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**Forest Resources for Rural Household Food and Nutrition Security:
The Case of Eastern Province of Zambia**

by

Rhoda Mofya-Mukuka and Asunta Simoloka

**Working Paper 102
December 2015**

Indaba Agricultural Policy Research Institute (IAPRI)

Lusaka, Zambia

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The views expressed or remaining errors and omissions are solely the responsibility of the authors.

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EXECUTIVE SUMMARY

Zambia is among the countries with the highest levels of under-nutrition in the world (see IFPRI 2014), and these levels have remained high—around 40%—even when the country has achieved significant growth in agricultural production. About 60% of Zambia’s population lives in the rural areas where poverty levels are estimated to be as high as 75%. This aspect alone makes most rural households highly dependent on agriculture, the natural forests, and woodlands for their livelihoods including food provision and income generation.

Focusing on Eastern Province that has one of the highest child stunting levels in the country, this study explores the contribution of forest products to rural households and child nutrition. Specifically, the study reviews the national and regional forest conservation policies for sustainable use of food products; assesses the availability, accessibility, and utilization of food and non-food forest products in the province; and examines the nutritional and medicinal properties of forest foods available in the province based on scientific evidence and as known by the local communities.

The study focuses on five districts in Eastern Province namely Nyimba, Petauke, Katete, Chipata, and Lundazi. These districts form the Zone of Influence of the Feed the Future initiative of the United States Government. This initiative seeks to address global food insecurity by focusing on growth of the agricultural sector and improvement in nutritional status in developing countries. Therefore, various agricultural and forest interventions have been implemented and reliable nutrition-related data is available. For this study, two areas in each district were studied, one in a densely forested zone and another in an open forest zone. Focus group discussions with women and men from the local communities were conducted to collect information about diversity, availability, seasonality, and use of the various forest products in the areas. The discussions also included forest management strategies and their implementation to assess sustainable use of forest products. In addition, information from observations that were made during visits to the villages studied was also useful for analyzing the impact of forest resources on rural household nutrition.

Zambia has various policies aimed at guiding the utilization of the forests. For example, the Revised National Forest Policy of 2014 strongly emphasizes the participation of local communities, traditional institutions, the private sector, and other stakeholders at all stages of decision-making regarding forest management, utilization, and monitoring. However, forest cover and biodiversity have continued to be lost at alarming rates rendering existing forest management strategies ineffective.

Findings show that forests are an important source of food and income that contribute to livelihoods and dietary diversity for rural households. Forest foods are consumed on a day to day basis either in the form of snacks or as part of the meal, by all age groups and both the male and the female household members.

However, malnutrition in the province has remained high and this study identified several factors limiting availability, accessibility, and utilization of the forest resources. First, forests in the areas do not provide all the food types needed for proper nutrition. Only three out of the six food groups are provided by the forest in sufficient quantities to contribute significantly to child nutrition. These are non-starchy fruits, non-starchy vegetables, and bush meat. Starchy foods such as grains and tubers, dairy, legumes, and nuts are not provided by the forest areas studied. Eggs of wild birds are available but not in sufficient amounts.

Vitamin A, protein, iron, zinc, and folate (vitamin B9) are some of the major nutrients found in the three food groups that are critical for reducing child stunting.

Second, forests resources need to be supplemented by the other foods that are purchased or cultivated, but these are largely missing or inadequate due to, among other factors, the high poverty rates in the districts. Third, forest cover is on the decline. This is higher in the more populated open forest areas but is also on the rise in densely forested areas due to high immigration of people especially from the open forest areas. Reduction in forest cover has led to a rapid decrease in the amount of forest resources available to rural households exacerbating food and nutrition insecurity. Fourth, some food preparation methods deplete the nutrients, thereby affecting food utilization. Lastly, some forest resources such as bamboo that have potential to increase income are not being utilized. In addition, the forest resources are used for various medicinal purposes by the communities. What is interesting is that some of the medicinal uses mentioned by correspondents are actually backed by scientific evidence (i.e., in phytochemistry and pharmacology).

