THE CONSUMPTION AND USE OF WILD FOODS BY CHILDREN ACROSS A DEFORESTATION GRADIENT IN ZOMBA DISTRICT, MALAWI

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by

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..Children are active users of wild foods and possess knowledge on wild foods in their environments…

Declaration

I declare that this thesis is my own work and all sources used and quotes made have been fully acknowledged with appropriate referencing. The thesis is being submitted for Degree of Master of Science, Environmental Science at Rhodes University. It has not been submitted to any other university and institution for examination.

Abstract

Despite consensus on their significant nutritional value, wild foods are continually excluded from both food security statistics and economic values of natural resources. Though largely unexplored, there is evidence on the use of wild foods by children to supplement their diets and as a source of income. Children have knowledge on the gathering and hunting of selected wild food species and sources thereof. Wetlands, agro-ecosystems, natural forests, human landscapes and river systems remain important sources of wild food resources. The provision of and access to these resources are significantly affected by the interference and disruption to natural ecosystems. In Malawi, interference has been largely due to deforestation and land use change caused by an interplay of pressures from population growth for development and agricultural expansion. Against this background, the implications of deforestation and vegetation cover on the availability of wild foods and their access and use by children is largely unexplored.

Through a comprehensive analysis of data collected from 150 children and 50 elderly men and women, the integration of Participatory Rural Appraisal (PRA) exercises and Geographic Information System (GIS), in the four sites of Mpheta, Mtuluma, Kasonga and Makombe in Zomba district, wild foods availability was established and their contribution to the nutritional status of children and households' food security assessed. Study sites were identified along the deforestation gradient of Lake Chilwa, Zomba Mountain and Shire River basin with an additional focus on varying landscapes. One hundred and twenty species of wild foods were identified with greatest availability in areas of high vegetation cover and the lowest in areas of low vegetation cover, but with meaningful differences per wild food category.

There was considerable reduction in the availability of wild foods with increasing deforestation; mainly wild game and fruits species and, in turn, decreased access of these by children. Nevertheless, small game, insects, other wild fruits and wild vegetables thrive well

in agro-ecosystems and therefore were minimally affected by deforestation but largely by management practices of those systems and can be possibly improved through the promotion of agro-ecological farming systems.

The research reveals that wild foods form an important component of the starch based diets of households from agricultural communities in the various landscapes. Besides securing the household's food base, all children largely supplemented their diets with wild foods but with increased dependence by children from poorer households who are highly vulnerable to food insecurity. Access and use of wild foods was largely dependent on children's knowledge, perceptions of the wild food and ease of access, with considerable variations due to gender and socio-cultural norms. Besides contributing to the nutritional status and food security, commercialisation of wild foods was common among children, hence providing them with an alternative livelihood strategy and in some cases only viable source of income.

KEY WORDS: Children wild foods, food and nutrition security, deforestation

Table of Contents

List of Figures

List of Tables

Appendices

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
GDP	Gross Domestic Product
FAO	Food and Agriculture Organisation
FGD	Focus Group Discussion
FI	Food Insecure
FS	Food Secure
HDDS	Household Dietary Diversity Score
HDR	High Deforestation Rate
HFC	High Forest Cover
HIV	Human Immune Virus
IDDS	Individual Dietary Diversity Score
IQ	Intelligence Coefficient
KII	Key Informant Interview
LDR	Low Deforestation Rate
MFC	Medium Deforestation rate
NTFPs	Non-Timber Forest Products
PCA	Principle Components Analysis

PRA	Participatory Rural Appraisal
PVA	Poverty and Vulnerability Assessment
RDA	Recommended Daily Allowance
Spp	Species
TOF	Trees Outside Forests

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CHAPTER 1: INTRODUCTION

.. Children are a perennial users and active participants in sourcing wild foods….

1.1 General introduction

In this chapter, I review literature on the status of wild foods, and their use by children. The varying roles of wild foods to rural household's diets are explored with a specific interest in the linkages between children's socioeconomic status and their dependence on wild foods. In addition, a background of children's nutritional status, dietary requirements and consumption patterns in rural Africa and Malawi, in particular, are presented. Extracting from contemporary literature, there is compelling evidence on the contribution of wild foods to rural people's livelihoods. However, lacking is an in-depth inquiry on the use and consumption of wild foods by children and their perceptions on the same. Concurrently, the implication of deforestation and forest cover on the availability of wild foods and their access and use by children has not been explored extensively in previous literature.

In southern Africa and many developing countries, there is an inextricable link between forest resources and livelihoods of rural communities (Angelsen et al., 2014; van Wyk, 2005). Deep poverty continues to prevail in sub-Saharan Africa where 80 per cent of the rural population is poor (Whiteside, 2002). In addition, hunger is a pervasive problem in these areas (Smith et al., 2006). In countries like Malawi, the situation is exacerbated by the high prevalence of HIV and AIDS and malnutrition (Department of Nutrition HIV and AIDS, 2009). Food insecurity is a continued phenomenon as some communities face recurrent, yearly and daily food deficits and famine conditions (Vaughan, 2007) and thus a high dependence on wild resources for their livelihoods is anticipated.

According to van Wyk (2005), wild resources can then be perceived as "nature's gift for sustaining humankind". These natural assets are located throughout southern Africa, often in relative abundance in the poorest areas of the region (van Wyk, 2005). Several studies in Africa (Akinnifesi et al., 2008; Barucha & Pretty, 2010; Mikkola, 1997) and beyond, reveal that wild foods such as wild fruits, wild vegetables, mushrooms, wild nuts and seeds, wild game, insects, rodents and birds are regularly taken by individuals and households with

increased intensity of use during periods of hunger. Overall, the use of wild foods contributes to livelihoods (Kamanga et al., 2009; World Bank, 2004) as both a 'daily net' (Lowore, 2006; Shackleton et al., 2011) and as a 'safety net' during crises (Campbell, 1987; Diedrichs, 2005; McGarry, 2008).

As a daily net, wild foods are an important source of both macro-and micro-nutrients (Powell et al., 2011; Uusiku et al., 2010). In addition, they help in diversifying the diets of African people by complimenting the mostly cereal based diets (Grivetti & Ogle, 2000; Mikkola, 1997). On the other hand, commercialisation of wild resources is a source of livelihood for some rural households or an additional source of cash income for others (Mahapatra & Shackleton, 2012; Paumgarten & Shackleton, 2009). Overall, most literature and research indicates that poorer households are major beneficiaries of food resources from the wild, both as a contribution to their diet and source of income (Cavendish, 2000; Heubach et al., 2011; Maroyi, 2011; Paumgarten & Shachleton, 2009; Shackleton & Gumbo, 2010; Shackleton & Pandey, 2013; Vaughan, 2007).

Like many other NTFPs (Non Timber Forest Products), commercialisation of wild foods plays a significant role in the local market systems and people's livelihoods despite them being undervalued (Bharucha & Pretty, 2010). While exact estimates of the economic value or volumes is difficult because much trade is informal and the structure of local market systems is diffuse, what is not in dispute is that trade in these resources provides cash income supplements (Bharucha & Pretty, 2010), especially to poorer households (Heubach et al., 2011; Shackleton & Pandey, 2013) although there are exceptions in some areas, where the contribution is most significant to middle and high income households (De Merode et al., 2004), especially if such use is in production or trade (Belcher et al., 2005).

Wild food use varies spatially and temporally because their availability and use is greatly affected by seasonality, preferences of different socio-economic groups (Garcia, 2006; Heubach et al., 2011; Uusiku et al., 2010), climatic changes and environmental degradation (Kamanga et al., 2009). Socio-cultural differences affect people's perceptions of wild foods and their use (Shava, 2000). In some populations particular wild foods form part of the daily meal while the same food may be considered as famine foods in other populations and totally ignored by others (McBurney et al., 2004).

At a casual glance, there appears to have been considerable work undertaken investigating the value (nutritional and economic) of wild food plants in Africa. For some species, such as *Moringa oleifera* and *Uapaca kirkiana*, this perception is propagated by data recycling, whilst actually there is only limited up to date, or reliable information (McBurney et al., 2004). In addition, children have usually been ignored in rural environmental research despite being a significant user group and are invisible actors in this field of research (Alexander et al., 2015; McGarry & Shackleton, 2009). In this regard, children's consumption of wild foods in their environments and during play (Campbell, 1987; Garcia, 2006), or as snacks and meals, is hardly quantified and explored despite the mindfulness that these foods may contribute significantly to their well-being (Lowore, 2006; McGarry, 2008).

1.1.1 Rural livelihoods in Malawi

The economies of many African countries, including Malawi, are strongly agricultural and large areas of natural vegetation have been converted to this end to increase production (Egoh et al., 2012; Kamanga et al., 2009). Malawi is a small land-locked country with one of the highest population densities in sub-Saharan Africa, and one of the lowest per capita income levels in the world. Agriculture contributes 30 per cent to the country's Gross Domestic Product (GDP) (National Statistics Office, 2010) with almost 90 percent of the population living in rural areas and are engaged in smallholder, rain-fed agriculture (Nucifora et al., 2007). The Poverty and Vulnerability Assessment (PVA) reaffirms that the

majority of households derive most of their livelihood from household farm or fishing activities, and have little opportunity for off-farm income generation since economic opportunities outside agriculture are limited (World Bank, 2007).

Almost 90 per cent of Malawian households and 95 per cent of poor households have access to agricultural land (Ministry of Environment and Natural Resources, 2010). However, per capita land holdings have declined from about 0.4 hectares in 1970 to about 0.2 hectares in 2007 (Ministry of Environment and Natural Resources , 2010). Climate and environmental risks play important roles in the country's vulnerability since the majority of the population relies on rain-fed farming for their income and Malawi's climate is marked by extreme variability; erratic and unpredictable rainfall (Devereux, 2006; World Bank, 2007). As a result, the Malawi Welfare Monitoring Survey reported that of the 46 per cent of households that grow staple foods, 80 per cent reported that their food would run out as early as August and October and wait on the next harvest in March to April (National Statistics Office, 2011). Overall, a large proportion of the population, mostly children, are chronically food insecure, and droughts and other adverse natural events cause widespread hunger or famine (Ellis et al., 2003).

1.1.2 Children's dietary requirements and consumption patterns

Children's consumption patterns vary by regions, from country to country and within a country. For instance the national food consumption survey in South Africa revealed that:

"…Almost 90 per cent of children of all age groups ate breakfast regularly irrespective of area of residence. A significant percentage of children (10–20 per cent), however, ate breakfast only occasionally in other provinces. The greatest majority of children of all ages (87 per cent) shared the family's main meal in all areas of residence with notable exceptions in KwaZulu/Natal, Mpumalanga and Northern Province, where 16–30 per cent of children had food specially bought and prepared for them. The main meal pattern for children of all

ages was primarily that of three daily meals, with (44 per cent) or without (31 per cent) in-between meals. This was the pattern, irrespective of area of residence, in all provinces. Notable exceptions were North West Province, where almost one in five children ate two daily meals with in-between meals, and Gauteng, where 14 per cent of children ate two daily meals without in-between meals…" (Labadarios et al., 2005).

Nonetheless, the results from this study give an outlook on overall children's consumption patterns and preferences. The study revealed that children know which foods are healthier choices, even though it did not affect their buying behaviour (Labadarios et al., 2005). Despite the presence of nutritional knowledge, learners would still opt for unhealthy but tastier foods and drinks, therefore, nutritional knowledge did not correlate with healthy eating practices (Temple et al., 2006).

Children actively participate in sourcing supplementary foods and thus consume snacks and other small foods outside the meals provided at household level and some in the form of wild foods (McGarry, 2008). Furthermore, consumption patterns of children are also greatly influenced by intra-household food distribution. It is important to recognise that intra-household food distribution is not always such that all household members receive the food that they need even if sufficient food is available at the household level (Smith et al., 2006). Households could allocate resources according to need, and need varies by the activities in which household members engage. Gender roles in this case affect the bargaining power of males and females within the household, thereby affecting the sharing rules (Kimhil, 2004). In less developed countries although men usually provide the main source of income to the family, women take the direct and major responsibility for the allocation of food and other resources to children (Kimhil, 2004) with much consideration set on men's diets.

1.1.3 Nutritional status of children in Malawi

Nutritional status is the result of complex interactions between food consumption and the overall status of health and care practices (National Statistics Office, 2010). Nutritional disorders continue to be a silent crisis in Malawi and contribute to high morbidity, especially for children (National Statistics Office, 2010). Malnutrition further impacts on the next generation as studies show that undernourished girls tend to become shorter adults, and thus are more likely to have small or stunted children (Department of Nutrition, HIV and AIDS, 2009).

High malnutrition levels have long-term adverse effects on the intellectual and physical ability of an individual and undermine an individual's academic and professional achievement and productivity (Department of Nutrition, HIV and AIDS, 2009; Smith et al., 2006). Under nutrition similarly affects cognitive development by causing direct structural damage to the brain and by impairing infant motor development and exploratory behaviour (Department of Nutrition, HIV and AIDS, 2009). This is caused by iron deficiency and anaemia, which delays mental development in infants, and is the primary cause of preventable mental retardation in children which is correlated with poorer performance on cognitive tests in older children (Department of Nutrition, HIV and AIDS, 2009; Smith et al., 2006).

In Malawi, 60 per cent of pre-school and 38 per cent of school children suffer from sub-clinical vitamin A deficiency (National Micronutrient Survey, 2001). Vitamin A deficiency lowers immunity thus increasing the incidence and severity of illnesses which increases absenteeism and reduces concentration in school (Department of Nutrition, HIV and AIDS, 2009). The National School Health and Nutrition Baseline Survey of 2006 also found 54 per cent of children in school were anaemic while 50 per cent had iodine deficiency disorders (IDD) and 30 per cent were stunted (Department of Nutrition, HIV and AIDS, 2009). Though this is less obvious, micronutrient (vitamin A, iodine and iron) deficiencies—mostly caused

by insufficient intake of food rich in bioavailable minerals and vitamins, are high (Ecker & Qaim, 2010).

Iodine deficiency is also widespread with a loss of IQ of the order of 13.5 points has been recorded in some studies (Department of Nutrition, HIV and AIDS, 2009). As a result of iron deficiency, children have considerably reduced learning abilities, school performance and retention rates are low and hearing and speech are impaired (Department of Nutrition, HIV and AIDS, 2009; Smith et al., 2006).

Both plant and insect wild foods are highly nutritious and could assist in meeting some of the nutritional requirements of people living with HIV and AIDS (Chidumayo & Marunda, 2010), especially children (McGarry, 2008). For households afflicted by HIV and AIDS, wild foods offer nutritious dietary supplements at low labour and financial costs. This is important when considering the negative impact of a household's HIV and AIDS status on income and food security together with the fact that deficiencies of micronutrients (in which many wild foods are rich) critical to immune-system function are commonly observed in people living with HIV and AIDS in all settings (Bharucha & Pretty, 2010).

1.1.4 Defining wild foods

To many cultures, defining "the wild" remains problematic and often simply refers to ecosystems that have not been dominated by humans. In reality, it is evident that over time people interact with, modify, and manage all ecosystems (Bharucha & Pretty, 2010). Currently there is no single acceptable definition of wild foods. However, Cavendish (1997) and Kajembe (2000) indicated that for something to qualify as wild, it must be freely provided by natural processes. In this study, wild foods include edible species that are not commonly locally domesticated, ranging from truly wild to wild protected, semi-domesticated plants (fruits, vegetables, tubers and nuts), that may be locally promoted,

protected, tolerated, or cultivated in *situ* or *ex situ* (Garcia, 2012). Furthermore, they include small mammals, birds, edible insects, honey and mushrooms (De Merode, 2004; McGarry, 2008). For the purposes of this study, fish are excluded from wild foods definition because their availability is largely dependent on water sources and to a lesser extent affected by deforestation; a core parameter in this study.

1.1.5 The contribution of wild foods to rural livelihoods and food security

According to USAID and FAO, "food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and health life" (Ministry of Agriculture and Food Security, 2006; Smith et al., 2006; Swindale & Bilinsky, 2005). Food insecurity is a common occurrence, especially in developing countries, prompting countries to focus the development agenda to providing food for the growing population (Smith et al., 2006). Recently, it is clear that the wild plants are a significant part of the global food basket with the potential of addressing food insecurity and malnutrition challenges (Bharucha & Pretty, 2010). Overall, Lowore (2006) and Heubach et al. (2011) suggested that the uses of wild foods can be categorised in three loose groups: (1) foods to sell, (2) foods to vary the diet or 'daily net' and (3) famine foods or 'safety nets'.

1.1.5.1 Wild foods in trade and income generation

For local communities living in the forest fringes in Malawi and elsewhere, wild foods are not only a source of food but also a source of income, second from agriculture (Belcher & Schreckenberg, 2007; Fisher et al., 2010; Rawat et al., 2003; Syampungani et al., 2009). In South Africa, McGarry (2008) reported that 38% of children, mostly vulnerable, participated in the commercialisation of wild foods.

Marketing of wild edible plants is important since the commercialisation of wild foods improves the well-being of households as the income can be used to acquire basic household items and assets, agricultural inputs, pay for education, and cover other expenses that enable people to enhance their livelihoods (Maroyi, 2011; De Merode et al., 2004). For instance, in Zimbabwe, Nhema Communal area, out of 67 wild edible plants 10.4 per cent were marketed (Maroyi, 2011).

Of all wild food categories, bushmeat is a particularly valued product which can contribute to household income flow (Mgoola, 2007). Unlike other wild foods, bushmeat and rodents are more important as a source of income than food for hunters and are often sold to obtain cheaper alternative foods (Shackleton & Gumbo, 2010). For example, Katundu (2001) showed that a rodent hunter in central and southern Malawi was reported to be earning an average income of between MK4 604 and MK10 878 per annum, equivalent selling 18-45 50 kg bags of maize at the time (Katundu, 2001; Mgoola 2007). Also, pricing of wildlife products is determined by the market forces of demand and supply, providing rural people more bargaining power than with agricultural products whose pricing is controlled by the government (Syampungani et al., 2009).

Insects such as termites and caterpillars are also an important source of income for rural communities (Barnett, 2000). For instance, wildlife based enterprises (bee-keeping and caterpillar utilisation) were superior to other typical agricultural enterprises such as maize, beans and groundnuts in Kasungu, Malawi (Syampungani et al., 2009). According to Munthali and Mughogho (1992), when combined, other subsistence rural enterprises only make MK417 ha^{-1}, whilst wildlife-based enterprises make MK1,015 ha^{-1}, representing 59 per cent better income (Shackleton et al., 2010).

Besides having direct income for instant use, households using forest resources on a regular basis and in significant quantities for direct household consumption usually enjoy a significant saving of cash and so does the state (Shackleton & Shackleton, 2004; Shackleton et al., 2007). Collection and use of NTFPs such as wild foods to meet daily energy and nutritional needs allows households to save cash resources, to be invested in other household needs such as education, agriculture and other income generating activities (Shackleton & Shackleton, 2004).

Despite the growing evidence on the trade in wild foods, not much research has been carried out in Malawi on forest food dependence. However, there are reasons to believe that dependence on wild foods for income may be similar to findings from other African countries (Fisher et al., 2010; Kamanga et al., 2009).

1.1.5.2 Wild foods as a daily net

Throughout history, wild foods have been important for hunter-gatherer communities and foragers and similarly today, to agricultural communities. With over 7 000 edible plant species and many similar numbers of edible animal species, the contribution of wild foods to people's diets can never be overestimated (Bharucha & Pretty, 2010). Wild foods contribute significantly to overall household food security, dietary diversification and nutritional well-being (Kajembe et al., 2000), as they add diversity to the mostly cereal based staple diets of rural households (Uusiku et al., 2010; Powell et al., 2011; Shackleton et al., 2011). A detailed study of 36 households in an agricultural community in Malawi over two years revealed that at least two different leafy vegetables, two root vegetables, 21 fruits, 23 mushrooms, and 14 caterpillar species were collected (Kalaba et al., 2010; Lowore, 2006; Syampungani et al., 2009).

Overall, the majority of households in rural areas use many wild vegetable species and they complement each other and increase the overall diversity of vegetables consumed through the year (Ogle et al., 2003). In addition, Malawi, as part of the miombo woodlands, is a rich source of edible mushrooms with at least 60 different species, compared to 45 species in neighbouring Zimbabwe, and 53 species in the Democratic Republic of Congo (Syampungani et al., 2009). The world's largest and one of the tastiest mushrooms, *Termitomyces titanicus*, is restricted to miombo woodlands (Syampungani et al., 2009).

Additionally, common insects such as termites and caterpillars are widely consumed in Africa in the form of snacks or as a side dish (Syampungani et al., 2009). Caterpillar collection for consumption is a common practice in communities living close to woodlands in Malawi such as national parks in the Northern Region of the country (Lowore, 2006). In South Africa for instance, Van der Waal (2004) identified the collection and consumption of 42 different species of grasshoppers for food, by the Tshvenda people in Limpopo Province. Children and women have been identified as the primary harvesters and processers of insects, with some children walking up to 6 km to collect grasshoppers (Dzerefos et al., 2014; McGarry, 2008; Shackleton et al., 2010).

Besides insects and termites, honey products from the woodlands of southern Africa form an important food supplement to rural communities, and are especially abundant under tree species such as *Isoberlina angolensis*, *Julbernadia paniculata* and *Brachystegia spp.* (Syampungani et al., 2009) which are common in Malawi. Against this background, Vaughan (2007) warns that in many cases it is erroneous to interpret the collection of wild foods as only a sign of distress.

1.1.5.3 Wild foods as a safety net

Much literature portrays use of wild foods as a safety net or coping strategy during times of hunger, distress and other shocks that households may encounter (Chidumayo & Marunda, 2010; Diederichs, 2005; Kajembe et al., 2000; Shackleton & Shackleton, 2004). A safety net comes into play in periods of natural and human made disasters, food shortage and when other sources of household income fail to meet dietary shortfalls or whenever a quick cash option is required (Shackleton et al., 2010) during which populations become heavily reliant on wild foods for survival (Hunter et al., 2007; McBurney et al., 2004).

Periods of distress and food insecurity include the beginning of the rainy season when food shortages are most acute (Syampungani et al., 2009). Such findings have been reported for Malawi, Zambia and Mozambique, with over 90 per cent of households experiencing hunger periods during the rainy season between November and April (Akinnifesi et al., 2008; Syampungani et al., 2009) with the worst month in Malawi being February. During this period 61 per cent of households lacked food and collected wild fruits as a coping strategy and to reduce vulnerability (Akinnifesi et al., 2008; Chidumayo & Marunda, 2010). Fisher et al. (2010) also indicate that in Malawi, forest foods compose 57 per cent of the meals during food shortages compared to 10 per cent after a good harvest. As Fisher et al. (2010) states, when misfortunes such as adverse weather events strike, forests "can make the difference between good and bad nutrition or food security and starvation".

Dependence on wild foods is also a function of the level of vulnerability of particular individuals and households. Vulnerable households and individuals, such as those infected and affected by HIV and AIDS, and female-headed households, are more reliant on wild foods compared to non-vulnerable households (Challe & Price, 2009; McGarry & Shackleton, 2009; Paumgarten & Shackleton, 2011). For instance, McGarry and Shackleton (2013) showed that vulnerable children such as out-of-school children do not have sufficient resources or come from households with additional labour demand hence have frequent

access to wild food sources as they are conducting other household activities such as collection of water or firewood (McGarry & Shackleton, 2009). Poorer households are also more dependent on wild foods due to a lack of alternatives and the associated "cost saving function" (Paumgarten & Shackleton, 2011).

1.1.6 Nutritional value of wild foods

Malnutrition is a major health burden in developing countries, and the recognition that nutritional security and biodiversity are linked is fundamental for enlisting policy support both to secure wild food use and preserve habitats for wild edible species (Bharucha & Pretty, 2010) The contribution of wild foods to human nutrition is best analysed from the nutritional analysis of the wild foods and the frequency of consumption, which may not always be captured in cases were these foods are simply taken as snacks (Grivetti & Ogle, 2000; McGarry, 2008).

The nutritional value of wild foods is dependent on the species, and climate and soil characteristics, especially for plants (Saka & Msonthi, 1994). In addition, cooking or preparation methods and duration of cooking may affect the nutritional value as well as bioavailability of many nutrients (Uusiku et al., 2010). Cooking may however, have no effect on other nutrients such as iron and zinc, and may increase β carotene bioavailability, and reduce vitamin C due to leaching (Uusiku et al., 2010). Nutritional data indicates that wild foods are important source of carbohydrates, vitamin C, Calcium (Ca), Magnesium (Mg), and Potassium (K) with their nutritional value being similar or substantially higher than those of domesticated foods (Campbell, 1987; Kajembe, 2000)

Several studies have indicated that wild leafy vegetables contain micronutrient levels as high as or even higher than those found in exotic leafy vegetables (Flyman & Afolayan, 2006; Mavengahama et al., 2013; Modi et al., 2006). For instance, *Amaranthus* and *Bidens* are

more valuable sources of vitamin C and E, respectively, compared to cabbage and swiss chard (Modi et al., 2006) with a portion of *Amaranthus* spp. having 200 times as much vitamin A as the same size portion of cabbage and more than 10 times the amount of Iron (McGarry, 2008). The role of leafy vegetables as sources of micro-and macro-nutrients is even more pertinent given the prevalence of malnutrition in developing countries. For example, as many as 190 million, an estimated 42.4 per cent of young children in sub-Saharan Africa, are vitamin A deficient (Uusiku et al., 2010).

In addition iron deficiency remains a major cause of malnutrition amongst children and pregnant mothers (Department of Nutrition, HIV and AIDS, 2009; Saka & Msonthi, 1994). Consumption of the fruits studied in Malawi would meet this deficiency. For instance, *Flacourtia indica* and *Syzigium guineense*, are the best sources of this mineral with both fruits supplying above 5 mg iron per 100 kj of daily energy intake (Saka & Msonthi, 1994) meeting a person's RDA (Recommended Daily Allowance). Some wild fruits and nuts are also excellent sources of protein, Ca (Saka & Msonthi, 1994), and vitamins A and C (McGarry, 2008). Fruits also constitute an important source of energy and some are also useful sources of plant protein (Bharucha & Pretty, 2010; Saka & Msonthi, 1994).

Bushmeat is nutritionally superior and an important source of protein, rich in bioavailable iron, zinc and vitamin B (Vinceti et al., 2013). Some areas of eastern and southern Africa register bushmeat consumption rates of being more than the FAO recommended annual meat protein intake requirement of 22 kg per capita (Barnett, 2000; Mgoola, 2007). In Botswana, for instance, the majority of animal protein comes from wild animals of every kind and size, where over 50 species of wild animals are hunted for food, providing on average, 90.7 kg meat per annum per person (Barnett, 2000; Mgoola, 2007). Insects, such as grasshoppers, termites and caterpillars, are a valuable food source for rural communities and their consumption been recorded in southern and central Africa (McGarry & Shackleton, 2009; Syampungani et al., 2009). They form important sources of animal protein

in the region such as the *mopane* worm which contains protein (76 %) and vital minerals and vitamins (100 % of recommended amount per 100 grams) (McGarry & Shackleton, 2009).

Against this background on the nutritional value of wild foods, several diseases associated with micronutrient deficiency could be prevented if adequate information on the existence and uses of wild foods that provide these nutrients were made available to rural households and decision makers. This could be through appropriate policy interventions through better designed and implemented nutrition education and agricultural interventions (Bapu, 2000).

1.1.7 Sources of wild foods

With little or no complete wild landscapes remaining the dry forests and woodlands in sub-Saharan Africa are an important source of numerous wild plant and animals. Foods found in these landscapes include fruits, leafy vegetables or edible herbs, roots and tubers, seeds, nuts and kernels, edible fungi, and a range of processed products such as traditional beers and palm wines and fats and oils extracted from fruit nuts and kernels (Shackleton et al., 2010). In addition these forest and woodlands also remain a natural and an important source of edible insects, bushmeat, birds and small mammals (McGarry & Shackleton, 2009; Syampungani et al., 2009).

Large quantities of wild foods are also found in trees outside the forests (TOF) scattered across human and natural landscapes and include areas in the form of woodlots, trees scattered in farmlands, in homesteads and along linear features (Rawat et al., 2003). Pathways, roadsides, home sites and field edges are therefore potential sites for wild foods (Barucha & Pretty, 2010; Cavendish, 2000), making them readily available for children who frequent these places for play (Alexander et al., 2015). Despite this established notion, information on the composition of wild foods found in TOF's is scarce since they are not usually included in standard forest inventories

Farmlands and gardens are also an important source of wild foods as some species are being domesticated and incorporated into farming systems (High & Shackleton, 2000), including wild vegetables (Bharucha & Pretty, 2010; Scoones et al., 1992; Modi et al., 2006) and wild fruits (Akinnifesi et al., 2006). In addition, farmers conduct selective clearing of land for agriculture, and usually retain particular tree species, especially those of wild fruits (Scoones et al., 1992; Schreckenberg, 1999). For example, High and Shackleton (2000) reported that 31 per cent of the value of all food plants in home gardens in a village in South Africa came from wild species. Besides fruit trees and wild leafy vegetables farmlands are also a source of many forms of small bushmeat species and insects (Delang, 2006). Although the greatest diversity of wild foods is found in complex agroforestry systems and home gardens, the significance of wild foods found in simple, monoculture systems cannot be underestimated (Delang, 2006; Scoones et al., 1992)

Wetlands are an important source of edible aquatic species, vegetables and birds that contribute significantly to food security. For instance, Mgoola (2007) reported that an estimated 1.2 million birds were hunted every year in the Lake Chilwa wetland in southern Malawi.

1.1.8 Wild food availability and access

Availability and use of wild foods varies with time (seasons) and spaces (regions) (Ogle, 2001). For instance, of the 75 species of edible fruits recognised in southern Africa, not all are in common use (Akinnifesi et al., 2000; Shackleton et al., 2010). Popular fruit species from the miombo region include *Uapaca kirkiana, Parinari curatellifolia, Strychnos cocculoides* (and other *Strychnos* species)*, Flacourtia indica, Diospyros mespiliformis* and *Azanza garkceana* (Saka & Msonthi, 1994; Shackleton et al., 2010).

Besides vegetables and fruits, bushmeat, insects, birds and other animal products such as honey are also an important source of food and may be considered as a delicacy, especially in areas close to natural forests and to a lesser extent urban dwellers (Mgoola, 2007; Shackleton et al., 2010; Walter, 2001). The highest concentration of wildlife resources in Malawi occurs in protected areas, due to unsustainable harvesting and deforestation that is frequent on customary land (Barnett, 2000; Mgoola, 2007). Nevertheless, smaller wildlife species like insects, rodents and birds are found in abundance in customary land and survive in modified landscapes (Barnett, 2000).

On the other hand, it is important to note that consumption patterns of wild plants varies among households within different countries and at the intra-household level. In South Africa, for instance, the consumption pattern is highly variable and depends on factors such as poverty, status, degree of urbanisation, distance to fresh produce markets and season of the year (Uusiku et al., 2010). In addition, preference of the species differs depending on the gender, and age of consumers as well as the cultural background and geographic location (Garcia, 2006; Uusiku et al., 2010). In Nairobi, ethnicity was shown to strongly influence households' choice and consumption of leafy vegetables, while in Uganda, consumption of wild plants is limited to casual encounters, periods of food shortages and as supplements to major crops (Uusiku et al., 2010).

On the other hand, the availability and use of wild foods also varies depending on factors such as region, time of year, purpose for exploiting the foods, economic standing and the food security situation of individual households (Shackleton et al., 2010). In general, most wild foods, especially fruits, are seasonal and consumed in spring and summer, which correlates well with shortage of most cultivated foods (Campbell, 1987). Wild edible vegetables are also available and extensive on a seasonal basis, mainly during the rainy season (between October and May) but are also available in irrigated fields or wetlands even during the dry season (Scoones et al., 1992).

Wild foods are usually an open access resource that can be accessed freely. Access requires limited or no capital input and engages minimal landscape transformation for their harvesting, hence a domain of the poor and marginalised users (Maroyi 2011). A prerequisite for the access of wild foods lies in having the necessary indigenous knowledge regarding the collection and processing of these foods (McGarry, 2008 & Maroyi, 2011). Despite them being a freely accessed resource, the provision of these sources of food may be declining as natural habitats come under increasing pressure from development, conservation-exclusions (Bharucha & Pretty, 2010), deforestation for agricultural expansion, and energy use (Fisher et al., 2010; Lowore, 2006). Malawi has one of the highest rates of deforestation internationally, 2.8 per cent per annum (Ministry of Environment and Natural Resources , 2010). In addition, unregulated and unsustainable traditional hunting on customary land, have contributed to the decline of wildlife and other wild foods on customary land (Mgoola, 2007).

1.1.9 Trends in wild foods use and availability

There are a number of important drivers for wild food availability and use. While some drivers can be clearly traced to the implications on availability and use of wild foods, the impact of others is ambiguous and context-dependent (Bharucha & Pretty, 2010). According to (Bharucha & Pretty, 2010), the drivers could be summed into; changing climate, land use change and degradation, unsustainable harvesting and loss of ecological knowledge. In addition, the contexts set by deepening poverty, HIV and AIDS, conflict and socio-economic change have contributed on the same (Alexander, 2010; Barucha & Pretty, 2010; McGarry & Shackleton, 2009).

In many regions, the frequency of consumption of wild food plants has decreased over the years, probably because with globalisation and modernisation in some areas, they are

considered to be inferior in their taste and nutritional value (Uusiku et al., 2010) and are increasingly seen as a symbol of poverty and 'tribalness' (Garcia, 2006). Yet in others, use is stable and quantities required increase with increasing population (Van Vliet & Mbazza, 2011; Pasquini et al., 2009).

Besides preferences affecting the use of wild foods, population growth has also led to high harvesting pressures of some of these resources for economic uses therefore leading to their decline and even extinction for some (Syampungani et al., 2009). Increasing human populations lead to both a high demand for these resources and exerts pressure on the sources of these wild foods through deforestation, conversion to farmland, charcoal production and bushfires (Heubach et al., 2011; Johnson et al., 2011; Syampungani et al., 2009). The situation is compounded with widespread poverty in southern African countries due to slow rates of economic growth (Syampungani et al., 2009).

Often, studies reveal that there is a decline in the diversity of wild foods in the diet during the conversion of complex woodland systems to simplified crop land or the reduction of the woodland (Johnson et al., 2013; Scoones et al., 1992) even though this does not apply to all wild food categories. For instance, in three Tanzanian villages there is a positive correlation between the diversity of edible plants being eaten and the degree of deforestation (Scoones et al., 1992) with higher tree cover associated with high diversity of wild food. Similar findings were found in Malawi (Johnson et al., 2013), Tanzania (Powell, 2010) and in Kenya where for the last twenty years of land use change (to agricultural systems) have reduced the availability of *Mbeere* wild food collection and use (Scoones et al., 1992). Recently, Ickowitz et al. (2013) reports a strong positive relationship between forest cover and household nutrition.

