preferences for growing TLVs in a certain area are important to consider. Promoting cultivation of a TLV on a larger scale where they are only planted in the home garden due to various reasons is counter productive. It is also important to determine if some TLVs prefer to grow under certain conditions.

Table 6. 9: Distribution of respondents according to the most preferred areas for production of TLVs in the three villages

Preferred area or soil type	Arthurstone (N=80)		Mars/Glenroy (N=80)		Watershed (N=80)	
	n	%	n	%	n	%
Preferred area						
Homegarden is close, limited labour needed	32	40	7	8.8	7	8.8
Home garden, because it is fenced	0	0	17	21.3	0	0
Home garden and field, it spreads risk	0	0	19	23.8	0	0
Momordica balsamina prefers fences	40	50	0	0	0	0
Preferred soil type						
TLVs prefer fertile soil	10	12.5	6	7.5	50	62.5
Corchorus spp. prefer loam soils	21	26.3	0	0	0	0
Pumpkin prefers loam soils	15	18.8	17	21.3	1	1.3

In Table 6.9 respondents indicate the preferred area for TLV production. In Arthurstone 40% of respondents reported that they prefer to plant their TLVs in the home garden because they do not have much labour and it is also close to the home. This was only reported by 9% in both Watershed and Mars/Glenroy. In Mars/Glenroy 21% of respondents reported using home gardens because they were fenced and kept the livestock out. They planted the crops with the softer leaves here, as livestock would eat those crops in the unfenced fields. This was not reported as a reason in Arthurstone or Mars/Glenroy, though it was reported during the group discussions as a very important factor. In Mars/Glenroy about a quarter (24%) of the respondents reported that TLVs were planted at home and in the fields in an effort to spread the risk of possibly losing their crops.

Many respondents in Arthurstone and Watershed (Table 6.9) reported that TLVs prefer to grow in a specific area. Fifty percent of the Arthurstone respondents mentioned the preference of *Momordica balsamina* (nkaka) to climb fences and about a quarter mentioned that *Corchorus* spp. prefer to grow in loam soils. Watershed respondents perceived that TLVs preferred fertile soil, though this was reported by less than 13% in Arthurstone and Mars/Glenroy. Almost one fifth of Arthurstone (19%) and Mars/Glenroy (21%) respondents perceived that pumpkin preferred loam soil, though almost no respondents in Watershed (1%) reported this preference. The other respondents did not perceive any soil preference for pumpkin.

During group discussions held in Watershed and Mars/Glenroy a few reported that their home gardens were too small. In Mars/Glenroy *Cucumis melo* (phara) was reported to prefer climbing against a vertical structure and is often found against fences, though this makes them vulnerable to passing livestock.

Several studies in Africa found that TLVs are generally grown in the home gardens because the application of manure and the management is easier (Abukutsa-Onyango 2007b, Chweya & Eyzaguire 1999) and the losses to thieves

and animal damage is lower (Abukutsa-Onyango 2004). Abukutsa-Onyango (2007b) and Hart and Vorster (2006) report that some TLVs such as pumpkins, melons, cowpeas and slenderleaf can be grown as intercrops in the fields between maize. In Southern Africa few TLVs are cultivated for the leaves. Pumpkins and cowpea tend to be the exception. The use of sweet potato and pumpkin leaves has also been reported (Hart & Vorster 2006, Vorster & Jansen van Rensburg 2005).

6.3.6 Labour and food production

The family composition of the households can have an influence on a family's ability to meet its labour needs. In Table 6.10 the labour sources are evaluated for various agricultural activities in all three villages.

In all villages the families needed to hire labour, though much of it was for clearing of new fields, soil preparation and planting (Table 6.10). In Arthurstone mechanisation is scarce and expensive. With the bigger household sizes (average of seven members) and the lower number of people who contribute to the households, more family labour is needed to cultivate the 500-5000m^2 cultivated by 56% of households. Table 6.10 indicates that women in Arthurstone provide the majority of the labour for clearing new fields (90%), soil preparation (91%), planting (91%) and harvesting (93%) of TLVs. Children support them with soil preparation, planting and weeding (24%). Labour is hired for seedbed preparation (19%) and clearing of new fields (21%). Women are the main labour source for all aspects of crop production.

With the smaller family size (average 5.85) and 50% of respondents cultivating more than 5000m^2 in Mars/Glenroy, the use of tractors and animal traction (hired labour during seedbed preparation) is expected. Women provide most of the labour for weeding (60%) and harvesting (61%) of TLVs (Table 6.10). Clearing of new lands is limited as almost all land has been cleared, thus only a few still clear land. Hired labour, in the form of a tractor or animal traction team, is mainly used to prepare the seedbed (31%). Other family members are an important

source of labour during seedbed preparation (40%) (provide animal traction) and planting (30%). The children mainly help with weeding (26%) and harvesting (34%). The women and other family members provide most of the labour.

Table 6. 10: Distribution of labour sources in the three villages for the different stages in a traditional leafy vegetable production cycle (N=80)

Village	Clearing of new fields		Soil preparation		Planting		Weeding		Fertilise /compost		Harvesting	
	n	%	n	%	n	%	n	%	n	%	n	%
Women												
Arthurstone	72	90	73	91	73	91	54	68	64	80	74	93
Mars/Glenroy	13	16	14	18	42	53	48	60	8	10	49	61
Watershed	25	31	23	29	38	48	46	58	29	36	54	68
Children												
Arthurstone	23	29	19	24	19	24	19	24	11	14	8	10
Mars/Glenroy	2	3	1	1	19	24	21	26	1	1	27	34
Watershed	19	24	17	21	18	23	20	25	12	15	10	13
Hired labour												
Arthurstone	17	21	15	19	11	14	12	15	5	6	10	13
Mars/Glenroy	10	13	25	31	12	15	19	24	8	10	8	10
Watershed	14	18	20	25	14	18	2	3	9	11	12	31
Men												
Arthurstone	12	15	3	4	5	6	3	4	5	6	2	3
Mars/Glenroy	3	4	6	8	4	5	6	8	5	6	7	9
Watershed	0	0	13	16	10	13	5	6	11	14	8	10
Other family members												
Arthurstone	4	5	0	0	0	0	0	0	0	0	0	0
Mars/Glenroy	12	15	32	40	24	30	13	16	16	20	18	23
Watershed	2	3	2	3	2	3	7	9	4	5	6	8

In Watershed 61% of households cultivate areas smaller than 500m^2. Households with more than two adults between 19 and 60 years of age cultivate areas larger than 5000m^2. The women provide most of the labour for weeding (58%) and harvesting (68%) (Table 6.10). Their children, who help with clearing new fields (24%), weeding (25%) and planting (23%) TLVs, support them. Hired labour is mainly used for harvesting (31%). The men provide support with seedbed preparation (16%). Support from other family members is minimal. The women provide the labour in the production systems of all three the villages. The size of the area cultivated determines the importance of hired labour in the form of tractor or animal traction use.

In an effort to determine if there were statistical differences in labour distribution between the three villages the X^2 was determined. In Arthurstone women who are cultivating less than 500m^2 tend to be less involved with weeding than women in Watershed and Mars/Glenroy (X^2=10.4337, df=2, p<0.0054). In Watershed, when compared to Arthurstone and Mars/Glenroy, more women clear new fields (X^2=9.9158, df=2, p<0.0070) and hand plough (X^2=10.7268, df=2, p<0.0047) areas smaller than 500m^2. When keeping in mind the lower availability of mechanised help (see Table 6.11), the hand ploughing seems to be the only option for many. In Mars/Glenroy more hired labour (these are mainly the tractor drivers) is used to prepare the soil in the larger (>5000m^2) cultivated areas (X^2=12.0387, df=2, p<0.0024). The labour distribution reflects the human aspects that affect production decisions. These differences in use of labour affect decisions on the outsourcing of services (use of tractors, animal traction, hired labour) and the production systems that can be followed. These findings support the hypothesis that the three villages have different production systems.

6.3.7 Cultivation practices for traditional leafy vegetables

The soil preparation, fertilisation, planting, pest and disease control and irrigation practices of the different crops in the three villages are reported.

6.3.7.1 Soil preparation and fertilisation of crops

The survey investigated the seedbed preparation and fertilisation practices of farmers (Table 6.11). Three main types of seedbed preparation methods were found namely hired animal traction (oxen and donkey teams), hired tractor services and ploughing with a hand hoe. A high use of tractors (89%) for seedbed preparation in Mars/Glenroy was reported. Animal traction teams still exist and are hired in Mars/Glenroy and Arthurstone, but the knowledge associated with animal traction has been lost in Watershed. The time and effort invested in hand hoeing is large, even if the field has been tilled before. Kraal (cattle) and poultry manure, self-made compost and bought inorganic fertilisers are the main types of fertiliser used in the villages.

Table 6. 11: Distribution of the most common seedbed preparation and fertilisation methods used by respondents in the three villages.