Undoubtedly, forests have played a pivotal role in offsetting starvation among rural households and have served as safety nets. Nonetheless, forests still fall short of supplying adequate food and other basic requirements of rural households in general and child nutrition in particular. In order to improve rural household food and nutritional status as well as sustainable use of forest resources, poverty reduction strategies must be a matter of priority. Increased household income will enable them to access diverse food. Effective implementation of the forest management policy remains critical and requires multi-stakeholder participation including local communities. Other useful interventions that support and promote sustainable forest resource use include agroforestry, sustainable agriculture, afforestation, and reforestation. In addition, it is important to step-up raising awareness on the importance of forest foods in household food security and child nutrition and the need for sustainable use of forest resources. Lastly, there is need for the deployment of underutilized species such as bamboo for their direct benefits such as cash income.

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ACRONYMS

CIFOR	Center for International Forestry Research
CSO	Central Statistics Office
DHS	Demographic Health Survey
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Group Discussions
FTF	Feed the Future
GDP	Gross Domestic Product
GRZ	Government of the Republic of Zambia
IAPRI	Indaba Agricultural Policy Research Institute
NFNC	National Food and Nutrition Commission
NFP	National Forest Policy
NTFP	Non-Timber Forest Products
SADC	Southern African Development Community
SD	Standard Deviation
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VAD	Vitamin A Deficiency
WB	World Bank
WHO	World Health Organization

1. INTRODUCTION

Wild foods form a significant portion of the diets for most rural households especially when agricultural products are in low supply (Grivetti and Ogle 2000). This kind of dietary makeup means that wild foods actually infuse a lot of nutritional diversity that is essential for combating malnutrition in people's diets. In addition, cash income generated from selling forest foods and other non-edible forest products commodities such as timber and firewood form a huge part of livelihoods (Mulenga, Nkonde, and Ngoma 2015). Some health properties of wild foods are known by rural communities' population, but for the most part food is eaten because of availability, however a large gap still exists between the perceived benefits of wild foods and what has been documented.

Despite the diverse and vast forest resource base, Zambia's malnutrition levels, in the form of child stunting, are among the highest in the world (CSO 2007 2015). Rural stunting rates are around 40%, a rate noticeably higher than the 36% experienced in the urban setting. The Eastern Province has one of the highest rates of stunting in the country, averaging about 45% of which 20% is severe stunting. According to the WHO (2009a), children with severe stunting (weight-for-height below -3 SD) have a high risk of death exceeding nine-fold that of children with a weight-for-height above -1 SD.¹ In addition, stunting negatively affects cognitive development (WHO 2009a), implying that, going by the current stunting rates in Zambia, almost half of the future population will be less capable of economically empowering themselves and contributing to national development.

Previous studies (Ickowits et al. 2014; Campbell-Asselbergs 1986; Dourojeanni 1978; FAO 1982; FAO 1989) have found strong positive links between localized tree cover, food security, and child nutritional outcomes. Ickowits et al. (2014) concluded that deforestation induced by cultivation of crops presents a huge threat to food security. This finding echoes the conclusion of other studies that also maintain that forests play a key role in maintaining food security (Campbell-Asselbergs 1986; Dourojeanni 1978; FAO 1982; FAO 1989). Other studies conclude that forests do act as a direct source of food and resources (Sunderlin et al. 2005; Jumbe, Bwalya, and Husselman 2008).

According to Ickowits et al. (2014), data from twenty one African countries showed children living in communities surrounded by forests to have more nutritious diets than children from households in areas with fewer local forest resources. One key dietary trait that stood out was that the amount of fruits and vegetables eaten increased along with the level of tree cover. The study observes that the amount of fruits and vegetables people consumed drastically declined with tree cover exceeding 45%. Additionally, forests have been widely appreciated for nature conservation purposes and their positive impacts on the environment (World Bank 2015). However, a lot remains to be studied regarding how food and other resources obtained from the forest influence food security and nutrition. To the best of our knowledge, no study in Zambia has examined how forests are linked to household food and nutrition security.

¹Weight for height index is an indicator of stunting measured as a standard deviation (SD) of the child weight-height from the medium weight-height of a reference population of children of the same age. The height-for-age index explains the linear growth of a child. A Z-score of below minus two standard deviations (<-2 SD) from the median of the reference population indicates stunted. Children falling in this category are considered short for their height, an indication of chronically malnourished and recurrent illness. Below minus three (<-3 SD) from the median of the reference population is an indication of severely stunted WHO (2009a).