On the contrary, Campbell (1987) indicated that deforestation does not significantly affect availability of selected wild fruits, because people tend to be selective during land clearing for agricultural production. In his research, the abundance of fruit trees, as measured by percentage canopy cover, showed no relationship to frequency of wild fruits used. This indicates that people living in climax woodland or other complex systems are not basing selection of fruits on mere abundance of fruit trees; they are actively selecting for certain fruit species (Campbell, 1987; Kalaba, 2007). In Zambia, Kalaba (2007) reported that rural households intentionally retain fruit trees in their fields by leaving trees standing on agricultural land. In Malawi, the prevalence of cultural restrictions governing the use and exploitation of indigenous trees hence maintaining wild fruit species such as *Parinari curatellifolia*, *Stychnos cocculoids* and *Uapaca kirkiana* around homesteads or crop fields has been recorded (Syampungani et al., 2009). Thus, despite significant changes on woodlands and their use, their contribution to maintaining well-being and providing people's basic needs appears to have remained important (Lowore, 2006).

1.1.10 Children and wild foods

All members of a household use wild fruits, but it is often the younger children who use them most (Campbell, 1987; Lowore, 2006). Mgoola (2007) identified the major bird hunting population as being young people. In addition, in Malawi, it is primarily children who not only gather the bulk of produce, but also consume the most wild foods as snack items (Grivetti & Ogle, 2000; Chirwa, 2006 in McGarry, 2008). Children are usually involved in opportunistic collection of wild edible foods while undertaking activities such as firewood gathering or water collection and during play (Maroyi, 2011).

Addis et al. (2005), in Ethiopia, described children in three districts as perennial users of wild foods who even consume wild foods during seasons of food availability when adult consumption declines (McGarry, 2008). In Zimbabwe, Maroyi (2011), indicated that some plant species, while familiar to many, were considered children's sources of food (for

example; roots, corns, or tubers of *Babiana hypogea, Cyperus esculentus, Eriosema pauciflorum, Eriosema shirense, Lannea edulis* and *Oxalis latifolia*) and some wild fruits are only consumed by children (Campbell, 1987). In Namibia, the collection of wild foods is important for school children who consume these as snacks (Egoh et al., 2012). In South Africa, the fruits of *Sclerocarya birrea* subspecies *caffra* are not just widely consumed by children (Cavendish, 2000), but also commonly traded for pocket money, or exchanged for other foods (Shackleton et al., 2002).

Children's consumption of wild foods is mostly motivated by factors such as taste and texture (Garcia, 2006). In other instances, taste and marketability have also been identified as primary factors that influence children's valuation of wild foods and as a result, their gathering and consuming activities (Setalaphruk & Price, 2007). Ease of access, gathering and abundance of the foods in their surrounding are supplemental to these factors (Setalaphruk & Price, 2007).

Knowledge of wild foods is an important factor that ensures sustained access and use of wild foods. Garcia (2006) ratified that women are the knowledge holders and are the primary means of knowledge transmission to their children through social learning which occurs when the women collect wild foods with their children. Children have knowledge on wild foods (McGarry & Shackleton, 2009) and important channels of knowledge transmission include friends and neighbours. An important instance for learning is collecting for consumption on the spot, which mostly occurs on the way to school or during play and hence children have the opportunity to share their knowledge with friends (Garcia, 2006). While women are particularly knowledgeable on plant based wild foods; men, fathers and grandfathers, are also significant in transmitting knowledge related to the hunting and use of bushmeat to their sons (Setalaphruk & Price, 2007).

The preservation of the knowledge on wild foods is therefore vital and sustained by continued reliance on wild edible plants by many households. In principle, the widespread use of wild edible plants by both young children and adults will result in passing on of this indigenous knowledge to future generations (Maroyi, 2011). Nevertheless, in some areas, fewer children are collecting wild food plants with mothers and learning about them because of lack of time, formal schooling and perhaps a lack of interest. Even older people acknowledge that change in preferences is occurring among the younger generation and wild food use is increasingly associated with low status and poverty, leading to feelings of shame and inferiority (Garcia, 2006) and hence lower consumption by children, unless intimately tied to local culture and taste preferences where even urban consumers maintain demand.

1.2 Problem statement

Within the context of heightened deforestation, urbanisation and HIV and AIDS in sub-Saharan Africa, rural children are highlighted as the most vulnerable group to food and nutritional insecurity. It has been established that good nutrition for children is imperative for optimal mental and physical development, learning and school performance (Department of Nutrition, HIV and AIDS, 2009). In Malawi micronutrient deficiencies are high, and their corresponding nutritional disorders are mainly due to lack of access to high nutritive foods for a diversified and varied diet (Eckim & Qaim, 2010).

Wild foods have the potential to bridge this gap and supplement the diets of many rural people to improve dietary diversity, and consequently contribute to their nutritional status and well-being. Overall, wild foods are seen as supporting livelihoods, providing a daily net and critical safety net for rural people (McGarry & Shackleton, 2009; Shackleton et al., 2010). They include fruits, leafy vegetables or edible herbs, edible fungi, roots and tubers, wild cereals and grains, seeds, nuts kernels, insects, small mammals and rodents (Shackleton et al., 2010; Syampungami et al., 2009). These foods are commonly eaten

because they are nutritious (providing both macro-and micro-nutrients) and supplement staples (Garcia, 2006; Shackleton et al., 2010), freely available (Maroyi, 2011), palatable and their taste is widely appreciated (Setalaphruk & Price, 2007; Kajembe et al., 2000).

The generalisation of wild foods into their main food categories, i.e. leafy vegetables, fruits, mammals, insects, is widely adopted in most literature and little emphasis is placed on the specific genera or species being used by individuals of different ages and socio-economic statuses. The seminal work by Saka and Msonthi (1994) is considered a landmark in identifying wild fruits that are consumed in Malawi and their nutritional values. However, a comprehensive database of wild foods consumed by children needs to be generated to present a clear classification on the wild foods consumed. In addition, the contribution of wild foods to children's daily meals is thus far not well captured and explained though this would help in understanding the contribution of wild foods to food and nutrition security addressing their nutritional requirements. Similarly, various reasons for consumption of wild foods have been widely documented but children's perceptions on the same are lacking in such studies. Conversely, trends in availability of wild foods will automatically influence their access and use by children, therefore understanding the significance of deforestation and its implications on wild food availability is pertinent as they are mostly disregarded in resource management plans and children often go unnoticed as resource users.

1.3 Aim and Objectives

The research aims to explicitly analyse the uses of wild foods by children in Malawi in different landscapes by quantifying the wild food consumed and analysing factors that determine the uses and consumption. The objectives of the study were to:

- Examine the contribution of wild foods to children's food and nutrition status
- Examine children's Knowledge on wild foods within different socio-economic groups

- Produce an inventory of foods used and consumed by children in landscapes of varying deforestation rates and levels of forest cover
- Explore the spatial and temporal variation in the access, collection, and consumption of wild foods

1.4 Research questions

Children's use of natural resources is rarely documented officially, despite the contribution of wild foods to overall food security and their health and nutritional needs. This research seeks to bridge some gaps in understanding with reference to perceptions and uses of wild food by children in the different village landscapes in Malawi, and provide evidence for policy intervention or further research.

It seeks to answer the following research questions:

- What is the contribution of wild foods to children's diets in Malawi?
- What are the perceptions of wild foods used by children of varying socio-economic statuses?
- What are the main wild foods collected by children in Malawi in different village landscapes?
- What are the techniques, places and spaces used to access wild foods by children?
- What are the linkages between deforestation and wild food availability, access and consumption by children?

1.5 Study sites

The four study sites; namely Makombe Kasonga, Mtuluma and Mpheta; are from the district of Zomba in southern Malawi and within the Lake Chilwa basin, Zomba Malosa Forest reserve and its catchment. The sites were purposively selected and all lie on a gradient across the Zomba Mountain Forest reserve and Lake Chilwa. Sites along this gradient were selected based on tree cover and deforestation rate against the background of growing deforestation in the district. The sites were categorised into four groups of high to low

vegetation cover and similarly high to low deforestation rate (Table 2). Land use change maps were used to make this categorisation (Figure 1).

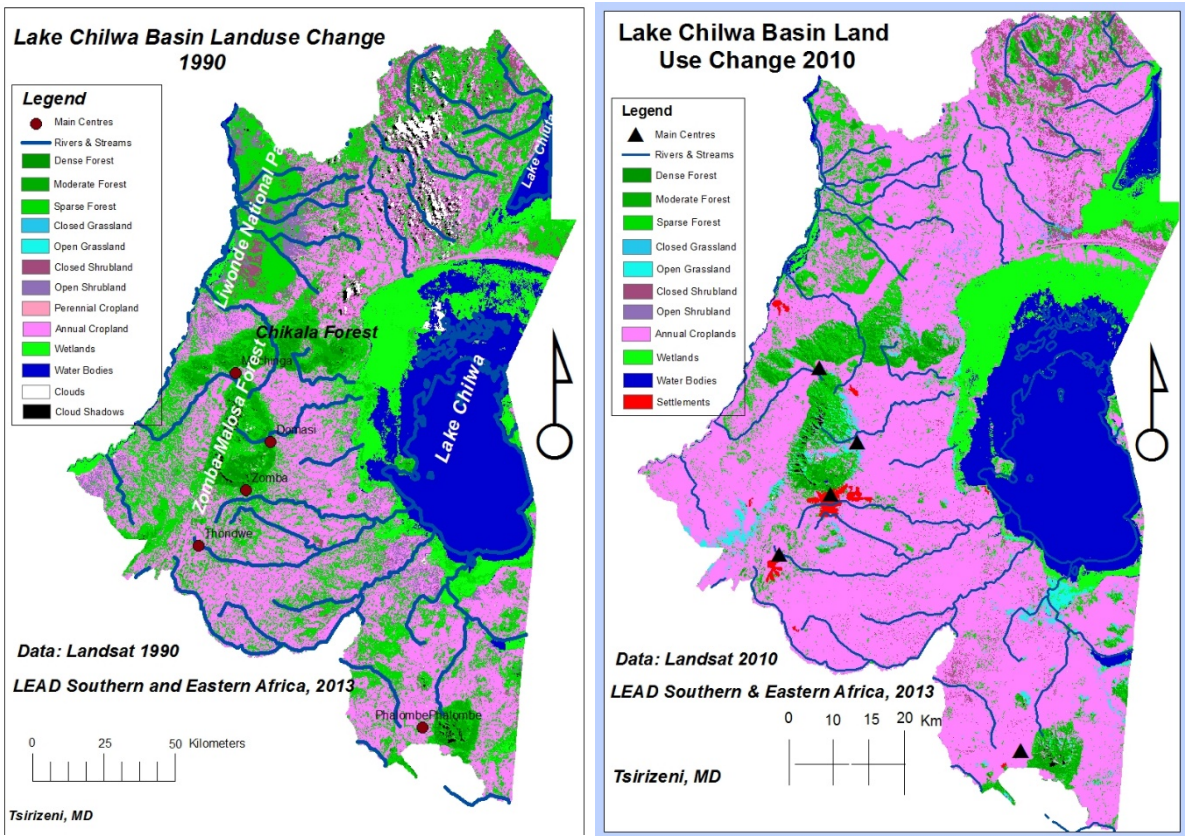


Figure 1: Zomba District vegetation cover between 1990 and 2010

Zomba district is located in southern Malawi and bordered by Balaka, Phalombe, Machinga and Blantyre (Figure 2). The district's governing body, the Zomba district assembly was established and is headed by a District Commissioner with support from department heads (Zomba District Assembly, 2009). Zomba also has local Traditional authorities, custodians of traditional values and customary land.

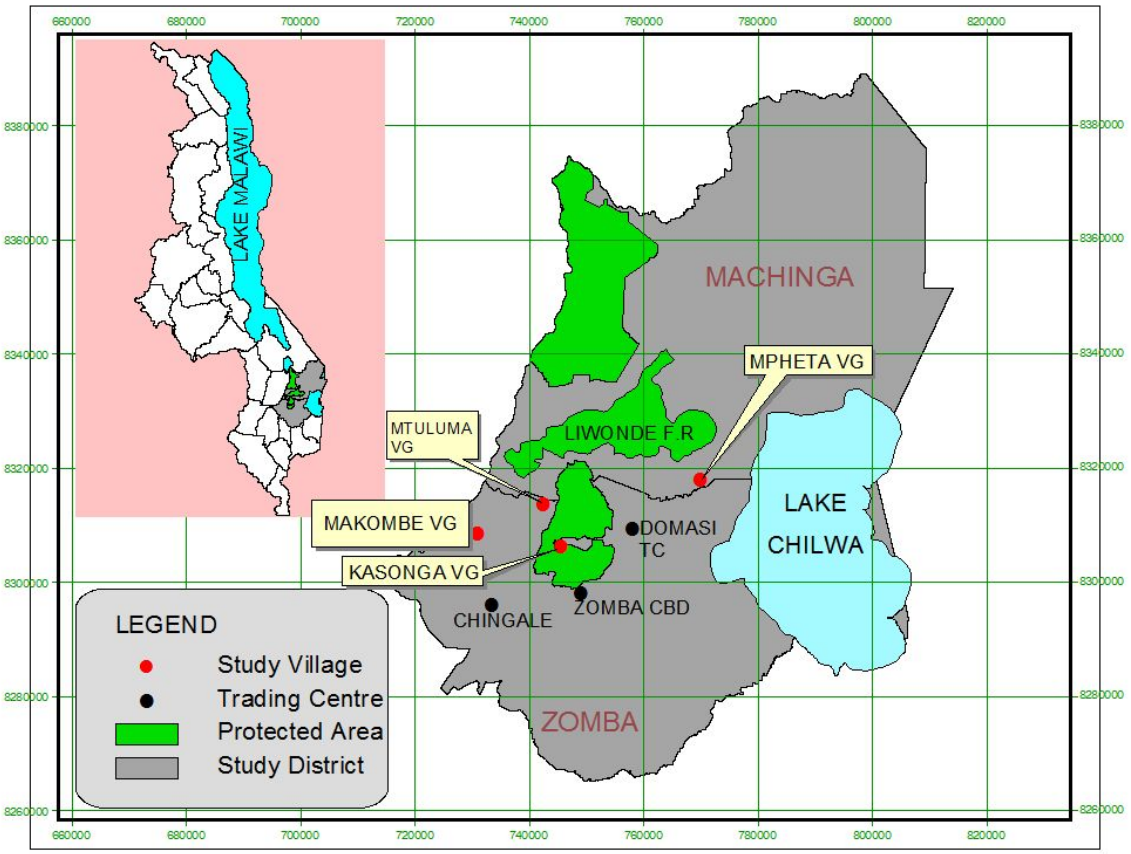


Figure 2: Map of the study sites in Zomba District

The education system in Zomba is offered from pre-school, primary, secondary, tertiary, adult literacy classes and vocational training. The district has a higher school net enrolment at 87.2 % against the country's 80 % (Zomba District Assembly, 2009). Nevertheless, 24 % of males and 28 % of females in the district are illiterate (UN-HABITAT, 2011).

Table 1: Summary of study sites characteristics

Study Site			Kasonga	Makombe	Mtuluma	Mpheta
Location	Physical		Zomba Forest Reserve	Shire River Basin	Zomba Forest Reserve	Lake Chilwa Basin
	Coordinates		x=745591, y=8306380	x=728527, y=8309350	x=742772, y=8313525	x=769814, y=8317498
Land Use	Deforestation rate		High	Low	Medium	Low
	Vegetation cover		Medium-High	Low	High	Low
Economic activities			Quarrying, Timber production, Agriculture (Maize and Irish potatoes)	Agriculture (Cotton and maize). Livestock production	Agriculture(Maize, Cassava), Small -scale businesses	Agriculture (Rice, fisheries), small-scale businesses. Livestock production
Population dynamics	Household Population	Male HOH	96	96	38	307
		Female HOH	33	25	17	90
	Population of children (8-19 Years)		293	299	134	1,051
	Total Population (Zomba District)		583,167			
	Population density		231 persons per km^2			
Culture			Yao, Lomwe and Mng'anja/ Nyanja			
Wealth status	Better off		87	13	4	5
	Poor		42	45	13	251
	Very poor		0	63	38	51
Soil and vegetation	Soil Type		Lithol soils	Ferrigenous soils	Lithol soils	Eutric and mollic gleysols
	Vegetation		Semi-Evergreen forest (Miombo)	Savanna (Mopane)	Savanna (Miombo)	Wetland (Mopane)
Climate and rainfall			Tropical climate and 600-1500mm rain			

The economy of Zomba district is agro-based, with maize production dominating as the main activity and tobacco production undertaken in some areas as a cash crop (Zomba District Assembly, 2009). Other crops grown in the district include rice, cassava, potatoes, beans and pigeon peas. Livestock production or husbandry is still underdeveloped, however, cattle, goats, pigs and poultry are raised for meat production with poultry being the most common (Zomba District Assembly, 2009). The non-agro based economy of Zomba district is dominated by small and medium-scale businesses, mostly retail. The social and physical description of the four study sites from the districts for this study are being provided in Table 2.

1.6 Methods

Several methods were employed during the research for triangulation and to validate the results. Both qualitative and quantitative methods were used. Participatory Rural Appraisal (PRA) exercises that include transect walks, participatory land use mapping and seasonal calendars were used. In addition Key Informant Interviews (KII), Focus Group Discussions (FGD), Semi-structured interviews, observation and food diaries were employed. Each chapter has a section on the methods that where employed to address corresponding key questions with the subsequent findings. To help achieve effective communication, Chichewa which is the national language, was used throughout the field work.

1.6.1 Data collection process

Data collection was conducted in three phases in a period of eight months from October 2012 to May 2013. The time frame was selected to cover different seasons, food availability periods and in school and off school periods. A summary of the data collection process and method used at each stage has been presented (Table 1).

Table 2: Summary of data collection process

	Four sites along a deforestation gradient			
Methods	Site 1	Site 2	Site 3	Site 4
Phase 1: Baseline information				
Focus group discussion with 10 elders	1	1	1	1
Key informant interviews with elders	2	2	2	2
Household interviews with adults & children	50	30	25	35
Phase 2: Food insecure season				
Focus group discussions with 8 male and 8 female children	2	2	2	2
Food diaries for one week	10	10	10	10
Phase 3: Food secure season				
Household interviews with adults & children	50	30	25	35
Transect walk with 8 – 12 children	1	1	1	1
Food diaries for one week	10	10	10	10

1.7 Layout of thesis and chapter description

Chapter 1 lays the background of this research by providing relevant literature and insight on the subject of the research. The chapter examines existing literature on the livelihoods of rural children, their food and nutrition requirements, status and gaps and their dependence on wild foods. It then focuses on wild food availability and use by children and other populations in the region and in the country. It also illustrates the rationale for this research in the problem statement and research questions, provide the study objectives and methodology used and finally describe the study sites. Chapter 2 seeks to understand the status of children's food and nutrition security and their reliance on wild foods in the four sites and the drivers on the same. Findings are segregated according to the sites, status of

households, gender, and other socio economic factors. Children's knowledge of wild foods is also extensively discussed. Thereafter, Chapter 3 looks at availability of and access to wild food by children in the four sites. Wild foods, plus their sources and characteristics are examined from the children's perspective. The chapter also discusses the drivers affecting wild foods availability, such as deforestation and forest cover, processes and strategies used by children to access the wild foods and any other factors affecting children's access to the wild foods or wild food sources. The final Chapter, 4, presents key findings of the study and an in-depth discussion of the findings in relation to existing literature. It thereafter concludes with recommendations drawn from the insights provided by this research.

CHAPTER 2: FOOD SECURITY, CHILDREN'S DIETS AND THEIR USE OF WILD FOODS

…Children from Kasonga eating the stem of *Rumex abysinicus* on their way from school, which is found along the rivers, pathways and fields…

2.1 Introduction

Attaining food security remains the centre of the development agenda in sub-Saharan Africa and Malawi in particular, as evidenced in the country's development strategies such as the Malawi Growth and Development Strategy (MGDS). "*Kulemera ndi kudya*", being wealthy is defined by having enough to eat, is a common sentiment in agricultural communities in rural Malawi. Drawing from wide literature on the debate on defining food security, the Food and Agriculture Organisation (FAO) sets out the conditions that delineate a food secure household. According to FAO, from the World Food Summit of 1996, household food security exists when all people living in a household have physical, social and economic access to sufficient and nutritious food at all times that meets their dietary need and food preferences for an active and healthy life (Hoddinott & Yohannes, 2002; Pangaribowo et al., 2013). The FAO definition is based on three core concepts of food security namely; availability, access and utilisation (Pangaribowo et al., 2013).

In Malawi, food security is typically seen as equivalent to adequate maize production, the country's staple, accounting for more than 60% of total food production (Ecker & Qaim, 2011). Drawing from the Integrated Health Survey (IHS), Ecker and Qaim (2011) report that the diets of Malawians are poorly diversified, with over 60% of the total food consumption consisting of starchy food, primarily maize (Chilimba et al., 2012).

It is widely agreed that a healthy diet refers to a meal with good nutritional status. It comprises of a balanced diet, containing all major food groups, with sufficient levels of micronutrients such as vitamins, essential proteins and minerals (Mazunda & Droppelman, 2012). According to the USAID 2012 food security update, up to 1.63 million people in Malawi are unable to adequately acquire food to meet their minimum basic food needs and over one-third of the population is undernourished. In addition, about 47% of school going children have micronutrient deficiencies while 30% are stunted (Department of Nutrition, HIV and AIDS, 2009). Although there was some improvement in the nutritional status of

children in Malawi between 1998 and 2004 (when the integrated household surveys were conducted), with the incidence of underweight dropping from 29.6% to 22%, the overall position remains that many children in Malawi are generally malnourished (Chirwa & Ngalawa, 2006). The situation is worsened by the prevalence of HIV and AIDS (Department of Nutrition, HIV and AIDS, 2009), and the high incidence of poverty in the country. The immediate cause of malnutrition is inadequate dietary diversity (Pangaribowo et al., 2013). With such alarming statistics on food insecurity and nutrition, attaining food security is a concern for policy makers, health practitioners and agriculturalists and yet the debate remains toned down to simply ensuring staple foods availability (Mazunda & Droppelmann, 2012), with a clear neglect of micronutrient sources.

More recently, there is the growing attention on the contribution of ecosystems in improving food security (Egoh et al., 2012; Poppy et al., 2014). Drawing from the theory of landscape ecology, there is recognition on the role of humans in landscape level processes and an approach to determine trade-offs between human and ecosystem health is handled in a more holistic manner (Powell et al., 2011). The sustainable use of forest resources is equally important in securing the livelihoods of forest dependant and agricultural communities living in proximity to the forests (Cooper et al., 2004; Egoh et al., 2012). Wild foods are rich in micronutrients and have the potential to fill the nutritional gap for rural households (Charrondiere et al., 2013; Powell et al., 2011).

The consumption of wild foods, however, varies in different countries and this is mainly due to spatial and temporal differentiation in the availability of the wild foods, government interventions and socio-cultural factors (FAO, 2011). In Malawi, the cultural value of wild foods was determined by Morris (1992) and its historical contribution to peoples' diets has been established by the work of Mikkola (1997). Elsewhere, the contribution of wild foods to peoples' diets and livelihood has been explored; worldwide (Bharucha & Pretty, 2010), in Asia (Bharucha & Pretty, 2010; Delang, 2005), and southern Africa (Barnett, 2000; Nielson,

2006; Shackleton et al., 2007; Shackleton et al., 2010; Shackleton & Gumbo, 2010). Wild foods play an important role in nourishment and varying peoples' diets, and providing supplementary income opportunities (Shackleton et al., 2007). Animals and animal products such as caterpillars, termites, honey and game are widely consumed (Charrondiere, 2013). Similarly, wild vegetables (Flyman & Afolayan, 2006; Ogle, 2001), bushmeat (Nasi et al., 2011; Nielsen, 2006) and wild fruits (Saka & Msonthi, 1994; Shackleton & Gumbo, 2010) have been identified as major components of rural peoples' diets.

Researchers also agree on the high nutrient quality in most wild foods compared to many conventional foods (Batal et al., 2007; Flyman & Afolayan, 2006). However, accounting for wild foods consumption is challenging due to the multiplicity of wild foods and direct household provisioning and hence some hardly appear in the markets (Dawson et al., 2014). In addition, wild foods undergo informal trade and bartering and are left out of large-scale rural household surveys and official statistics (Bharucha & Pretty, 2010; Dawson et al., 2014). Nevertheless their contribution to human nutrition cannot be neglected. Therefore, for wild foods to be incorporated into food security, nutrition and environmental policies there is a need to establish the role of wild foods as a forest resource and provisioning ecosystem service in addressing food security. In doing this, it is imperative that all wild foods user-groups are represented and accounted for. While considerable research has looked at poor rural families as major beneficiaries of wild foods (Cavendish, 2000; Heubach et al., 2011; Maroyi, 2011; Paumgarten & Shackleton, 2009; Shackleton & Gumbo, 2010; Shackleton & Pandey, 2013; Vaughan, 2007), such data need to be further disaggregated using other social classifications such as age and household composition, and geographic locations of varying landscapes.

This chapter establishes the status of food security for households and children in Mpheta, Makomba, Kasonga and Mtuluma villages in the Zomba district in Malawi. It explores the diets of rural children and ascertains the contribution (if any) of wild foods to the diets. In

addition, I examine the various uses of wild foods by children in the four sites and provide a reflection of the contribution of wild foods to their diets and their overall nutritional status.

2.2 Methodology

In considering the contribution of wild foods to the diets of children of varying socio economic status; I established the economic statuses of the children's household, examined the status of children's diets and dietary patterns (to assess their food and nutrition status), assessed children's use and consumption of wild foods and their knowledge of wild foods. The economic status of a household was determined through participatory rural appraisal (PRA) exercises, where community members defined the parameters to be used for categorisation. Food security was the main proxy for defining poverty, ill-being and vulnerability. Other indicators included vulnerability of particular households such as the old, disabled and child-headed households and those living alone and isolated from social networks.

To examine the status of children's diets and dietary patterns, data on the number of meals consumed by children, and Dietary Diversity Scores (DDS) for the children and their households were collected. The number of meals was established through Key Informant Interview while FAO guidelines were used to determine the Household Dietary Diversity Score (HDDS) and Individual Dietary Diversity Score (IDDS) as a lens for measuring food security and nutritional status through a questionnaire (Appendix A). Increasing dietary diversity is associated with increased household food access as well as individual probability of adequate micronutrient intake (Kennedy et al., 2010). Using the methodology of Swindale and Bilinsky (2005), and as recommended by FAO, 24 hour household dietary recall data were coded according to a set of 12 food groups and a HDDS was calculated. The person responsible for food preparation in the household, most commonly the mother or older girls, was interviewed to provide foods prepared in the household in the last 24 hours. These interviews were held firstly in the months of January and February during food

insecure periods and secondly in the months of March to April during periods of food security. The following food groups were considered:

1. Grains and cereals
2. Roots or tubers
3. Leafy vegetables/other Vitamin A rich vegetables
4. Fruits
5. Meat, poultry
6. Fish, seafood
7. Eggs
8. Pulses/legumes/nuts
9. Milk and milk products
10. Foods cooked in oil/fat
11. Beverages
12. Confectionaries

Household and individual food security status was then derived at by forming terciles of income or socio-economic status and the average dietary diversity of the richest 33 % served as a guide for setting the target level (Swindale & Bilinsky, 2005). Reference was also made to similar studies such as McGarry (2008) that used the 24 hour food recall to translate dietary diversity scores. Households consuming three or fewer food groups were classified as Highly Food Insecure (HFI), while those consuming four food groups were classified as Moderately Food Secure (MFS), and households consuming five or more food groups were categorised as Food Secure (FS).

Besides the dietary diversity scores, indirect food insecurity indicators were employed, given the substantial resources that are required to obtain direct measures of insecurity such as

anthropometric measures which could not be done in the scope of the study. It was hence worthwhile to include the indicators of food insecurity which are categorised into financial, psychological and social dimensions. In this instance, I assessed the infrastructure of the household, membership of social groups such as village unions, number of household members against income of household and status of head of household, with elderly-headed households and women-headed households considered to be more vulnerable. Household income was also considered to reduce vulnerability to food insecurity and households obtaining income between MK0-MK2,000 a month were considered very vulnerable, MK2,001-MK5,000 were considered to have medium vulnerability and MK5,000 and above were considered to be less vulnerable. This information was also utilised to triangulate outcomes on the socio economic status of the households.

To analyse the consumption of wild foods by children, one week food diaries were used. The sampling of children was two tier, firstly purposive sampling was done to select areas in the village for the selection of children to ensure good geographic coverage. Thereafter, children were selected by identifying eligible children in every after fourth house as for Mpheta, every other third house for Kasonga and Makombe and every other second house for Mtuluma. Children identified were provided with interactive food diaries which were filled by children, in case of older children, or with the help of an immediate guardian indicating all foods consumed in that particular day and their sources. The food diaries were clearly explained to the children and their guardians and an assistant, appointed by the chief in all villages, assisted in supervising the families.

Children's knowledge of wild foods was established by giving the children three minutes during an interview to recall as many wild foods as possible and the number of species identified by the child was then computed. During the in-depth interviews, for the identified wild foods, children were asked to explain the methods used to fetch, collect, gather or hunt

the wild foods' identified (Appendix C). In addition, an inter-generational difference in wild foods knowledge was established through FGDs.

In total, eight FGDs where conducted in the four study sites, with two discussions in each site; one with a group of eight to twelve girls and the second with eight to twelve boys. Through the FGDs and 150 in-depth questionnaires (50 in each study site), I articulated the factors that affect children's diets, and their use of wild foods. A total of 120 households were selected through purposive sampling for analysing children's and household food and nutrition security and also contribution of wild foods to their diets. The sample size was set to represent least 30% of households in each village (Table 3). Food diaries were completed by 150 children aged between 8 and 18 over a period of one week during February and later during April during food insecure and food secure periods respectively.

Table 3: Summary of study sites and population sample

Village	**Location**	**Land use change**		**Number of households sampled**	**Number of children**
		Deforestation rate	**Vegetation cover**		
Makombe	In the Shire River basin, bordered by Lisanjala river, a plain and hills	Low	Medium to Low	28	48
Kasonga	On top of Zomba Mountain, bordered by farms, mountain ranges and rivers	High	Medium to High	22	40
Mtuluma	At the foot of Zomba Mountain, bordering Zomba Mountain Forest reserve	Medium	High	21	37
Mpheta	Located in the Lake Chilwa Basin, bordered by Lake Chilwa Wetlands	Low	Low	50	70

The data collected from DDS, and KII was recorded in Statistical Package for Social Sciences (SPSS) where several tests were done. Data from food diaries was recorded in excel where statistical tests were done. Principle Component Analysis (PCA) in Statistic version 10 was done to determine possible relationships between variables such as DDS and social economic factors including wealth, head of household, education and gender. T-tests were performed to asess the differences in means between two sets of data, for example between number of meals between FS and FI periods. Where there were more than two groups (three or more), a One-Way analysis of variance was performed.

2.3 Results

2.3.1 Food security and children's dietary patterns

2.3.1.1 A child's diet in four sites of rural Zomba

At household level, women and older girls were responsible for the preparation of meals. From the 24 hour food recall, all children consumed cereals whether alone, or complimented them with side dishes. Common cereals consumed include maize and maize products and rice. The consumption and dominance of cereal based diets were common during both food security periods of March to April, and food insecurity periods of the months from December to February. Children commonly consumed tubers or a processed cereal such as whole grain porridge with or without any beverage, such as tea, in the morning. A child's typical diet in afternoon and evening, in the four study sites, consisted of a processed cereal, mostly *nsima,* with vegetables and/or pulses, meat and meat products. A meal of *nsima,* made from maize flour was widely believed to be a satisfying meal regardless of the presence of other foods. Children wrote in their food diaries, "*Sindinadye nsima, ndangodya chimanga*", meaning 'I didn't eat *nsima*, I only ate cooked maize' to indicate their dissatisfaction of meals that do not have *nsima*.

Various African Leafy Vegetables (ALVs) and pulses were recorded as common side dishes taken to compliment *nsima* and other grains. Data from the food diaries show that common ALVs consumed by children across the four villages included pumpkin leaves, small beans leaves and selected lentil leaves. From the 24 hour food recall the percentage of children that consumed ALVS were 59% in Makombe, 63% in Kasonga, 27% in Mtuluma and 65% in Mpheta.

The diets of children in the four villages contained little of meat and meat products. Of the children that consumed meat products, the common sources were fish, birds, poultry and bushmeat. The consumption of common, cheap, processed meat alternatives such as Soy Pieces was recorded by the children. From the four study sites, high meat consumption was registered in Mpheta and mostly comprised of fish and crabs reflecting that the area is located in a wetland and in proximity to Lake Chilwa. In Mpheta, four percent of children had meat in their diets while an additional 51% had fish in their diets. Kasonga also registered a high percentage (31%) of meat consumption with a considerably high variety of the products including bushmeat. Only 11% of children in Mtuluma consumed any meat product and none in Makombe. Most households did not purchase meat and meat products as they were not affordable or not easily found within the community.

During the FGDs, children indicated that the cultivated food reserves do not last till the following growing season. The months from October to March were listed as food insecure periods with growing intensity of food insecurity occurring in the month of February. However, there was a delay on the onset of the food insecure period in Kasonga. This could be attributed to the late harvesting period (May to June instead of March to April) caused by the low temperatures and high rainfall in the area. During periods of food insecurity, households purchase and borrow food or rely on aid from the government or other aid organisations and were likely to increase their dependence on wild food. Food secure

periods were defined as those periods when food stocks were available. Therefore, periods of the year affected the nature of a child's diet.

2.3.1.2 Household and children's dietary patterns

A PCA (Principle Component Analysis) analysis (Figure 3) was done to determine children's diets and presumed factors that may affect these diets. The analysis suggested relationships between indicators of the children's food and nutrition security; Dietary Diversity Score (DDS) and number of meals, and relationship between status of household with food and nutrition status (Figure 3). For instance the analysis signifies a strong relationship between household status and the DDS, with poor households scoring low DDS.