Method	Arthurstone (N=76)		Mars/Glenroy (N=80)		Watershed (N=63)	
	n	%	n	%	n	%
Soil preparation method						
Tractor	24	32	71	89	25	40
Oxen	36	47	1	1	0	0
Donkeys	0	0	19	24	0	0
Hand	62	82	4	5	16	73
Fertilisation						
Kraal manure	41	54	53	66	42	67
Poultry manure	1	1	2	3	5	8
Inorganic fertiliser	5	7	25	31	4	6
Compost	52	68	5	6	27	43
Other	0	0	0	0	2	3

Table 6.11 illustrates 24% use of animal traction in Mars/Glenroy and 47% in Arthurstone. Hand ploughing is common in Arthurstone (82%) and Watershed (73%). Respondents use more than one method of seedbed preparation, though

this study had not captured the reasons for using these different methods. The type of seedbed preparation and planting method (monocropped or intercropped) used should be considered when making suggestions for crop maintenance, as hand ploughing tends to be broadcast while animal traction and tractors plough furrows. Planting method will influence field management decisions.

Most TLV producers (76%) in Arthurstone use some form of organic fertiliser. Table 6.11 illustrates that the use of compost (68%) is the highest, with many farmers using more than one type of fertilisation. Only 7% of respondents use inorganic fertiliser. The combination of high percentage of *de jure* and *de facto* female-headed households and the long distance from a co-operative could explain the lower use of inorganic fertilisers. In Mars/Glenroy kraal manure (66%) plays an important part in the fertilisation of soils. The use of inorganic fertilisers in Mars/Glenroy is also quite high. Discussions with the local extension officer and observations by the research team during the study period, showed that extension support actively promotes the use of commercially oriented practices like mechanisation and the use of inorganic fertilisers. In Watershed kraal manure (67%) and composting (43%) plays an important part in the fertilisation of soils. The local NGO has taught many households to make liquid manure and successful composting (observations made in the ten years of working with the NGO). In all three villages, livestock forms an important part of farming systems, thus manure can play an important part in fertilisation.

The different conditions in the three villages are expected to influence the methods for seedbed preparation and fertilisation practices of farmers. When compared to Arthurstone and Watershed, significantly less households in Mars/Glenroy hand plough (X^2=108.4073, df=2, p<0.0001) and significantly more farmers use tractors (X^2=59.5825, df=2, p<0.0001). The smaller household sizes, larger cultivated areas, access to a tractor in the area and strong extension drive for mechanisation are contributing factors to the use of this practice in Mars/Glenroy.

Animal traction is used significantly more in Arthurstone than in Watershed and Mars/Glenroy (X^2=40.6313, df=2, p<0.0001), and higher income households utilise tractor services more (X^2=7.8600, df=2, p<0.0051). Significantly more farmers with cultivated areas larger than 5000m^2 use animal traction (X^2=6.02768, df=2, p<0.0263).

In Watershed tractors are used significantly more by households with higher incomes (X^2=5.3866, df=1, p<0.0203). Significantly more farmers with cultivated areas larger than 5000m^2 use tractors to plough (X^2=27.405, df=2, p<0.0001). No association was found between income and area cultivated. Watershed households will use tractors for areas larger than 5000m^2, as no animal traction teams exist in the area and some form of mechanised help is needed to cultivate areas of this size. The association between use of tractors and income is an important issue and should be kept in mind by the extension officer when transferring technologies that are appropriate for the specific conditions in the village.

The use of organic and inorganic fertilisers is influenced by income, access to resources and the size of the area planted (ACAT, personal communication). In Mars/Glenroy significantly more respondents from the lower income groups use inorganic fertiliser (X^2=5.3863, df=1, p<0.0203), which is surprising. Significantly less people use organic fertiliser (X^2=76.9427, df=2, p<0.0001) and more use inorganic fertiliser (X^2=23.7661, df=2, p<0.0001) than in Arthurstone and Watershed. This might be due to the extension focus on the poorer households and their strong support for the use of commercially oriented agriculture (discussion with local extension officers and personal observations). The shortage of raw materials for compost making can be ascribed to the very dry season and the roaming livestock consuming anything edible.

In Arthurstone significantly fewer home gardens (areas smaller than 500m^2) are fertilised (X^2=8.3003, df=2, p<0.0158) than in the other villages and significantly more farmers use compost (X^2=64.4712, df=2, p<0.0001) when compared to the other villages. No significant associations were found in Watershed.

Several studies in various African countries have also shown that most of the time no fertilizer or farmyard manures have been used (AVRDC 2003 a-e, Mhlontlo, Muchaonyerwa & Mnkeni 2007).

6.3.7.2 Production practices for traditional leafy vegetables

Common practices on planting and maintaining TLVs, as discussed during group sessions, are reported per TLV for the villages where they are utilised. Monocropping and intercropping practices are also reported.

The maize intercropping nature of TLV production links the soil preparation, fertilisation and irrigation to the management practices of maize. All practices followed for maize are automatically also done for intercropped crops (cowpea, pumpkin, bambara, peanuts, etc.). Monocropped pumpkin, *Momordica* spp. (nkaka) and *Cucumis melo* (phara) were the only distinctive production methods that did not follow the maize practices. Hand irrigation of monocropped pumpkin is more common than other crops as they are grown in the home garden and small amounts of water are added to the roots.

The following cropping systems were found to be common in the three villages:

- Amaranth tends to be harvested between the maize where it usually self-seeds. Few individuals in Arthurstone might broadcast seed between the maize. Amaranth is generally not found in home gardens and also harvested in marginal and other disturbed areas.
- Pumpkin is planted in the home gardens as a monocrop in areas that tend to be more marginal (slopes, close to fences, at end of rows). A few seeds

are planted per hole to which some fertiliser has been added. The number of seed sown is usually determined by the quality, age (expected germination rate) and expected harshness of the season. In the fields they are seldom monocropped and are commonly being planted between maize rows and at the end of a row if another crop is intercropped between the maize rows. The time of planting the pumpkins seem to differ between and within villages as some are planted together with maize while others plant as different stages of the maize's growth cycle. In Arthurstone pumpkins will not be planted in a cowpea intercropping system as they compete in terms of growth and negatively influence each other. This was not reported in the other villages. One maize field may in part be intercropped with cowpeas, the rest planted with pumpkin. Where pumpkins are intercropped with peanuts or bambara they do not share the same space between the two maize rows, but tend to be broadcast in alternate rows or the maize field is separated into different blocks in which only bambara, pumpkins or peanuts are planted between the maize. Intercropping of maize with bambara and peanuts is also common.

- Blackjack (*Bidens pilosa*) tends to self-seeds. Found in home gardens, fields, marginal and other disturbed areas. No broadcasting or selective weeding was found.

The following cropping systems were found in Arthurstone and Mars/Glenroy:

- Cleome tends to be harvested between the maize where it usually self-seeds. Few individuals might broadcast seed between the maize. Generally not found in home gardens. Also harvested in marginal and other disturbed areas.
- Cowpeas are usually broadcast in the field as an intercrop with maize. It is generally planted at the same time that the maize is planted. In Arthurstone cowpeas can not be planted with pumpkins as they compete in terms of growth and negatively influence each other. A maize field may in part be intercropped with cowpeas and in part planted with pumpkin.

Often cowpeas are only intercropped with maize. They are seldom monocropped and not grown in home gardens. In Arthurstone the spreading type is preferred for the leaf harvest, while the upright type is preferred for seed harvesting. Mars/Glenroy only utilises the upright type. Mars/Glenroy respondents report that the soil type cowpea is planted in affects the taste of the leaves and seed.

- Corchorus is generally self-seeding and tends to be found between the maize, in home gardens and in unproductive areas. In Arthurstone a few people might broadcast seed in areas where they want the crop to grow.

Calabash cropping system found in Mars/Glenroy and Watershed:

- *Lagenaria* spp. (Moraka/ calabash) and motšhatšha are generally planted in the fields between the maize. A few seeds are planted per hole to which some fertiliser has been added. The number of seed sown is usually determined by the quality, age (expected germination rate) and expected harshness of the season.

Cropping systems in Arthurstone:

- *Momordica* spp. (Nkaka) generally self-seeds. Nkaka is a climber and is commonly found on fences. When someone wants to establish nkaka in a specific spot the ripe fruit are cut open and the seeds are scattered where the crop is desired. Only a few women will keep seed and these will be scattered close to fences after the first rains. They will also be sown in difficult area in the same way as pumpkin is used. Some plants self-seed when the fruits rot and the seed drops to the ground.

Cropping systems in Mars/Glenroy:

- Watermelon is generally planted in home gardens, sometimes in fields on a small scale. Usually planted in a small space that might be difficult to grow other crops (slope, near fence, etc.). A few seeds are planted per hole to which some fertiliser has been added. The number of seed sown is

usually determined by the quality, age (expected germination rate) and expected harshness of the season.