Against this backdrop, this study aims to examine the contribution of wild foods and other forest resources to rural household's food security in general and to child nutrition in particular. With a specific focus on Eastern Province, we hypothesize that forest foods, if prepared in ways that preserves nutrients, eaten in sufficient quantities, and collected in a sustainable manner, can significantly contribute to reducing malnutrition. Given that more than 60% of Zambia's population lives in the rural areas (CSO 2012), examining the role of the forest in improving nutrition at the national level becomes necessary as rural populations are highly dependent on forest resources (Grivetti and Ogle 2000).

This paper examines how forest resources can be used as an effective tool for reducing child malnutrition, with the goal to inform policy makers, local communities, and other relevant stakeholders on the nutritional benefits of forest foods and their sustainable use. Specifically, the paper has the following three objectives:

1. Assess the availability, accessibility, and utilization of forest foods and non-food products in Eastern Province;
2. Explore nutritional properties and medicinal uses of forest foods available to the local communities; and
3. Examine the contribution of forest foods to child nutrition.

2. FOREST RESOURCES, RURAL LIVELIHOOD AND NUTRITION CONTRIBUTION

This section is divided into three parts. The first part reviews literature on the livelihood benefits of forest resources. In order to understand sustainable use of forests, the second part of the section examines the management of forest resources from the national and regional perspectives. The third part looks at literature on food categories and nutritional content and narrows down to the nutritional attributes that are critical for reducing child stunting and are found in forest foods of the study area. These are vitamin A, folate, and protein.

2.1. Benefits of Forest Resources

Apart from their contribution to environmental sustainability, forests have been studied widely for their connection to a range of human welfare aspects such as poverty, economic development, and energy provision. Studies show rural communities, especially the extremely poor, to be highly dependent on forests for income generation, employment, and food, as well as multiple purposes that include meeting daily energy needs, roofing material, medicinal requirements, and fodder for livestock (Kaimowitz 2003; Oksanen and Mersmann 2003; Grivetti and Ogle 2000; World Bank 2015). Grivetti and Ogle (2000) examine how certain societies with impoverished communities in semi-arid regions of the world survive in repeated drought areas if it were not for wild products.

Research has found forests to be a dependable option for fighting poverty especially in rural areas. A study done by Sunderlin et al. (2005) identifies two ways through which forests function as an anti-poverty instrument. Firstly, forests resources are used as a safety net and gap filler that allows people to meet basic needs when regular sources of income fall short of doing so. Forest resources are used for supplementing income and providing food and other day-to-day needs, enabling communities to mitigate poverty. Secondly, since forest resources can be used for deriving income, forests count as a major contributor to the means necessary for lifting people out of poverty.

On income generation, Jumbe, Bwalya, and Husselman (2008) found some forest resources to be highly lucrative due to high demand by urban populations; leading examples of such commodities are caterpillars, honey, and charcoal. Their study further shows that even on an individual basis, these commodities tend to fetch far greater revenue than is obtained from agricultural products. This study also found that the trend is that rural residents typically use income derived from selling forest resources as start-up capital for various other income generating activities like agriculture, further scaling up on the streams of income. With a broader income base, many rural households find it more prudent to migrate to other income generating activities and reduce dependence on forest products, while other households continue to obtain income from forest resources on a much larger scale.

Use of forest resources for livestock feed and the tendency by some households to invest income derived from trading forest products in agriculture inputs show that trade in forest products contributes towards household agriculture production, another source of food and sustainable livelihoods for the households.

According to the World Bank (2015) forests play an important role in rural development through food security, energy provision, job creation, and general enhancement of the rural economy. On a national scale, the World Bank shows forests to make an important

contribution towards a country's economy, for example, approximately 6% of Cameroon's GDP comes from forests.

Forests provide wood-based fuel, a primary source of energy in Africa. It is reported that as much as 65% of total primary energy comes from solid biomass such as firewood and charcoal (World Bank 2015). In addition to providing goods, the World Bank lists a number of important benefits that forests also provide including soil fertility improvement, watershed protection, habitat provision to multiple species, and reducing the risk of natural disasters including floods and landslides.