During Food Secure (FS) and Food Insecure (FI) periods, children's dietary pattern was measured by analysing the number of meals taken in a day and analysing HDDS against IDDS. There was no significant difference ($t=0.36$; $p>0.05$) in the number of meals taken by children at household level during food secure and food insecure periods, averaging two in both. During FI period, a smaller group of households (4%) only had one meal a day, while the lowest number of meals at household level during FS period was two.

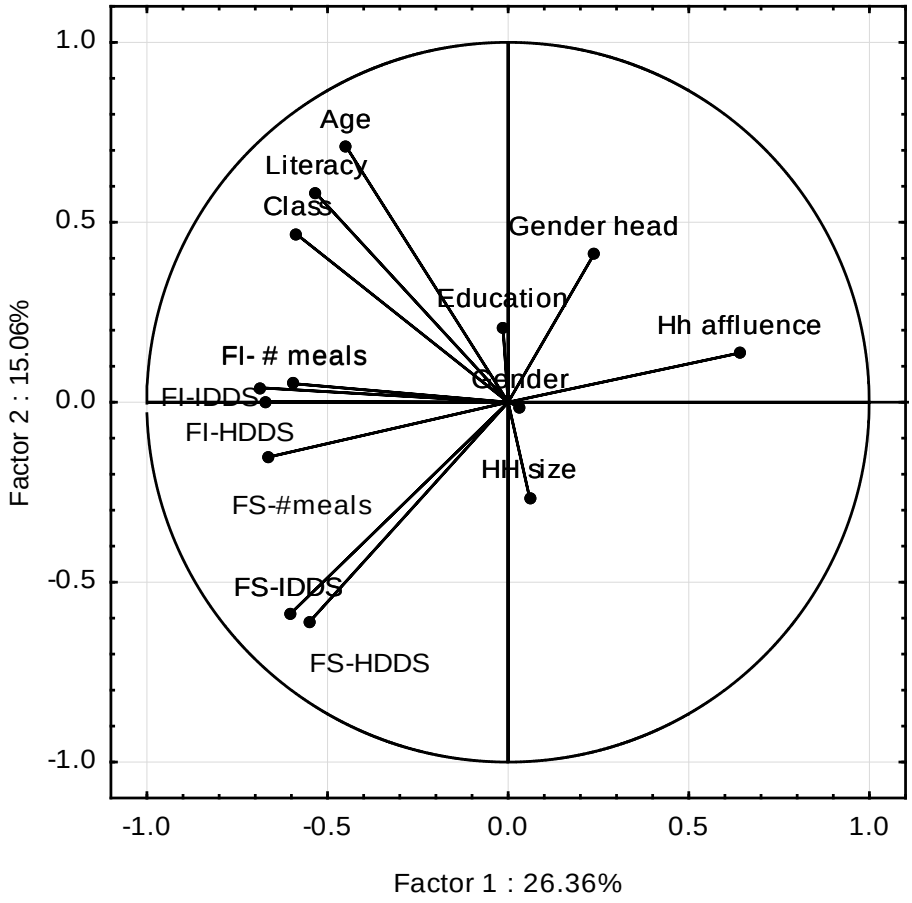


Figure 3: PCA plot of children's dietary patterns

Children from Makombe, Mpheta and Kasonga all received porridge (made from soya beans) at their school during school days which would have contributed to the average number of meals taken by children in FS and FI periods. In Malawi, the School Feeding Programme (SFP) was introduced in primary schools to accelerate the achievement of the Millennium Development Goal (MDG) number two on Education; to increase enrollment, attendance and retention of children in schools (Department of Nutrition, HIV and AIDS, 2009).

Despite the insignificant difference in the number of meals taken by children in their households, children indicated that there was a difference in the quantity and quality of meals during the FI and FS period as foods taken during FS period were satisfying and of good quality. This was similar to the outcomes of the HDD and IDD scores for the four villages during the FI and FS period which were significantly different ($t=4.47$, $p<0.0005$). In all the study sites, HDDS and IDDS scores for the FI period were lower that the HDDS and IDDS recorded in the FS period (Table 4). As anticipated, a high number of meals taken by children translated to a higher HDDS and IDDS.

Table 4: Children's dietary patterns; number of meals a day, HDDS and IDDS

		Village				F value	P value
		Makombe (n=28)	**Kasonga (n=21)**	**Mtuluma (n=20)**	**Mpheta (n=52)**		
Food Secure period	Number of meals	2.36	2.96	2.21	2.43	12.7	<0.0001
	HDDS (Food consumed in the household)	3.18	4.96	3.53	3.61	7.99	<0.0001
	IDDS (Food consumed within and outside the household)	3.71	5.52	4.11	4.22	6.98	<0.0005
Food Insecure period	Number of meals	2.21	2.78	2.42	2.45	4.46	<0.01
	HDDS (Food consumed in the household)	2.57	3.48	3.05	3.06	3.82	<0.05
	IDDS (Food consumed within and outside the household)	2.86	4.17	3.53	3.55	4.57	<0.005

Examination of results between the four villages indicated that there were significant differences between the villages in the number of meals, HDDS and IDDS (Table 4). In both FS and FI periods, Kasonga registered an overall higher dietary diversity score followed by

Mpheta, Mtuluma and Makombe. However, the difference was insignificant between Mpheta and Mtuluma. Makombe reported the lowest dietary diversity scores for both FS and FI periods.

The results show that children complimented the meals taken in their homes with other foods outside their home, because the IDDS was always larger than the HDDS in all study sites and both food availability periods (Table 4). Children consumed other meals and/or snacks outside their home; at school, at the market, during play and in their friends' homes. Snacks reported in children's food diaries included biscuits, sweets, drinks and fruits (both wild and conventional fruits). There was a high correlation between the child's dietary diversity score and household affluence with children from better off households reporting higher dietary diversity scores than children from poor households.

2.3.2 Use of wild foods by children

2.3.2.1 Consumption of wild foods by children

All children in all study sites consumed at least one or more types of wild foods but there were inter-and intra-location variations in wild food use. There were clear similarities in the consumption patterns of certain wild foods (such as wild fruits) from children who lived near each other by comparing their food diaries hence suggesting that these wild foods were consumed as snacks outside their homes. The food diaries also revealed that some wild foods such as wild vegetables, bushmeat, some birds and insects, were taken as part of the meals as side dishes and complimented cereals or in some cases consumed solely.

From the 24 hour recall, 23 % of children complimented their diets with a particular type of wild food. However, during a period of one week, the food diaries revealed that 82 % of children consumed at least one type of wild food during FS and FI period. There was no

variation in the overall number of children consuming wild foods during periods of food availability and during periods of food unavailability. However, I noticed that wild vegetables are more consumed during periods FI while other wild foods did not follow such a trend (Figure 4). During food insecure periods, some children reported having only a wild food, such as insects or a mixed dish of wild vegetables as a meal. One girl from Mpheta narrated, "When we do not have other food, we ground okra to create flour and prepare it just as *nsima*, then we have it with *Amaranthus* as a relish. Sometimes we simply mix okra and A*maranthus* to have a vegetable soup and take it as a meal".

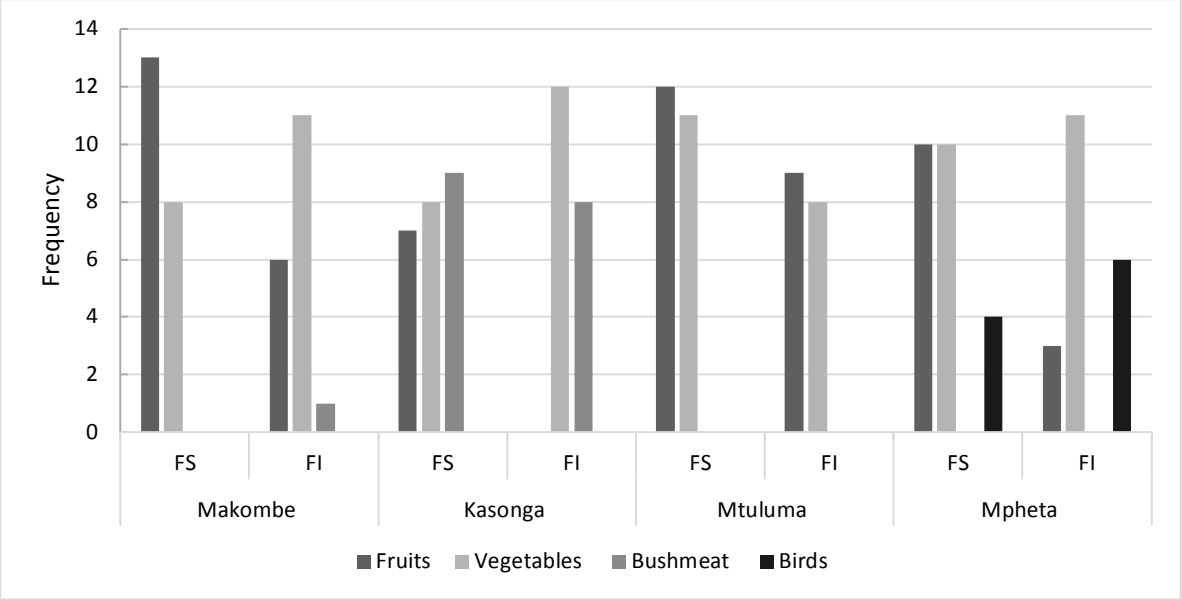


Figure 4: Frequency of consumption of wild foods by children during FS and FI periods in Makombe, Kasonga, Mtuluma and Mpheta during a 24 hour recall

Consumption of wild vegetables and wild fruits was common in all the sites with an average of 64 % and 58 % of children consuming wild vegetables and wild fruits, respectively. Of all the wild foods categories, in a period of seven days, wild vegetables were the most consumed, with 70 % of children consuming wild vegetables during the food insecure period and 58 % of children consuming wild vegetables during food secure periods. Consumption of

mushrooms was also higher during food insecure periods (17 %) than food secure periods (2 %). Wild fruits were most consumed during food secure periods with 60 % of children consuming, and 55 % of children consuming wild fruits during food insecure periods. In addition, the consumption of wild fruits was high among children in Makombe and Mtuluma.

A variety of other bushmeat and small mammals were consumed by children commonly in Kasonga, with a low frequency in both food secure (11 %) and food insecure periods (13 %). These include, hare, mice, duiker, monkey, and bushbuck. Consumption of crabs was also recorded in Kasonga and Mpheta with 10 % of children consuming crabs. On the other hand, consumption of insects was low in all villages and varying food availability periods with only 2 % of children consuming insects. Consumption of birds was common in Mpheta with up to 11 % of children eating birds during the food insecure period and 7 % of children during food secure periods. Consumption of honey was also reported in Kasonga. The 20 most commonly consumed wild foods are presented and an indication of their frequency in consumption during the seven day period (Table 5).

In all study sites, wild foods significantly improved the dietary scores of children that consumed wild foods. Overall, the dietary score of 77 % of the children improved with 1+ with the consumption of wild foods across the two food availability periods. However, the average contribution to a child's dietary diversity was higher during food insecurity at (mean 2.04, std. dev. ±0.9545) and lower during food security (mean 1.85± std. dev. 1.2128) with considerable variation among the children as shown by the standard deviation.

Table 5: Wild foods commonly consumed by children in Makombe, Kasonga, Mtuluma and Mpheta

	Frequency in consumption							
	Makombe		Kasonga		Mtuluma		Mpheta	
Wild vegetables	**FS**	**FI**	**FS**	**FI**	**FS**	**FI**	**FS**	**FI**
Bidens pilosa	0	0	4	2	3	0	3	0
Cleome monophylla	0	0	0	0	1	1	0	0
Cleome gynandra	3	0	0	0	1	2	0	0
Cochorus trilocularis	3	4	1	2	5	2	3	0
Amaranthus spinosus and *hybridus*	2	7	0	2	0	3	4	0
Alternanthera pungens	0	0	0	0	0	0	7	0
Galinsonga parviflora	0	0	2	0	0	0	0	0
Aloe meynharthii	0	0	1	3	0	0	0	0
Mushrooms	0	0	0	3	1	0	0	0
Wild fruits								
Adansonia digitata	1	0	1	0	0	0	3	0
Vitex domiana	0	0	0	0	1	0	1	0
Vangueria infausta	2	3	0	0	2	1	0	0
Anclylobathrys amoena	2	2	0	0	0	0	0	0
Flacourtia indica	1	0	0	0	4	5	0	0
Sclerocarya birrea	0	0	0	0	0	0	2	0
Annona senegalensis	5	0	0	0	2	1	1	0
Uapaca kirkiana	0	0	1	0	1	1	0	0
Landolphia buchananii	0	0	3	0	0	0	0	0
Ziziphus mauritania	0	0	0	0	1	0	3	0

However, there was a clear distinction in the consumption of wild foods, both in frequency and intensity (Table 6), over long periods of time, such as a year. “How often do you consume wild foods?” was asked to determine the level of continued dependence or non-dependence on wild foods by the children.

Table 6: Children's frequency in consumption of wild foods in Makombe, Kasonga, Mtuluma and Mpheta.

Wild food category	Time period interval	Percentage			
		Makombe (n=22)	Kasonga (n=20)	Mtuluma (n=27)	Mpheta (n=37)
Wild vegetables	Several times a week	31.8	40.0	35.3	32.4
	Several times a month	54.6	45.0	41.2	38.6
	Several times a year	9.1	5.0	17.6	13.5
	Never	4.5	10.0	5.9	5.4
Wild fruits	Several times a week	34.6	20.0	53.0	8.1
	Several times a month	15.3	65.0	4.2	16.2
	Several times a year	38.5	10.0	5.9	37.8
	Never	1.5	5.0	0.0	37.8
Bushmeat	Several times a week	11.5	5.0	0.0	2.7
	Several times a month	19.2	30.0	5.9	10.8
	Several times a year	23.1	55.0	52.9	10.8
	Never	46.2	10.0	41.2	75.6
Birds and insects	Several times a week	0.0	10.0	11.8	8.1
	Several times a month	33.3	20.0	35.2	13.5
	Several times a year	55.6	50.0	35.3	59.4
	Never	11.1	20.0	17.6	18.9

The trends in the frequency in consumption of wild foods by children across the study sites and between different food categories differed. In all study sites, wild vegetables were commonly taken several times a month or several times a week. Only a few respondents admitted to never eating wild vegetables. Most children in Makombe, Kasonga and Mtuluma reported consuming wild fruits. Children from Mtuluma reported the highest frequency in the consumption of wild fruits with at least 53% of children consuming them weekly while children (65%) in Kasonga consumed wild fruits several times during the month. In Makombe, while some children (35%) consumed wild foods more frequently, other children's frequency in consumption was low (39%). In Mpheta, 38% of children reported a low frequency in the consumption of wild fruits, and an additional 38% did not consume the fruits at any time in a year.

Most children in Kasonga consumed bushmeat and the village recorded the highest frequency of consumption. Across all sites, bushmeat was often consumed several times a year with increased frequency in Kasonga and Makombe. Most (76 %) children in Mpheta did not consume bushmeat and the lowest frequency in consumption was reported in the village. Similarly, birds and insects were commonly consumed several times a year in all study sites.

2.3.2.2 Preparation of wild foods

Children use various strategies in the collection of wild foods (see Chapter 3) and similarly use various methods in the preparation of the foods. The preparatory processes of wild foods were dependent on the type of wild food, amount of wild foods and preference. Other factors such as the time of collection of the food and distance from wild food source to the household also affected wild foods preparation strategies.

Fruits that were identified in the survey in all sites are directly picked from the trees and consumed raw, without any processing. Due to the snack nature of wild fruits they were consumed as they were collected. However, in some cases, children would collect unripe fruits, such as *Uapaca kirkiana,* and put them in the ground or in a sack bag to ripen and to be consumed later. This was especially the case when the source of the wild foods was far from their homestead or they wished to store the fruits for future consumption or for sale. Both girls and boys participated in this practice.

Wild vegetables were prepared to be consumed as a side dish with household meals. Mothers or elder girls were responsible for the preparation of the vegetables. The preparation of vegetables varied from household to household. While some simply boiled

the vegetables, other households added tomatoes, cooking oil and onions to add flavour and make them appetising. In addition, some households added groundnut powder to make the vegetables delicious, and despite most households wanting to do so, this was limited by the availability of the additives. Of particular interest was the preparation of mixed-wild-vegetable dish by some households. Households mixed *Bidens pilosa* and okra or with other African leafy vegetables such as pumpkin leaves to have a mixed vegetable side dish. During food insecurity these mixed vegetables could be consumed independently of "*nsima*". Children admitted to enjoying and preferred mixed-wild-vegetables dishes and vegetables with additives.

Birds were mostly collected and prepared by boys. Boys indicated that they hunted birds and are similarly knowledgeable on the methods used, such as the use of catapults, nets and "*Ulimbo*" involved in catching birds. Birds are caught from various sources such as the farms, riverside, bush and forests but are prepared in the households by removing their feathers, drying them or grilling them on an open fire or frying them in hot oil. Birds were viewed as a delicacy by most children and sought after by many households. Birds and insects were consumed as a snack or side dish and sometimes sold by the children.

The preparation of bushmeat was usually a two phased process; pre-cooking activities and the cooking phase. Older boys and men are responsible for hunting and preparing bushmeat by separating the edible parts from the inedible (such as hides) and handing them to the women in the household for preparation. Just like wild vegetables, preparation of bushmeat varies per household and is very dependent on the knowledge and preference of the person preparing the meal. The preparation of bushmeat ranged from roasting/grilling the meat on an open fire, or boiling to make stew. Respondents indicated that remaining parts were sold at the market and no preservation methods were mentioned.

2.3.3 Factors affecting children's consumption of wild foods

In-depth interviews revealed the various reasons why children consume wild foods. The choice by children to consume wild foods is determined by several internal (those inspired by children) and external (those not made by children) factors that affect their choices, but at times they are left with no choices at all. Of special interest is the level of knowledge that children have and its impact on the decisions they make on the use of wild foods. These two notions were uncovered by asking children "Why do you consume wild foods"?

Most children provided similar answers on the factors affecting their consumption of wild foods. In the first instance, children indicated that they consume wild foods because the foods contribute positively to their nutritional status and give them good health. According to the children, wild foods were fattening, provide energy and strength, protects the body from diseases and supplements blood. In addition wild foods were said to provide nutrients such as iron, carbohydrates, vitamins and proteins. Forty-five per cent and 28% of children indicated that wild fruits and wild vegetables, respectively, provide good health and nutrition. While the older children (13-18 years old) were able to provide details of nutritional information of wild foods, younger children (8-13 years old) simply indicated that the wild foods contribute to good health.

Convenience was another reason that influences children's use of wild foods. It was clear that children considered wild fruits to be tasty and sweet and that it was a common snack to take when hungry (Figure 5). When children go to school, for play, to fetch firewood or water, to conduct farm activities or to the market they consume wild fruits along the way to satisfy themselves. For instance, children in Kasonga consume *Rumex abysinicus* and *Caesalpinia decapetala* on their way from school when they are hungry.

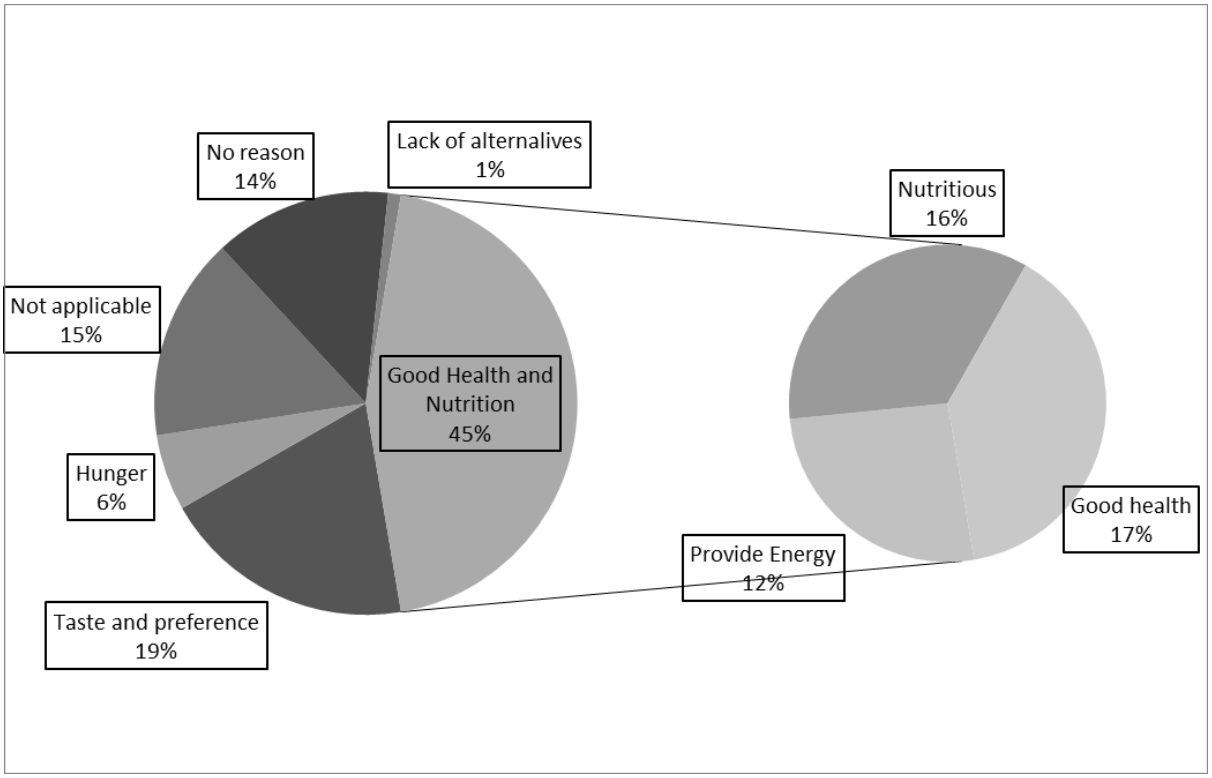


Figure 5: Reasons for the consumption of wild fruits

Lack of other alternative foods in the households, mostly caused by poverty, drove children into collection and consumption of wild foods, hence supporting the notion that socio-economic status influences which foods are consumed by particular households. The children indicated that they did not have other alternative foods and sources of food and that was the relish available and provided to them in their households. Households who lack income to obtain other types of relish depended on cheap and readily available relishes such as wild vegetables which are mostly freely accessed. Thirty-three per cent of children consumed wild vegetables because they lacked other alternative side dishes (Figure 6).

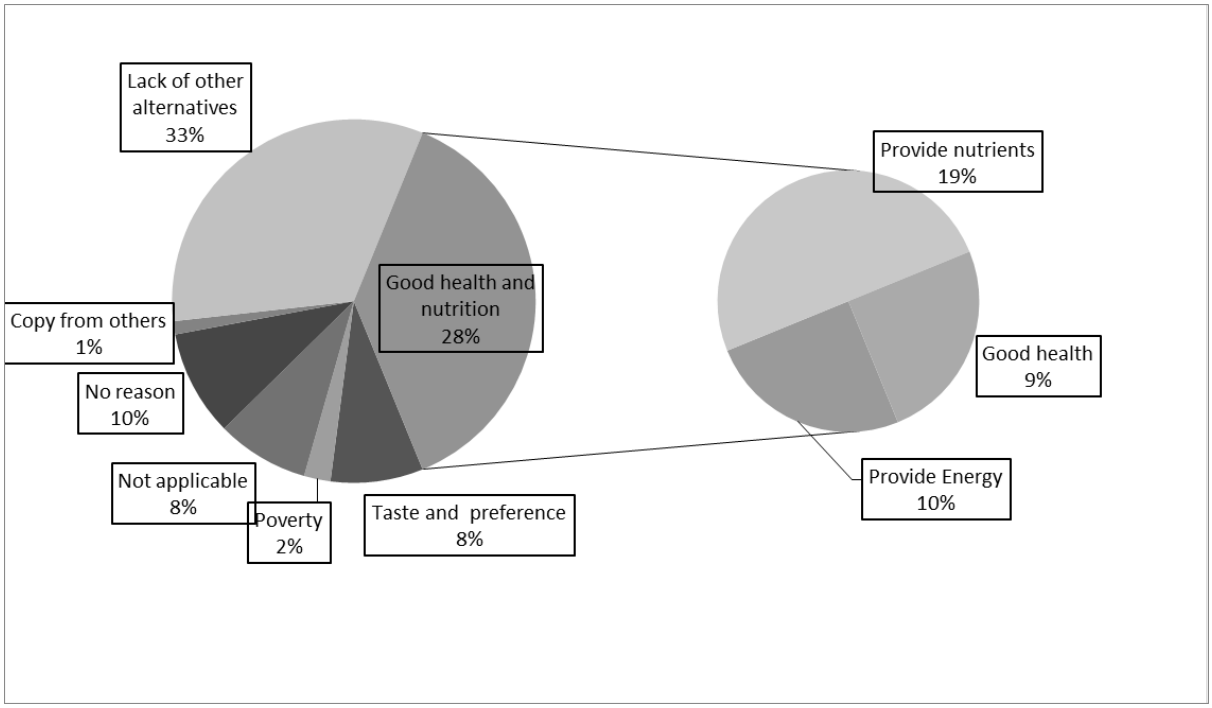


Figure 6: Reasons for consuming wild vegetables

On the other hand, wild foods, such as some insects, birds and bushmeat were consumed because they are delicious and provide variety to the diet and locally termed "*zakudya za nkhwiru*" (a delicacy; nutritionally valuable and tastier) (Figure 7). This was common for animal based wild foods. They were considered a delicacy and provide alternatives to commonly consumed side dishes, they are fattening and also considered a source of protein. Some children also indicated that they consume wild foods to satisfy the six food groups in order to be healthy.

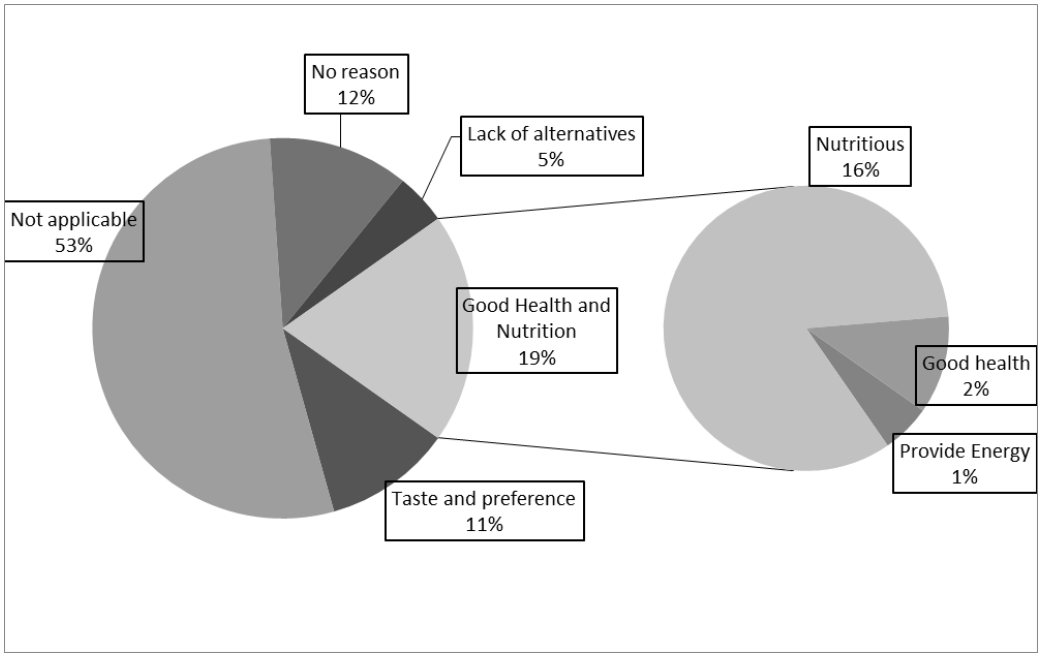


Figure 7: Reasons for consuming bushmeat

While a small population of children (15 %) did not consume either birds or insects, many children (29 %) consumed them for health and nutrition reasons or for no reason at all (Figure 8).

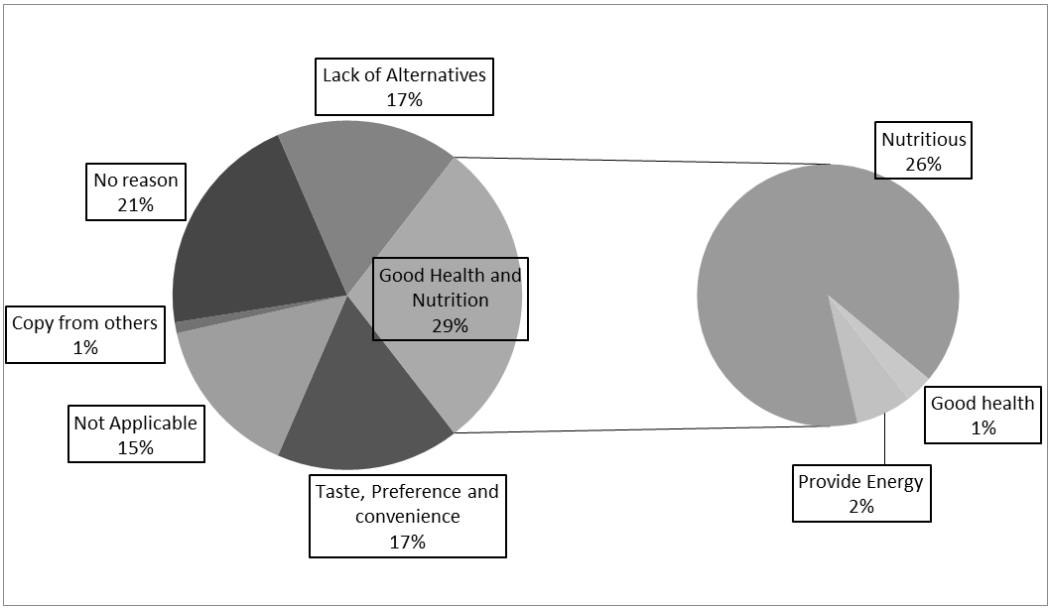


Figure 8: Reasons for the consumption of birds and insects

The main reason why children did not consume some wild foods was as a result of the stigma associated with some wild foods. During focus group discussions, one girl indicated that, "*some children consume the mentioned wild foods in their homes but are too shy to reveal and are afraid that others will laugh at them*". These notions differed between wild foods in different sites and possibly mean that perceptions on wild foods are determined by sociocultural norms of people in that area. While one wild food was associated with the "poverty complex" at one site, the same food was highly valued at another site. For example, mice and vervet monkeys were considered food for the poor in Makombe, whilst some children in Kasonga considered them as delicacies. Similarly, wild foods that were associated with the poverty complex in Kasonga include okra, black jack, and *Amaranthus*; were highly valued and commonly consumed in Mtuluma. Against this background, one could draw that culturally accepted knowledge (indigenous knowledge systems) affected children's perceptions and consumption of some wild foods.

Secondly, some children indicated that they do not eat some of the wild foods because they do not taste nice or they smell badly. For instance, *Aloe meynharthii* and black jack are not consumed by some children because they taste bitter, while to others, *Amaranthus* species smelled badly. Nevertheless, when asked by the parents to collect these vegetables, they complied. It was noted that the bitterness may be attributed to the various cooking methods employed. Some children indicated that they do not consume wild foods due to medical reasons. For instance, some girls do not consume black jack because they suffer from what is culturally known as "*mutu waukulu*" (migraine).

Some children do not eat some wild foods due to beliefs, taboos and faith. For instance, it was stated that most Muslim children in all the study sites do not consume mice. There were also various beliefs among children that affected their preference and use of wild

foods. For example, some children in Mtuluma indicated that they do not consume vervet monkeys because they resemble humans. On the other hand, some children from Kasonga and Makombe did not consume caterpillars because they looked scary.

2.3.4 Children's knowledge pathways of wild foods

Even though children admitted to learning about wild foods from the elders in their society, the basic knowledge for learning about wild foods was seen to be shared amongst the children themselves. This was evident when a particular species was known to children only and not their elders, such as the case of *Lububa (Rumex abysinicus)* in Kasonga. Similarly, elders, during focus group discussions, identified several species that were not recognised by children. In addition, the elders admitted to some of the species becoming extinct or not found as commonly as before, such as *Gynandroposis gynacondra* in Mpheta village. Beyond identification and consumption, there were noted differences in the use of the wild foods.

Socialisation among children, especially during play was the main channel of knowledge transmission amongst children. However, in some cases, (though not many), children accompanied elders to collect or gather wild foods and are taught of particular wild food species and their cultural significance (if any). Forty-three per cent of children indicated that they had learned of wild foods from mothers while 24% had acquired this knowledge from their grandparents. Elders admitted to this trend fading because of the lack of interest by the children in learning about wild foods and usually highlighted that "*children think these foods are for the old fashioned and old generation*".

There was a clear distinction between the knowledge and perception of wild foods between the older and younger generation. Elders believe that intergenerational loss of knowledge of wild foods has led to children having less knowledge of wild foods and succumbing to social

stigma of these foods. This trend was clear during the FGDs and administering the questionnaire because some young people had problems recalling the time of the year when particular wild foods were available. However, they clearly indicated that they know and notice when these foods are available since they frequent the sources of the wild foods and consume them, especially during play.

Due to the new laws in Malawi and the free primary school education system, the proportion of children not going to school was negligible even though absenteeism rates were high, especially during farming seasons. In addition, the school feeding programme, which encompasses the free distribution of soya porridge in the morning to young children, acts as an incentive for children to go to school. However, there was a gap between "school going" and being literate, with most school going children still not able to read and write. This defeated one of the initial objectives of the research to find differences in knowledge of wild foods between school going and non-school going children.

Despite this, literacy level of each child was still determined by asking if the child can read and write. There were no differences in knowledge of wild foods between literate children and illiterate children of the same ages and gender. With only 5% of children learning of wild foods from school, formal education did not provide for knowledge on wild foods.

2.3.5 Commercialisation of wild foods by children

Commercialisation of wild foods was done in all study sites at varying intensities (Figure 9), depending on alternative sources of income available and availability of the wild foods and their marketing. Poverty was the main reason why some people collect and sell the fruits. Thirty per cent of children participated in the sale of wild foods. Overall, 40 % of children from poor households agreed to selling wild foods at some point in their lives whilst only 7%

of children from the better off households had sold wild foods at some time (x^2=30.3; p<0.0001).