- *Cucumis melo* (phara) is a climber and is commonly found on fences. When someone wants to establish phara in a specific spot the ripe fruit are torn open and the wet seed is scattered where the crop is desired. Only a few women will keep seed and these will be scattered close to fences after the first rains. Some plants self-seed when the fruits rot and the seed drops to the ground. Phara must be managed, as it needs water and cannot survive in the veld.
- Monyaku self-seeds and the plant is a perenial that stays in the soil after harvesting. Plants start to grow after the first rain in August and limited harvesting can be done at the end of August. Plants are disturbed during tilling in November, re-establish themselves in December and are harvested till March if not disturbed.

Cropping systems in Watershed:

- Intshubaba can be monocropped in the home garden but is also commonly intercropped between the maize. A few seeds are planted per hole with the number of seed sown usually determined by the quality, age (expected germination rate) and expected harshness of the season.
- *Solanum americanum* (nightshade) tends to self-seeds. Found in home gardens, fields, marginal and other disturbed areas. No broadcasting or selective weeding was found.
- *Portulaca* spp. (purslane) is self-seeding and harvested where it is found. No broadcasting or selective weeding was found.

The formal cultivation of ALVs is more common in East and West Africa than in Southern Africa, were it is often harvested from the wild (Abukutsa-Onyango 2007b, Modi *et al*., 2006, Kgaphola and Viljoen 2000). Nguni and Mwila (2007) reported that the TLV specie determined if it was cultivated or not. Diouf *et al*. (2007) found that Senegalese farmers normally use traditional cultivation

practices when cultivating TLVs. TLVs are quite often intercropped with grains, other TLVs or vegetables (Hart and Vorster 2006, Maundu *et al*. 1999). A study done in the Letsitele area (Hart & Vorster 2006) also showed that selective weeding did sometimes take place in some fields and backyards in an effort to give the preferred uncultivated TLVs a competitive advantage above those less preferred. Similar production systems for pumpkin type crops reported in this study were found in the Letsitele area (Hart & Vorster 2006) and three villages in the Eastern Cape (Vorster & Jansen van Rensburg 2005). The TLVs in this study illustrate that both cultivation and wild harvesting is practiced. TLVs are often intercropped with maize, though monocropping also occurs.

6.3.8 Pest and disease control in the three villages

Arthurstone producers use limited chemical pest (19.7%) and disease (18.4%) control. Pest control tends to be in the form of cutworm bait or 'Blue Death', a general pesticide, with few using other agro-chemicals. The relatively high use could also be contributed to their high production of exotic crops.

No chemical control is used in Mars/ Glenroy where there are also few exotics grown due to the drought.

Watershed producers use chemical pest (65.1%) and disease (41.3%) control. Pest control tends to be in the form of cutworm bait or 'Blue Death', a general pesticide. The local NGO actively promotes cutworm bait due to the high incidence of cutworm related losses experienced by farmers. Alternative organic recipes are used to help control pests. Farmers do not know the names of the chemicals they use to control disease. Group discussions held after the questionnaire had been administered, showed possible confusion between a pest and a disease, as red spider mite was seen by respondents as a disease and chemicals were bought to combat them. The red spider mite was identified when one of the farmers brought some leaves of a diseased tomato plant. With

78% of farmers producing tomatoes (Table 6.7) and the problems they experience with red spider mite, it could explain the high use of chemicals. The red spider mite population pressure is too high for effective alternative organic spray use. In Arthurstone and Watershed it is the women who apply pest and disease control.

Watershed farmers who cultivate areas larger than 5000m^2, spent more than 25% of their income on agricultural inputs (X^2=9.2584, df=2, p<0.0098), which is much higher than for Arthurstone and Mars/Glenroy farmers. Cutworm bait and 'Blue Death' are the general pesticides used in Arthurstone and Watershed**.**

No pesticides are registered for use on TLVs in South Africa, as this has never been an economically important area of research for private agro-chemical companies (personal communication, several crop pathologists). Personal communication with several researchers working on TLVs in Kenya, Senegal, Mali, Uganda, Benin and Tanzania report some use of unregistered chemicals. Pest and disease incidence levels on TLVs are unknown (EU IndigenoVeg network project workshops).

6.3.9 Irrigation of traditional leafy vegetables

Irrigation practices can increase the potential of an area, as yield increases if plants grow in more optimal conditions and crops that need more water can be grown where irrigation practices are adequate.

The irrigation practices of the three villages are discussed in Table 6.12. No irrigation is done in Mars/Glenroy. This makes the production of drought tolerant crops very important, as there is little disposable income available to establish an irrigation system. The semi-arid climate in this area would suggest low-cost water-harvesting techniques in the cultivated areas in an effort to keep rainwater available for longer.

Table 6. 12: Irrigation practices in the home gardens and fields in the three villages

Irrigation type	Arthurstone			Mars/Glenroy			Watershed		
	N	n	%	N	n	%	N	n	%
% farmers irrigate	76	38	50	80	0	0	63	60	95
Hand	38	38	100	-	-	-	60	52	87
Flood	38	3	8	-	-	-	60	6	10
Pipes	38	7	18	-	-	-	60	3	5

Table 6.12 reports that 50 percent of the farmers in Arthurstone irrigate while all of them (100%) irrigate by hand with a few individuals also using flood irrigation (8%) or hosepipes (18%). The majority (95%) of farmers in Watershed irrigate. Hand irrigation is very common (87%) and few farmers use flood irrigation (10%) or hosepipes (5%), with many areas being quite far from a water supply point. Hand irrigation is common practice and the high labour input of this should be taken into consideration when new technologies are introduced. Any technologies that will decrease labour would have a positive impact on the time women need to spend on crop maintenance.

Observations in Arthurstone found the cultivated areas were usually far away from water sources. Some agricultural group members and households carry water from the rivers and fill up drums that are used as water storage containers. This will help to optimise the time that irrigation is done as the members can store water and can schedule their time for irrigation to some degree. In Watershed some farmers irrigate from a self-constructed, small dam or from water carried from the household supply point. In Arthurstone and Watershed producers grow the more drought sensitive crops such as spinach in these irrigated areas. The more drought tolerant crops such as maize and TLVs are planted where irrigation is difficult due to various constraints.

6.3.10 The farming systems in the three villages

The main farming systems, as described by Dixon *et al.* (2001), for the three villages in terms of TLV production are described below.

Arthurstone is a sub-tropical region dominated by smallholder farmers. Arthurstone households produced diverse fruit, vegetable and field crops. Most households cultivated areas between 500 and 5000m^2. Uncultivated TLVs grew between the maize that was intercropped with cowpea and pumpkin. Cowpea and pumpkin were never planted together as they affect each other's growth. Only pumpkin and cowpea are planted, with a few individuals spreading seed of the more herbaceous, uncultivated TLVs. Selective weeding of these uncultivated TLVs was observed. Women commonly hand ploughed, though animal traction and tractors were used for the larger areas. Farmers mainly depended on rainfall production of TLVs and 50% of the households hand-irrigated high-value crops grown in the home gardens. The water was generally carried from the river to the garden. Organic fertiliser use is common, with inorganic fertiliser used infrequently. Only a few household gardens make use of fertilisation programs. Use of chemicals for pest control was relatively low.

Mars/Glenroy is situated in a temperate region dominated by smallholder, extensive, maize-based farming systems. Poor rainfall limited exotic vegetable, fruit and field crop production. Maize is the most important crop produced in the area and was produced on the unfenced fields. Maize was commonly intercropped with cowpea and to a lesser extent with pumpkin, with uncultivated TLVs growing in between the crops. The variety of priority TLVs mainly consisted of various types of pumpkins that were all cultivated. The softer, herbaceous types of TLVs were uncultivated and unmanaged. Pumpkins were generally grown in home gardens where the softer leafed uncultivated TLVs were also found. The majority of households cultivated areas larger than 500m^2 and 50% cultivated more than 5000m^2, with tractors and animal traction hired to prepare

the soil in the cultivated areas larger than 5000m^2. Women provided most of the labour during the production cycle, while other family members also played an important role during seedbed preparation and planting. No irrigation was practiced, therefore no exotic vegetables were produced. Kraal manure and inorganic fertiliser use was common amongst farmers. Many farmers from the lower income group used inorganic fertiliser. No chemical control was used.

Watershed is situated in a temperate region dominated by smallholder, extensive, maize-based farming systems. Several exotic vegetables were produced, though cold winters limited the variety of fruit crops that were grown. Maize was commonly intercropped with pumpkin, with uncultivated TLVs growing in between the crops. Cowpea production is limited, but mainly used as an intercrop with maize. Households mainly cultivated household gardens and small communal plots (<500m^2) due to the livestock not being herded. Women tended to hand plough areas smaller than 500m^2 and provided most of the labour during the production cycle. Crops mainly depended on rainfall for production of TLVs. Hand irrigation was made possible by the digging of small water capturing dams close to the communal gardens. Irrigation was used for the production of high-value crops grown in the home and communal gardens. Kraal manure and composting were the most important fertilisers used. Chemical pest control on cultivated crops was relatively high, with women applying the chemicals.