According to the World Bank (2015) forests in most developing countries are under threat due to agricultural expansion, timber extraction, fuel wood collection, and other human activities. Resuscitating degraded forest area can have multiple positive outcomes including improving rural livelihoods, enhanced food security, greater climate resilience, and Green House Gas mitigation (ibid).

2.2. Forest Resources and Management Policies

Zambia has a large forest cover estimated at 60% of the total land (Kalinda et al. 2013; Vinya et al. 2011), placing it among the highly forested countries in Africa. However, the rate that forest cover is being lost has increasingly become worrisome such that if it remains uncontrolled it may lead to complete loss of biodiversity (Mbindo 2003; Mulenga, Nkonde, and Ngoma 2015). Between 1990 and 2000 about 851,000 hectares of forest was lost (Mbindo 2003). Both Mbindo (2003) and Mulenga, Nkonde, and Ngoma (2015) find wood fuel extraction to be the main contributing factor to the high levels of deforestation.

Forest resources, in this paper refer to materials provided by a forest for direct consumption or commercial use such as tree products and forage. In addition, a forestry policy involves strategic guidance for managing and using forests and trees (FAO 2014). There are several policies providing guidelines on the extraction of forest products. One such policy is the 2010 National Forest Policy (NFP) that stresses the importance of non-timber forestry products (NTFP) for poverty reduction. To implement this policy, the Forestry Department through Parliament introduced Statutory Instrument Number 52 of 2013, the emphasis of which was on controlling the loss of biodiversity, restricted access to some NTFPs by local communities. However, the statutory instrument appeared to be contradictory to the 2010 NFP that looked at NTFP as a tool to improving the livelihoods of the local communities. As follow up to that, the Revised National Forest Policy of 2014 strongly emphasized inclusion of local communities, traditional institutions, private sector, and other stakeholders in the management and utilization of forest resources at all stages of decision making, implementation, and monitoring (Mulenga, Nkonde, and Ngoma 2015). However, there remains little understanding of the contribution of NTFPs to most rural household welfare (Mulenga et al. 2014).

Considering that Zambia's heavy reliance on wood fuel is an underlying reason for deforestation, the National Energy Policy is another important policy that guides how to reduce the country's dependence on wood fuel by promoting cleaner and cheaper alternative energy sources.

At the regional level, Southern African Development Community (SADC) considers forests to play an essential role in poverty alleviation and economic development. The 2002 SADC

Protocol on Forestry seeks to promote the development, conservation, sustainable management, and utilization of all types of forest and trees. It is hoped that the outcome of such policies will achieve environmental protection while also safeguarding the interests of the present and future generations. SADC actively encourages member states to enable local people to effectively participate in forest management activities as well as respect traditional knowledge related to forests (SADC 2002).

On a global level, the Food and Agriculture Organization of The United Nations (FAO) has forestry policies that involve providing necessary support to forestry policies at country and regional level. Support is provided in various forms including provision of guiding documents, training material, and working papers. The nature of support given is directed towards creating a good understanding of forest policy by different stakeholders and this encourages people who have a direct relationship with forests to actively participate in a way that contributes to successful management of forests (FAO 2014).

In addition, the World Bank (2015), whose policies on forestry do not differ significantly from SADC and FAO, has a robust forestry policy committed to assisting countries in their efforts to keep forests in a vibrant state since forests have been identified as a viable tool for poverty reduction, economic vitality, and environmental sustainability. Furthermore, the World Bank forestry policy advocates ownership of forests by local communities to ensure that forest products are traded in a way that guarantees communities who are found at the bottom of the supply chain of forest commodities receive their fair share. The World Bank also attaches great value towards the involvement of the local communities during the forest policy formulation process.

Overall, forest policies of different countries, organizations, and regional groupings recognize forests to play an integral role for sustainably fighting poverty and maintaining food security. The extremely poor have also been identified as direct beneficiaries of vibrant forests; this same population group also gets directly affected by degradation of forests, hence, the emphasis on participation and ownership of the forests by the local communities. Forests are also widely viewed to highly correlate with employment rate and economic growth. All these factors need careful consideration during formulation and implementation of forest policies.