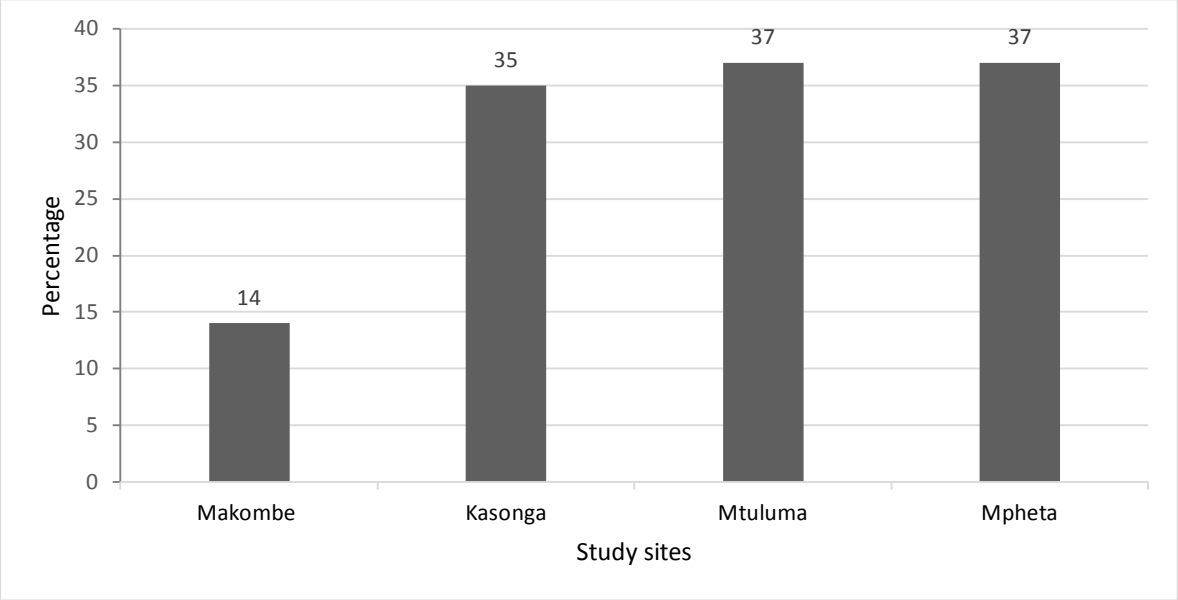


Figure 9: Commercialisation of wild foods by children in Makombe, Kasonga, Mtuluma and Mpheta

Wild fruits were the commonly commercialised products, with 18 % of children participating in the sale of wild fruits. *Uapaca kirkiana* was the most sold wild fruit with children in Kasonga commonly selling *Uapaca kirkiana* at the market and nearest tourist destination sites, Zomba Plateau. In this site, on average, a plate of *Uapaca kirkiana* is sold at MK2,000 to a white person, MK1,000 to Asians and MK500 to black people. On the other hand, in Mtuluma, a plate of *Uapaca kirkiana* is sold at MK50 to fellow community members.

Children in the two sites of Kasonga and Mtuluma are also involved in the sale of mushrooms. In Kasonga, a basin of mushrooms is sold at MK3,000 to a white person, MK2,000 to an Asian and MK1,000 to black people, while the same quantity of mushrooms is only sold for MK100 at Mtuluma. All vegetables are sold by children at the local markets

but the most commonly sold wild vegetables are *Amaranthus (*in all villages*)* and tubers (*Chikande)* in Kasonga.

Commercialisation of birds was only common in Mpheta with five small birds being sold at MK100, while larger ones are sold at MK50 per bird. The commercialisation of birds was usually carried out by boys, since girls did not engage in bird hunting. Children did not independently participate in the sale of bushmeat.

The market prices for wild foods are not fixed and are simply determined by the demand and supply of the wild foods. This in turn is determined by the availability of the wild foods and seasonality. Wild fruits and insects are largely seasonal foods and tend to be cheaper when they are in abundance and costly towards out of-season periods for those foods. Overall, commercialisation of wild foods was more profitable in Kasonga than other study sites because of the nature of the market that included tourists and demand for wild foods by external or urban communities and individuals.

Children participated in the sale of wild foods for several reasons; mainly to obtain household basic items and utilities, personal items, supplement food and purchase school items (Figure 9). Some children provided several reasons for their participation in commercialisation of wild foods. According to the children, household basic items that were purchased using money from wild foods composed of groceries for the household such as soap, sugar, salt, matches and cooking oil. Individual items purchased using income from wild foods included clothes, body oils/lotion and snacks for themselves. School materials such as notebooks, pens and pencils were also cited as being purchased using money from the sale of wild foods.

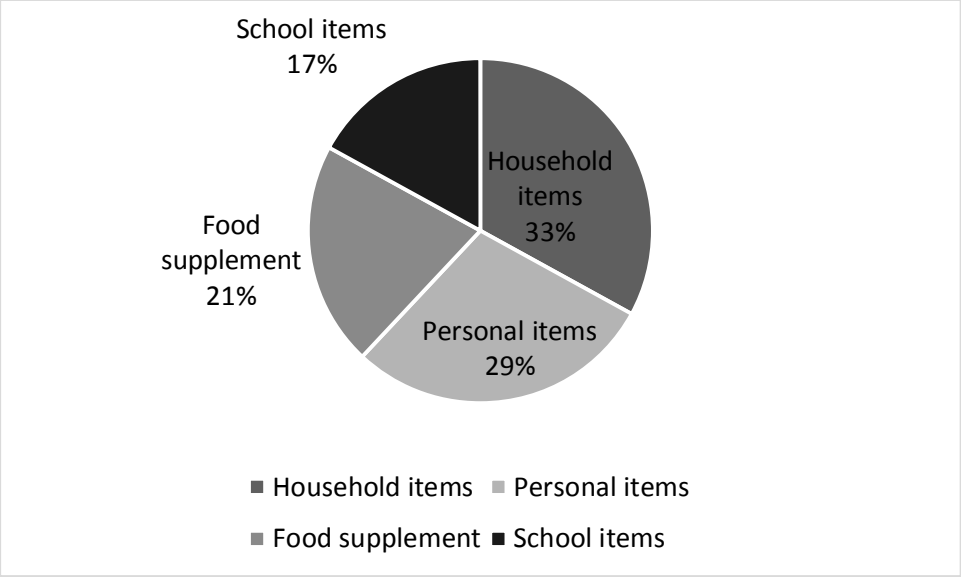


Figure 10: Reasons for commercialisation of wild foods by children in Makombe, Kasonga, Mtuluma and Mpheta

2.4 Discussion

2.4.1 Children's food security status

A healthy diet for human health and development is comprised of an adequate meal with a balance in protein, energy provided by carbohydrates and small quantities of essential elements such as iron and iodine and vitamins (Cooper et al., 2004). Like in many developing countries, rural Malawian diets are predominantly cereal based and nutrient poor (Eckim & Qaim, 2011), with a typical rural Malawian meal consisting of *nsima* (pulp prepared from maize flour) with a side dish or relish of either vegetables, nuts or pulses, or animal products. Households consume two to three meals per day depending on the availability of food with a small percentage of households (4%) affording one meal a day during food insecure periods.

A rural child in Malawi who will not get a meal of nsima at least once a day will not consider themselves properly fed even if eating large quantities of other filling foods; feeling unsatisfied and will still indicate that “they will sleep with hunger”. Against this background there is a high dependence on cereals, particularly maize and other starchy foods, in the country (Chilimba et al., 2012). As evidenced in the study, children’s diets in Malawi are starch dense and monotonous, usually comprising of *nsima* with a side dish, commonly a type of ALV and other pulses or tubers. Meat products were hardly present in the diets of children, with extreme areas reporting no intake of meat products in a 24hour food recall among children. In areas close to water sources, at least halve of the children supplemented their diets with fish products. Overall, the average low dietary diversity score of three is evidence of the poor diets of children. Despite the similarities in the number of meals consumed during food secure and food insecure periods, the notable differences in the quality of the meals are possible indicators of the fluctuations in children’s food and nutrition status during the two periods.

Ecker and Qaim (2010) reported that food consumption in Malawi is characterised by high rates of malnutrition with people hardly meeting the required nutritional needs with average consumption of required nutrients falling short or only exceeding the recommended standards by a margin. This increases the likelihood of malnutrition wherein, already 60% of school going children in Malawi have been reported to have a type of malnutrition (Department of nutrition, HIV and AIDS, 2009). In comparison, in Tanzania, 27% of children are underweight, 40% are anaemic and 86% have iron deficiency with a larger population affected by various forms of malnutrition (Ruffo et al., 2002). Other results on children’s poor diets have been recorded by McGarry (2008) in South Africa where children’s diets were of poor quality and quantity which lacked protein rich foods and were 62% lower than standards set by FAO. Hidden hunger (inadequate nutrition) (Golden et al., 2011) is therefore common even in places where cereals are widely available and commonly results from poor food utilisation and narrow diets (Cooper et al., 2004); with a lack in balance of both micro and macronutrients.

2.4.2 Factors affecting the diets of rural children

There are several factors that affect the type of food, quantity consumed and dietary choices at household level. Morris (1992) identifies seasonality, gender norms, personal dietary preferences, ethnicity and religious affiliations as factors affecting children's access to and use of foods. In most rural study sites, and equally most parts of Malawi, there are seasonal variations in the availability of food with food shortages being recorded from December to January during the rainy season and more severity increasing till just before harvesting in February. Similar results are reported across the region by Akinnifesi et al. (2008) and Syampungani et al. (2009). Both children and elders have knowledge of such patterns on food security in their communities and the measures taken to reduce vulnerability during periods of food shortages such as engaging in piece work in the farms and increased reliance on wild foods.

Household affluence greatly influenced the diets of children. Wealth households reported higher DDS compared with poorer households. This could be linked to the ability of wealth households to afford adequate and a variety of foods to diversify the diets. There was a clear intrinsic link in the definition on wealth of a household and food availability.

2.4.3 Household food security and childrens' individual food security.

Realising the differences that arise in accessing and utilising food by different members of the household across a gender-age spectrum, this paper draws attention to the concept of individual food security. Though not widely documented, intra-household factors affect food consumption and consequently nutritional status of particular individuals (Tarasuk, 2001). Adequate food availability at household level does not automatically translate into consumption and good nutritional status for all individuals in the household since individuals of various ages have different nutritional requirements and conditions that affect

their access to foods. For instance, school going children require more energy and protein because of growth and increased physical activity. In general, conditions of food security are believed to affect all household members although not necessarily in the same way (World Bank, 2011).

Individual food security is measured by determining the individual dietary diversity score which aims to capture nutrient adequacy for the individual while calorific intake is measured by the quantity of food consumed (Mazunda & Droppelman, 2012). Children supplement their diets with meals outside the home because of the inadequacy of food provided within the household as shown by the low HDDS and their attraction to food outside the home. The former is common in poor households and during food insecurity. Children therefore graduate and become active in the provision of food to ensure individual food security (hence high IDDS recorded) and overall household food security. Mgoola (2007), Grivetti and Ogle (2000), McGarry and Shackleton (2009) and Maroyi (2011) have all cited children as active participants and collectors of foods, especially wild foods.

Household food security on the other hand is measured by determining the household dietary diversity score which reflects on the household's ability to consume a variety of foods (Tarasuk, 2001). Household food security studies often link dietary diversity and individual's affluence as it is presumed that one's access to food determines their food and nutrition security status (Hoddinott & Yohannes, 2002). Children from well-off and better-off households registered high dietary diversity compared to children from poor households. The positive correlation between food insecurity and child's affluence may be attributed to the lack of resources by poor households to produce adequate food or purchase additional food during times of food insecurity and other shocks. It is important to note that humanitarian aid (present during data collection during the food insecure period) and school feeding programmes may have cushioned the severity of food insecurity in low income households hence portraying an improved dietary diversity score.

2.4.4 Children and wild foods

In some African countries such as Namibia (Egoh et al., 2012), South Africa (McGarry, 2008) and Malawi (Mgoola, 2007) children are recognised as the main collectors of wild foods, especially fruits, but many nutrition and natural studies overlook this (Ruffo et al., 2002). Households often supplement their diets with wild foods and hence increase their dietary diversity (FAO, 2014). For such populations, wild foods are ample sources for nutrient sufficiency and well-being (Johns & Maunda, 2006). Wild foods are a rich source of micronutrients and microbial agents in some cases posing as better sources than conventional foods (Barany, 2003; Cordeiro, 2012). These foods prove clinically useful for improving the health among the food insecure populations in Sub-Saharan Africa (Cordeiro, 2012).

Wild foods identified and used by children include wild leafy vegetables, edible insects, bushmeat, wild fruits, tubers and small mammals and rodents. Consumption of various wild food categories such as bushmeat (Johns & Maunda, 2006; Nasi et al., 2011), small mammals (Katundu, 2001), birds (Mgoola, 2007), wild vegetables, and insects (Syampungani et al., 2009) has been explored. Wild vegetables, bushmeat, small mammals and insects are taken as side dishes to compliment the staple *nsima*. Ruffo et al. (2002) also reports the use of wild vegetables as a side dish and fruits as snacks in Tanzania.

During a period of one week, up to 82% children supplemented their diets with wild foods while in a day at least 23% of children compliment their diets with at least one type of wild food. Similar findings were made in Namibia were the collection of wild foods was particularly important to children and herders (Egoh et al., 2012) and in South Africa (McGarry, 2008). Commonly consumed wild foods by children included wild leafy vegetables such as *Amaranthus spinosus, Bidens pilosa, Cochorus trilocularis*, and *Cleome gynandra,*

wild fruits such as *Annona senengalensis, Vangueria infautsa, Uapaca kirkiana, Flacourtia indica* and *Ziziphus mauritania*. Similarly, at a global level, consumption of plant based wild foods was higher than animal based wild foods, but this consumption was relatively significant (FAO, 2014). Although the quantity of wild foods consumed and as reported in this study may be relatively small, Asfaw and Tadesse (2001) reports that their nutritive value is very significant. Powell et al. (2011) showed that children who supplemented their diets with wild foods had higher nutrient adequacy and nutrient density across multiple nutrients.

Children in particular, demonstrated their knowledge on the nutritional significance of wild foods. The main reasons for consumption of wild foods as cited by children was good health and nutrition. For instance, the children indicated that wild foods supplement their body, prevent diseases, provide energy, and provide proteins and vitamins. However, I could not determine if this knowledge affects their selection and use of wild food and their overall interest in the same. There is sufficient information on the superiority of the nutritional value of selected wild foods (Campbell, 1987; Grivetti & Ogle, 2000; Kajembe, 2000). Such information is, however only available to selected common species while the nutritional value of many species remains unknown (Ruffo et al., 2002). In addition, children described certain foods, especially bushmeat and insects, as a delicacy and highly sort after. Knowledge on the health benefits of wild foods (drawn from existing databases or through new research), could lead to increased consumption of wild foods and in turn improve children nutritional status (Cordeiro, 2012).

The use and dependence on wild foods during different periods of plenty, stress and shocks has also been widely documented (Chidumayo & Marunda, 2010; Diederichs, 2005; Kajembe et al., 2000; Shackleton & Shackleton, 2004). In Malawi, Fisher et al. (2010) has reported that forest dependent communities agree to depending on forests foods during weather related shocks. In these communities the proportion of meals with wild foods

increased (57%) in times of famine and was only 10% in times of plenty (Fisher et al., 2010). Of the foods only consumed during the famine periods, 25% were wild foods, and *mpama*, a drought resistant forest yam, was often used (Fisher et al., 2010). In this study, higher consumption of wild vegetables was reported during food insecure periods in three study sites of Makombe, Kasonga and Mpheta. Interestingly, the consumption of wild fruits by children was not dependent on the other food availability. This is similar to reports by Addis et al. (2005) who described children as perennial users of wild foods.

2.4.5 Commercialisation of wild foods

In rural Malawi, 86% of employed persons are engaged in agriculture, forestry and fisheries (National Statistics Office, 2011). Just as in many other African rural communities, the majority depend on farm activities and NTFPs for their income as there are little economic opportunities for off farm income and many people engage in the selling of various natural resources (Angelsen et al., 2014; Egoh et al., 2012; Kamanga et al., 2009). Children largely participate in piece work for various farm activities during school holidays.

In such areas and periods where economic opportunities are limited, the common norm has been to collect natural resources for sale and compliment household income (Barany, 2003; Cavendish, 2000; Egoh et al., 2012), as an adaptive strategy (Fisher et al., 2010). Therefore, wild foods are not principal earners for children in Mpheta, Mtuluma and Makombe but they play an important “gap filling function” and compliment other sources. Despite income from selling of wild foods being relatively small, their contribution to the overall status of the household can be large especially where there are limited forms of livelihoods or social support systems (Challe & Price, 2009; Egoh et al., 2012; Wunder, 2001). However, this is untrue for areas with a good market for forest products such as Kasonga were earnings where more than double those from other villages and income from wild foods is a possible primary source.

In the four villages, 40% of children are engaged in the commercialisation of wild foods. Income from the sale of wild foods is were either used to acquire basic household items thereby contributing to household members' well-being or to compliment and acquire their individual needs such as food items, school items and other necessities. Overall, since the incomes acquired by children in the sale of wild foods is very low, limited research explores how such income is used. Valuing of wild foods is challenging as trade in wild foods is largely done in informal markets (Egoh et al., 2012) and due to the differing values in areas and times of the year. In addition, trade in wild foods may be an opportunistic activity undertaken by the children hence hard to account for. Regardless, Ninan and Makote (2013) indicates that economic valuation is vital in influencing policy-makers and for them to make informed decisions hence further research is required.

2.4.6 Food security, wild food use and deforestation

The four study sites were selected based on their differential deforestation rates and vegetation cover (Chapter 1). Elsewhere there is evidence on the positive contribution of tree cover to the diets and nutrition of surrounding communities (Ickowitz et al., 2013; Powell et al., 2011). In this study, key indicators of food and nutrition quality, such as dietary diversity, fruit and vegetable consumption and animal source food consumption was determined for individuals including children in relation to their tree and vegetation cover (Ickowitz et al., 2013).

From an analysis of the diets of children; dietary pattern, IDDS and HDDS, of children in the four study sites, I conclude that tree cover is not the sole factor but among the factors that contribute to a good diet and individual's food and nutrition security. Dietary diversity for children in the four study sites indicated that children in Makombe reported the lowest dietary diversity score (3.71) and was even lower (2.86) during food insecurity period. None

of the children in Makombe, an area with MFC (Medium Forest Cover) and LDR (Low Deforestation Rate), reported consuming animal sourced foods which has a possible contribution on the low DDS. On the other hand, children from Kasonga, a High Forest Cover (HFC) and High Deforestation Rate (HDR) area, reported the highest dietary diversity (5.51). Kasonga's high dietary diversity can be attributed to high animal source food consumption from bushmeat with 31 % of children consuming animal sourced foods. Forest cover is closely associated with the availability of bushmeat (Chapter 3), thereby increasing the dietary diversity of nearby communities.

Children from Mtuluma, a HFC and LDR area, reported an average DDS of 4.11 during the food secure period and 3.53 during the food insecure period. At least 11 % of children in the area consumed an animal source food which significantly improves a child's dietary quality and nutrition status (Ickowitz, et al., 2013; McGarry, 2008; McGarry & Shackleton, 2009). On the other hand, Mpheta, a Low Forest Cover (LFC) and LDR area reported an averagely higher dietary score of 4.22 during the food secure period and 3.55 during the food secure period. The high dietary score in the area can be attributed to children's high consumption of animal source foods, mainly fish and crabs, with 51 % of children having fish and crabs in their diets. This is not correlated with low tree cover in the area.

Tree cover creates a bio-diverse environment (Vinceti et al., 2013) that serves as a source of a variety of a wide array of wild foods. Despite overall similar quantity of wild foods consumed by children, the diversity of wild foods in children's diets was higher in Kasonga and Mtuluma. Children in these sites also consumed other wild foods such as honey and mushrooms. From a glance, bushmeat was positively correlated with the tree cover with the highest consumption reported in the forested area of Kasonga (Figure 4), and similar results have been reported elsewhere (Nasi et al., 2011). On the contrast, Ickowitz et al. (2013) did not find any relationship between animal source food consumption to tree cover and this could be attributed to the focus on non-wild animal source foods. There was no significant

relationship between other types of wild foods (such as wild vegetables and fruits), tree cover and deforestation of the sites. This is similar to findings by Termote et al. (2012), who dismissed the link between a bio-diverse environment and dietary quality. In addition, it is vital to note that the availability of wild foods in an area may not be commonly used and accessed by children due to various socio economic and cultural factors (Chapter 3).

Children from areas of high forest cover reported to participating in commercialisation of wild foods. For instance, Kasonga also reported the highest commercialisation in wild foods among the four sites. The area is located to a renowned tourist destination and this has significantly contributed to setting a higher value on the wild food products. Children from Mtuluma also participated in the commercialisation of a variety of wild foods including fruits and mushrooms but had lower returns. Children in Mpheta on the other hand, only participated in the commercialisation of birds.

While studies have presented the positive relationship between tree cover and dietary and individual's food and nutrition status, much of the outcomes from such studies are circumstantial (Vinceti et al., 2013). The link between tree cover and people's diets cannot be discussed outside consideration of other factors affecting diets such as socio economic status, analysing various sources of wild foods besides forests and gaining a full understanding of the biophysical characteristics of each area (Chapter 3).

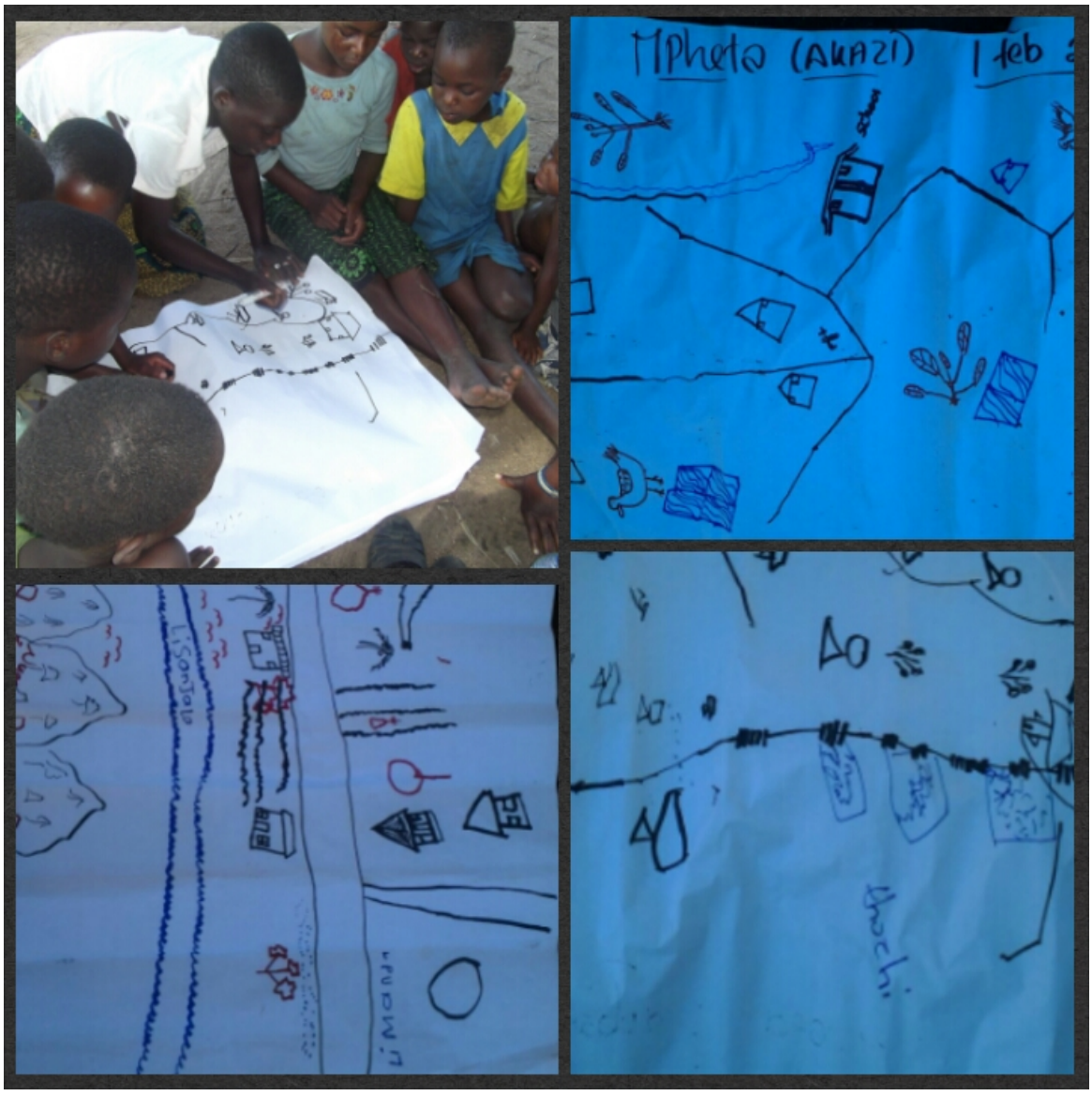
2.5 Conclusion

With most school going children having lower than recommended nutritional status, radical measures need to be undertaken to improve the nutritional status of children in the country. The dependence and use of wild foods by children is high, with 82% using wild leafy vegetables, wild fruits, bushmeat, and insects.

Wild foods have the potential to bridge the food security and nutrition gap for children. Good health and nutrition, and preference and taste is a major factor that influences children's choice and consumption of wild foods. They selectively pick wild foods to consume depending on the knowledge they have, but have little control over the wild foods that are prepared for household consumption.

Commercialisation of wild foods remains the second source of income for children in the study sites from agricultural piece work. School materials and basic items remain the driving force for children to participate in the commercialisation of wild foods; even though we do not rule out the contribution of peer pressure to this sometimes social activity.

CHAPTER 3: WILD FOOD AVAILABILITY AND ACCESS: SPACES AND PLACES



…Children from the four villages drawing maps of the villages and wild food sources….

3.1 Introduction

Most ecosystems have been modified to enhance the production of naturally occurring resources or cropping for communities that depend on them (Bharucha & Pretty, 2010). Historically, hunter gatherers and forager cultures depended on provisioning services from ecosystems, especially wild foods, for their dietary needs. Presently, wild foods are supporting forest and agricultural communities by forming a part of their food basket (Bharucha & Pretty, 2010; Shackleton et al., 2007). Just as other districts in Malawi, Zomba is largely comprised of agricultural communities whereby maize production accounts for the main economic activity and is supplemented by other crops such as rice, cassava, groundnuts, potatoes, beans and pigeon peas, whilst husbandry is still under-developed (Zomba District Assembly, 2009). In Malawi, studies on the use of selected wild food species have been done by Saka and Msonthi (1999), Syampungani et al. (2009) and Mgoola (2007).

Wild foods are available as common property resources and are often considered *de facto* open resources (Sunderlin et al., 2008) which are accessed freely (Harris & Mohammed, 2003). However, their availability varies depending on place and time of the year (seasonality) (Ogle, 2001). For instance, in Malawi, bushmeat is commonly accessed from protected and dense forests (Barnett, 2000; Mgoola, 2007). Plant based wild foods such as wild fruits and wild edible vegetables though available at many sources are seasonal and mostly consumed during the rainy season (Maroyi, 2011; Uusiku et al., 2010). Wild vegetables however, may be accessed throughout the year from irrigated fields and wetlands (Scoones et al., 1992).

Since they are a free resource, little capital or skill is required to access them hence they are a common domain for poor and marginalised households (Harris & Mohammed, 2003; Maroyi, 2011). In addition, dependence on wild foods by the poor remains high (Harris &

Mohammed, 2003) since besides less capital needed, accessing wild foods requires minimal landscape transformation (Maroyi, 2011). Nonetheless, cultural preferences and tastes mean that many wild food species are also relished by both affluent and urban consumers (Chidumayo & Marunda, 2010; Shackleton et al., 2010).

Agricultural communities and rural people at large access wild foods from various sources. Several studies have reported forests as an important source of wild foods (Delang, 2006; Pouliot et al., 2012; Powell et al., 2011; Vinceti et al., 2013), hence wild foods are also termed as "forest foods" (Johns & Maunda, 2006; Powell et al., 2011). Wild food products extracted from the forests includes fruits, mushrooms, edible plants, honey, edible insects and bushmeat (FAO, 2010; Kalaba et al., 2010). Forests, as used in this study, include woodlands or areas dominated by woody plants, primarily trees with a canopy cover of more than 10% of the ground cover (Chidumayo & Marunda, 2010).

Forested landscapes and areas with tree cover often have a high density and diversity of plant species (Powell et al., 2011) and animal species (Carey & Harrington, 2001; Sunderland et al., 2013). These places remain ample sources of animal and plant foods to provide dietary diversity (Johns & Maunda, 2006). Powell et al. (2011) also indicated that there is a link between tree cover and wild food consumption by children as children living in areas close to dense tree cover consumed more of "forest foods". However, other studies show no relationship between tree cover and the availability and selected wild food species such as rodents and small mammals (Nasi et al., 2011).

Besides forests, wild foods are also accessed from non-forested areas (Pouliot et al., 2012). Trees outside forests (TOF) remain an important source of wild foods. Though not widely documented, trees in rural landscapes such as those along roads and streams also provide wild foods (FAO, 2010) to households and children. Ambrose (2003) reported that fields,

home gardens, cultivated patches and farmland and land close to the house, rivers and streams are also important sources of wild foods. These naturally growing wild foods gathered from farmlands and fields offer farmers a “hidden harvest” to supplement their food and income (High and Shackleton, 2000; Bharucha & Pretty, 2011). Such sources pose as a refuge for wild foods amidst deforestation and urbanisation (Bharucha & Pretty, 2011). In some quarters, wild foods have been transplanted and are grown on farmlands (Bharucha & Pretty, 2011; Maroyi, 2011). This has been reported for wild vegetables in home gardens (Bharucha & Pretty, 2011) and fruit trees in fields (Maroyi, 2011).

Powell et al. (2011) argue that different landscapes as sources of wild foods are vital in understanding human actions towards the landscapes and highlights the link between conservation efforts, well-being and livelihood. In addition, there is growing interest in other sources of wild foods besides forest landscapes (Bharucha & Pretty, 2010). The varied topography of Zomba, the tropical climate and the moderately fertile soils in the region make it suitable for agriculture (Zomba District Assembly, 2009). Generally, the low lying areas in the district (where Mpheta and Makombe villages are located) are suitable for intensified agriculture while the uplands (where Mtuluma and Kasonga are located) accommodate agro-forestry and riverine agriculture (Zomba District Assembly, 2009). The district has seven major rivers, six of which flow into the Lake Chilwa and there are many small tributaries flowing into these rivers (Zomba District Assembly, 2009). The district has a dominance of miombo and mopane woodlands and wetland fringes towards Lake Chilwa, Mpheta site (Zomba District Assembly, 2009).

This chapter responds to the second and third objective of the study and identifies the wild foods consumed and used by children, examines the process of collection and gathering the wild foods, and explores the variation in the availability and access of wild foods by children across the four study sites. Through collection and analysis of data in Kasonga, Makombe, Mtuluma and Mpheta, the chapter addresses the following questions:

1. What are the wild foods used by children in Zomba district?

2. What is the distribution and availability of wild foods in Zomba district?

3. What are the factors affecting access to and use of wild foods by children in Zomba district?

3.2 Methodology

To develop an inventory of wild foods used by children, and examine the variations in the availability and access to wild foods; data was collected on identification of wild foods, sources of wild foods, availability of wild foods in varying spaces, the collection and access of wild foods. Through PRA exercises and KII, children identified wild foods that they used, their sources and the corresponding techniques that children use in accessing them. Food discussions (see Appendix B) were held with groups of male and female children in all the study sites to develop the list of wild foods used by children in the particular area. On the other hand, during KII, children elaborated the various uses of the wild foods to their knowledge.

To identify the names of the wild foods, samples of wild plants were collected by the children during transect walks (when samples are found further from the village) or after FGDs (when samples are within the villages). Wild plant samples from the study sites were sent to the National Herbarium and Botanical Gardens (NHBG) for identification. A verification exercise was also done by the senior herbarium officer. The identification of wild animal species was done through review of literature and verbal communication from colleagues which was verified through desk research. The identification of birds was done with the help of members of the local bird hunter's association from Mpheta study site.

To identify sources of wild foods accessed by children, PRA exercises on participatory land use mapping and transect walks were used. Participatory land use mapping was done to understand their village landscapes and later on to identify and map out the spaces where different kinds of wild foods are accessed by the children. During this PRA exercise, both groups sketched a map of their village on a flip chart and highlighted the major features in the areas such as roads, farms, mountains, rivers, and houses. On these maps the children also highlighted the places that they frequent and collect wild foods and the routes taken.

In addition, transect walks were also conducted with the children to identify wild foods (through collection of samples) and their sources.. A transect walk was done in each study site with a group of 6-10 children. The transect walks took up to three hours in some areas such as Kasonga and were carried out in the afternoon since most children attended school in the morning hours. Girls did not participate in transect walks that required walking of more than one hour, presumably due to their demanding roles at household level or physical fitness and unfavourable weather to undertake the journey.

The transect walks were also used to understand the process of collection and gathering of wild foods. During the walks children identified wild food hotspots/sites and demonstrated how the wild foods were collected or fetched. The demonstration of strategies and tools used in the collection of wild foods was limited to the available wild foods during that particular season and mostly included wild fruits and vegetables, birds and small insects. In addition, Interviews were used to understand the process of the collection and gathering of wild foods. Children were individually asked to elaborate their experience in collection of wild foods during the interviews.

FGDs with the children were used to understand access of wild foods in the various sources. Separate FGDs were conducted for girls and boys. In addition, the transect walks

contributed understanding key issues affecting children's access of wild foods in various spaces. In addition, two FGDs were conducted with 10 elderly (five women and five men) people in each study site at the beginning of the study in November - December to understand factors affecting access to sources of wild foods. The elderly group included a representative of the traditional authority. Among other things, the discussions were aimed at understanding the spaces that are available in the area and related socio-cultural factors that affect access to those areas. For instance, the discussions revolved around user access rights, by-laws, and cultural issues attached to particular spaces which also act as sources of wild foods.

During all FGD discussions, randomly selected children were categorised into two groups (male and female) of eight and participated in the various PRA exercises that were conducted at the local community grounds in each village. Participation of the children in transect walks was dependent on their willingness hence the numbers varied from groups of three to eight. The PRA exercises were conducted in November to January and included FGDs, transect walks and participatory land use mapping. A total of 150 children selected through purposive sampling were involved in the interiews.