6.4 SUMMARY

Social groups in the three villages formed important additional networks outside of kinship relations that helped to increase potential access to resources. This was especially important, as the number of female-headed households in all three villages was high, with females taking day-to-day decisions.

The households in Mars/Glenroy are relatively small with only a few children younger than 18 years and few adults under 60 years of age who contribute to the household income. A relatively high number of pensioners per household

was noted. In comparison Watershed has the highest number of children under seven, as well as the highest number of adults contributing to household income. In Arthurstone relatively large households exist with very few pensioners. The number of household members who contribute to the household income is very low.

Pensions and formal employment were rated under the top three income sources for households in the three villages. Farming was perceived as an important income source in Mars/Glenroy and Watershed. In Arthurstone, a peri-urban environment, more opportunities exist for people to be self-employed and therefore farming was only rated in the fourth place. No statistical differences exist between the three villages with regard to income. Households spend more than 60% of their income on food. Expenditure on farming varied from 3 to 8% of household income.

Arthurstone and Watershed reported gender oriented crop restriction, though this was restricted to the older respondents. Cultural beliefs and taboo's associated with agricultural activities were, however, still reported widely. All three villages reported cultural taboos on menstruating, pregnant and lactating women. These cultural beliefs and taboos influence agricultural productivity significantly in Arthurstone (89%).

The field sizes farmers cultivated in the three communities were very diverse, from less than 500m^2 (home garden) to more than 5000m^2 (smallholder plots). In Arthurstone farmers cultivated TLVs on areas smaller than 5000m^2. In Watershed households mainly cultivated TLVs on areas of less than 500m^2 (home gardens and small communal garden plots). In Mars/Glenroy cultivation of TLVs was done on areas larger than 500m^2. In all three villages the lack of fenced cropping fields and free roaming of livestock prevent large-scale cultivation of TLVs. TLVs production mainly exists in home gardens since

families lack labour to do it on a bigger scale. Furthermore these gardens are properly fenced to prevent theft and damage caused by livestock.

Various crops are grown in the three villages depending on the biophysical (soil, climate and availability of water) conditions. In Arthurstone, water is freely available and apart from a variety of vegetables and field crops, various fruit types are produced. In Mars/Glenroy water is scarce and home food gardens form the basis of vegetable production. In Watershed, where boreholes ensure more available water, a variety of indigenous and exotic vegetables are produced.

Cultivated and many uncultivated TLVs are intercropped with maize, therefore their production and management practices are linked with maize. The use of tractor services and animal traction is common in the medium to large cultivated areas (500 to more than 5000m^2) of Mars/Glenroy and Arthurstone. Hand-ploughing is common in Arthurstone and Watershed, especially in the small to medium sized (up to 5000m^2) cultivated areas. Watershed and Arthurstone farmers utilised more organic types of fertilisation while Mars/Glenroy tended to use more inorganic fertilisers. Mars/Glenroy did not chemically control pests or irrigate their crops. Limited chemical control was found in Arthurstone and Watershed. Hand-irrigation was relatively popular in Arthurstone and most of the farmers in Watershed hand-irrigated. Cultivated TLVs tended to share the same production methods. Uncultivated TLVs differed in production systems between especially Arthurstone and the other two villages. Interactions between crops in the production cycle were especially apparent in Arthurstone. Types of varieties used also had an influence on production decisions made.

CHAPTER 7

CONCLUSION

7.1 INTRODUCTION

The objectives of this study were to determine the utilisation and production systems of the five most important traditional leafy vegetables (*morogo/ miroho/imifino*) in three rural villages in South Africa that are culturally and agro-ecologically diverse.

The hypotheses were:

H_1: There are differences in the utilisation of traditional leafy vegetables between the three rural villages.

H_2: There are differences in the production system of traditional leafy vegetables between the three rural villages.

7.2 UTILISATION OF TRADITIONAL LEAFY VEGETABLES

The utilisation of TLVs incorporate aspects such as the ability of species to grow in a specific environment, (agro-ecological zone) therefore indirectly influencing the preferences for certain plants; the IK associated with TLVs as illustrated in their role in household food security, perceptions of the nutritional value, their conservation and their importance in supplying households with additional income. The IK associated with the utilisation of TLVs include knowledge on what, how, where and when to consume TLVs, as well as their preservation and conservation (seed systems).

7.2.1 Agro-ecological zones and household preferences of TLVs

Differences between villages regarding the preferences of TLVs exist due to the availability of certain uncultivated and semi-cultivated crops. Climate and IK associated with TLVs are critical factors that influence these preferences. Although a specific TLV may grow in all three villages, it is not necessarily consumed in all three villages, because of the IK associated with the utilisation of the TLV. Some crops like nkaka have become part of an ethnic group's diet through the process of aculturisation. Biodiversity, IK and taste preferences of consumers in an area determine the inclusion of a specific TLV in the daily diet of a rural household.

The popularity of TLVs in the daily diet is a function of factors such as their taste preference, status with men and youth, availability and ease of preparation. The role of palatability regarding the popularity of a specific TLV needs further research. The importance of cleome, amaranth, cowpea and cucurbits indicate that these are the crops that need to be researched in more depth as they are well adapted, commonly known and consumed by villagers. Further research should also identify plants that had been lost or became scarce. The associated IK of these plants should be document in an effort to prevent the loss of biodiversity. Extension can, through close collaboration with research, impact on the food security strategies of communities by recognising these crops and the role they play in household livelihoods and incorporating this knowledge into their extension strategies.

Preference ranking, as used in this study, has various meanings for different respondents. Differences between ranking for taste, ease of preparation and food security highlights the difficulty of asking the correct questions to ensure the capture of the real situation in the three villages. In this study the answers provided were similar, but for various reasons. This would probably not have been similar if more than five TLV crops had been evaluated. Even with the pre-

testing of the questionnaire the ambiguity of the question had not been discovered. Perceptions of words commonly used by scientists need to be tested with farmers to ensure a thorough understanding of a question in order for more specific data analysis.

7.2.2 TLVs, IK and household food security

The important role of TLVs on the livelihood strategies of rural people is not always recognised. People are often encouraged to use exotic vegetables, many of which are poorly adapted to the marginal production conditions many subsistence farmers encounter. With the frequency of dry spells, changing climatic conditions and marginal soils experienced by many poor, TLVs could play an important role in household food food security strategies.

TLVs are mainly seasonal and relatively perishable. Various preservation methods are used by households to ensure availability for winter and spring. The utilisation of sufficient fresh and preserved TLVs was influenced by the agro-ecological zones, cultivation practices and the associated level of IK still retained in a village. In fresh form uncultivated TLVs are especially important as a pre-harvest crop. During periods of low availability of fresh TLVs, dried TLVs played an important role in household food security, as the growing of winter crops as alternative food sources are limited.

Pumpkins were the most important dried TLV, with cowpea found to be important in its dried form due to its long shelf life. The long shelf life enabled villagers to store them effectively for extended periods, and therefore formed an integral part of drought survival strategies identified in Arthurstone and Mars/Glenroy. The length of storage, method of drying and storage management are critical factors that influenced the utilisation of dried TLVs during the winter and spring months. Length of storage differed between households within villages and was influenced by the yield, preservation method used, household food needs and

ability to buy other food. Most of the dried TLVs were stored for up to one year, with the bulk utilised within six months. The drying practices used for uncultivated TLVs differed between the three villages, with blanching or drying of fresh leaves determined by the availability of time and fuel materials. Blanching times tended to be very long and most of the leaves were dried in the sun. Storage of dried leaves in flexible containers (such as bags and sacks) led to higher contamination and crushing.

The prevailing socio-economic conditions of a household determined the reasons for consuming TLVs and at what growth stage. During times of food shortages, unsustainable harvesting practices were followed as seedlings were harvested. When seen in the light of the declining TLV population and lack of local seed systems, this is cause for some concern. The prevailing IK in a village determined which TLV plants parts (seed, stalks, leaves, growth points, flowers and fruit) were harvested at a specific growth stage. Harvesting practices of multipurpose crops clearly showed the villagers' awareness of the detrimental effect of over-harvesting of one product (i.e. leaves) on another product (i.e. seed).

TLVs were mainly prepared as a relish for maize porridge, though limited variation was found. The extended cooking periods observed raises concern about the retention of nutritional value. Various preparation methods were utilised in the three villages, which influence taste, consistency, nutritional value and popularity of dishes. The preparation methods included: types of crops and proportions commonly mixed; additions to dishes in the form of ash, peanut flour, bicarbonate of soda, mashed pumpkinseed, exotic vegetables, flowers and fruit. Ethnicity played an important role in the selection of preparation methods. Gender-based differences on the consumption of TLVs were only found amongst the Zulu group (Watershed) where women had to prepare alternative meals for men when TLVs other than pumpkin and amaranth were prepared.