2.3. Critical Nutrients for Reducing Malnutrition in Zambia

From the findings of the study (which are presented in the results section below) the forest foods found in the Eastern Province contain several macro- and micronutrients critical for reducing malnutrition. This section reviews literature on three nutrients that have been identified as key for reducing malnutrition in Zambia (see e.g., NFNC 2014). These are vitamin A, folate, zinc, iron, and protein. The section discusses the importance of some of these nutrients based on literature.

2.3.1. Vitamin A

Zambia is among the countries in Africa with severe vitamin A deficiency. Estimates show more than half (53%) of Zambian children between 0.5 and 4 years of age lack vitamin A (WHO 2009b). Despite the government implementing a biannual vitamin A capsule distribution program as well as mandatory sugar fortification, vitamin A deficiency has remained a major health problem in Zambia. With high poverty levels in the rural areas,

many people in rural Zambia cannot afford conventional vitamin A-rich foods such as orange fruits, dark leafy vegetables, meat, or even the fortified sugar.

Several stakeholders in the country have realized the importance of promoting vitamin A foods. The USAID's FTF Harvest Plus project is one of the projects that has rigorously campaigned to increase the consumption of vitamin A-rich foods and has been promoting orange maize production among the smallholder farmers in the area.

Vitamin A, found in abundance among forest foods in Eastern Province, is one of the key nutrients required for maternal health and child growth. Vitamin A is important for a healthy pregnancy, and during the breastfeeding stage, there is need for lactating mothers to take adequate levels of this nutrient. Breast milk enriched with vitamin A provides supreme nourishment to breast feeding infants. Furthermore, breast feeding mothers are faced with a higher need for vitamin A; forest foods, which are obtained free, are instrumental for providing this critical nutritional requirement. From birth onward, a diet rich in vitamin A continues to play a key role in ensuring proper child development. One area of health where vitamin A does well is eye health.

UNICEF (2011) describes vitamin A as a fat soluble vitamin. Therefore, fat is necessary for the proper absorption of vitamin A or any other fat soluble nutrient. What is striking about the manner in which vitamin A foods are prepared and eaten in the areas surveyed for this study is that vitamin A foods are typically eaten along with other fat-based foods or cooked together with an ingredient containing fat. One popular cooking method calls for cooking green vegetables with groundnuts. This food combination really boosts the amount of vitamin A that is available for use by the body.

Vitamin A Deficiency: At global level, up to 500,000 children are blinded annually due to a vitamin A deficiency that also increases the risk of disease, blindness, and death, especially in Sub-Saharan Africa. According to UNICEF, vitamin A deficiency weakens the immune system in children, greatly impairing their ability to fight diseases such as diarrhea, measles, and acute respiratory infections (UNICEF 1990). UNICEF further emphasizes that addressing vitamin A Deficiency (VAD) by increasing intake of vitamin A has been shown to decrease childhood mortality from these diseases by about 23%. Taking adequate vitamin A also considerably cuts hospital stays and reduces the number of days children miss school. World Health Organization findings also indicate that vitamin A deficiency is the leading cause of preventable blindness in children (WHO 2009b).

2.3.2. Folate

Folate, also known as vitamin B9, is another vital nutrient that fulfills essential roles at every stage of human growth. Starting from pregnancy, folate is instrumental for proper fetal development especially regarding the brain and spinal cord. Folate continues to play a central role in child development also relating to brain and spinal cord health. Another feature that makes folate a valuable nutrient is that it has been identified to have a leading role in cognitive development and health that happen to be an important area of child development (McGarel et al. 2015).

Folate Deficiency: According to the Alaofe et al. (2014), folate deficiency is widespread in Zambia and a major cause of high stunting rates. In the Northern Province alone, about 84%

of the children are deficient in folate (NFNC 2014). Folate is so important that lack of it during pregnancy leads to birth defects of the brain and spinal cord. Premature births and low birth weight are additional consequences of folate deficiency. Furthermore, inadequate folate in children's diets is tied to retarded growth and poor cognitive health leading to severe stunting (Black 2008). Cognitive abilities are the skills required for processing information, learning, problem solving, memory, and other important mental functions and they affect how well children perform in school. Insufficient folate also leads to a condition known as folate-deficiency anemia; this is where there is a decrease in red blood cells due to lack of folate. Having enough blood in the body is of prime importance especially relating to pregnant mothers and children.