Quantitative data collected from the field were entered in Excel and SPSS (Statistical Package for Social Sciences) for analysis. Simple statistics were done using Excel. Relationships between variables were determined by first developing a PCA plot using Statistic version 10. Consequently, further tests were done based on the outcomes of the PCA plot. For those variables that the PCA indicated may be related, I conducted Linear Regression analysis to establish the strength of the relationship. Comparison was also made between wealth classes and villages, with regards children's identification of wild foods. This was done with a Kruskal-Wallis test because the data were not normally distributed.

3.3 Findings

3.3.1 Identification of wild foods by children

During individual interviews, children were able to recall and identify wild food species in the various wild food categories of wild fruits, wild vegetables, tubers, bushmeat, birds and insects in their local language. Further analysis was done to examine the number of wild foods known by children of different sex, age, literacy level, village and household wealth status. The PCA suggested relationships between identification of wild foods by children between villages for bushmeat, fruits, and the overall total species (Figure 11). Likewise, the analysis suggested a possible relationship between children's recollection of wild foods and their household wealth status, being higher for poorer households.

Among the children, there was a very weak, significantly positive relationship between age of the child and total number of species recalled or known to them (Figure 11). Between age of the child and number of wild fruits, wild vegetables and bushmeat, there was no relationship ($p>0.05$). Therefore, regardless of age, children know and can identify at least a particular type of wild fruit, wild vegetable and bushment. Interestingly, there was a weakly significant relationship between age of the child and number of bird and insect species known ($r^2=0.074$; $p<0.005$).

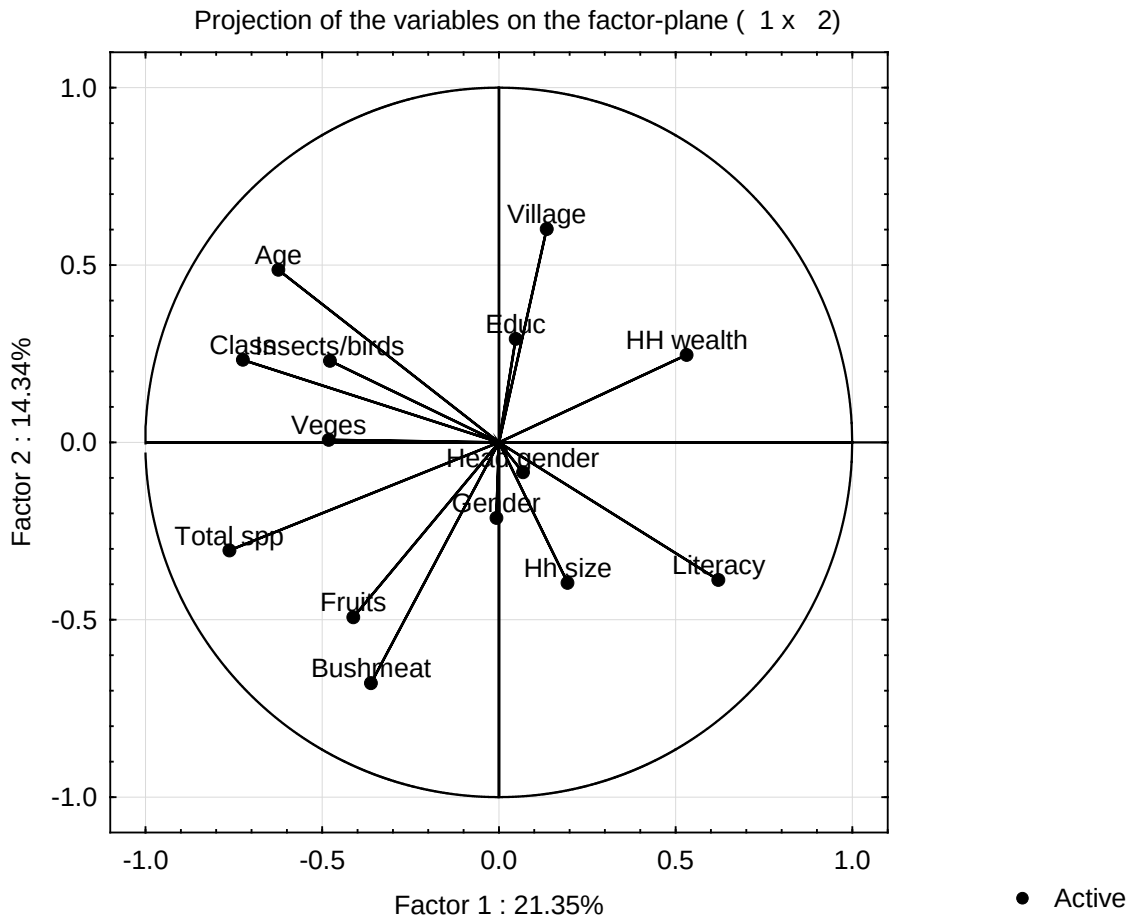


Figure 11: PCA plot of number of wild foods recalled by children relative to their profile

During FGDs and transect walks, older children (14-18 years old) were able to identify more bird species than younger children (8-13 years of age). However, there were other exceptionally young children who were frequently involved in the use of wild foods and live near wild food sources who recalled more or a similar number of wild food species than their seniors.

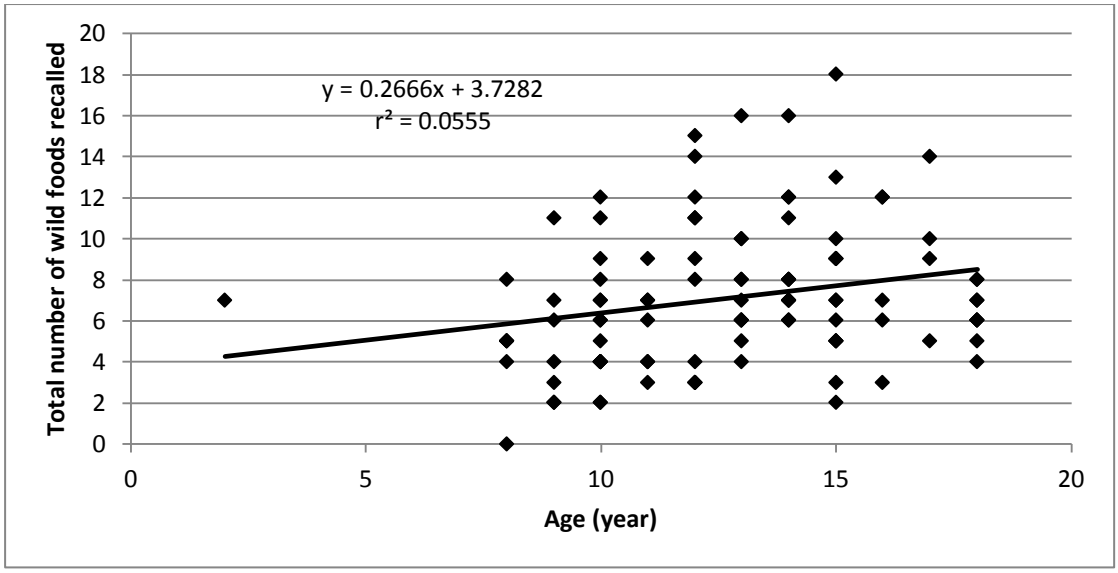


Figure 12: Relationship between age of children and number of wild species recalled

Besides age, the PCA also suggested a relationship between household wealth status and children's identification of wild foods. There was significant relationship between household wealth status and children's identification of wild fruits ($H=8.21$; $p<0.05$) and bushmeat ($H=14.99$; $p<0.002$). On the other hand, a significant relationship between village and number of wild foods identified by children ($H=12.91$; $p<0.005$). In groups, children recalled a higher number of wild foods as compared to when asked individually during individual interviews. From the four villages, individually, a child from Mtuluma recalled the highest number of wild foods (mean 2.33 ± 0.6) of wild foods, while a child from Kasonga and Makombe recalled on average 1.70 ± 0.5 and 1.71 ± 0.6 number of wild foods, respectively, while a child from Mpheta recalled the least number (1.46 ± 0.9) of wild foods (Table 7). Similarly, during focus group discussions, children from Mtuluma reported the highest amount of wild foods, followed by Kasonga, then Makombe and Mpheta (Figure 13).

Table 7: Average number of wild foods recalled by a child at Kasonga, Makombe, Mtuluma and Mpheta

	Kasonga (n=20)	Makombe (n=28)	Mtuluma (n=17)	Mpheta (n=38)	H value	P value
Wild fruits	1.65	1.86	3.23	0.64	46.60	<0.0001
Wild vegetables	1.90	0.96	2.30	2.23	25.00	<0.0001
Bushmeat	2.35	1.14	1.50	0.51	12.84	<0.005
Birds and Insects	0.90	2.89	2.30	2.46	12.91	<0.005

For all wild foods, a total of 119 species were recalled by children (Figure 13). Of these wild foods, a high number of species was identified for wild fruits (33%), birds (20%) and wild vegetables (16%). This supported the outcomes of the FGDs, were children demonstrated more knowledge on these wild food categories. Discussions on bushmeat and tubers, involved fewer children.

The number of wild food species identified in the four villages also varied (Figure 14). Some wild food names that were used by the children were known to other community members. Wild food names that were only known to the children could not be easily identified. In such a case, scientific or English names were made available only to those wild food species with samples, but were the wild food sample was not available, identification was not done. For instance, bird names such as *daniele* and *sisisi* were only used by children and identification of these species could not be done. Meanwhile, plants such as *lububa* (*Rumex abysinicus*) were only known to children but could be identified through the samples collected. For the purposes of this section, tubers and insects have been presented as independent wild food categories.

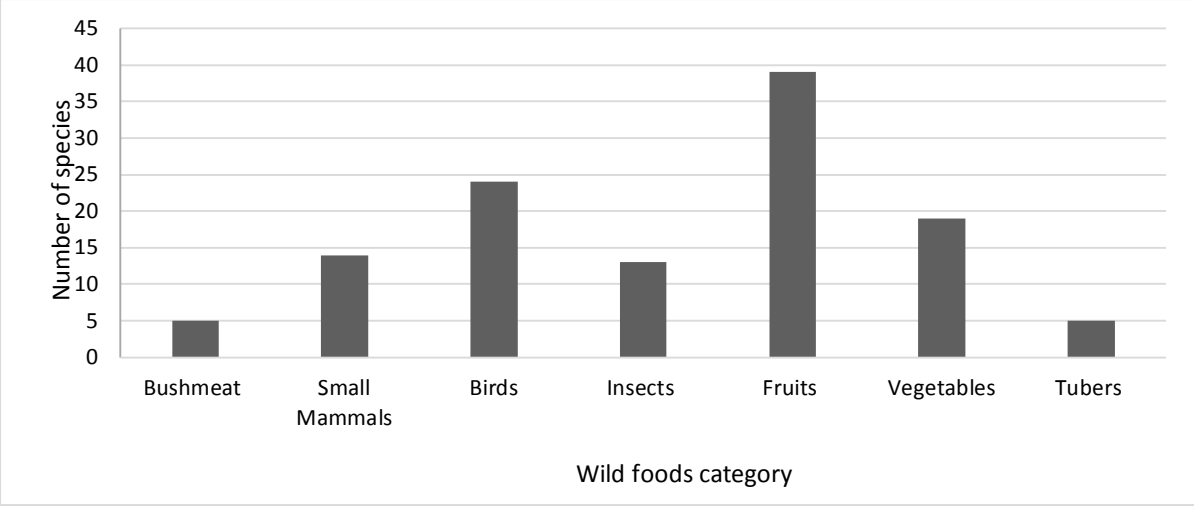


Figure 13: Total wild food species identified by children

Children in some villages recorded a higher diversity of wild foods while some areas were dominated by a particular category of wild foods. For instance, the same number of wild food species (44) was recorded for Makombe and Mpheta. However, in Mpheta, 33 % of all species recalled by the children were birds and no bushmeat was reported for the village. On the other hand, 34 % of wild foods reported in Makombe were fruits, 25 % were vegetables, 18 % were birds, whilst the remaining were bushmeat.

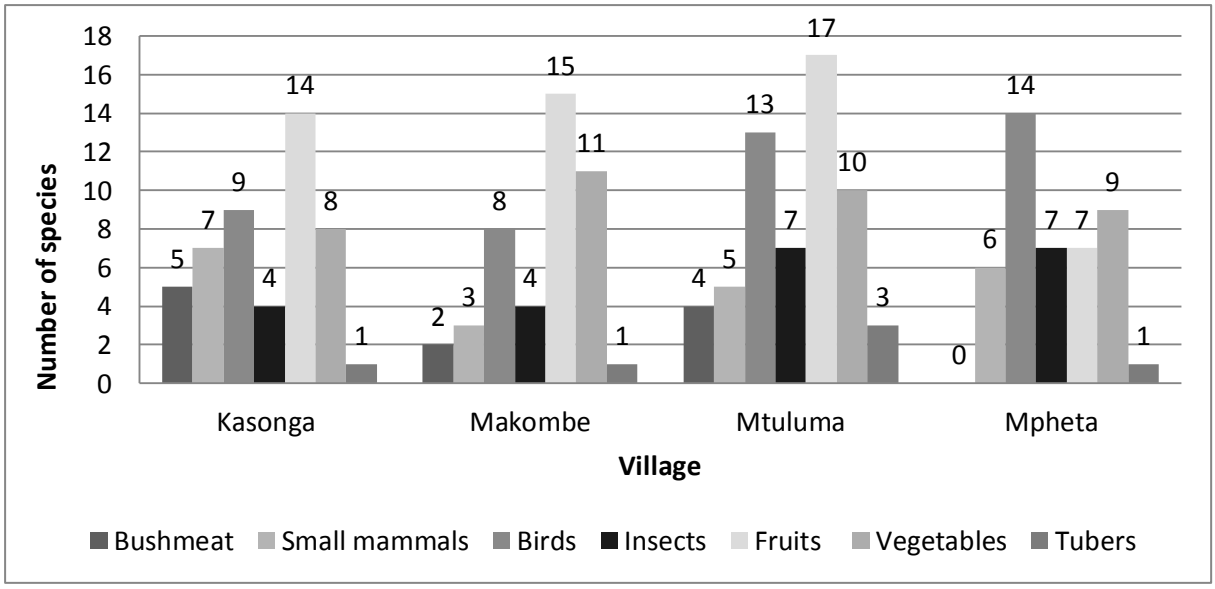


Figure 14: Number of wild foods species identified by children at Kasonga, Makombe, Mtuluma and Mpheta

The overall database of wild foods and their sources as recalled by children in Kasonga, Makombe, Mtuluma and Mpheta has been presented in Table 8. Children from all study sites recalled a total of 119 species of wild foods.

Table 8: Wild food species recalled by children in Makombe, Kasonga, Mtuluma and Mpheta

Food category	Wild Food names		Village			
	Local	**English/ Scientific**	**Makombe**	**Kasonga**	**Mtuluma**	**Mpheta**
Bushmeat	*Kalulu*	Hare	MF	WB, F,	MF	
	Nguluwe	Wild pig	MF	F1	MF	
	Gwape	Duiker	MF	F2	MF	
	Nyani/ntchima	Monkey	MF	H, B		
	Mbawala	Bushbuck	MF	B, F		
Small Mammals	*Mbewa*	Mice	FD, F	B	R	FD
	Ngwime	(Animal that looks like a rat)		B		B (Anthill)
	Bwampini	African giant rat	H(Anthill),	B	MF	
	Fuko	(Kind of mice)		B		
	Mbila	Rock Rabbit/ hyrax		B	R	
	Gologolo	Squirrel	MF, H (anthill)	B	R	
	Ntchezi	Cane cat				RS
	Likongwe	Slender mongoose				B
	Nyenga	Mongoose			R	B
	Kamba	Tortoise				L
	Nkhanu	*Crab*				W
	Ngangayila				R	
Insects	*Bwalanga*			H, B		
	Vivi			H, B		
	Zitete	Grasshoppers	FD, W	H, W, FD	FD	W, FD

	Ziwala	Grasshopers; *Acantabacris ruficornis or Cyrtacanthacris aeriginosa*				W, FD
	Mphalabungu	Green Caterpillars		B		
	Nunkhadala		H		FD	
	Nyamu /Mafulufute	Edible black flying insects; *Carebara vidua*	H		F	
	Ngumbi	Flying termites	H		F	H
	Nkhululu	Giant /sand cricket; *Brachystrupes membranaceus*			F	
	Mbumbutela				F	
	Abwanoni	Large green bush crickets; *Homorocaryphus vicinus*			R	
Birds	*Timba*	Cisticola	H	H, B, FD	R	L, B, H
	Tukutuku			H, B, FD	R	
	Solokoto			H, B, FD		
	Taye			H, B, FD		
	Songwe	Sunbird		H, B, FD		
	Chokochoko			H, B, FD		
	Nkhwali	Francolin		H, B, FD	R	W, B
	Natyola			H, B, FD		
	Pumbwa	Bulbul		H, B, FD	R	L, B
	Njiwa	Dove	H (Trees), F		R	L, B
	Phwiti	Blue waxbill	H (Trees), F		R	
	Mpheta	Quelea	H (Trees), F		R	L
	Nkuta					L
	Nkhanga	Guinea fowl	H(Trees), F			
	Nkachipande		H (Trees), F			
	Tsisisi	Blue waxbill	H (Trees)			
	Usanjo	Bishop				L
	Chipiyo					L
	Nadititi					L

	Mphipi					L
	Chingolopiyo	Yellow eyed canary			R	L
	*A sekwe (*Looks like a duck but its larger*)*					L
	Kakowa	Egret				W, B
	Anjinji (Njinjinji)					W, FD
	Kope				R	
	Pingo	Brone mannikin			R	
	Nanchoso				R	
	Mpumba				R	
Vegetables	*N'nasi*	*Aloe meynharthii*		MF		
	Kuyamani	*Ceratothera ssamoides*			R, W	
	Bonongwe	*Amaranthus (spinosus* and *hybridus*	FD, G, H	H, FD		H
	Ntsonyo	*Cleome monophylla*		FD, W	R, W	
	Chisoso	Black Jack, *Bidens pilosa*	FD, H	FD	R, W	FD and (Garden)
	Therere	Okra, *Cochorus trilocularis*	FD	F, B, FD	R, W	FD
	Mwamunaaligone	*Galinsonga parviflora*	FD	F, H	R, W	
	Chatata					
	Bowa	Mushrooms; *Amaranthus lindus*	FD, H	F,B,H		FD
	Denje				R, W	
	Luni	African spider flower, *Gynandropsis gyncondra/ Cleome gynandra*	FD, H			H
	Chewe		W		R, W	
	Mwazinje		H			
	Mwandudwa / Kandundwa	*Alternanthera pungens*	R			W, FD (Garden)
	Nangogodo		R			
	*Phalansenga (*taste like tunips)		R			

	Chamwamba	*Moringa oleifera*				FD
	Kamphango					W, B
	Chinunkhe					FD, G, W
	Dimbudimbu	*Cissus integrifolia*			R, W	
	Chagwammunda				R, W	
	Kalile	*Crotaliria lachnocarpoidis*				
	Ntembe				R, W	
Tubers	*Chikande*	Wild tuber, *Disa sp. /Eulophia sp.*		F		
	*Zinyanya (*Looks like Chilazi*)*	Yams	F, FD (Garden)			
	zicheche					B
	Mpama	Type of yam			FD, F	
	Chilazi				FD (Garden), F,	
	Cocoa	Cocoa yam			FD, F	
	Gumbwa				FD, F	
Fruits	*Zilu*			F		H, B
	Mikwakwa			F		
	Mapoza	Wild custard apple, *Annona senegalensis*	F	F	F, B	
	Masuku	Wild loquat tree*, Uapaca kirkiana*		F	F	
	Mlunguzi	*Caesalpinia decapetala*		F		
	Mlunguzi 2	*Rubus ellipticus*		R		
	Jamu	*Physalis peruviana*		F		
	Mphepu			F		
	Lububa	*Rumex abysinicus*		R		
	Mkuyu	*Ficus capensis*		F		
	Sapotonji			F		
	Zitokosho/ Makolosho	*Landolphia buchananii/ Anacardium occidentale*		F	H	
	Matowe	*Azanza garckeana*	F	F	F, H	

	Matutungwa	*Ancylobathrys amoena*		F		
	*Nthema/ Nthudza (*Indian Plum*)*	*Flacourtia indica*	F, H		F, H	
	Mpinjipinji	*Ximenia caffra*	F		R, MF	
	Mbulukutututu	*Vangueria infausta*	F		F	
	Mtonongoli	*Vitex domiana*	F		F. H,	W
	Malambe	Baobab*, Adansonia digitata*	F			
	Makombe	*Strophanthus combe*	GY			
	Kafupa	*Ehretia amoena*	F, H		F	
	Bwemba	*Tamarindus indica*	F			
	Kamblangete	*Grewia inaequilatera*	B			
	Masawu	*Ziziphus mauritania*	H		H	
	Mpululira	*Antidesma venosum*	W, FD		B	
	Matutungwa	*Ancylobathrys amoena*	F, GY			
	Ntalala	*Lecaniodiscus flescinofolius*	B		B, F	
	Nsumbwa					
	Zinyopa	*Grewia sitolzii*				B, R, W
	Ntondoko	*Sclerocarya birrea*				B, W, H
	Jambula	*Syzygium owariense*				H
	mabulosi	*Morus alba*				
	Nyowe					H
	Kankhande	*Ziziphus abysinica*				R, H
	Ndundira (Like masawu)				F, H	
	Mawula				F,	
	Matonga	*Stychnos spinosa*			F	
	Mateme				F, B, H	
	Mabwilibwise				F,B, H	

(B= Bush, F= Forest, FD=Field/Farm, G= Garden, H= Household, L= Lakeside, MF=Mountain Forest, R= Riverside, W= Wetland)

Mtuluma, a HFC (High Forest Cover) LDR (Low Deforestation Rate) village reported the highest number of wild foods at 59 species (Table 8). Overall, the village has the highest number of wild fruits (16), tubers (2) and insects (7). The high number of wild food species could be associated with availability of multiple sources of wild foods and abundance of tree species as discussed in subsequent sessions.

Kasonga, a HFC (High Forest cover) and HDR (High Deforestation Rate) village, reported the second highest number (48) of wild foods species. However, children from the area identified more bushmeat (5) and small mammal species (7) (Table 8) compared to other villages. The presence of a mountain forest adjacent to the village may have contributed to the overall high number of animal based wild foods found in the area.

Makombe and Mpheta both reported the lowest number of wild foods species at 44 (Tables 8). Makombe is as area of MFC (Medium Forest Cover) and LDR while Mpheta is an area of LFC (Low Forest Cover) and LDR. Despite the similar number of wild foods identified by children in the two areas, there was clear differences in the composition of the wild foods identified. Children in Makombe reported the highest number of vegetable species (11) while children in Mpheta on the other hand reported the highest number of bird species (14).

Mpheta, located in the Lake Chilwa wetland, is a recognised RAMSAR site for migratory birds (Ministry of Environment and Natural resources, 2010) hence the high number of birds reported. Besides being a designated RAMSAR site, Mpheta also had bird management structures for the conservation of migratory birds in the area supported by the Bird Hunters'

Association (BHA). Such structures were not available in other study sites. All this attributed to the high number of bird species in the area Mpheta.

Unlike other wild food categories, the total number of wild vegetables identified by children did not vary significantly (Std Dev 1.47902) among the study sites with a mean number of wild vegetables identified at by children 9. All villages had sources of wild vegetables such as fields or farms, wetlands and the homesteads.

3.3.2 Sources of wild foods

All children, especially older ones, demonstrated knowledge of the spaces and places they frequent to obtain wild foods. Children were able to identify wild foods and their corresponding sources, and times of availability (even though this was not specific) regardless of whether they used these foods or not. However, gender disparities arose when recalling particular details of the sources of wild foods in Makombe and Kasonga. Boys easily recalled and described sources they frequent to hunt and play whilst girls also easily described places they frequent to collect firewood and conduct other household chores and play. Both boys and girls were able to provide similar details of sources of wild foods that were closer to the homesteads.

Figure 15: Children from Mpheta fetching crabs in the wetland

Through matrix scoring, children identified the preferred sources of wild foods. Overall, mountain forests, wetlands, bushes or thickets and graveyards, rivers and riversides, homesteads, farm or fields and wetlands (*dambos)* or gardens were identified as the sources and places from which children obtained their wild foods.

3.3.2.1 Sources of wild foods in Mtuluma

Mtuluma reported the highest number of wild foods and it borders Zomba Malosa Forest Reserve, a five minute walk for people living close to the forests and a 20 minute walk for those living at the centre of the village. The village also has trees within the homesteads and there are pockets of bushes spread in the area. Farms and fields which were also reported as sources of wild foods by children, are widespread in the village and located close to homesteads. Other sources of wild foods in Mtuluma included rivers, wetlands (areas along the rivers) and homesteads (Figure 16).

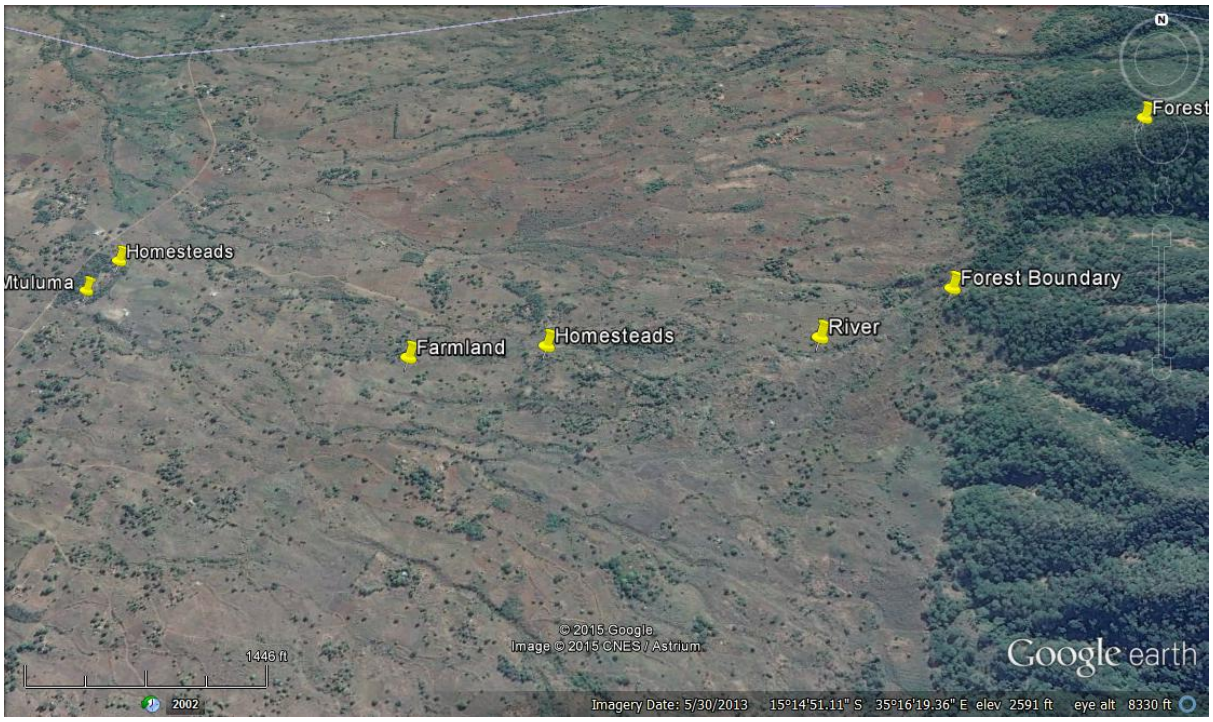


Figure 16: Map of Mtuluma showing the sources of wild foods

3.3.2.2 Sources of wild foods in Kasonga

Kasonga registered the second highest number of wild food species and most of these were sourced from the Zomba Malosa Forest Reserve. Kasonga borders the protected Zomba Malosa Forest Reserve which is at least 90 km^2 (Zomba District Assembly, 2009). It takes approximately one hour to walk to the forest borders and mostly involves going uphill. According to the villages the forest is shrinking and it now takes people more time to reach the forest unlike a decade ago. Other wild food sources in the area include riversides, farms, wetlands and homesteads (Figure 17). Farmlands surround the homesteads and were easily accessed by the children. Kasonga has considerable amounts of trees within the homesteads and in the riversides.

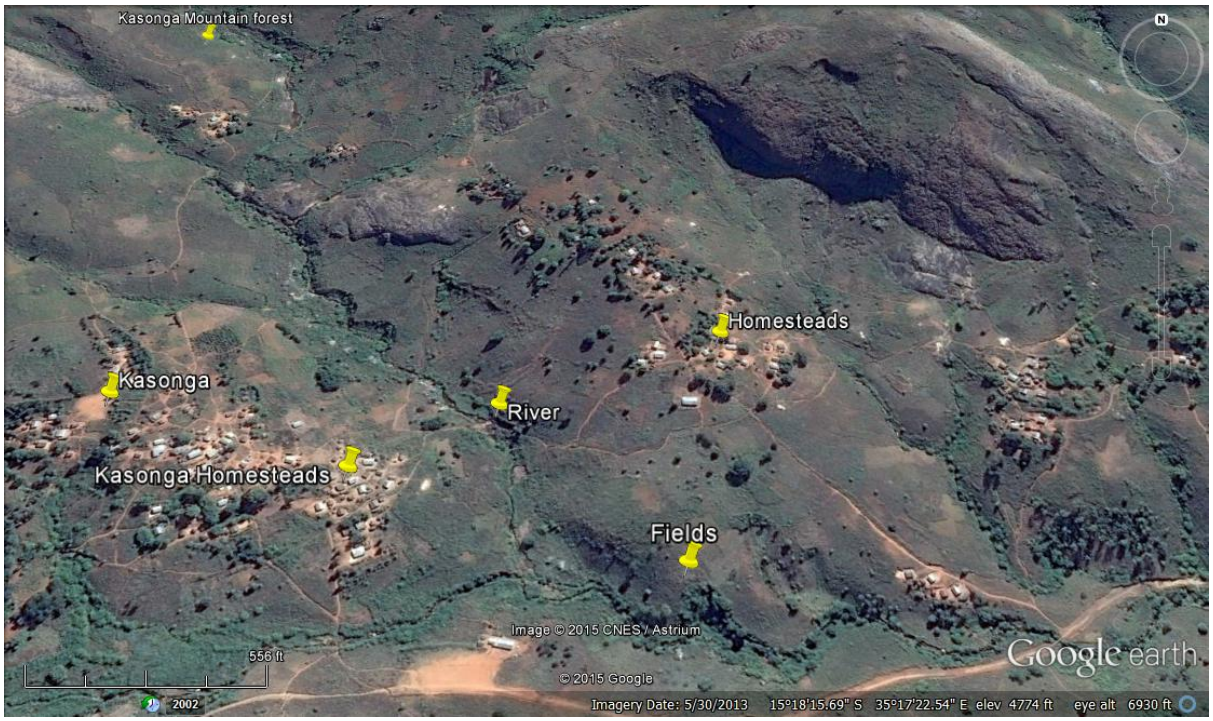


Figure 17: Map of Kasonga showng the sources of wild foods

3.3.2.3 Sources of wild foods in Makombe

Makombe is located at least 45 minutes from a mountain forest. The mountain forests form an important source of wild fruits, birds and game. The area lies in the Shire river basin and

is bordered by Lisanjala River, which also forms an important source of wild foods such as vegetables and other aquatic foods. Other wild food sources in the area include wetlands, farms or fields and within homesteads (Figure 18).

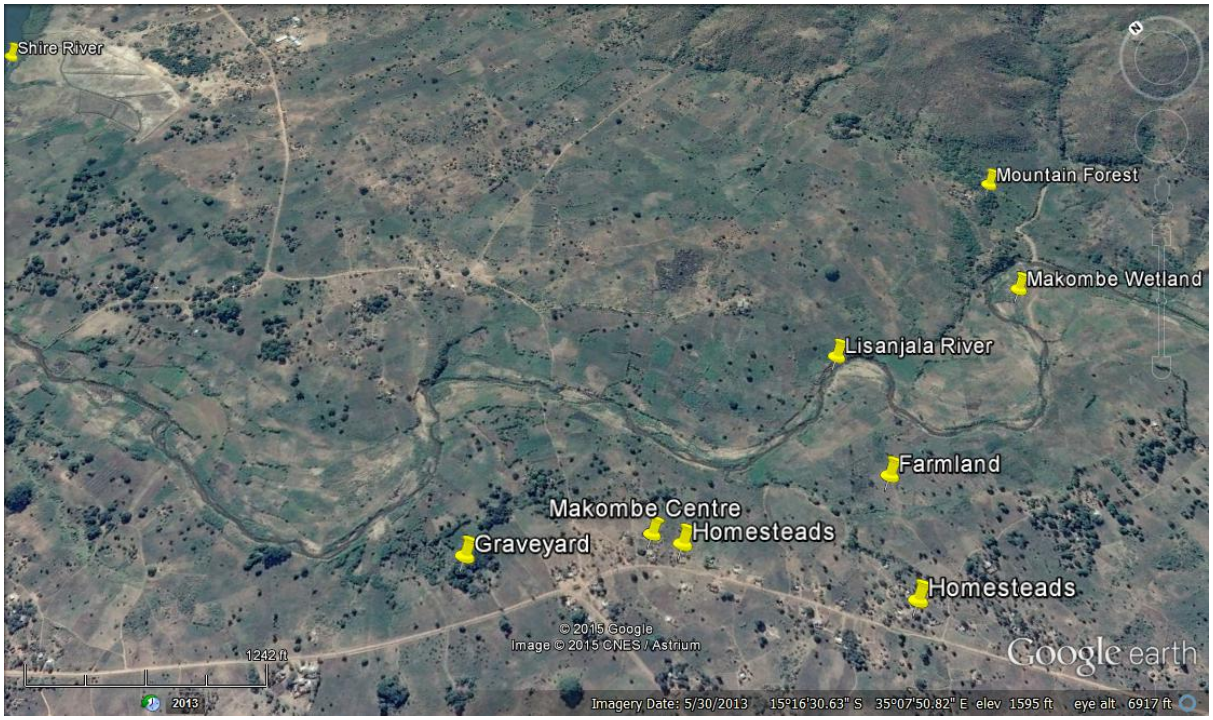


Figure 18: Map of Makombe showing the Sources of wild foods

3.3.2.4 Sources of wild foods in Mpheta

Mpheta has two main settlements separated by a wetland, river and rice fields. A narrow path connects the two sides of the village, which are 45 minutes apart (Figure 19). The main land in Mpheta was 10 minutes from the main Chisani River and 10 minutes from the main rice scheme. The homesteads were located along the village paths to form a linear settlement.