The westernisation of the palate caused by urbanisation and intense media exposure has caused a switch to a few exotic foods. This has caused a narrowing of the diversity on the plate, which can lead to an increase in malnutrition. Nutritional studies have indicated the importance of these traditional crops in providing essential nutrients needed by specific vulnerable groups. In an effort to address periods of extreme food shortages, research, farmers and extension should collaborate to develop, evaluate and disseminate technologies that will help improve food security with the help of TLVs. This collaboration is extremely important as women have very specific needs and the constant communication between the role-players will ensure access to appropriate technologies. To help address this, the following actions should be taken:

- The preparation methods of TLVs used by rural households need to be evaluated in terms of nutrient retention and new recipes need to be developed where needed. Reduce the extended cooking times used in the communities where necessary.
- Increasing shelf life of dried TLVs can be established by blanching leaves, rather than drying fresh leaves. Labour and fuel saving methods would enable more women to blanch, thus extend storage periods into the extreme food shortage periods. Improved preservation methods would help to retain most of the nutritional value of the TLVs. Promoting the addition of readily available crops to dishes to increase nutritional value is important, especially during times of extreme food shortages when mainly dried food is consumed. Promoting the use of currently disposed disintegrated dried leaves into soups and other dishes could help increase nutritional value of dishes and minimise nutrient losses from the preservation system. Minimising contamination and storage losses of dried leaves through the promotion of airtight containers would help extend food availability.
- Research on preserved cleome insect damage will enhance households like Arthurstone's ability to store bigger volumes of cleome for longer periods.

- Addressing the blandness of food preparation through the development and dissemination of new and existing recipes will increase the variety in which the crops are prepared.
- An effort should be made to increase palatability of dried TLV leaves, a constraint mentioned during group discussions, by developing and disseminating new and existing recipes.
- Women are the main decision-makers when food is bought for the household. Increasing the status of TLVs amongst women and youth could be achieved by highlighting the nutritional value of TLVs and developing 'modern' recipes. This can be done by placing recipes and nutritional information in magazines and in local clinics.
- Methods to increase yields that will influence both fresh and dried availability should be investigated. As the fresh form was more popular, extending the harvesting period could possibly increase consumption of TLVs

Distinguishing differences in IK levels was limited when only working on the most important crops. Should differences between IK be important, more than five plants should be studied. Many of the younger people still posses IK on five or six TLVs, with the older people utilising and possesing IK of more TLVs. Time and budget, however, remain constraints.

7.2.3 Perceived nutritional value of TLVs

Research conducted more than fifty years ago, reported on the potential nutritional value of TLVs for vulnerable groups (i.e. pregnant women, the ill and those who need to build their strength). However, this research found that members of the three communities do perceive potential advantages of TLV's in particular for certain vulnerable groups. In Arthurstone nkaka (*Momordica balsamina*) is believed to have medicinal value for people with high blood pressure and diabetes, while the same plant is not utilised by the Pedi (Mars/Glenroy). Not realising the relatively higher nutritional value of some TLVs in comparison to consumed exotics such as cabbage, has a negative impact on

vulnerable groups. Creating awareness of the potential nutritional value for specific vulnerable groups need to be done through the women who are the main caretakers of rural households.

7.2.4 Conservation of TLVs

All three villages reported a decline in population of TLVs. Low soil fertility and adverse weather conditions are perceived to be some of the factors that play a role. From a conservation point of view the decline in TLV population is of some concern. The number of people who do not know what is causing the decline of TLVs in their area also prevents them from taking corrective action in this regard. This can lead to permanent loss of crops in a particular area. Declining TLV populations could be linked to the decline in utilisation reported in all three villages. The consumption of TLVs declined in favour of exotic vegetables promoted by research, extension and urbanisation. The 'poverty crop' status attached to TLVs amongst the youth was one of the main reasons for declining utilisation amongst younger people. This lack of popularity amongst the youth has led to decline in IK associated with these crops.

Complex, multiple TLV seed systems were found in the three villages. The seed systems for cultivated crops were well established while those for uncultivated TLVs were unstructured and therefore difficult to understand. Elderly women in general know how to preserve seed quality when it is stored, but training is required. The lack of sustainable harvesting mechanisms in villages, combined with declining populations, emphasise the need for the development and sustaining of seed systems of the uncultivated TLVs. For biodiversity and associated IK to remain in an area, TLVs must be used and appreciated by the community at large. Should this not be the case, both plants and IK might be lost to future generations. Due to the many useful characteristics, including drought tolerance, of many of these plants, the loss of these genes in the face of the global warming facing the world today, could lead to loss of agricultural potential

in future crops. Bio-prospecting by global companies has incorporated many genes from local, farmer-kept varieties into currently successful hybrids, as these genes had been lost during the mainly yield oriented breeding that had dominated for a few decades. The re-introduction of seed custodians and the importance of this must be addressed in an effort to prevent further loss of uncultivated crops.

Sharing of knowledge in this regard between the community members should be included in the communication strategy implemented by agricultural support services. The high reporting of the use of “strong seed” as an important criteria for selection of seed indicates the importance of the background knowledge and experience of enumerators are, as they did not have enough experience to ask for more detailed information. The use of enumerators with a background in all aspects of a questionnaire is, however, expensive. The combination of qualitative and quantitative methodologies enabled the clarification of some of these concepts and enriched the documentation of information, especially in areas of study that is relatively unknown.

7.2.5 Marketing potential of TLVs

The marketing of cultivated and uncultivated TLVs was limited and mainly done on an *ad hoc* basis where households were in need of additional income. The popular TLVs were marketed locally by mainly women (84%) and children (60-80%). Peri-urban Arthurstone showed a higher number of traders, where high competition between traders was evident. Local informal communication networks provided traders of valuable market information. Traders identified the distance to the market, poor market infrastructure, poor business skills, relatively short shelf life of fresh TLVs, low local buying power and availability of wild TLVs as major constraints. The drying of surplus TLVs for selling during winter and spring months could circumvent the availability of wild TLVs during the growing season. Sowing TLV seed and irrigating them before the rains start could also

provide produce in a time when crops are scarce and should be considered by farmers. Creating awareness on the nutritional value of TLVs and promoting recipes that modernise the dishes (i.e. using TLVs as a topping on pizza) could improve the general marketing of the produce.

Utilisation of TLVs in a specific village is mainly influenced by the agro-ecological conditions, IK and utilisation patterns. Evidence in support of the first hypothesis, namely that differences exist in the utilisation of TLVs between the three villages are supported by the following findings as discussed in Chapter 5:

- Availability of TLVs was mainly influenced by the different agro-ecological conditions and cultivation practices that exist in the three villages. The diversity of plants able to grow in village will have an influence on the selection and importance of TLVs for a specific household. If only a few TLVs are available of which some are bitter, even those will be consumed, though in smaller quantities or prepared in more elaborate ways to reduce bitterness like calabash leaves in Watershed where it was mixed with porridge to reduce bitterness. In Arthurstone where a greater TLV diversity was found, the 'bitter' TLVs were only used occasionally. Availability of a TLV alone, however, does not automatically lead to its inclusion in the diet, since IK associated with its utilisation also needs to exist amongst villagers. *Momordica balsamina*, a TLVs that grows in Shangaan (Arthurstone) and Pedi (Mars/Glenroy) villages, but is only utilised by the Shangaan group illustrated this.
- Different harvesting practices exist in the three villages in terms of the plants parts harvested (leaves, stalks, growth points, seed, fruit and flowers), at which growth stage these plant parts were harvested and time elapsed between harvesting periods of the same plant. These harvesting trends are mainly determined by the IK associated with the utilisation of a specific plant. The time elapse between harvesting the same plant could also be a function of the climate within which the TLV grows as more optimal conditions (i.e. Arthurstone) allow faster re-growth.

- Preparation practices between the three villages differed in terms of the different types of additions (ash, nuts, bicarbonate of soda, seed, etc.) to a dish, the types of plants and proportions of plants mixed into a dish and also the different cooking times used for the dishes.
- The various methods used to preserve and store TLVs for winter and spring, as well as the types of crops preserved, varies between the three villages. These practices are linked to the indigenous knowledge associated with the utilisation of the TLV.
- Utilisation patterns of TLVs influenced the conservation status of TLVs in the three villages. In Arthurstone TLVs were mainly used to supplement household income (when compared to Watershed and Mars/Glenroy), that ensured greater awareness and priority of these plants in this specific village. This tendency was not identified in Watershed and Mars/Glenroy. Arthurstone villagers were able to recognise smaller differences in the population than Watershed and Mars/Glenroy villagers. The research found amaranth and cleome to still be abundant in Arthurstone, but many respondents raised their concern about the decline in TLV populations that was observed. This is encouraging since phara (*Cucumis melo*) had all but vanished from Mars/Glenroy before it's scarcity was noted by the villagers. Perceived reasons for the decline in TLV populations also varied between the villages as Arthurstone mainly mentioned environmental factors while Watershed and Mars/Glenroy referred to human factors that caused the decline.