2.3.3. Iron

Iron is a vitally important nutrient in the human body. It is responsible for the formation of hemoglobin that aids the transfer of oxygen from the lungs to all body tissues. Additional hemoglobin is essential given that human beings lose blood through internal and external injuries and many other ways (see Organic Facts website).² Women especially, lose considerable amounts of blood every month during their menstruation years.

Iron is also important for cognitive development especially in children as it is responsible for increased transportation of blood to the brain. According to Zambia Demographic Health Survey (ZDHS) 2013-14 iron requirements are most critical between the ages of 6 and 23 months, when growth is extremely rapid (CSO 2015). However, the 2013-14 ZDHS data shows that about half of the children in Zambia do not consume foods rich in iron leading to high cases of anemia and stunting. The data showed that while iron requirement is critical between the ages of 6 and 23 months, consumption of iron-rich foods is only highest among children aged 18-23 months.

Iron Deficiency: Iron deficiency is among the most common micronutrient deficiencies in Zambia. According to MOST (2004), anemia—a result of iron deficiency—is a major cause of low birth weight, lowered resistance to infection, and stunting in children leading to poor cognitive development and decreased work capacity in the long term. Women are also more likely to suffer from anemia than men considering that they lose a substantial amount of blood during menstruation.

2.3.4. Zinc

Zinc is one element that is found in every body cell and is important for cell division that is necessary for growth. According to Poliquin Group (2012), zinc is necessary for optimal physical performance, energy levels, and body composition. As such, intake of sufficient amounts of zinc-rich foods is important for child growth and prevention of stunting (Poliquin Group 2012). Zinc deficiency can be indicated by stunted growth, diarrhea, chronic fatigue, poor immunity, and inability to focus.

² <https://www.organicfacts.net/health-benefits/minerals/health-benefits-of-iron.html>

2.3.5. Protein

Protein is an important nutrient for body building and growth. In children's diets, protein is a vital nutrient the body needs in order to develop and stay in good health. One more function of dietary protein is that it helps the body in the production of other proteins that are not obtained from diet. With children being highly susceptible to disease, protein with its immense ability to strengthen the immune system proves to be an indispensable nutrient for children. A strong immune system helps children fight off infections of different kinds. Protein is also a helpful nutrient against malnutrition.

Protein Deficiency: Scarcity of protein in children's diets leads to what is known as protein-energy malnutrition. According to the National Food and Nutrition Commission (NFNC) of Zambia, the country's high malnutrition rates are a result of protein-energy deficiency (NFNC 2014). WHO/UNICEF (2009) further explain that depending on the severity and length of protein deprivation in a child's diet, a child suffers from stunting, underweight, or wasting.

Two types of protein energy malnutrition are acute malnutrition (wasting) and chronic malnutrition (stunting). The third type of protein energy malnutrition is a combination of acute and chronic malnutrition. Acute malnutrition is caused by a short-term shortage of nutrients such as protein and it can lead to rapid weight loss or failure to gain weight normally. The symptoms of acute malnutrition are wasting or thinness. Chronic malnutrition is a result of insufficient protein and other vital nutrients over a prolonged period of time. Children that are subjected to this kind of improper nutrition have stunted growth, making them shorter than they should be as their bodies fail to grow taller. The co-occurrence of acute and chronic malnutrition happens when there is lack of proper nutrition in the short term and long term. Children suffering from this type of malnutrition tend to be severely underweight. For further information, see http://conflict.lshtm.ac.uk/page_115.htm.

3. DATA AND METHODS

Qualitative methods of analysis were applied for this study to examine the nutritional profiles, availability, accessibility, and utilization of forest products. The study focus was the USAID Zone of Influence comprising five districts in Eastern Province namely Chipata, Lundazi, Katete, Petauke, and Nyimba. The districts were selected because of the availability of reliable anthropometric data, which was collected under the USAID’s Feed the Future (FTF) initiative in Zambia. The data was necessary to understand the current nutrition status of especially women and children. Under the FTF, various agricultural and forest interventions have been implemented although malnutrition levels are still high.