Figure 19: Map of Mpheta showing the sources of Wild foods

The wetlands in Mpheta surround the homesteads and were identified as the main source of small mammals in the area as large game or bushmeat is not found in the village. Crabs are also found in abundance due to the presence of small drainage systems and large rice scheme and wetlands, commonly referred to as the *dambo*. Mpheta does not have natural forests beside a small Village Forest Area (VFA) which is dominated by scattered Eucalyptus species and grass. It however had scattered patches of bush and trees adjacent to the homesteads. Children identified the lack of a natural forest in the area as the reason behind the unavailability of big game. Mpheta reported the lowest number of wild game, mostly small mammals was available in the bushy areas of the village with a matrix score of 10.

Birds were found in abundance in the wetlands, and to an extent in the bush and homesteads. Insects were commonly found and freely accessed from homesteads. In some cases, homesteads remained the only source of the insects, as is the case of flying termites.

Children were hence able to catch these insects when they are available. Fields or farmlands and wetlands also formed important sources of insects.

3.3.2.5 Preferred sources of wild foods

Children presented their preferred wild food sources through matrix scoring. They considered availability of wild foods, access to the source and the foods, distance to the sources and ease of travel to the source. Therefore, sources that had abundant wild foods, easily accessed and closer to their homes were categorised as preferred sources. In addition, children preferred wild food sources which were closer to the areas where they play. Various sources were preferred by children for different wild food types (Figures 20-23).

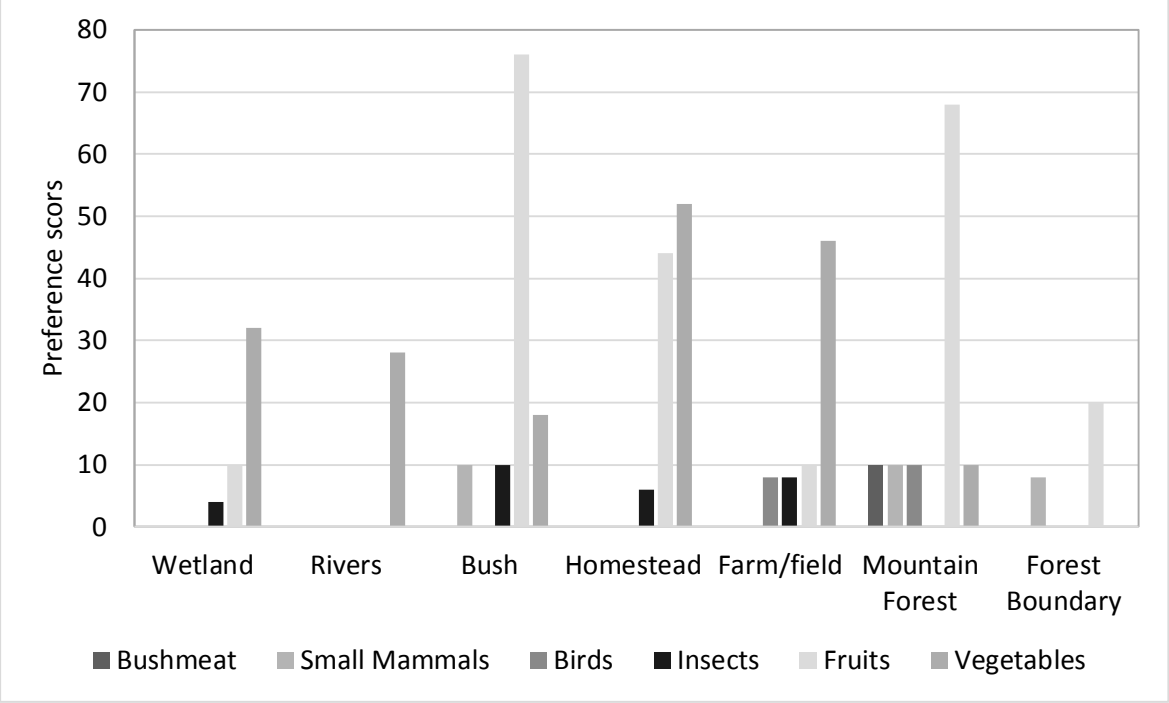


Figure 20: Preferred sources of wild foods in Mtuluma

The scattered patches of bush comprising of grass, shrubs and trees were the most preferred source of wild foods in Mtuluma. Bush areas were found within the village in close proximity to homesteads and farmlands and were an important and common source of wild fruits, birds and insects. Children also preferred homesteads and mountain forests as important sources of wild foods. Homesteads were popular for their provision of wild vegetables and fruits whilst forests were a source of most wild foods besides insects.

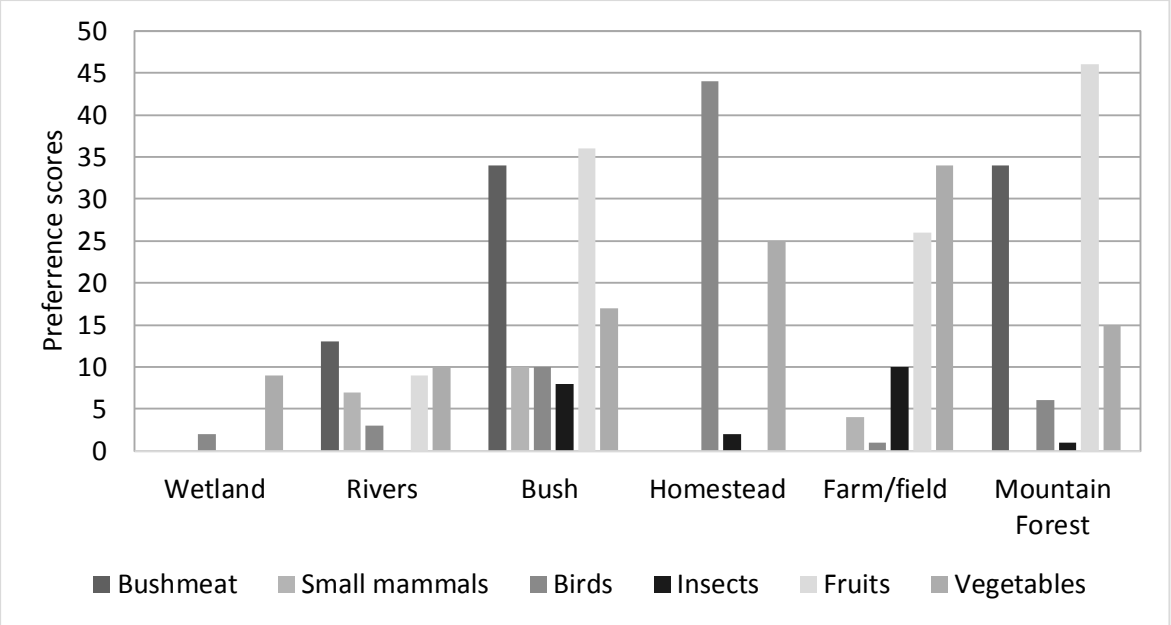


Figure 21: Preferred sources of wild foods in Kasonga

The Zomba Malosa mountain forest and bush areas in Kasonga village were selected as the most preferred source of wild foods in Kasonga. The children highlighted these as important sources of fruits and bushmeat. On the other hand, the fields and homestead were ranked as the second most preferred source as they were both an important source of vegetables, and birds.

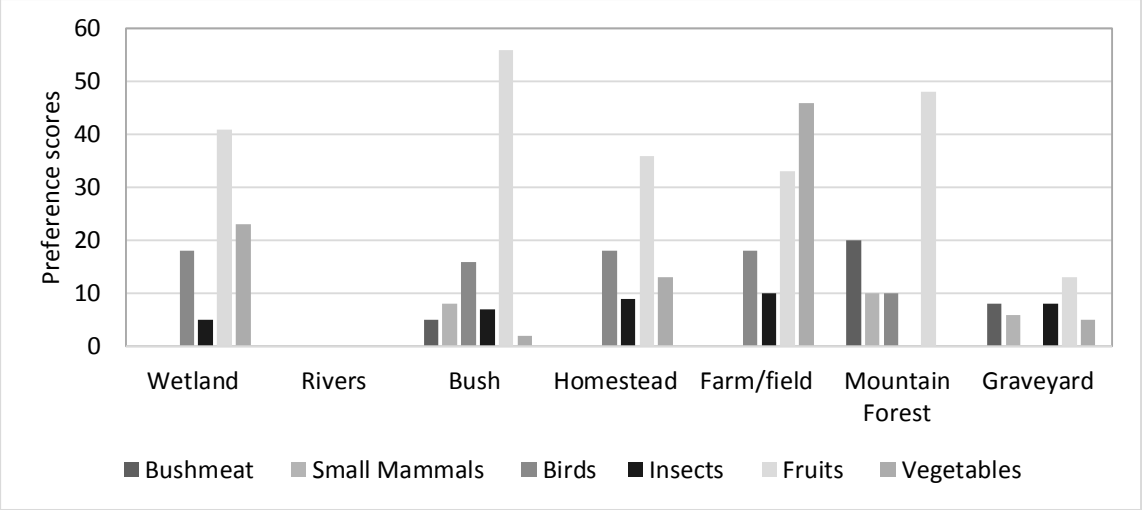


Figure 22: Preferred sources of wild foods in Makombe

In Makombe, fields were the most preferred source of wild foods as they were an important source of vegetables and a source of wild fruits for children. This was followed by bush areas which were a common source of vegetables and birds. On the other hand, mountain forests and wetlands were preferred sources of animal based wild foods and fruits and vegetables, respectively.

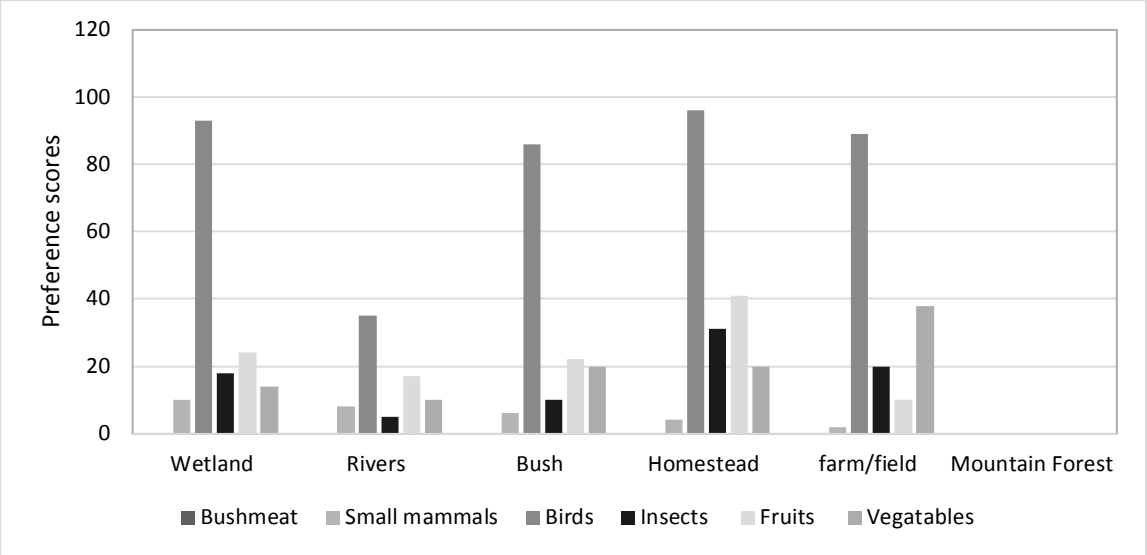


Figure 23: Preferred sources of wild foods in Mpheta

The children cited the homestead as the most preferred source of wild food in Mpheta. Most wild foods in Mpheta were found within the homesteads and all communal areas such as the playground and church or hospital compound. Wetland which was the main land type was a common source of other wild foods such as small mammals, vegetables, birds and insects. In addition, this was the only source of crabs to the children. A few fields surrounding the wetlands were a common source of vegetables. These were located close to the homesteads.

3.3.3 Temporal and spatial availability of wild foods

Children indicated that wild vegetables, wild fruits, and some insects and birds were subject to seasonality. Children defined seasons according to rainfall patterns in the year and on-farm activities. Against this background, descriptions such as rainy season and planting time were used interchangeably by the children. Generally, wild plants have their particular season or period in which they flourish and are in abundance with a few or none being available all year round. Children indicated that wild vegetables and mushrooms are in abundance from the start of the rainy season in November and December when households indicated to be crop insecure. An exception is on *dambos* or wetlands where wild vegetables are found all year but in higher abundance during the rainy season. Wild fruits were also considered to be seasonal and their seasonality varied from species to species.

Some insects were seasonal whilst some were available all year. Grasshopper species were available all year while other insects such as *Mafulufute* and flying insects are only available during the beginning of the rainy season. Just like insects, some small mammals were available during particular times of the year. For instance, mice were commonly found in fields after harvests while hares were found all year round in the bush or thickets. The availability of wild foods was at times associated with particular events, usually on farm or weather events, as one child indicated, "*Flying ants come out of the anthills at night after*

the first rain and we go and catch them... Here in Mpheta, birds are available when the rice has started producing in the fields because they go to the fields to search for their food".

In contrast, bushmeat was available all year and its abundance was determined by the availability of the habitat. Bushmeat was only found in thick mountain forests that were available in Kasonga, and Mtuluma and to a lesser extent in Makombe, while small mammals could be found in mountain forests, as well as thickets and bushes closer to the homestead. No large bushmeat were reported from Mpheta as the village does not have the said habitat, mountain forest.

Overall, children showed that they know seasons in which particular wild foods are available but could not provide the specific details for all wild food species of the times of the year when a particular species would be in abundance. Hence there was no consistency in describing wild foods availability during the year.

3.3.4 Collection and gathering of wild foods: Processes and strategies

The collection of wild foods for household use is shared among different members depending on age and gender. Women and girls are responsible for the collection of wild vegetables and sometimes insects and, to a lesser extent, birds. The hunting of bushmeat and birds is left to older boys and the men and to a lesser extent younger boys would participate in the collection of wild vegetables. Both girls and boys, however, equally participated in the collection of wild fruits and insects.

Outside their homes, the collection of wild foods by children was mostly a social activity and groups of children participated in this event usually after school or during holidays.

Collection of wild foods was triggered by varying factors such as hunger, play, or to conduct household chores. Since the collection of wild foods was mostly a social event, a collective decision was made among the children on which places to go. Older or popular leaders have the power to influence their friends over such decisions. Largely the types of groups of children could be broadly categorised into three. Firstly, 5-10 boys aged between 12-18 years old would form a group and usually collect wild foods further from the homestead. Secondly, groups of 5-10 girls aged between 15-18 years old would form a group and collect wild foods. Younger children of ages 8-12 would form one group of both girls and boys and collect wild foods in sources close to the homesteads. However, exceptions were noticed and heterogeneous groups were formed especially in terms of larger age differences.

In their groups, during socialisation, children learn about wild foods; their name and collection method, from each other. Socialisation included various forms of play that children undertook in different spaces. For instance in Makobe, a group of boys usually stop by the village river on their way to the mountain forest to catch birds. When conducting transect walks, it was clear that older children have more knowledge of wild foods than younger children but young children are equally actively involved in the collection and consumption of wild foods.

On the other hand, there were clear differences on the "groupings" of children as they were collecting wild foods. When asked "who do you collect wild foods with", responses varied according to the type of wild food, gender and age of the child and purpose of collection (Table 9). Collection of wild fruits was done by a group of children, though in isolated cases, individuals agreed to collecting wild fruits especially when sources are within or near the homestead. This was common among both girls and boys in all study sites. Very young children (8-10 years old) did not collect wild foods from sources that were further from their homesteads.

Table 9: Children's social groups during collection of wild foods

Social group	Fruits (%)	Vegetables (%)	Bushmeat (%)	Birds and insects (%)
Alone	2	11	0	2
Friends	70	50	34	48
Siblings	1	22	0	1
Other relatives	5	5	8	6
Others	0	0	1	1
Do not collect/hunt wild food	22	12	57	42

Girls indicated that they also collect wild vegetables with their mothers while boys also collect bushmeat with older member of the family. In addition, children join other community members to collect wild foods. However, this was only done for bushmeat and birds and insects.

The collection of wild foods was also an activity that happened out of convenience like during play, household chores and walking from school. During play children collect wild foods to satisfy their energy needs when they are hungry. In Mpheta for instance, most wild foods are located at the village ground and children access these during their breaks in play. In Makombe on the other hand, boys access wild fruits from the mountain when they are hunting for birds. Similarly the children admitted to collecting wild foods when carrying out other chores such as collection of firewood, bathing and cleaning dishes at the river, and farming. Children also consumed wild foods on their way from school. For instance, in Mpheta, children feed on *Rumex abysinicus* and *Caesalpinia decapetala* on their way from school. Opportunistic consumption of wild foods is therefore common to children who undertake/ participate in activities that lead them to a particular wild food source.

Children's knowledge of wild foods includes details of processes involved in acquiring wild foods. There were clear gender differences in describing methods and strategies used in the collection of wild foods. While girls identified the wild food collection tool, especially for bushmeat and birds and insects, they were unable to illustrate the use of the tools. Girls admitted to occasionally hunting for small mammals, insects and birds and strongly refused in taking part in the hunt for larger mammals. They cited hunting as a health risk and that it is a tedious activity that requires more strength than they have.

3.3.4.1 Methods used by children in collection of wild fruits

Collection of wild fruits varies according to the type of wild fruit. Fruits such as *Ziziphus mauritania*, can easily be collected by simply shaking the tree and later collecting the fruits when they fell to the ground. Similarly, where the *Ziziphus mauritania* tree is big, children whip the tree with a stick and fell the fruits. Short (shrub like) fruit trees such as *Vitex domiana* usually have low hanging fruits. Children simply pluck these fruits from the tree with their hands. This exercise was done for creeping fruit trees too whose fruits were low hanging.

Children climbed in trees whose fruits were not low hanging. Boys commonly practised this while only a few girls were able to collect such fruits. Girls who are not able to climb trees would either wait for the fruits to ripen and fall by their own or get assistance from their male counterparts. Most fruits are usually directly consumed fresh after collection and without any processing. In a few cases however, unripe fruits are placed in warm conditions such as sack bags to enhance ripening and protect the fruits from pests.

3.3.4.2 Methods of fetching wild vegetables

Girls collected more vegetables than boys and hence were able to describe the vegetable collection methods. Plucking was identified as the most common method of collecting vegetables. In this instance, leaves, usually the young and tender leaves, were plucked. However, for some vegetables, such as *Cochorus trilocularis,* when being collected further from the household, the whole plant is uprooted and the leaves are plucked when the children arrive in their homestead. This was done to keep the vegetables fresh and prevent them from drying. Children indicated that wild vegetables are carefully plucked and careless plucking of vegetables may cause them to be bitter when cooked.

3.3.4.3 Methods used to hunt bushmeat

"*Hunting is a man's job*", was the response from girls when asked if they have ever hunted wild game. Girls could state the sources of wild game and the tools used to get wild game but failed to explain the techniques and processes involved in hunting. Boys on the other clearly illustrated hunting tools and their corresponding techniques to acquire game.

In hunting for wild game, the boys use dogs who assist in flushing the wild game and chase after the game when identified. Older boys, aged 14-18, participated in the hunting. Bushbuck and other large game are usually hunted through this method. The dogs are trained to bark when they identify wild game, and the boys would rush in and kill the wild game. Children also used clubs, sticks and stones as additional tools in hunting for big wild game. However, when hunting for small game, they would easily use these tools without the aid of dogs. For instance, crabs were hunted solely by the use of sharp sticks. In addition, when hunting for hare, clubs, stones and sticks were used. Hunting for bushmeat was largely carried out at night.

3.3.4.4 Methods used by children to catch insects and birds

Insects were commonly found in homesteads, fields and bush areas and accessed by both girls and boys. Insects were caught by hand and in abundance when they are in season. For instance, flying termites where only caught during the rainy season in the homesteads. They came out of their mounds during the evening hours and at night and were caught by children. They are then placed in water to avoid them from escaping. Some of these termites are consumed in the households while others were sold at the local markets.

Grasshoppers are caught in the fields or wetland areas and available throughout the year. Collection of grasshoppers is done by boys who go out to heard cattle or play in the bush or the wetland. Boys hid from the grasshopper in the tall grass in order to catch them. According to the boys, the grasshoppers fled at the sound of noise or their movement.

Figure 24: A child from Mpheta displaying a net trap used to catch birds

Children used traps, catapults and nets to catch birds. These snares were set in the bush or at the forest where birds frequent and left there for hours or in some cases days until a bird is trapped. Snares were often set on tall grasses in the forest as witnessed in Makombe village. Children would later come and check if any birds have been caught in the snares and more snares were set. Nets were used to catch both birds and aquatic food such as fish and crabs. In catching birds, the net was loosely placed just next to

an open land. Food such as rice, was placed adjacent to the net. Birds seeking to eat the food were then trapped under the nets by pulling off the net stand. On the other hand catapults were an instant mode of killing birds. Young boys made their own catapults from a twig and rubber band. They would use these with stones to kill birds.

3.3.5 *Access of wild foods by children*

Access on wild foods focused on determining the ability of the children to acquire the wild foods from its available sources. As presented in section 1.3.2, main wild food sources that were identified included farms and fields, rivers and lake, wetlands, bush, forests and homesteads. Despite availability of wild foods in these sources, access to wild foods varies due to several factors. Children in all four sites do not pay to acquire these resources.

The Zomba Malosa Forest Reserve is managed with government restrictions, near Kasonga. Co-management has however been adopted in Mtuluma that also borders part of the reserve. Such sources are set by the government as protected areas for conservation and management of biodiversity. Therefore, in Kasonga, procedures are set for people who want to access resources from the reserve such as procuring a ticket (as a licence). During the time of the study the ticket cost MK100-MK200 per day and the forest is patrolled by forestry officials to enforce this. However, this was largely for wood products. It was not clear whether children are subjected to such requirements but the children indicated that they do not like visiting forest areas where forest patrol officers are. In Mtuluma however, children visited all forest areas to access wild foods.

In Mpheta, an important habitat for migratory birds, there are laws affecting access that were set by the bird hunters association. According to these laws, bird hunters in the area are required to purchase a ticket that gives them access to the birds in the area. The ticket

currently costs MK100. In addition, hunters are told the maximum amount of birds that can be accessed from the area. Some places, especially the bird's breeding areas are prohibited and hunting is not allowed. Such laws are operational throughout the year and affect all community members. However, these laws do not apply to children since most of them hunt for birds in their homesteads or in the nearby bushes.

Besides designated areas for management and conservation, areas that are privately owned cannot be accessed by the children. For instance, in Kasonga, children are unable to access wild fruits and animals in a forest within Ku Chawe Forest reserve or do so with difficulty since that part of the forest is privately owned. In the words of one child, "*Parason a Japanese (the owner), chases us on his four wheel big motorbike when he finds us picking the fruits and accuses us of destroying the environment. We then throw away any foods that we might have collected and flee back to the village since when you get caught, you are beaten up. However, we still return to the forest another day and time and hope not to meet him or forest patrol officers".*

There was limited access to areas of cultural significance. For instance, areas of cultural significance such as the graveyards were not easily accessed by anyone. Only children in Makombe indicated that they were able to access some wild foods from the graveyard. In this regards, when found collecting foods in the graveyard, children were summoned by the traditional leaders and punished. In all sites, graveyards comprised of a patch of dense trees. In addition, places of spiritual significance are not accessible by children; hence wild foods in these places cannot be accessed. '*Ziwale*' in Mpheta is surrounded by natural bushes and is believed to be a home of ancestral spirits hence the by-laws of the area prohibit anyone from visiting or approaching this site. Only the spiritual mother of the village and traditional chief goes to this site to offer sacrifices for good food production in the area.

Some wild food sources are not easily accessible due to long distances and safety of these routes and places. In Mpheta for example, the distance from the village to the "bush" where they access large amounts of wild birds is about two hours. In addition the nearest mountain forest (in the neighbouring village) where wild fruits could be accessed is two hours away. Similarly, a trip to the second closest forest at Kasonga may take up to two hours. As a result, children are unable to visit these sources unless they are on school holidays. In Mtuluma and Makombe however, the forest and main rivers are in close proximity with the village. Regardless, people may still walk great distances to access some wild foods such as bushmeat as they are found deep in forests that are predominantly wild. In Kasonga for instance, access is also affected by geographical challenges such as slopes and gorges found in the areas.

3.4 Discussion

3.4.1 Identifying wild foods

During the study, a total of 119 species of wild foods were recalled by children in Zomba district**.** Of these 32% were wild fruits, 20% were birds, 15% were wild vegetables, 12% were small mammals, 11% insects, 4% comprised of bushmeat and 4% were tubers. During the study, no edible reptiles were identified and this has been reported elsewhere in Malawi (Mikkola, 1997). Wild foods were identified by their local names, and sometimes only known to the children hence were not translated to English, especially were samples were not available. During identification of wild foods, Mikkola (1997) also reported that despite 56 bird species being identified, the names could not be easily be translated to English or scientific names. There were clear variations in the number of wild foods recalled by children of different ages, with older children (age 14-18) being able to recall higher numbers of wild foods than younger (8-13 years) children although there was an exception of children with high dependence on wild foods. While many studies have focused on

reporting wild foods used by households in rural areas, only a few have focused on children's identification and use of wild foods (McGarry, 2008).

Of the various categories of wild foods, wild food plants have been identified as the common wild food used by rural communities. Johns and Maunda (2006) reported that communities access wild food plants such as leafy vegetables, fruits, tubers and other plant parts and these form diverse dietary options. Half of the wild foods identified by children were plants comprising of wild leafy vegetables, wild fruits and tubers. Wild fruits particularly, are widely known to and used by children and have been termed as "children's food" in other parts of Africa (Maroyi, 2011; McGarry, 2008). Asfaw and Tadesse (2001) reported that young children are particularly excited and enthusiastic about wild fruits.

Common species of wild fruits identified by children in more than one of the four study sites include *Uapaca kirkiana, Ziziphus mauritania, Annona senegalensis, Azanza garckeana, Flacourtia indica, Vitex domiana, Adansonia digitata, Ancylobathrys amoena* and *Vangueria infausta*. Species such as *Adansonia digitata, Uapaca kirkiana, Tamarindus indica, Flacourtia indica* and *Azanza garckeana* have also been recognised as popular wild fruit species elsewhere in the miombo region in Africa (Barany et al., 2005; Johns & Maunda, 2006; Saka & Msonthi, 1994; Shackleton et al., 2010; Timberlake et al., 2010) and elsewhere (Setalaphruk & Price, 2007). Both girls and boys identified and used wild fruit species equally in all study sites. Other studies, such as a study in Coffee Bay, Eastern Cape in South Africa however, reported that more boys consumed wild fruits (McGarry, 2008). This influence of gender on identification and use of wild foods may be attributed to varying sources and access to wild foods, the socialisation of gender and freedom to roam (Alexander et al., 2015).

Wild vegetables, despite having only a few species identified during the study, were known and used by the children in all the study sites, mainly as a side dish in their households as indicated in Chapter 2. Common species of wild vegetables identified by children across the study sites included *Bidens pilosa, Cochorus trilocularis, Indigofera* species*, Galinsonga paviflora, Amarunthus thunbergii* and *Amarunthus spinosus.* Of these *Amaranthus thunbergii, Bidens pilosa and Galinsonga parviflora* are also common in South Africa (Modi et al., 2006). Ogle (2001) has also reported the use of wild vegetables such as *Amaranthus* species in Asia. Most studies on wild vegetables focus on their contribution to rural households' food security, associated indigenous knowledge of the wild vegetables, their therapeutic use and their sources and availability in time and space (Modi et al., 2006). Very few studies have segregated this information by age and gender. In his study, McGarry (2008) notes that girls use wild vegetables, especially wild spinach, more than boys in Eastern Cape, South Africa. In our study, girls identified more wild vegetables than boys, but their use and dependence was similar, as it was done at household level.

Different studies done in Africa have defined bushmeat differently. A broad or limited description of bushmeat or wildlife will affect outcomes of studies on bushmeat. Overall, in most studies across Africa, bushmeat includes large and small mammals or ungulates, primates, rodents, reptiles and amphibians (De Merode, 2004; McGarry, 2008; Nasi et al., 2011; Nielson, 2006; Timberlake et al., 2010). Birds and insects are considered separately. Duikers, African giant rat and cane rat, mice, mongoose and hare were some of the common bushmeat species identified during the study. No bushmeat was recalled in Mpheta, a LFC HDR area. Other studies in Africa have also identified duikers, medium-sized ungulates and large rodents as making up most of the bushmeat harvest (Nasi et al., 2011; Nielson, 2006; Van Vliet et al., 2015). The use of bushmeat has reportedly been high among forest dependent communities and communities where there are limited alternative sources and limited livestock production (Arnold et al., 2011; Sunderland et al., 2013). Although in some areas, use is driven by cultural and taste preferences (Van Vliet et al., 2015). Katundu (2001)

has also reported on the use and dependence of communities in Southern Malawi on rodents.

Children recalled and identified birds and insects that they use. The average number of insect species identified per village was 5.5 while the average number of birds identified in a village was 11. Common species of insects included flying ants and flying termites, giant crickets and grasshoppers. Flying ants are also frequently used by children in South Africa (McGarry, 2008). The importance and use of insects has been reported in the Zambezian woodlands of Malawi, Zambia and Zimbabwe (Timberlake et al., 2011) with a large focus on caterpillars (Syampungani et al., 2009) which were only found in Kasonga during the study. They are also widely used in drier savannas (Obopile & Seeletso, 2013; Dzerefos et al., 2014).

Of the 24 bird species identified by children, 37% were from Mpheta, a study site located in the Lake Chilwa wetland and a listed RAMSAR site (Ministry of Environment and Natural Resources , 2010). The wetland has fulfilled several RAMSAR criteria for its consideration as a wetland of international importance. In this wetland, about 160 species of birds have been recorded, including many migrants (Bhima, 2006). Common species in the wetland and other study sites include quelea, bulbul, francolin, cisticola and the dove. Only limited studies have identified particular bird species used. McGarry (2008) also cited the bulbul as a common bird eaten by children in Eastern Cape, South Africa. In Malawi, Mgoola (2007) also reported hunting of birds by the young population around Lake Chilwa.

3.4.2 Sources of wild foods

In this study, farmlands, wetlands, bush and thickets, rivers and river sides, lake, forests, and homesteads are important and common sources of wild foods from which children access

wild foods. Ambrose (2003) further described sources of wild foods as including "*gardens, cultivated patches, land close to the house, open water and land close to rivers and streams, farmlands and dense canopy forests further from settlements"*. The study indicates that large to medium bushmeat (as defined in this study) is commonly found in forests, bushes and thickets. Farmlands remain important sources of vegetables, wild fruits and smaller bushmeat such as rodents. Wild fruits are also commonly found in forests, and homesteads. Birds and insects are found in all areas with trees and thicket cover and are in abundant in wetlands. This also provides the link between vegetation and sources of wild foods. Overall, each landscape is habitat to and supports selected wild foods' categories therefore contributing to the access of the wild foods (Sunderland et al., 2013).

The findings of the study reveal that, besides the general known-to-everyone sources of wild foods, children have their preferred sources. Boys and girls have differential preferences in sources of wild foods. The type of wild food source that was preferred was determined by the availability of wild foods at the source, ease of access and convenience. Wild foods availability in these sources varies largely according to the type of wild food and nature of the source. Knowledge on the sources of wild food is vital for understanding the link between wild foods and people's livelihoods, natural resources conservation and appropriate management measures (Arnold et al., 2011; Sunderland et al., 2013). Different sources of wild foods should therefore be studied independently through the lens of a selected user group to understand their contribution to availability and use of wild foods.

3.4.2.1 Forests and Woodlands

Chidumayo & Marunda (2010) define woodlands as vegetation dominated by woody plants; primarily trees with a canopy cover more than 10% of the ground cover. Similar definitions have been provided when defining forests. In this study woodlands also extend to include shrubland, thicket, savanna and wooded grassland. A lot of studies have focused on forests as a source of wild foods and their role in providing wild foods to forest dependent

communities (Arnold et al., 2011; Chidumayo & Marunda, 2010; Delang, 2006; Nasi et al., 2011). Other studies have termed wild foods fetched from the forests as “forest foods” (Powell et al., 2011; Vinceti et al., 2013).

Forest landscapes and areas with tree cover have been reported as one of the richest sources of wild foods as increased complexity of such space is related with increased habitat space (Carey & Harrington, 2001; Sunderland et al., 2013). Dense understory vegetation and woody debris found in forests are believed to be sources of various edible wild plant and animal species (Carey & Harrington, 2001). Zomba district is endowed with natural rich forests with protected forest area at around 90 km^2 and unaccounted for trees outside forests in human landscapes with the former forming a part of local land use systems (Zomba District Assembly, 2009; FAO, 2010).

Also termed as woodlands, forest landscapes provide an array of wild foods ranging from wild fruits, wild vegetables, fungi, insects and insect products, and bushmeat (Shackleton et al., 2010) and their use in supplementing diets in the African region has been established (Vinceti et al., 2013). For instance, in Malawi, studies by Akinnifesi et al. (2004) have identified up to 75 species of wild fruits that are accessed in forests though not all are in common use, while Munthali and Mughogho (1992) reported the consumption of insects such as caterpillars in the country.

In this study, children accessed various wild foods from forests including bushmeat, birds and fruits. While the forests was in close proximity to other villages, children in Kasonga travelled up to one hour to access the forests and Mpheta did not have a forest. Both girls and boys visited forests to access wild fruits. However, only boys visited forests to hunt for bushmeat and birds which was considered boys work but girls were still able to recall names of bushmeat and bird species found in the forests. Similar findings have been found in South

Africa (McGarry, 2008) and Asia (Setalaphruk & Price, 2007) where hunting for game is only practised by boys and a limited number of girls.

3.4.2.2 Trees and spaces outside forests

TOFs includes trees in homesteads, wetlands, farms, fallows, graveyards, roads and pathways are an important source of wild foods (Rawat et al., 2003) especially where natural forests do not exist as evidenced in Makombe. Wild foods elsewhere are even accessed from state lands (Shackleton et al., 2010). Recently, research has focused on the contribution of other landscapes, besides forested landscapes, in providing wild foods (Scoones et al., 1992; Shackleton et al., 2010; Timberlake et al., 2010). Farming communities derive wild foods from agricultural landscapes such as fields, ditches, and pathways (Ogle et al., 2003).