Though limited substantial statistical evidence is available to illustrate these differences between villages, the qualitative data collated strongly support the first hypothesis namely that differences in the utilisation of TLVs occur between the three villages.

7.3 PRODUCTION SYSTEMS OF TRADITIONAL LEAFY VEGETABLES

Each farm exists within a complex of biophysical, socio-economic and human elements. The type of TLV cropping systems that have been developed at a specific village is mainly a function of the agro-ecological conditions. The production systems of TLVs applied in the three villages were influenced by factors like cultural beliefs of households regarding agricultural activities, household demographics and incomes, agro-ecological conditions and perceived production status of TLVs.

7.3.1 Beliefs and hindrances

Beliefs and taboo's associated with agricultural activities varied between the villages and ethnic groups. The Shangaan (Arthurstone) seemed to have more beliefs associated with agriculture than the Pedi (Mars/Glenroy) and Zulu's (Watershed). All three villages reported beliefs and taboos associated with the female fertility cycle (menstruation, pregnancy and lactating women). These beliefs and taboo's have critical effects on availability of labour resources, especially in female-headed households, which are dominant in these villages. Females not working in the agricultural fields should not be seen as 'spare labour' capacity, since many are often fulfilling non-agricultural chores to stay true to the ethnic prescriptions. The cultural hindrances identified should be taken into account with future agricultural support services planned. The type of crop that can be grown by male or female is mainly influenced by cultural beliefs. The Shangaan and Zulu villages reported gender sensitivity with regard to the type of crop that can be grown, though these beliefs are perhaps restricted to the older generation.

In an effort to assist female-headed households, research and extension should be developing labour saving technologies with these households to help address the labour effects of cultural beliefs. Technologies such as rainwater harvesting and conservation tillage are just some examples of these. Since many of the farmers involved with TLV production are old, the gender-crop cultural beliefs

should be taken into consideration when promoting certain crops. When documenting cultural beliefs and taboos, sensitivity for these aspects should prevail with the enumerator.

7.3.2 Household demography

The interaction between household income (financial factors), household composition (human factors) and area cultivated (natural factors) are dynamic and constantly changing. The interaction of these factors influenced the production decisions taken by households. Where external incomes were high, households tended to buy more exotic food and produce less TLVs.

The number of *de jure* female-headed households in all three villages is high with no significant statistical differences between the villages. Although females in the household are responsible for the day-to-day decisions, the degree of freedom in agricultural decisions for *de facto* female-headed households (which crops to plant, where, how) varied between households and villages. These factors influenced the farming system decisions taken and often complicated planned interventions in a village. This is an important finding to consider when interventions are planned, as many women need to confer with their absent husbands before decisions can be made. Females from *de facto* households might be incorrectly labelled as risk averse or laggards when adoption of new technologies are evaluated, as this might be an effect from the lengthy process of discussions and decisions on the few times that husbands are at home. *De jure* households commonly have less access to resources, including adult labour, and are more vulnerable to shocks. These households tend to be more risk averse, therefore introduction of high risk or high resource use technologies into these rural communities will marginalize many of these households.

Expenditure on farming varied from three to eight percent of household income. The low expenditure on inputs should be an important factor in the intervention planning of agricultural support services. The introduction of medium to high input agricultural practices should be discouraged in areas where incomes are

low, as the vulnerability of the households will increase with higher input costs. Introducing more sustainable low input methods that can progress over time to higher input agriculture as the incomes increase due to increased profits is being promoted by many international institutions.

Women were the main source of labour in the production systems of all three the villages. Households in Mars/Glenroy were relatively smaller, with fewer children and adults younger than 60 years of age. In comparison Arthurstone households were relatively large with fewer pensioners present, therefore the number of household members that contributed to a specific household income was much lower. In Watershed the number of children was the highest, with more adults contributing to household income. The relatively lower family labour resources found in Mars/Glenroy also necessitated these villagers to use some form of mechanisation to enable the cultivation of the predominantly larger areas (more than 500m^2). The larger family labour resources in Arthurstone enabled families to cultivate areas larger than 500m^2, though the lower employment rates lowered the ability to hire mechanised services for areas larger than 5000m^2. The larger number of household members contributing to household income in Watershed enabled them to buy more food, therefore cultivation was mainly done in household and communal gardens (smaller than 500m^2). Households with a higher income and larger cultivating areas (larger than 5000m^2) tended to make use of tractors. Decisions regarding the size of cultivation and crop choice are linked with resource availability, of which labour and finances are important factors. Understanding why villagers cultivate a specific area can help agricultural support services to tailor-make their activities to help address constraints experienced and to improve the impact of interventions in specific areas. Lack of fencing also influenced production, as livestock consumed unprotected crops. Agricultural support services should also take the socio-economic circumstances of women into consideration when organising farmer meetings and training sessions. Technologies developed and promoted should incorporate aspects such as labour saving and low resource (human, financial, natural and physical) use.

The peri-urban village of Arthurstone offered more opportunities in terms of self-employment and therefore farming was less important to support household income in comparison to rural villages like Watershed and Mars/Glenroy. The relative importance of farming should be taken into account when research and extension address the needs of a rural village. Off-farm employment might generate more income than a specific farming enterprise, and therefore opportunity costs should be taken into consideration when promoting agriculture. During this research it was realised that many households do not perceive farming as a form of self-employment or an indirect source of income. Future research on farming systems should also include the importance of farming as a source of employment and possible source of indirect income. Capturing household income was found to be problematic and unreliable, as respondents refused to share their financial information. This is a common problem often found by social scientists and therefore calculations that take the income into account remain approximations.

7.3.3 Cultivation practices

The availability of animal traction and tractor services in Mars/Glenroy suggested different seedbed preparation than applied in Arthurstone and Watershed, where hand ploughing is common. Choices between relatively extensive vs. intensive farming and the types of crops selected to produce were influenced by the soil preparation opportunities of the area. Households in Arthurstone cultivated larger areas because of availability of animal traction teams and availability of tractor services to rent for seedbed preparation. The high incidence of hand ploughing in Arthurstone and Watershed imply a high labour demand on mainly women. In Watershed a clear tendency exists where tractors are used for soil preparation by higher income households and households with relatively large cultivated areas (> 5000m^2). Women hand ploughed when the cultivated area is smaller than 500m^2. Assisting in access to mechanised seedbed preparations could enable resource poor households to optimally utilise available land. Releasing women labour from hand ploughing will enable them to use their labour resources on other agricultural activities that would help optimise agricultural production.

7.3.4 Pest and disease control and irrigation

The choice of technology and approaches to address pests and diseases is influenced by the socio-economic situation of the specific household, the crops planted and the size of area cultivated. No chemical control occurs in Mars/Glenroy while chemical control of pests and disease occur in Watershed and Arthurstone. This tendency could be linked to the production of exotic vegetables and availability of water. The relatively low household income available for agricultural inputs forced many farmers not to use chemical control of pests and diseases. Farmers involved in production on a relatively large area (more than 5000m^2) tended to be more prepared to use chemical control. Research and extension should assist farmers with the selection of the most cost-effective methods of controlling pests and disease for their specific cropping system and keep the input sacrifices in mind when one type of input should be seen as more important in their situation. Training in chemical control is urgently required with women as the target learners.

Little or no irrigation was done in Mars/Glenroy and Arthurstone, while almost all the farmers in Watershed irrigated. Rainwater harvesting techniques could be of primary importance in Mars/Glenroy and Watershed to help improve production yields. Hand irrigation is the main method of irrigation used by farmers in Watershed and Arthurstone. This irrigation method could, however, be improved with low-level irrigation technologies such as the water wheel. This irrigation method could save time and increase the production potential of the crop. In-field water harvesting technologies could increase effective water use in all three villages and should be promoted.

7.3.5 Cropping systems

The sub-tropical climate of Arthurstone enables farmers to produce a wide variety of crops. The high biomass available in sub-tropical areas like Arthurstone facilitates the use of organic compost. By intensifying agricultural production in

the mainly medium sized cultivated areas, Arthurstone has great potential to support emerging farmers. The transfer of knowledge about animal traction to younger adults would help to minimise compaction and increase farmers' access to this service.

The relative poor rainfall in Mars/Glenroy lends itself to more extensive, maize-based farming systems. Crops for this area should be chosen with care as it should be adapted to exclusively rainfed conditions. Medium to large areas cultivated are only possible due to the accessibility of tractors for seedbed preparation. This service must be ensured, as failure of delivery of an appropriate service to farmers will have a negative impact on household food security. Organic fertilisers have limited potential, as the plant biomass is low. Kraal manure is, however, important to households that have cattle. The promotion of the use of kraal manure amongst farmers increased demand that led to kraal manure being as expensive as inorganic fertiliser. Optimising the use of inorganic fertilisers through on-farm trials would help to optimise use within the semi-arid to arid conditions that prevail here.