Besides forests, children during the study identified homesteads, riversides, wetlands, bushes and grassland, farms and gardens as important sources of wild foods. In Mpheta, despite not having a forest, children still identified and used wild foods from other sources especially the wetlands. Similarly in Tanzania, Powell et al. (2011) noted that even though households did not have access to forests, the consumption of wild foods was still high as they were source from farms. Children from all study sites accessed wild fruits, rodents, wild vegetables and insects from field/gardens and wetlands. What some researchers have termed as strong community management practices (Shackleton, et al., 2010), wild fruit tree species such as *Parinari curatellifolia, Stychnos occuloids* and *Uapaca kirkiana* have been left uncut and observed scattered in crop fields and homesteads in Malawi (Akinnifesi et al., 2006). This also supports various research on growing domestication of wild plant species (Bharucha & Pretty, 2010; Modi et al., 2006; Vinceti et al., 2013).

Such wild foods collected from fields, farms and gardens have been termed as “hidden harvest” (Bharucha & Pretty, 2010; Grivetti & Ogle, 2000; Scoones et al., 1992). The results of the study show that wild fruits, vegetables, birds and insects were also sourced from childrens’ homesteads. In Makombe and Kasonga, children could harvest mushrooms in the interior corners of their houses during the rainy season. Wild fruit species such as *Ziziphus mauritania, Azanza garckeana* and *Flacoutia indica* and wild vegetables such as *Amaranthus* species and *Bidens pilosa* could be commonly found around the homestead. In addition, children in Mpheta, set traps for birds within the homesteads. During the first rains, children would catch flying termites on anthills that are found within the homestead and other idle lands in the village.

On their way from school, children from Kasonga are commonly seen to be chewing on *Rumex abysinicus* which is common in fields and riversides along their path from school. Most research does not include such information as the collection and use of such wild foods is simply opportunistic (McGarry, 2008) and often regarded as food by only the children themselves. The elders from Kasonga village did not know about *Rumex abysinicus.*

Water bodies and land near water sources were important sources of wild vegetables and other wild foods. In Mpheta, crabs are commonly caught by the children from wetlands, water drain systems and rivers. The study however, did not focus on the identification of fish. In all the study sites, gardens located in the *dambo* and riversides were reliable sources of wild vegetables all year round. Girls indicated that they fetched wild vegetables from these sources as they went to conduct household chores.

Graveyards were also identified as an important sources of wild foods for children in the four study sites. Graveyards normally contained a good cover of natural trees and thick bush. In Makombe, wild fruit trees also grew freely at the graveyards. Despite customary

laws surrounding the use of resources at the graveyard (as seen in the next section), graveyards formed a ready source of wild foods such as fruits and small mammals.

The results of the study show that landscapes outside the forests are equally important sources of wild foods though the level of importance is determined by the category of wild foods. Homesteads, fields and scattered patches of bush scored very highly as preferred sources of wild foods by children in Mpheta, Mtuluma and Makombe respectively. Similar results have been reported in Tanzania, were the use of forest sources is currently limited, but overall use of wild food is high due to its availability in farms (Powell et al., 2011). In addition, households is close proximity to tree cover were also more likely to consume wild foods.

3.4.3 Temporal availability of wild foods: Seasonality

Besides the source of wild foods, seasonality was identified as a factor affecting the availability of wild foods and the results of the study show that wild food availability varies at different times of the year. Children had described the times of the year in relation to the farming calendar and rainfall pattern. There are seasonal factors affecting wild foods and this equally affects their abundance during the year. Wild vegetables, wild fruits, birds, insects and rodents were found in their abundance during different types of the year.

Harris and Mohammed (2003) reported that in Nigeria, wild foods are abundant and important during the rainy season. Two factors have been considered: people are busy providing labour for crop production, it is a common food insecure period as it is before harvest (Harris & Mohammed, 2010). Maroyi (2013) indicated that most wild foods are seasonal, found abundantly during the rainy season but their seasonal appearances alternate with cultivated species thereby providing a continuous supply of food. Children

indicated that wild vegetables were commonly found during the rainy season from November to March. Wild fruits were also commonly found during the rainy season. Elsewhere, many wild food plants produce leaves and flowers on the onset of the rains when grain stocks/stores are running low and when the next harvest is far off (Harris & Mohammed, 2003). According to Maroyi (2013), most edible wild plants are gathered and consumed during the rainy and harvest seasons.

Besides wild fruits and vegetables, some species of insects and birds were also seasonal. For instance children reported that flying termites could only be caught just after the onset of the rains. The *mopane* worm, which was commonly accessed in Kasonga, is abundant from October to December (Munthali & Mughogho, 1992). On the other hand, Bhima (2006) reported that birds, especially around the Lake Chilwa, breed during the months of January to July at various sites around the lake but preferably river mouths. In Mpheta, hunting was not allowed around the breeding sites during these months. Bird hunting takes place throughout the year with the peak periods in the rainy season (Bhima, 2006). So although the annual quantities of wild foods consumed are small, they are very significant on a seasonal basis (Illgner & Nel, 2000).

On the other hand Bharucha and Pretty (2010) reported that in Nigeria, some wild foods are also available during the dry season thereby creating an all year around supply of wild foods. According to children, rodents, including the Giant African Rat, were abundant soon after harvest in March to May when maize stocks are still laying in the field and during the dry season. In addition, wetlands and streams and rivers that flow all year through were considered as permanent suppliers of wild edible plants. This is especially common for weedy vegetables (Maroyi, 2013). On the other hand, bushmeat availability and use was not affected by seasonality. Nevertheless, children have been singled out as perennial users of wild foods (Addis et al., 2005; McGarry, 2008). Children therefore access and use wild foods whenever they are available, all year round.

3.4.4 Wild foods collection strategies and process

Methods and tools used for collection of wild foods were similar across the study sites but were dependent on the type of wild food. According to the children, methods would also vary across the same category of wild foods. Children demonstrated knowledge on the different methods used in collection of wild foods which Bharucha and Pretty (2010) termed as local ecological knowledge. Gender disparities were also noted in demonstration of tools used in collection of wilds with girls having more knowledge on wild plants collection while boys had more knowledge of animal based wild foods besides insects. Such findings have been reported elsewhere by Bharucha and Pretty (2010) where men had more knowledge on hunting and fishing while women had more knowledge on the collection of wild food plants, insects and shrimps.

Wild fruits were plucked from the trees by children. However for smaller fruit species, children simply shook the tree and collected the fallen fruits. While most wild fruits were consumed during collection, others were brought home to be shared with other household members or sold, especially were they are collected in bulk. In Zimbabwe, local people harvest unripe wild foods and store them underground for use later in the year (Maroyi, 2013). Children in this study also harvested unripe fruits and stored them in a warm place to be consumed later.

Children illustrated the use of various tools used for collecting birds. Just as reported by Bhima (2006), traditional traps, snares or string, bird lime, tangling net, fish traps and drop nets are common tools used during bird hunting around the Lake Chilwa wetland. Children in Mpheta showcased a higher number of tools used in bird hunting compared with children elsewhere. This could be attributed to the high rate of bird hunting in areas especially during times when the water levels in Lake Chilwa are low (Bhima, 2006). In addition,

catapults was widely used by children in all study sites to hunt birds. This tool, which requires precision and usually targets one bird at a time, is also referred to as slingshots (McGarry, 2008). Boys demonstrated how most of these tools were used while girls simply identified the tools but could not demonstrate their use.

Strategies used in hunting for bushmeat are common across Africa and mostly traditional. For subsistence hunting, methods used range from the use of dogs, clubs and traps or snares (McGarry, 2008; Kaschula & Shackleton, 2009). Kaschula and Shackleton (2009) reported that the use of dogs and clubs was the most common and was used by 81% of the hunters in Eastern Cape, South Africa.

The study revealed that it is difficult to determine time taken to collect wild foods due to the nature under which wild foods were collected. Delang (2006) similarly reports that this is the case since wild foods are collected while undertaking other activities and on the way to or from the village. Amongst the children, wild foods collection was part of a socialisation processes. Wild foods were collected when girls visited the river to conduct chores or the farm. On the other hand boys collected birds when they visited the forests to play and in the course consumed wild fruits. Similar results have been recorded elsewhere in South Africa (McGary, 2008).

Collection of wild foods was mostly a group activity with the composition of the group varying with age, gender, types of wild food and the source of wild foods. In Eastern Cape in South Africa, collection of wild foods was done in groups of children using varying techniques and tools (McGarry, 2008). Groups of boys only of various ages would go to hunt for small mammals and birds at the forest and bush and crabs from the wetland. It could be assumed that this was the case because most of these wild food sources were far from the homesteads. On the other hand, groups of girls of mixed ages collected wild vegetables as

they visited the rivers or fields to conduct various chores. Younger children (age 8-14) could form one group and collect wild foods from sources that closer to the homestead.

Collection of wild foods as a socialisation process formed a learning knowledge exchange platform for the children on wild foods though studies have reported that there is declining knowledge of the wild foods among children (Setalaphruk & Price, 2007) Women have been widely recognised as the custodians of ecological or traditional knowledge related to wild foods (Maroyi 2013; Setalaphruk & Price, 2007; Shackleton et al., 2010).

3.4.5 Access to wild foods by children

Ease of access and availability of wild foods affects children's access to and use of wild foods. Despite having abundant wild foods in forested areas or tree landscapes and agricultural land, ex situ and in situ factors affect children's access to these foods. Overall, distance to the sources of wild foods, management systems, time, knowledge and skills affect children's access of wild foods in the sources.

For a long time, local communities living in and close to forests have accessed foods from these areas (FAO, 2014; Wunder, 2001; Angelsen & Wunder, 2003) and other landscapes (Bharucha & Pretty, 2010). These wild foods are freely accessed across Africa as they are a common property resource therefor access tends to be open and informal. They are also called a free resource. Wunder (2001) argues that since access rights to wild foods are informal, it is difficult to protect against external interests or conflict between on-site users.

Children in the study indicated that they freely accessed wild foods from the various sources including forests, farms and fields, wetlands, rivers, bush and thickets and the homestead.

Elsewhere, wild foods have been reported as a free resource (Barnett, 2000; Shackleton et al., 2010; Sunderlin et al., 2008) and in some cases are the only free resource especially to people with no employment (Alexander, 2010). Areas with limited sources of wild foods like Mpheta could access wild foods that are in-season buying from the local market.

Conversely, there has been the establishment of natural resource management systems that affect people's access to wild foods. Shackleton et al. (2007) reported that access to forest resources and the benefits from resources are not equitable across and within communities. For instance, in South Africa, Alexander (2010) indicated that government restrictions on Pirie state forest, led to the decline of access to the resources and related cultural activities. In Mtuluma, Community Based Natural Resource Management (CBNRM) was being practiced. Villagers who were aware of the structure admitted to improved conservation of natural resources in the nearby forests, especially trees. Alexander (2010) also noted that local people were usually unaware of current management strategies in their area. The Zomba- Malosa Forest Reserve that Kasonga borders has stricter government restrictions. The forest has office patrols and a fee is paid by people who want to access resources from the forest. However, children were not aware of such practices and it did not provide any restrictions to access wild foods by children. Nevertheless, elsewhere, there has been growing interest to involve communities in the management of their natural resources (Barnett, 2000).

Children in all study sites had difficulties accessing wild foods found on private property such as privately owned forests especially those outside their village. However, they could still access wild foods from the private sources such as farms and fields and homesteads within their village. At times, to gain access rights, a request from the owner was adequate to grant them access to wild foods found in the homestead. Challenges to access to world foods in various sources is often generalised hence information on children's access to wild foods is largely unavailable.

3.5 Conclusion

Wild food species are known, accessed and used by children across Zomba district in Malawi. Wild vegetables and wild fruits, are widely accessed and used by children though availability may vary across areas. Wild animals such as bushmeat, small mammals and rodents, birds and insects also contribute to wild foods accessed and used by children. Children's ecological knowledge of wild foods; associated with identification of wild foods and sources, and strategies of collection varies with gender and age. Local knowledge of wild foods is widely acquired and transferred among the children during socialisation.

Woodlands, both protected and communal forests, and other tree landscapes, open fields and farmlands, wetlands, bush and thickets, rivers, pathways, open grounds, graveyards and homesteads are equally important sources of wild foods. Availability of wild foods in these sources is dependent on the category of wild foods as each source is characteristic of minimum conditions required to support a selected category of wild foods. Children use various strategies and tools to access the various wild foods in these sources, and gender disparities are evident in collection of wild foods. While wild foods are widely recognised as a free resource, access to selected private sources of wild foods by children is limited.

CHAPTER 4: GENERAL DISCUSSION, RECOMMENDATIONS AND CONCLUSION

..Some wild foods found in Zomba district and commonly accessed by children…

4.1 Introduction

"It can be said that every tree, shrub and grass species is used in one way or the other for food and nutrition in a particular area" (Sene, 2000). The use of different types of wild foods by communities across the globe and particularly in southern Africa (De Merode, 2004; FAO, 2000; Mikkola, 1997; McGarry, 2008) has been recognised. Rural communities and selected urban dwellers generate a wide range of non-timber forest products including wild foods and wild food products such as edible fruits, edible insects, wild vegetables, bushmeat, honey and mushrooms from forests and non-forested landscapes or TOFs (Akinnifesi et al., 2006; Kalaba et al., 2010). Particularly in Malawi, the historical use of wild foods has been reported by Mikkola (1997), Munthali and Mughogho (1992) and Saka and Msonthi (1994). A majority of the population in rural Malawi use wild foods (Mikkola, 1997) to complement their daily starch dense monotonous diets (Kajembe et al., 2000; Uusiku et al., 2010), during times of food stress (Kamanga et al., 2009) and as a source income (Chidumayo & Marunda, 2010; Diederichs, 2005). Of all the wild food uses, self-consumption of wild foods is common and more important (FAO, 2011; Mikkola, 1997), even though commercialisation of wild foods remains an important source of income for some local communities in forest fringes (Belcher & Schreckenberg, 2007; Fisher et al., 2010). Particularly, women and children have been recognised as the main collectors of wild foods (Challe & Price, 2009; McGarry, 2008; Shackleton et al., 2010) and children are reported as perennial consumers of a wide of array of wild foods and wild food products (Addis et al., 2005).

The study revealed that all children from the four study sites in Zomba consume at least one type of wild food across the year regardless of age, socio-economic status of the household and geographic location. Children in southern Africa are widely recognised as a major collector of wild foods (Egoh et al., 2012; McGarry, 2008; Mgoola, 2007). Although the quantity of wild foods consumed by children was small, the contribution of the wild foods to their overall diets, nutritional status, income and local ecological knowledge is relatively significant. Food consumption in the country is characterised by enormous risks of malnutrition due to the narrow, monotonous and starch dense diets (Ecker & Qaim, 2010;

FAO, 2014). At least 82 % of children supplement their diets with wild foods over a period of one week and the dietary score for a majority of the children significantly improved with the consumption of wild foods. Wild edible vegetables, wild fruits, bushmeat, small mammals, insects, birds, crabs, tubers and mushrooms made their way to children's diets either within or outside the households during different times of the year. Children recalled a total of 119 species with the highest being wild fruits, birds and wild vegetables. Wild foods identified and reported by children were similar to wild foods recorded elsewhere in southern Africa (Saka & Msonthi, 1994; Shackleton et al., 2010).

Besides complimenting diets, wild foods offer a significant source of income for some (Belcher & Schreckenberg, 2007; Challe & Price, 2009) and at sometimes the only alternative source of income for children besides farm work. Commercialisation of wild foods was influenced by the needs of the children and the ease of access of wild foods for sale. Wild foods elsewhere are considered a common property resources, are freely accessed and requires no, or limited, less capital for exploitation (Harris & Mohammed, 2003; Sunderlin et al., 2008), hence are easily accessed and brought to the markets by children. However, putting value on the economic benefits from wild foods remains constrained due to the multiplicity of wild foods, differential market structures and informal trade (Cavendish, 2003; Egoh et al., 2012; FAO, 2010). Very little quantitative work or valuation of the wild foods for use and trade by children has been done (Cavendish, 2003), but this study has presented a probable contribution of income from wild foods to children in the four study sites and their market structures.

Children access the wild foods from complex systems such as forests, wetlands, rivers, lakes, graveyards and simple spaces such as pathways, small bushes, homestead and open fallow spaces. Of these wild food sources, forests have been widely been recognised for their contribution to the wild food basket of households (Ickowitz et al., 2013; Kamanga et al., 2009; Shackleton et al., 2010). Forest or vegetative cover are widely associated with high

availability of wild foods as there exists a relationship between complexity of a vegetative system or habitat and availability of wild foods (Jamnadass et al., 2011; Powell et al., 2011). On the other hand, spaces that are neither forests nor other wooded land such as farmlands, pathways, fallows, human settlements and along streams are also gaining recognition as sources of wild foods (Ambrose, 2003; Barany, 2003; FAO, 2010; Setalaphruk & Price, 2007). Analysis of non-forested sources or TOF also proved to be an easy access source and contribute significantly to the overall quantity of wild foods used by children. Generalisations cannot be made on the quantity or availability of wild foods as each space made differential contributions and preference of particular spaces by children was clear. The sites and their respective sources were distinct in vegetative cover and deforestation rates. Overall, wild food availability and use per species varied across the sites depending on the wild food type and existing ecological knowledge. Besides intrinsic factors to the spaces, external socio-cultural factors, such as also household economic status, gender and cultural norms, affect the availability and access of wild foods by children in these spaces.

Children's access, perceptions and use of wild foods is largely dependent on the ecological knowledge they possess. Mothers and grandparents form the main source of ecological knowledge for children but further learning is facilitated during socialisation. This is evidence of trans-generational knowledge transfer on wild foods and the role of children as custodians of ecological knowledge (McGarry, 2008). Therefore, basic knowledge on wild foods that ranges from identification of wild foods, sources and corresponding methods of collection and the value of the wild foods remained with the children (Setalaphruk & Price, 2007). Children maintained basic knowledge of most wild foods recalled but had comprehensive knowledge of foods most frequently used. The collection of wild foods had gender disparities (McGarry, 2008; Setalaphruk & Price, 2007) as access to various sources of wild foods was linked to gender norms or responsibilities between a girl and boy in the households. As a result of this and other factors, girls had extensive knowledge on wild edible vegetables compared to boys while boys had extensive ecological knowledge on bushmeat.

Despite the wide recognition of rural people's reliance on wild foods, only a few studies go further to assess the contribution of the wild foods to children's nutritional status, children's relation to their environment to access the wild foods and children's ecological knowledge (Alexander, 2010). This chapter therefore presents a detailed analysis on the access, use and consumption of wild foods by children in Zomba district, Malawi. It also further queries the hypothesis of the study on the link between vegetative cover, deforestation rates and wild foods use by children. Drawing from the results of the study and existing literature, I make recommendations on the use, availability and access of wild foods by children and highlight areas requiring further research.

4.2 Children's food and nutrition security status

Maize is the principle food grown and dominating staple in diets in Malawi (Devereux, 2006; Ellis et al., 2003; FAO, 2014) and rural people's diets in Malawi are starch dense and largely monotonous (Chilimba at al., 2012; Eckim & Qaim, 2011; FAO, 2014). Food availability is mostly seasonal as the main source of food is own production (Chikhungu & Madise, 2015) and agricultural production is mainly rain fed (Deveruex, 2006; FAO, 2014). Agricultural production occurs during the single 4-5 month (November-March) growing season that the country experiences, with only a few households using residual moisture in the valleys or wetlands (*dambos*) during the rest of the year (Ellis et al., 2003). Households therefore experience a variation of food availability between seasons across the year, creating a food secure period from August to March and a lean period of September to February (Chikhungu & Madise, 2014). Children in the four study sites have knowledge on variations of food availability in the year and identified the postharvest period as the months from December to February as peak lean periods.

Children consider themselves well fed and food secure when their diet in a day includes the staple, maize. In Malawi, households rely on maize, with the average per capita consumption of 163 kgs per year and households spending an average of 40% of their food expenditure on maize alone (FAO, 2014). With a high emphasis on maize availability to define food security, a large population (55%) do not meet their nutritional basic needs or minimum food requirements (Kamanga et al., 2009). On average, children took at least 2.5 meals a day against the widely recognised nutritious three meals made from foods from the common six food groups with nutritious snack in between meals (Ministry of Health, 2007). Human health and development requires adequate protein, energy, carbohydrates, and small quantities of essential elements such as iodine and iron and complex compounds called vitamins (Cooper et al., 2004). Children particularly have high nutritional requirements (Ministry of Health, 2007) for growth and susceptibility to infectious diseases make them vulnerable to micronutrient deficiency (Steyn et al., 2005). Just as in this case, the vulnerability is worsened by narrow diets as there exists an intuitive link between dietary diversity and increasing nutrition intake (Steyn et al., 2005).

Dietary diversity is widely recognised as a proxy for measuring an individual's food and nutritional status by determining the nutrient adequacy and quality of diets, dietary energy availability, micronutrient dietary adequacy and household food access (Arimond & Ruel, 2004; FAO, 2008; Swindale & Bilinsky, 2005). The underlying principle is that diversity in the diets will ensure and increase adequate intake of essential nutrients for good health (Steyn et al., 2005). Narrow and monotonous diets therefore lack essential nutrients and are likely to contribute to the burden of malnutrition and micronutrient deficiencies (FAO, 2008) while high dietary diversity approximates improved national status and a greater likelihood of children meeting their daily energy and nutritional requirements (Arimond & Ruel, 2004). The children’s dietary diversity scores indicated that their diets were narrow, below the FAO recommended dietary score and mainly comprised of starchy foods and greatly lacking in meat and meat products. Such results were reported for the lean periods with dietary diversity scores during the food availability period being slightly higher at 2.4. Overall, there

was no significant difference in the number of meals taken during the food secure and food insecure periods of the year, however, there was noticeable difference (-1) in the dietary diversity scores. We can therefore conclude that there is a difference in quality and the quantity of children's diets between the food secure and food insecure periods. McGarry (2008) recorded similar findings in the Eastern Cape, South Africa, where diets were poor in quality and quantity during lean periods. Interestingly, Chikhungu and Madise (2014) have indicated that in Malawi, although the food availability varies across seasons, this does not affect the food consumed by children and that perhaps other factors such as child's physical and social status are more influential in affecting a child's health status. However, this may be only true for young pre-school children as children are affected by diminishing diets and actively participate in wild food collection (Kamanga et al., 2009). Dietary diversity also increases with income and wealth of the household (Arimond & Ruel, 2004) hence children from better-off households have a relatively high dietary diversity whilst children from poor households face a higher probability of low dietary diversity. A high dietary diversity was recorded for the village with the highest tree cover, Kasonga. This is similar to findings by Ickowitz et al. (2013) where dietary quality of children was positively correlated with tree cover. A later section presents the link between vegetation cover to the availability of wild foods in an area.

Overall, affordability, availability and seasonality affects the diversity of diets (Tarasuk, 2001; Shava, 2000). Children are active participants in acquiring foods to supplement their diets during different times of the year outside food provided in their households. They supplemented the diets provided in the household to satisfy their hunger and appetite and complement poor diets in the household (McGarry, 2008). Children from both poor and well-off households in all study sites registered higher IDDS than HDDS.

4.3 Role of wild foods in children's health and nutrition

The low quality of domestic diets is a probable cause for children to source additional supplementary foods, including wild foods, outside their homes. According to dietary diversity scores and daily number of meals, children in Kasonga reported better quality diets, followed by Mpheta, Mtuluma and Makombe. The mean daily average consumption of wild foods is high for children, as such foods are often viewed as children's food by adults who mostly only consume highly valued varieties (Kehlenbeck et al., 2013).

In this study, children largely used wild foods for their nutritional characteristics to supplement their diets and were consumed as part of children's diets inside and outside their households. Elsewhere, the majority of wild foods is also consumed directly by the collectors, such as children (Sunderlin, 2008). Children consume wild foods as snacks and side dishes or as both for selected wild foods. In the households, wild vegetables, mushrooms, bushmeat, insects, small mammals, crabs and tubers were consumed as part of the diets to compliment the staples. Wild vegetables were the most consumed wild foods and frequency of consumption was similar across the sites. Wild fruits were the second most consumed wild food and were consumed outside the household as snacks mainly in Makombe and Mtuluma. According to Asfaw and Tadesse (2001), children are particularly enthusiastic about wild fruits but a large percentage (38%) of children in Mpheta reported not consuming wild fruits due to various factors. Selected birds and insects were also consumed as side dishes and/or snacks at different times of the day within and outside the households across the study sites. Such wild foods consumed during play, during chores and in the midst of other activities contribute to the nutritional sufficiency and well-being of children by providing essential micronutrients (Barany 2003; Cordeiro, 2012; McGarry, 2008). Wild foods seldom form the staple (Angelsen & Wunder, 2003) but compliment other conventional staples such as maize, overcomes seasonal shortfalls and diversify the diets.

Overall, most wild foods have higher nutritional value than conventional foods (Flyman & Afolayan, 2006; Maroyi, 2011; Ogle, 2001). Wild foods provide a diversity of healthy foods, high in micronutrients and fibre, and low in sodium, sugar and fat (Arnolds et al., 2011). Wild fruits and vegetables remain good sources of vitamin A, C, folate, and photo-chemicals with vegetables also providing minerals such as calcium and iron (Vinceti et al., 2013). Micronutrient composition of wild edible vegetables in Africa and elsewhere, indicates higher mineral and vitamin content of wild vegetables as compared to cultivated species (Flyman & Afolayan, 2006). Children in the four study sites reported consuming *Moringa oleifera*, *Galinsonga parviflora, Amaranthus* species, *Bidens pilosa* which all contain high contents of micronutrients (Uusiku et al., 2010). Wild fruits offer energy and micronutrients such as vitamins and minerals thereby addressing malnutrition and sustaining human development and growth (Kehlenbeck et al., 2013). For instance, the fruits of *Adansonia digitata* which was widely consumed in all sites and *Syzigium guineense* are significantly high in protein while *Strychnos spinosa* is a good source of fat (Barany, 2003).

Bushmeat, insects, birds and mushrooms have higher amounts of crude protein in comparison with conventional foods (McGarry & Shackleton, 2009; Vinceti et al., 2013). Wild animal foods are a good source of highly bioavailable micronutrients and in some cases, provide much of the animal source foods (Suderlin et al., 2013). Bushmeat remains an important and cheaper source of animal protein and fats (Johns & Maunda, 2006; Nasi et al., 2011). It sometimes poses as the only source of animal protein in rural communities (Nasi et al., 2011; Sunderland et al., 2013; Van Vliet et al., 2015), especially in areas where livestock cannot be reared, such as Kasonga village. Besides bushmeat; large and small mammals and ungulates, birds and insects also form an important and cheap source of protein (Nasi et al., 2011). At least 11.5% of children consumed at least one type of animal based wild food even though most of them were from Kasonga. Just as reported in this study, bushmeat and other animal based wild foods are widely considered as delicacies by communities that use them and preferred for its taste (Nasi et al., 2010; Van Vliet et al., 2015). Van Vliet et al. (2015) show that bushmeat is consumed more than meat from

livestock by rural and urban households in Democratic Republic of Congo (DRC). Wild mushrooms are also a good source of protein as compared to commercial mushrooms with a protein content of up to 81% reported in some wild species (Barros et al., 2008). In other studies, crude protein in mushroom was 77% higher than beef (Barany, 2003).

Therefore, despite the low amounts of wild foods consumed, these healthy foods provide considerable macro and micro nutrients with an enormous contribution to a child's health. For instance, Sunderland et al. (2013) notes that although wild foods make little contribution to overall energy and calorie intake, due to their low fat content, their contribution to food security through dietary diversity and micronutrient intake is extensive. Such foods therefore, can make a difference between good and bad nutrition, and food security and starvation (Angelsen & Wunder, 2003; Fisher et al., 2010). In the absence of literature on the nutritional value of every wild foods reported, the contribution of wild foods to dietary diversification in itself signifies an improvement in overall nutrition (Flyman & Afolayan, 2006).

Despite the known nutritional value of some wild plant species, other factors have been listed as affecting the nutritional content in wild plant species and include composition of soil, time of harvest, post-harvest handling conditions and the methods of preparation (Barros et al., 2008; Flyman & Afolayan, 2006). In addition, seasonal conditions and geographic areas also largely affect the nutritional value of wild foods (Uusiku et al., 2010), especially wild edible plants. There was limited knowledge among children, even those involved in processing and preparation, on the factors affecting the nutritional value of wild foods. However, children were knowledgeable on some post harvesting and processing techniques of wild foods.

Unfortunately, literature on wild foods shows that these resources remain underutilised (Bharucha & Pretty, 2010; Flyman & Afolayan, 2006). Only 23% of children complimented their diets with wild foods in a day despite the availability of an array of wild foods in the village. Some wild food species despite being reported as edible hardly made it in children's diets or were largely ignored by children in a particular village. This was mainly due to lack of knowledge, preference, the characteristics of the wild foods such as taste and aroma, socio-cultural factors such as taboos and general acceptance of the wild food by other community members. The implication of knowledge on the use of wild foods has been elaborated in later sections. Elsewhere in Malawi, certain wild foods, such as amphibians and reptiles are not widely consumed (Mikkola, 1997) while others, such as velvet monkeys and mice are only consumed by a smaller population. Children in Eastern Cape, South Africa, also found reptiles to be undesirable (McGarry, 2008). All these consequently diminish the use of wild foods by children and limit the potential that wild foods have to address food insecurity and malnutrition among children.

With no significant relationship between wild foods use by children and socioeconomic status of the household, we can conclude that all children utilise wild foods, however, the level of dependence may vary with the status of household and access to alternative foods. Of all the wild foods; vegetables were mostly consumed during the food insecure period than during food secure periods. The consumption of other wild foods such as fruits, despite their seasonal nature, was similar across the year and in all study sites.

4.4 Access of wild foods by rural children: natural, social and gender contexts

The collection of wild foods by children has been reported as usually a group activity (McGarry, 2008) and often occurs during socialisation and when conducting chores. Children frequent sources of wild foods in groups to solely collect wild foods or to collect wild foods while undertaking other activities (Alexander, 2010). In perspective, hunting of game is a sole activity undertaken by boys while hunting for birds may be done as the boys play in the

bush as evidenced in Makombe. Somewhat similar scenarios can be drawn for girls who collect fruits around the homestead and in the bush as a sole activity and collect vegetables in the wetlands or riverside after collecting firewood as noticed in Mtuluma. These naturally forming groups of children demonstrated knowledge and skill in identifying wild food species, their sources and the corresponding strategies used in acquiring these wild foods by girls and boys.

Of interest are the social cultural factors, including children's perceptions, which enable or limit children's use of wild foods. Girls in Makombe and Kasonga, despite indicating that they collect wild foods from the forests, refused to join the research team to the forests, approximately 45 minutes to one hour away for transect walks to identify and collect wild foods. Girls were usually required around the house to conduct chores and attend to the needs of their guardians more than boys. Traditionally, girls in Malawi have more household chores than boys in the same household as they also spend longer hours in resource allocation (Nankhuni & Findeis, 2003). This is a typical division of labour at household level, common in sub-Saharan Africa (Nankhuni & Findeis, 2003). Similar findings have been reported in South Africa by Alexander et al. (2015), where girls are sent to conduct chores and sent on specific tasks such as fetching things from the shops. On the other hand, boys are usually given a more general permit allowance, while girls are only usually allowed to a specific place such as friend's house (Alexander et al., 2015). Overall, girls are expected to play and stay closer to the home when not conducting household chores and require prior permission to visit places further from the household. Against this background, the participation of girls in extensive wild food collection exercises further from the home was limited.

Similarly, the collection of wild foods during agriculture and non-agriculture periods varies with more wild foods collected during non-agriculture periods. Fisher et al. (2010) and Harris and Mohammed (2003) report that during the agricultural period there is increased

demand for household labour, hence extraction of forest products is limited. During the agricultural period, children engage in agricultural work and their main source of income is piece work commonly known as *ganyu,* thereby reducing the overall time spent by the children collecting wild foods. While this study focused on the differences of wild food use during food secure and food insecure periods, possible variations may also exist between agricultural and non-agricultural periods.

Seasonality of wild foods (Sunderland et al., 2013) also affects the access and use of wild foods by children during different times of the year. Wild foods such as insects and fruits were seasonal and in abundance during specified times of the year. This nature of wild foods has been associated with the benefits of wild foods by providing households with food during times of shortages and stress. Many times, wild foods are in abundance during periods of food shortages or when alternative sources of income are unavailable (Fisher et al., 2010; Fisher & Shively, 2005). Some wild fruit species provide food during droughts and they are resilient because of their deep roots and are usually available during the pre-harvest period (Kehlenbeck et al., 2013). Harris and Mohammed (2003) also notes that most wild food plants produce leaves and flowers or produce during the onset of the rainy season or "annual hungry" period when food stocks are low and the next harvest is way off (Kalaba et al., 2010). Children also indicated that flying termites are also in abundance after the first rains during the food insecure period and caterpillars were also reported to be in abundance during the June-July season (Termote et al., 2012).

Elsewhere, women and girls have been identified as the major collectors of wild foods (McGarry, 2008; Shackleton et al., 2010), who usually conduct opportunistic collection while undertaking other activities such as fetching firewood (Maroyi, 2013). While such sentiments are true, there are various circumstances that lead to the differentiation in the collection, harvesting or processing of wild foods and generalisations cannot be made across all wild food categories, gender and age. Plant based wild foods such as wild vegetables and

insects are commonly collected and prepared by girls; often with friends or siblings, as these were collected as part of the chores assigned to the girls. On the other hand, collection of animal based wild foods such as large bushmeat and birds remained a "boy's job" with few or no girls participating. For instance, the hunting of bushmeat is a predominantly male activity (Shackleton & Gumbo, 2010). Collection strategies that require more strength or often happen far from the households were widely undertaken by boys.

Collection of wild fruits was common among both girls and boys, but some older (15-18 years old) girls did not participate in some behaviours related to the collection of the wild foods such as climbing of trees. In Zambia, women expressed dislike of the idea of climbing trees to harvest wild foods and indicated that it was doubtful such a behaviour could be acceptable among their men folk (Shackleton et al., 2010). Younger children (8-14 years old) however do not subscribe to such norms. For this group of resource users, gender disparities are not strongly evident and both girls and boys form mixed groups that collect wild foods nearer to the households. Even though elders possessed knowledge on wild foods, most wild fruit species were considered children's food (Maroyi, 2013).

4.5 Children's ecological knowledge and use of wild foods

Indigenous knowledge on wild foods has developed from the continued use of wild edible species over generations and forms part of the communities' cultural knowledge (Setelaphruk & Price, 2007). In Malawi, like many countries in sub-Saharan Africa, the rich indigenous knowledge on wild foods has not been fully documented despite several attempts (Maroyi, 2011). Methods of hunting and gathering, preparation strategies, health and medicinal benefits and associated cultural values of the species are part of the indigenous knowledge and systems (Johns & Maunda, 2006).

Children's knowledge of wild foods is not independent but part of larger community contexts (Setalaphruk & Price, 2007). The study reveals that most commonly children acquire wild foods knowledge from their mothers and their grandparents; 43% and 24%, respectively. Therefore, children may share the valuation of wild foods made in the households and by the communities. Against this background, and as shown in this study, wild foods consumed by children in one area or in one household may be disregarded or inedible by other children due to the differences in communal and household knowledge. For instance, velvet monkeys were widely consumed and considered a delicacy in Kasonga but regarded as inedible in Mtuluma or Makombe. Similar findings were reported by Ogle et al., (2003) were social and cultural factors significantly influenced the type of foods consumed where one-third of wild foods plants were not used or not familiar by other populations that occupied the same ecosystem. In addition, tribalness and stigma is largely associated with children's perception of wild foods (Garcia & Howard, 2013).

Although, the main source of knowledge of wild foods for children was mothers and grandmothers most of the knowledge exchange and learning was done through socialisation among the children. Where this parental generation is absent however, other social contacts were important. In addition, since contacts between children and parents tends to decrease with age (Setalaphruk & Price, 2007), children's peer support becomes a vital system for wild foods knowledge as children grow older. Since acquisition of wild foods is the child's living experience, equally important in the process is their cultural contexts, social, economic and bio-physical environments (Setalaphruk & Price, 2007), which affect their perception and use of the wild foods.

There is growing concern over the decline of the use of wild foods by the younger generation (Abu-Basutu, 2013). Such research shows that young people are not interested in wild foods and it is feared that this will lead to loss of knowledge through the loss of skills for identification and use of the wild food species. The changes have been attributed to

urbanisation and modernisation which has led to wild vegetables, tubers and other wild food types to be looked down upon and preference shifting towards exotic foods (Abu-Basutu, 2013; Alexander, 2010). This study shows that this loss of knowledge on wild foods was seen to be closely associated with the decline in availability of the species and socio-cultural factors. Children possessed knowledge on widely available and commonly used wild food species and emerging edible wild species, such as *Lububa (Rumex abysinicus)* in Kasonga. We however, acknowledge the possible changes in preference related with wild vegetables as they are also viewed as food for the poor.

Therefore, limited or infrequent use of some wild food species, especially by the younger generation, may lead to a complete loss of its associated knowledge in time. The reduction in use caused by changes in preference leads to erosion of the genetic resource and its accompanying local knowledge (Kehlenbeck et al., 2013). On the other hand, extinction, unavailability and disappearance of some wild food species, such as the disappearance of *Gynandroposis gynacondra* in Mpheta, is the probable cause of the gradual erosion of knowledge associated with the particular wild foods. Children from areas with a high usage and availability of wild foods like Mtuluma, Kasonga and Makombe had more knowledge on wild foods compared with children from areas with limited use and availability like Mpheta.

Wild food knowledge is generated and maintained through practical knowledge and hands on experience (Setalaphruk & Price, 2007) and children will have comprehensive knowledge on foods they gather or collect either for sale or for consumption. In the findings of this study, children have practical knowledge on wild foods they mostly collect, gather and consume within and outside their households. Of the wild foods recalled by children, wild vegetables such as *Amaranthus spinosus, Bidens pilosa, Cochorus trilocularis*, and *Cleome gynandra*, and wild fruits such as *Annona senengalensis, Vangueria infausta, Uapaca kirkiana, Flacourtia indica* and *Ziziphus mauritania* were commonly consumed. In another account by Setalaphruk (2007), children have practical knowledge on wild foods that have

desired taste, are marketable, easy to gather and in abundance. While this account is true for the latter, the decision on the gathering/collection, selection and use of wild foods within the house was made by elders while children only selectively choose wild foods outside the households. In either way, the knowledge by children on wild food largely affects their perception and use of wild foods.

4.6 Commercialisation and valuing wild foods

Though largely unnoticed in research, wild food trade is a common practice among children in rural areas. In this study, 30% of children in the four study sites participated in some trade of wild foods. Similar figures have been recorded in Eastern Cape, South Africa were up to 28% of school going children and 40% of non- school going children reported being engaged in the selling of wild foods (McGarry, 2008). Mostly, wild foods are traded raw, with no processing (Harris & Mohammed, 2003).

Children commonly traded in wild fruits such as *Uapaca kirkiana*, wild vegetables such as *Amaranthus,* tubers, mushrooms, insects and birds. There was a differentiation in the commercialisation of wild foods in the different study sites. From my analysis, alternative sources of income, availability of wild foods and types of markets led to the differentiation of wild foods trade in the various sites. As regards availability of wild foods, while plant based wild foods were traded in all study sites, birds were only traded by children in Mpheta. Besides wild foods, children in all sites acquired income from labour provided in agricultural activities and this acted as their main source of income. Agricultural activities and their corresponding incomes are however seasonal hence children engaged in this trade during the agriculture off season. Wild foods have been considered as a source of income when alternative sources are unavailable (Fisher et al., 2010; Harris & Mohammed, 2003). On the other hand, areas with a good market like Kasonga, commercialisation of wild foods is a more prevalent source of income among the children.

Children also cited poverty as the main driver for selling of wild foods. Children from poorer households (40%) were more engaged in wild food trade. For this population, income from commercialisation of wild foods was used to purchase other food either for themselves or for the household, obtain basic personal items and acquire school resources. Trade in wild foods provides income which improves the child's and in some cases household's ability to purchase or trade for food (McGarry, 2008). Besides Kasonga, children from other villages did not generate a lot of income (less than MK5,000) from the trade. Although NTFPs produce low returns, they are often used for subsistence in fulfilling income gaps (Harris & Mohammed, 2003; Angelsen & Wunder, 2003). Such evidence shows that even though wild foods are often excluded from economic analysis of natural resource systems, they have significant economic value (Wood et al., 2010).

It has often been reported that valuing ecosystem services such as wild foods is challenging since these foods are often not traded on the market and due to the absence of standard measurements for these services (Delang, 2006; Egoh et al., 2012; Uusiku, 2012). In essence, most resources are often used for direct household provisioning without products entering the markets at all (FAO, 2010) and even when the wild foods do, they are subjected to differential market conditions which may lead in many being undervalued. Therefore, wild foods which are collected in the sidelines of other activities for household use or consumed at source and do not enter the market system are not valued. We consider valuing of wild foods as broader than reporting the price tag of wild foods at the market even though market values could significantly contribute to valuation. There is certainty that economic, social and cultural values of wild foods exist, even though such literature remains scanty and location specific.

Despite studies that have valued wild foods, it is hard to compare across such studies due to differences in methodology and varying purpose of the study (Uusiku et al., 2012). While results from each study are true in themselves, making comparisons from different studies may be erroneous. As noted during this study, the market value of wild foods varies with location and largely depends on the type of market, availability and access of wild foods hence making valuation that could be comparable across areas difficult. This is also partly due to the multiplicity of foods (categories and species per category), informal trade and bartering (FAO, 2010). FAO (2014) acknowledges that global figures presented on wild foods could be a huge underestimate since information about the production and consumption of these foods at global level is far from complete.

Nevertheless, it is important that wild foods are valued to inform policy and management and conservation options. Though values may be presented in monetary terms, all benefits and co-benefits of wild foods for a particular resource user group such as children must be considered during valuation. Naidoo and Adamowicz (2005) reported that the economic benefits of biodiversity exceeds the cost of conservation hence the need to determine the benefits. The underlying rationale for valuation of ecosystem services including wild foods is that if proper valuation is done, policy makers will make better informed decisions (Ninan & Makote, 2013).

4.7 Availability of wild foods: Spaces and places preferred by children

4.7.1 Preferred sources of wild foods by children

The contribution of forests to diets as a source of wild foods is widely acknowledged (Ambrose-Oji, 2003; Ickowitz et al., 2013; Kamanga et al., 2009; Shackleton et al., 2010; Sunderlin, 2008) and hence wild foods been termed “forest foods” in some cases. People who are located in proximity to the forest depend on wild foods more for subsistence and income generation (Fisher et al., 2010; Shackleton et al., 2007) because populations close to

forests; both native forest dwellers and immigrant newcomers; have a long culturally rooted tradition of extracting resources from forests (Wunder, 2001). Forest environments have been reported to offer ample sources of animal protein and fat, complimented by plant derived carbohydrates, essential vitamins and minerals from fruits and tubers and other plant based wild foods (Johns & Maunda, 2006). The contribution of food from forests to global food supply was estimated at 0.6% of all global food production (FAO, 2014). Just as elsewhere, forests in Malawi play a role in the provision of food to help people survive famine and obtain cash earnings (Fisher et al., 2010).

Children living in proximity to forests, such as in Kasonga, Mtuluma, and Makombe recognise and obtain wild foods from the forests for home use and for sale even though the composition of forests in the three sites in Zomba district vary. Overall, Malawi's forests are dominated by closed, deciduous woodlands also common in east and central Africa and widely known as the miombo (Fisher et al., 2010). In the three study sites, children extracted large and small bushmeat, fruits, mushrooms, tubers and birds from the forests. Mostly the forest was the only source of bushmeat. In Kasonga, forests were regarded as the most preferred source of wild foods by children. A preferred source of wild foods by children was determined by ease of access to the source, and availability or abundance and use of wild foods. Since wild foods were gathered or hunted during socialisation among children, forests that are close to the child and accommodate children's play were among the most preferred sources. While this was true for the boys, girls accessed wild foods from forests when conducting other household chores such as firewood collection. Overall, villages with forests in its proximity reported a higher diversity of wild foods.

However, the contribution of wild foods to overall food produced in essence is much higher when data is localised and other sources of the "forest foods" are considered (FAO, 2014), hence the wide recognition of other sources of wild foods. Areas without forest cover are also important and sometimes preferred sources of wild foods. Children access wild foods

from other sources including wetlands, farms, river, bush or thickets, fallows, homesteads, rivers and lakes and even pathways. Gardens, uncultivated patches and fallows, land close to the house, and land close to rivers, and farmlands have all been recognised as important sources of wild foods (Ambrose-Oji, 2003). In Tanzania, where although households could not benefit from wild foods from forests, use of wild foods was still high as they were sourced from farms (Powell et al., 2011). In Makombe, Mtuluma and Mpheta, preferred sources of wild foods included bushes close to the fields, bush, and homesteads, respectively.

The study revealed that various sources of wild foods support different wild food types and categories. Forests and undisturbed tree spaces were sources of multiple wild food categories and are habitats for bushmeat. Increased complexity of a landscape such as forests is associated with increased habitat availability (Carey & Harrington, 2001; Sunderland et al., 2013). Due to their nature, large and medium sized ungulates and mammals are commonly found in forested areas and undisturbed woodlands (Nasi et al., 2011). Children also harvested insects such as caterpillars from the forests. In Malawi and elsewhere, forests are also recognised as a source of wild fruits and other plant based wild foods. In Malawi, up to 75 species of wild fruits are accessed from forests (Akinnifesi et al., 2004). In Kasonga, wild fruits were mainly collected from forests and wild tubers were only found in the mountain forests. These plant based wild foods contribute to the composition of the forests such as *Uapaca kirkiana* trees which are part of the forest landscape.

On the other hand, children accessed other wild foods such as vegetables from disturbed land and spaces such as fields, riverside, homestead, fallows, bush and wetland. Barany (2003), Rawat et al. (2003), Ogle et al. (2013), Scoones et al. (1992), and Timberlake et al. (2010) have all recognised non-forested spaces such as fields, fallows, ditches and graveyards as significant sources of wild foods. Girls access wild vegetables from the homestead, fields, riverside and wetland. Mushrooms were harvested from the homestead;

including inside the house, the bush and forested areas. Boys hunted for birds in trees in homestead spaces, wetland and bush while insects were caught in the field and homestead. Fruits were also commonly found around the homestead as some were domesticated, in the fields and pathways. *Adansonia digitata* and *Ziziphus mauritania* trees were scattered in the farm lands in Makombe. Wild foods are being domesticated (Bharucha & Pretty, 2010; Kehlenbeck et al., 2013) and found in homesteads or left in farming fields during the clearing of land for agriculture (Scoones et al., 1992; Schreckenberg, 1999).

In all study sites, graveyards comprised of undisturbed vegetation systems which were sources of wild fruits and a habitat of small mammals and insects. However, not all graveyards were accessed by children. In Makombe, children hunted for small mammals, collected wild fruits and insects from the graveyards.

4.7.2 Vegetation cover, deforestation and wild foods availability

Malawi's vegetation cover is mainly savanna and with closed deciduous woodland known as miombo (Fisher & Shively, 2005). Land use change has been widely reported in the region and up to 95% of the woodland has been heavily modified (Fisher & Shively, 2005; Harris & Mohammed, 2003). A number of processes have led to the gradual modification of landscapes including initial natural forests (Sene, 2000) and human landscapes including agricultural land. Mainly the modification in Malawi includes deforestation for conversion of land use functions and modifications of local agricultural systems. Malawi has one of the highest deforestation rates in sub-Saharan Africa, approximately 2.4% to 2.6% per annum (Fisher et al., 2010; Fisher & Shively, 2005; Ministry of Environment and Natural Resources, 2010). In Malawi, between 1990 and 2010, forest cover in the country declined from 41 % to 34% (Ministry of Environment and Natural resources, 2010).

Deforestation in the country has been attributed to the increase in demand for arable land, hence conversion of forests to agricultural land (Egoh et al., 2012; Harris & Mohammed, 2003; Kamanga et al., 2009; Ministry of Environment and Natural Resources, 2010, 2010), agricultural practices such as tobacco curing (Munthali & Mughogho, 1992) and extensive extraction of wood for energy, (Fisher et al., 2010; Kamanga et al., 2009; Ministry of Environment and Natural resources, 2010). The situation has been worsened by population growth; which exerts pressure on these natural resources; poverty and failure to enforce measures to curb deforestation (Harris & Mohammed, 2003; Ministry of Environment and Natural Resources, 2010). The pressure on natural resources continues to rise due to communities' dependence on natural resources for their livelihoods (Fisher & Shively, 2005; Kamanga et al., 2009). Eckholm et al. (1984) indicated that: "The poor are not ignorant of the process of deforestation, nor blind to its effects, they cut because they must" (Wunder, 2001).

The four villages in this study had varying vegetation cover and deforestation rates. Our interest links with the findings of various studies on the relationship between deforestation, vegetation cover and wild foods availability (Ickowitz et al., 2013; Powell et al., 2013), and the effects on children. Areas with high vegetation cover, in this case Kasonga and Mtuluma, are often linked with higher wild foods availability (Ickowitz et al., 2013). Powell et al. (2011), found that households with greater tree cover in close proximity are likely to consume more wild foods regardless of their few visits to forests.

Conversely, deforestation has been closely associated with the loss of biodiversity and wild foods (Pouliot et al., 2012). Unless careful selection is done, deforestation may result in the decline of fruit tree species. This is especially true where deforestation is done to convert land to non-agricultural land use functions. On the other hand, human activity in forest spaces may increase the diversity and density of plant based foods but not medium to large animal based foods (Nasi et al., 2011). For instance, deforestation for agricultural expansion,

may increase the habitat for vegetables, rodents and insects, while reducing the availability of bushmeat such as ungulates and other large and small mammals. Nasi et al. (2011) report that irrespective of region, large bodied species of bushmeat have low intrinsic rate of production compared to small bodied species. Species with high intrinsic rates of production, such as rodents and small to medium undulates maintain high populations in simpler systems despite high rates of harvesting due to their intrinsic growth rates (Nasi et al., 2011).

Besides vegetation cover, other land use systems such as farms, wetlands, rivers, fallows and lakes are important sources are of wild foods. Children from deforested areas, such as Mpheta, access selected wild foods in wetlands, rivers, lake, farm or field, bush and homesteads. There is however scanty vegetation cover in these sources; in the form of reeds and grass or crops. As the other sites face deforestation and loss of vegetative cover, the Lake Chilwa wetland system faces threats through “reclamation” for agriculture or as an irrigation reservoir, siltation through changes in the catchment land use and use of pesticides (Sarch & Allison, 2000). Soil loss in the catchments of Lake Chilwa (Likangala and Domasi rivers) ranged from 4t/ha/yr around the plain area and up to 55t/ha/yr on the Zomba mountain foot slopes (Ministry of Natural Resources, and Environment, 2010) which have probable negative implications on the availability of wild foods in the area.

While children did not appreciate the link between land use change, changes in vegetation cover and access to wild foods, the results are likely to affect the composition of wild food habitats, availability and access. The four villages faced significant transformations over the past two decades. Major modifications include the diminishing amount of vegetation cover (trees and shrubs) and increase in area under cultivation and built up areas.

4.8 Recommendations and areas for further research

Children of various social economic strata use wild foods either to supplement their diets or for sale. Wild foods are widely recognised as food for children, with some wild foods insignificant to the rest of the population but children only. In the first instance, the recognition of children as an important resource user group is vital when providing recommendations that are context specific. We support Nasi et al. (2011) who affirm the importance of understanding how significant the resource is to children in order to determine how they would be affected by changes in its availability. In this study, children were considered a heterogeneous group that exhibit a range of varying interactions with wild foods and their sources, therefore the recommendations also take into account physical, social economic, cultural and political conditions specific to the children and the sites.

The four villages in this study had varying vegetation, social and economic characteristics. Children from all study sites consumed at least one type of wild food to supplement their monotonous and starch dense diets. However, of the 119 wild foods recalled by children, only a few were commonly consumed, providing evidence of underutilisation of wild foods. A number of drivers were identified and included; limited knowledge on the wild foods, unavailability of the wild foods and cultural factors. Knowledge of wild foods by children is obtained from mothers and grandparents but reinforced through socialisation and continued practical and hands on experience. Underutilisation and disregard of wild food species may lead to the gradual loss of knowledge of the wild foods and further reduction in the use of wild foods or inclusion in children's diets (Kehlenbeck et al., 2013). Knowledge on the chemical, nutritional and toxicological properties of wild foods is important in advocating for their promotion as an alternative dietary source (Flyman & Afolayan, 2006; Johns & Maunda, 2006). Though limited to the older generation, there is rich traditional knowledge on wild foods (Johns & Maunda, 2006; Ruffo et al., 2002) with the potential to promote the general acceptance and continued use of the wild foods by communities and children (Flyman & Afolayan, 2006). However, documentation of such knowledge is greatly

lacking (Batal et al., 2007; Ruffo et al., 2002). We therefore recommend the documentation of wild foods' knowledge including; the identification of the wild foods, collection and preparation strategies, and nutritional information. Possible interventions include; the integration of such information in conventional knowledge systems such as schools for access by children and the development of a wild foods database for dissemination into communities and relevant institutions.

Current research and information gathered remains focused on common species of wild foods such as *Moringa oleifera* and *Uapaca kirkiana,* and other wild foods that have been domesticated fully or partially (Flyman & Afolayan, 2006). Additional research is therefore required for species that are preferred by children, have the potential for domestication and are widely available and used. For instance, the wild vegetables *Bidens pilosa* and *Cochorus trilocularis* and wild fruit *Vangueria infausta* were commonly used by children in all study sites and yet research on these species is limited. The promotion and continued use of wild foods by rural communities in turn reinforces and preserves indigenous knowledge systems related to the wild foods. In addition, the co-benefits of gathering adequate information and knowledge on the wild food leads to a review in their valuation by communities, and children later on. Highly valued wild foods are likely to do well on the market and be acceptable by communities and children alike.

The contribution of wild foods to children's diets and food security has been established. Even though children seemingly consume low quantities of wild foods, they are significant in the provision of micro-nutrients and bringing diversity to children's monotonous diets. As a result of the monotonous and starch dense diets, children in Malawi are particularly

vulnerable to many forms of malnutrition (Ecker & Qaim, 2010). Across the globe, three main strategies are being adopted to address undernutrition and malnutrition and these include supplementation[1], fortification[2] and dietary modification (Flyman & Afolayan, 2006). Dietary modification, and as recommended in this paper, focuses on increasing the amount of micronutrients in the diet by making a large share of these micronutrients available (Flyman & Afolayan, 2006). The use of food based strategies to address micronutrient deficiencies has become popular (Ogle, 2000). Food based strategies, such as promotion of wild foods, are often cheap, readily available and could be easily adopted by the local communities. Many researchers agree on the high nutritional content of wild foods, and yet they have been largely unrecognised and unacknowledged by agricultural policy makers and nutritionists (Batal et al., 2007; Bharucha & Pretty, 2010). Nutrition and health policies should therefore consider the integration and inclusion of wild foods in human diets for its protracted use to address malnutrition among children.

Evidence on the contribution of wild foods to children's wellbeing and livelihoods forms a basis for investment in the management and conservation of the wild food sources and forest biodiversity (Johns & Maunda, 2006). Particularly, increased attention to the demands of various resource user groups will promote legitimate strategies for management and conservation (Kamanga et al., 2009). We are uncertain if the current regime of natural resource management practices are sufficient to secure access of wild foods by various resource user groups and simultaneously conserve the wild resources for future generations. Children access wild foods from forests and other tree based systems, farms and fields, wetland, bush, homestead, pathways, fallows, lake and rivers. Each

[1] The direct supply of nutrients

[2] The use of accessible foods to supply one or more micronutrients

landscape makes a considerable contribution to the availability and access of wild foods (Sunderland et al., 2013).

Children living in proximity to forests obtain an array of wild foods from forests and in most villages forests are the only source of large bushmeat. We recommend policies that promote the sustainable management of forested areas (Fisher et al., 2010). Since wild foods from forested areas are an open access resource, they are susceptible to overexploitation (Sunderland, et al., 2013) and are under threat from deforestation and land use change. Management and control of forests may be exercised at local level (Sene, 2000). Besides Kasonga, forests in Makombe were unprotected while those in Mtuluma were co-managed by government authorities and the dependent communities. For instance, by-laws set by community authorities have proved effective in natural resource management and conservation, however children are hardly considered in their formulation. To this end, based on the findings of the study, we would also caution against simplification of management systems of forested areas to wood products (Carey & Harrington, 2001). The realisation of the dependence of children on forest resources, will ensure that proposed forest management practices take into account children's forest needs and priorities.

Programmes on sustainable management of forests and other sources of wild foods such as cultural places, wetlands and bushes are more effective if they include incentives for management rather than restricting access (Alexander et al., 2015). Even though this study did not explore the detailed structure of management structures and its implementation, it was clear that forests under co-management such as in Mtuluma were better managed than forests whose management procedures was based on restricting access such as in Kasonga. Indeed, Alexander et al. (2015) argue that such restrictions lead to a decline in knowledge to use species. Elsewhere in southern Malawi, under co-management the extraction of forest foods is not prohibited (Fisher et al., 2010). Restrictions to wild food sources have generally

been unsuccessful in Malawi and it would lead to diminishing welfare of dependent individuals (Fisher et al., 2010), especially children. However, since studies on access to forests by dependent communities are done on all NTFPS, more research is needed to have an analysis of effects of forest management systems on each NTFP and associated user group.

Besides forests, the study revealed other sources of wild foods preferred by children. Children gathered wild vegetables, wild fruits and edible insects from farms, fields and gardens. For farming or agricultural systems, two interventions have been particularly recommended. Firstly, promotion of agroforestry will enhance the provision of wild foods by fulfilling the multiple functions provided by the declining forests and agricultural systems (Kehlenbeck et al., 2013). The study recognised tree cover as one of the important factors in the availability of wild foods (Powell et al., 2013) and therefore recommends the inclusion of suitable tree species in the agricultural systems. Such systems will support wild foods that are dependent on tree cover such as some insects and wild fruits. Secondly, we recommend the intensification and promotion of multi-cropping systems to reduce expansion or conversion of agricultural land at the expense of other natural based systems (Bharucha & Pretty, 2010; Sunderland et al., 2013) and create complex systems to support wild foods. Overall, higher "hidden harvest" is anticipated in these systems while homogenisation of agricultural landscapes limits the availability and use of wild foods (Bharucha & Pretty, 2010). Small mammals such as mice, insects and wild vegetables, particularly thrive in farm systems that are not monocultures. We therefore concur with Carrey and Harrington (2000) who support the vision of the agro-ecological approach that integrates biodiversity and food production for sustainable management of resources and food production.

The extraction of wild foods has been largely done by communities living in proximity to the forest, as households living far from forests would require more time to travel (Powell, et al., 2013). This notion is also particularly true for children who may be limited to visit forests

further from their communities due to lack of time which is taken up by chores. Maintaining forest cover around the communities is therefore necessary to promote access and maintain forest sourced foods in the diets of the children (Powell et al., 2013). Besides the conservation of wild foods habitats or sources, we recommend domestication of wild foods. In areas like Mpheta with limited access to forests and surrounded by wetlands, wild foods may be domesticated within the homestead or in fields thereby increasing their availability and access by children (Bharucha & Pretty, 2010; Ruffo et al., 2002). Currently partial domestication of wild foods especially plant based foods is being done (Maroyi, 2013). Efforts by extension workers, community authorities and schools can be made to promote the domestication of additional species that are used by children and intensify domestication of wild foods that are also partially domesticated.

4.8.1 Children in research

Of particular interest in this study was the focus on children as the key population and subject of the research. Elsewhere, despite their recognition as an important user group of wild foods, related products and sources, their inclusion in contemporary research is limited. Perhaps of great concern is validating responses and outcomes from such interactions, however with good research methodologies, triangulation and assimilation into their environments, children hold key information and knowledge on issues affecting them. Children's interactions with sources of wild foods and their dependence on wild foods can be best presented by the children themselves. McGarry (2008) encourages researchers to allow children to guide and lead research and its practices.

Besides their inclusion in research, it is imperative that policy makers and authorities at all levels utilise such research when developing programmes and policies with implications for children's needs and priorities. Children are therefore not a passive population in society, but have the potential to contribute to improving their livelihoods and overall development.

Neither are children a homogenous group that will adopt and adapt into generic interventions.

4.9 Conclusion

With a high dependence on maize, the staple food, and other starch dense foods, the status of food and nutrition security of children in Zomba district is below the recommended levels. The current use of wild foods by children poses as a potential to improve the wellbeing of the children. Plant and animal based wild foods contain higher amounts of micronutrients to supplement rural children's poor diets. In addition, the sale of wild foods by children provides income for children to access food and basic amenities thereby improving their livelihood.

Children have knowledge on the wild foods they access and use from various sources. Tree systems such as forests are widely recognised sources of wild foods and yet children also commonly access wild foods from non-forested systems such as fallows, bush, wetland, lakes, rivers and homesteads. We support conclusions by Carey and Harrington (2000) on the importance of habitat complexity and limited disturbance for maintaining diverse and resilient medium and large bushmeat communities. The study also suggests that the availability of some categories of wild foods are not dependent on tree cover.

Through the analysis on the use and dependence of wild foods by children, the study recommended the effective management of information and knowledge related to wild foods, sustainable natural resource management, interventions on the promotion of the utilisation and use of wild foods, and proposed areas of further research that promotes children's participation.

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Appendix A: Questionnaire on measuring children's dietary diversity scores

Dietary Diversity Scores Questionnaire

HDDS Checklist

Questions will be asked to individual who is responsible for food preparation in the household or an adult who was present during food preparation.

Foods to be included:

- *Those that were prepared by members of the household and consumed within the household.*
- *Foods prepared within the household but consumed by household members outside the household (e.g. in the field, or meeting).*

Interviewer (Determine whether the past 24hrs were normal for household or unusual. Unusual days include when there were festivities or a funeral). If it was an unusual day, a different day should be selected.

QUESTIONS AND FILTERS CODING CATEGORIES

Household Number:

Number of household members:

Head of household: Female [ ] Male [ ] Child [ ]

1. Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night at home. Start with the first food or drink of the morning.

(Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients.

When the respondent has finished, probe for meals and snacks not mentioned.

Breakfast	Snack	Lunch	Snack	Dinner	Snack

2. Now I would like to confirm with you the types of foods that you or anyone else in your household ate yesterday during the day and at night.

(*Read the list of foods mentioned. Place a one in the box if anyone in the household ate a food against any category, place a zero in the box if no one in the household ate the food*.)

A) Any CEREALS [Nsima/kondoole, bread, rice, pasta, noodles, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat, ... |___|

B) Any WHITE ROOTS AND TUBERS potatoes, yams, manioc, cassava or any other foods made from roots or tubers? ..... |___|

C) Any DARK GREEN LEAFY vegetables? ..... |___|

Any additional vegetables; tomatoes, onions and eggplant: .....|___|

D) Any fruits? ..... |___|

E) Any ORGAN MEAT/ FLESH MEAT beef, pork, lamb, goat, rabbit wild game, chicken, duck, or other birds, liver, kidney, heart, or other organ meats? .....|___|

F) Any eggs? ..... |___|

G) Any fresh or dried fish or shellfish? ..... |___|

H) Any LEGUMES NUTS AND SEEDS foods made from beans, peas, lentils, or nuts? ..... |___|

I) Any cheese, yogurt, milk or other milk products? ..... |___|

J) Any foods made with oil, fat, or butter? ..... |___|

K) Any sugar or honey? ..... |___|

L) Any other foods, such as condiments, coffee, tea? L ..... |___|

IDDS Checklist

1. Did you eat anything (meal or snack) OUTSIDE the home yesterday?

I.

II.

III.

IV.

V.

(Results will be added to the scores in the food categories above)

2. Did you eat any **wild foods**, inside or outside the home in the past 24hrs?? *(Please state when you had them e.g as breakfast, lunch, dinner or as a snack)*

YES *NO*

a. *Wild vegetables and tubers?*

I.

II.

III.

IV.

b. *Bushmeat?*

I.

II.

III.

IV

c. *Small mammals and rodents?*

I.

II.

III.

IV.

d. *Insects and birds*

I.

II.

III.

e. Fruits

I.

II.

III.

IV.

Appendix B: FGD discussions guide

FOCUS GROUP DISCUSSION GUIDELINES

QUESTION 1: Food security and insecurity

1) Describe periods of food security and periods of food insecurity
2) What are the coping strategies during food insecurity?

QUESTION 2: Wild foods access and Use

1) What are the main wild foods found in the area?
   i. Vegetables and tubers
   ii. Small mammals and rodents
   iii. Insects, Birds And fish
   iv. Fruits

2) What are the main places that people visit to access the wild foods
   (*Children should sketch a map of the village indicating the main features of the village and in the area and highlight the sources of wild foods*. *Children should state how far it is to get to these sources. Distance can be calculated in terms of time taken to reach the source i.e. 30min walk*)

3) Children should draw a table and fill in for each wild food category; Wild vegetables, wild fruits, Bushmeat, birds and insects and prompt on other wild foods such as mushrooms, tubers and honey. (Template provided below).

DZINA LA CHOKUDYA (WILD FOOD)	KOMWE ZIMAPEZEKERA (COMMON SOURCES)	NJIRA ZOPEZERA (METHOD OF COLLECTION/HUNTING/)	NYENGO YOMWE ZIMAPEZEKERA (AVAILABILITY-SEASON)

QUESTION 3: Perceptions

1. What are the main reasons why you consume or do not consume wild foods?
   a) Wild vegetables?
   b) Wild fruits?
   c) Bushmeat?
   d) Small mammals and rodents?
   e) Birds and insects
2) Who commonly uses wild foods?

QUESTION 4: Access to wild foods.

1) What are the laws, rules or regulations that affect access to wild foods? Or are there any barriers to accessing wild foods in the area?
   i. Informal
   ii. Formal
2) When are these operational? Are there changes during the year depending on seasonality or cultural practices?

Appendix C: Questionnaire on children's socio economic status and knowledge on wild foods

SOCIO-ECONOMIC STATUS AND WILD FOOD SURVEY

PERSONAL INFORMATION	
FIRST NAME	
SURNAME	
GENDER: Female	Male
AGE	
SCHOOL	
CLASS	
VILLAGE	

B: HOUSEHOLD INFORMATION	
1. Who is the head of your household? (Tick where appropriate)	Father Mother Other male relative Other Female relative Brother Sister Other, Specify ……..
2. How many siblings do you have?	
3. Is one/both of your parents employed? (*State the type of employment and estimate of monthly earnings)*	

HOUSEHOLD RESOURCES	
4. Do you have cattle, goats, cows, or sheep at your home?	
5. Do you have chickens, ducks or pigeons at your household?	
6. (a) Do you have a farm/ garden at your home? (*Indicate the size of the house*)	
(b) If yes, what crops do you grow?	1. 2. 3. 4. 5.
(c) Does the produce last till the next growing season? (*please state when food stocks last)*	

C: MY DIET	
1. How many meals do you take in a day?	
2. What did you have yesterday for:	
Breakfast?	1. 2. 3. 4.
Lunch?	1. 2. 3. 4.
Supper?	1. 2. 3. 4.
Snacks between meals?	

D. WILD FOODS

List the wild foods found in your village:

FRUITS	***USES***	***COMMON SOURCES***	***METHOD OF COLLECTION***	***AVAILABILITY (TIME OF THE YEAR)***

With whom do you collect wild fruits with?

Friends:

Parents: Mother Father

Other relatives:

VEGETABLES (Including leafy vegetables, tubers and mushrooms)	***COMMON SOURCES***	***METHOD OF COLLECTION***	***TIMING OF THE YEAR WHEN THEYRE FOUND***

With whom do you collect wild vegetables with?

Friends:

Parents: *Mother* *Father*

Other relatives:

Bushmeat (Including game, rodents, birds and insects)	**COMMON SOURCES**	**METHOD OF COLLECTION**	**TIMING OF THE YEAR WHEN THEYRE FOUND**

With whom do you hunt or fetch bushmeat with?

Friends:

Parents: *Mother* *Father*

Other relatives:

E: WILD FOOD CONSUMPTION

Do you take any wild foods?

Yes No

If yes, how often do you take wild foods? (Tick where appropriate)

Wild vegetables

Daily?

Several times a week?

Once a week?

Several times a month?

Once a month?

Fruits

Daily?

Several times a week?

Once a week?

Several times a month?

Once a month?

Bush meat

Daily?

Several times a week?

Once a week?

Several times a month?

Once a month?

Insects and birds

Daily?

Several times a week?

Once a week?

Several times a month?

Once a month?

Why do you take the wild foods?

Where did you learn about the wild foods? (Tick where appropriate)

Grand parents

Parents: Mother Father

Other relatives:

Other community members:

Friends:

School:

Other (please state): ……

F: COMMERCIALISATION OF WILD FOODS

Do you sell wild foods?

Yes No

Where do you sell wild foods?

Why do you sell wild foods?