Production of TLVs in Watershed is mainly rainfed and form part of the maize-based farming system. Exotic vegetables are produced in both household and communal gardens and commonly irrigated by hand. Organic fertilisation practices are applied in this village. Many households buy food and therefore agriculture is mainly done on a supplementary basis. Frost prevents the production of late maturing crops and therefore crops with short growth cycles are promoted. The re-establishment of animal traction in the area would enable farmers to increase their cultivated areas. The poor general conditions of the roads and relative isolation of the village do not encourage the availability of tractor services.

All villages tended not to cultivate the softer, herbaceous TLVs (amaranth, purslane, cleome, blackjack, corchorus and nightshade). The importance of uncultivated TLVs, specifically because they do not affect family resources, was reiterated. Mars/Glenroy's TLV cropping system was mainly based on maize and

several pumpkin types while maize, pumpkin and uncultivated, softer TLVs characterised TLV cropping systems in Arthurstone and Watershed. Pumpkin and cowpea were often intercropped with maize, thus production was linked with the production and management practices of maize. This was also true for tolerated herbaceous TLVs that grew within these maize fields.

The cropping systems followed in each community should be thoroughly understood by researchers. Ignoring this will lead to the development and dissemination of inappropriate and unsustainable technologies. Female domination of TLV production and general agricultural practices are often not taken cognisance of, leading to the targeting of the wrong groups or working in an insensitive manner that does not take the multi-tasking of women into account. The integration of science with IK could help research, extension and farmers to effectively improve cropping systems together, within the reality of household possibilities and potential. This would also address some of Agenda 21's recommendations on lessening the impact on the environment. Production factors such as labour, fencing and rainwater harvesting are important for TLV production in all three villages. Harvesting rainwater more effectively would enable more sustainable agriculture. The possibility of establishing living fences (growing plants such as agave which animals will not eat or move) should be investigated, since it is a more sustainable alternative to fencing. Participatory technology development actions will ensure effective results that farmers will be able to apply within their farming systems. Promoting cultivation of TLVs might fail in some areas where labour and land access is low, as successful cultivation requires proper management, land and incurs costs. When farmers were asked to describe their crops the exotic crops and maize were commonly mentioned but secondary crops (pumpkin, cowpea, TLVs) were seldom mentioned. Farmers only described secondary crops within their farming system when specifically asked about them. This is an important finding that has to be incorporated into research methodology when studying intercropping systems.

The following factors determine a specific TLV production system for a specific production area:

- Female dominated practices influence the availability of labour, as well as crop and site selection for production.
- Cultural beliefs affected the availability of women as labourers and production of certain crops.
- Household demography determines labour availability and therefore the size of production. High percentages of *de jure* and *de facto* female-headed households influenced access to resources.
- Relative low household incomes limited expenditure on agricultural inputs like pest and disease control, which forced households to rely more on TLVs to support household food security.
- Agro-ecological conditions determine a specific cropping system, crop type and production practices.

Evidence in support of the second hypothesis, namely that differences exist in the production systems between the three villages are supported by the following findings as has been discussed in Chapter 6:

- Cultural differences influenced both availability of labour and crops utilised. The Shangaan village (Arthurstone) reported three times more restricting cultural taboos than the other two villages.
- The number and composition of a household influenced the respective household income and therefore types of services and inputs that could be paid for. The potential income sources between the villages differed, with farming important in Watershed and Mars/Glenroy. In spite of the relatively smaller households in Mars/Glenroy the easier access to tractor services enabled the cultivation of larger production areas. In Watershed smaller areas were cultivated since most of the land had to be hand-ploughed. This was due to a combination of both smaller household income and limited access to mechanised services.
- Agro-ecological conditions such as rainfall and frost occurrence influence the crops that can be produced, type of fertiliser used and the irrigation potential of the villages. The higher rainfall and mild winters of Arthurstone enables the production of a diversity of crops and a larger variety of wild TLVs grow in the area than in the other villages. The high rainfall allows production of exotic

crops and also ensures a higher biomass that can be used for composting materials. The availability of water and relatively high potential for crop production due to composting has a positive influence on the variety of crops that could be grown, as well as the production potential of crops. The intermediate rainfall and harsh winters of Watershed limit production periods and variety of crops that can be planted. The biomass in the area is enough to support the composting needs of the village. The relatively low rainfall and cold winters of Mars/Glenroy limit TLV production to the hardiest plants. In this village kraal manure and inorganic fertilisers address the fertilisation as the biomass is too low to support the making of compost.

7.4 GENERAL COMMENTS

With both quantitative and qualitative work, experience helps to improve the effectiveness of the research. The complementarily of qualitative and quantitative tools was reflected in subsequent research. Descriptive work on complex issues such as seed systems and criteria, work the best through observations, focus group discussions and key informant interviews that enable respondents to show-and-tell. The flexibility of qualitative studies facilitated understanding of new areas of study and encouraged discussions about sensitive issues like cultural beliefs and taboos. Unclear or poorly understood answers can be addressed immediately. The questionnaires are best used where quantifiable information is needed.

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APPENDIX 1

QUESTIONNAIRE: UTILISATION OF TRADITIONAL LEAFY VEGETABLES

Interviewer code
Observer code
Respondent code
Interview date

Particulars of the area

1. Province: KwaZulu-Natal
Limpopo

2.Village: Watershed
Arthurstone
Mars
Glenroy

Socio-demographic data

3. Sex: Male
Female

4. Age: ….. years

5. Marital status: Married by law/ Traditional marriage/ Living together/ Separated/ Widowed/ Single/ Other

6. How much do you use monthly for:
Food
Schooling
Farming
Saving
Clothing
Other

Q7-10 have same answers.

7. Who usually cooks in this household:
   - Father
   - Mother
   - Child
   - Grandparent
   - Aunt
   - Uncle
   - Cousin
   - Other

8. Who decides what food is bought?

9. Who is the head of the household?

10. Who decides how much money is spent on food?

11. How many of the following people are living in your household?
    - Children under 7 (these children get free medical treatment)
    - Children 7-12
    - Children 13-18
    - Pensioners
    - Adults (18-before receive pension)
    - Total number of people in your household
    - How many people contribute to household income

12. Ethnic group:

13. How many years have you lived here?

14. How many years of schooling have you had?

15. How many people in your household can read English?

16. How many people in your household can read the home language?

17. In what income group do you fall?

    - <R500
    - R500-R999
    - R1000-R1499
    - R1500-R1999
    - ≥R2000

18. What do you do for a living in the household? Rank the sources of income from most to least/no importance.
    Pensioner
    Formal employment
    Self-employment
    Farming
    Casual labour
    Other
    All unemployed
    Specify other

19. How big is the area that you cultivate?

20. What crops do you grow in your fields and home garden?
    Pumpkin
    Maize
    Onions
    Spinach
    Beans
    Tomatoes
    Sorghum
    TLVs
    Other

    Please specify TLVs
    Please specify others

21. Please list the crops from economically most important to least important.
    Rank Crop

22. Why do you grow these crops?
    For household food
    To sell
    For household food and selling

23. Do you grow TLVs?

24. Why do you grow TLVs?
    For household food
    To sell
    For household food and selling

25. Do you think growing of TLVs has increased or decreased?
    Why do you think so?

26. Do you think the use of TLVs has increased or decreased?

Why do you think so?

27. Do you like to:
    grow TLVs? Y/N
    eat TLVs? Y/N

Section for growers of TLVs (If not grown, continue in next section)

28. What is the size of the area you plant TLVs in?

29. What TLVs do you harvest where?
    (1) Field (2) Home garden (3) 1 and 2 (4) Other

Crop	Where harvested

30. Why do you grow them here?

31. Are there certain soils / places that some TLVs like to grow? Y/N

    If yes, please describe:

32. Please describe how you do your land preparation
    Tractor
    Donkey
    Oxen
    Mules
    Hand
    Other

33. Do you thin out?

34. Describe the planting process.

35. Are there special tools used for planting, weeding, harvesting or storage of TLVs? Y/N. Describe them.

36. Do you feed your plants? Y/N
    If yes, what with?
        Cattle manure
        Goat manure
        Chicken manure
        Fertiliser
        Compost
        Other

37. Do you use chemicals to manage your pests?
    What do you use for which pest?
    If you use natural products please mention them here.

38. Do you use chemicals to manage your diseases?
    What do you use for which disease?
    If you use natural products please mention them here.

39. Do you irrigate? Y/N
    If yes, how?
        Flood
        Hand
        Pipe
        Other
        Please specify other

General TLV questions

From here on all questions are based on the five most important TLVs for the household. The five most important TLVs for the household are first identified and used in the TLV answer for all questions till the end.

[This question is in the form of a table]
40. What part of the plant do you harvest and from which do you collect seed?
    Name TLV
        Young leaves
        Stalks
        All leaves
        Fruit
        Flowers
        Growth points
        Age of leaf makes difference to taste
        Collect seed?

[This question is in the form of a table]
41. How do you get your TLV seed, do you pay for it and what does it cost?
    Name TLV
        Collect self
        From neighbour
        From specific person in village
        Someone else
        Pay for seed
        Get seed for free
        Cost/unit

42. What do you look at when you select TLV seed?

43. Do you prefer certain TLVs? Y/N
    If yes, which ones and why.

44. Are there TLVs that may not be eaten by specific groups? Y/N
    If yes, which and why.

[This question is in the form of a table]
45. When do you harvest your five most important TLVs?
    Crop
    Months of the year in seasonal calendar form

[This question is in the form of a table]
46. During what stages do you harvest these five TLVs?

    Seedling
    Flowering
    Plant yellows
    Other (specify)

Gender roles and decision-making

[This question is in the form of a table]
47. Who performs the following tasks in the production of TLVs?
    Clearing the field
    Ploughing
    Planting
    Weeding
    Fertilising
    Spraying
    Harvesting
    Packing
    Marketing
        Not done
        Father
        Mother
        Hired labour
        Children
        Other (specify)

48. Are there crops that only men or only women can produce? Y/N

49.If yes, which crops can only be planted by
- men
- women

50. Does your culture sometimes prevent you from working in the fields? Y/N
If yes, please describe.

Storage of TLVs

[This question is in the form of a table]
51. Do you store part of your TLV harvest? Y/N
If yes, which ones, how much and for how long?
- TLV stored
- How much
- Sealed
- How stored?
  - Clay pot
  - Bucket
  - Plastic
  - Other
- How long do you store?
  - < 6 months
  - 6-12 months
  - 1-2 years
  - more than 2 years

Marketing

[This question is in the form of a table]
52. Do you sell part of your harvest from TLVs? Y/N
If no, proceed to next section
If yes, which ones, in what, what container/ size do you sell and where do you sell?
- Crop sold
- Who sells
  - Mother
  - Child
  - Other (specify)
- Rank of importance
- Price per unit
- Unit
  - Plastic bag
  - Own container
  - Bunches

Other (specify)
Where do you sell?
Door-to-door
Market
Gathering area
At home
Other (specify)

53. How far do you have to travel to the market? …… km

54. How do you transport your produce?
Walk
Private transport
Bicycle
Donkey cart
Taxi
Other

55. Do you have problems with selling your TLVs? Y/N
If yes, please list them in order of importance
Rank
Problem

56. Do you know the prices in the market before you go there? Y/N
If yes, how do you get your information?
From market
From friends
From neighbours
Other (specify)

57. How do you know what price to ask?

58. Do you think that last year's TLV harvest was good? Y/N

Household budgets

[This question is in the form of a table]
59. Who gets the money from sales and who decides how it is spent

Crop
Who gets the money from sales?
Father
Mother
Other (specify)

Crop
Who decides how to spend the money earned from sales?
Father
Mother
Other (specify)

Production knowledge and ethnobotany

60. Are there TLVs growing in your garden/ fields? Y/N
If no, where do they grow?

61. Are there TLVs you know that are not growing in your fields/ garden? Y/N
If yes, please name them

62. Why are these TLVs no longer growing in your fields/ garden?

63. Are there TLVs that have disappeared in your area?
If yes, please specify

64. Would you like to have some of those TLVs that have disappeared, back?
Y/N
If yes, which one's and why wouldyou want them back?

65. Are there TLVs you know that are not being used anymore? Y/N
If yes, describe them and indicate why they are no longer used.

66. Are there cultural ceremonies linked to some TLVs? Y/N

67. Are TLVs cooked in your home?

68. When there are no fresh TLVs available, what do you eat in it's place?

[This question is in the form of a table]
69. Do you dry, and if yes, how do you dry the five most important TLVs?
Crop: Do you dry? Y/N

Crop: Dry: Fresh
Shade
Sun
Crop: Dry: Blanched
Shade
Sun

Crop
When you cook, do you cover with a lid?

[This question is in the form of a table]

70. Describe how you prepare your specific TLVs:

- Crop name
  - After harvest
    - Wash
    - Remove stalks
    - Other (specify)
  - Preparation
    - Boil
    - Fry
    - Steam
    - Other (specify)
  - Raw?
  - Source
    - Collected
    - Bought
    - Both
  - How long after harvest do you prepare
    - <2 hours
    - <6 hours
    - One day
    - Other (specify)
  - How long must it be boiled/ etc.?
  - Is the boiling water re-used?

APPENDIX 2

THE DISTRIBUTION AND ROOTS OF ETHNIC GROUPS IN SOUTH AFRICA

Possible differences between ethnic groups could possibly be explained by the origins of the groups. Groups that developed from the same main groups would be expected to have few differences, while different main groups could possibly have big differences in the utilisation and production of traditional leafy vegetables.

The movement of the early African people was slow and was dictated by the needs of growing clans, as well as the political, climatic and geographical demands. At the beginning of the Christian era iron-working communities crossed the Limpopo river and farmed with crops and cattle. Tsetse-fly limited the cattle numbers and malaria affected human numbers. For the greater part of the first millennium people stayed in the savannah bushveld of the Limpopo Province and Mpumalanga (Hammond-Tooke 1993:12-13, Coetzee 1982).

The Nguni moved along the foothills of the Drakensberg into KwaZulu-Natal and later the Eastern Cape. The Nguni gave rise to the Xhosa, Zulu, Swazi and Ndebele people. Cattle became very important here as the rich pastures could support huge cattle herds. The varied terrain led to a varied distribution of resources. Localised areas contained much water and varied arable soils interspersed with grazing. This enabled the Nguni people to be almost self-sufficient, with homesteads spread out and quite isolated (Coetzee 1982:9, Hammond-Tooke 1993:12-14).

The Tsonga settled along the coast of Maputu and tilled the fields. Cattle were few due to the tsetse fly. Some trade was done with the Zulu to the south (Hammond-Tooke 1993:12-13). Wars with the Zulu later on forced many Tsonga (subgroups known as Tsonga and Shangaan) to move to Limpopo Province and Mpumalanga in an effort to escape the Zulu impi.

By the end of the first millenium the Sotho had established themselves well in Limpopo and Mpumalanga. The Sotho gave rise to the North, South and West (Tswana) Sotho people (Figure A1). They mainly cropped and had some cattle, and were also actively involved in mining activities. In about the fourteenth or fifteenth century a Shona group moved down from the current day Zimbabwe and established themselves over the Sotho speaking group. These Venda settled in the fertile ranges of the Soutpansberg. The Venda influence established the practice of non-royals being 'tenants' on the soils belonging to the chiefs. Defence in these open and wide expanses was a problem, and this led to concentrated settlements developing in an effort to increase security. More autocratic systems developed in these concentrated settlements, with only royalty serving in the circle of elders. The southward movement had stabilised by the end of the 18th century (Coetzee 1982:9, Hammond-Tooke 1993:12-15).

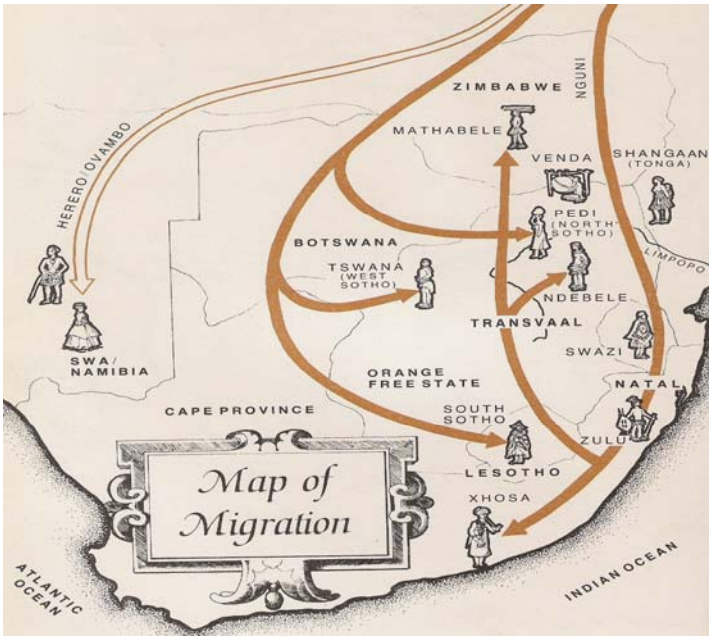

Figure A1: The map of migration illustrating the roots of black South Africans

Source: Coetzee, 1982:8

APPENDIX 3

Colourplate 1: Some common traditional leafy vegetables

Amaranthus spp.

Cleome gynandra

Corchorus spp.

Citrillus lanatus (tsamma)

Colourplate 2: Some common traditional leafy vegetables

Momordica balsamina

Cowpea

Bidens pilosa (blackjack)

Pumpkins in maize field