For this study, two areas in each district were studied, one in a densely forested zone and another in an open forest zone. Focus group discussions (FGDs) with women and men from the local communities were conducted to collect information about diversity, availability, seasonality, and use of the various forest products in the areas. The focus groups combined women and men in order to have diverse views based on their gender roles and experiences in accessing and utilization of forest products. The discussions also included forest management strategies and their implementation to assess sustainable use of forest products. Apart from the FGDs, observations of forest cover as well as of the daily traditional diets were made during visits. This additional information was useful in assessing the role of forest resources on rural household nutrition. Table 1 shows the districts, the villages, the number of participants that took part in the FGD, and the dates when the FGD were conducted.

3.1. Conceptual Framework

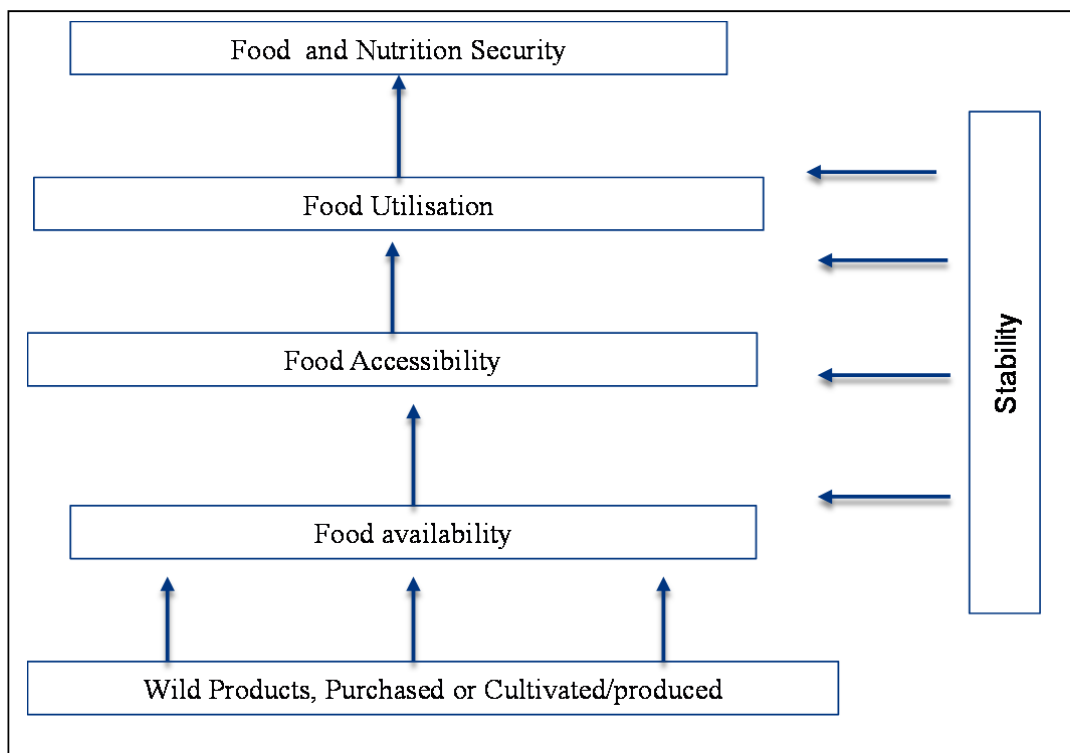
The conceptual framework for examining food security and child nutrition is adapted from FAO (2000) and UNICEF (1990). Figure 1 shows the relationship of the elements of the food and nutrition security framework based on the internationally accepted FAO (2000) framework. According to the framework, food is available if adequately at the disposal of the majority of the population in a given set up. Accessibility is achieved if a majority of the households have the necessary resources (e.g., income or human resources) to obtain required foods for a nutritious diet. On the other hand, food utilization is the ability of the body to metabolize and absorb the food. Therefore, preparation methods are important in determining food utilization. Stability has to do with political and environmental factors that must prevail in order for the four elements to be achieved.

Table 1. Districts, Village, and Number of Participates in FGD

District	Area	# Female Participants	# Male Participants
Nyimba	Chief Mwape’s area	6	10
Nyimba	Mpondani (Chief Ndake)	7	20
Petauke	Milimbo	8	25
Petauke	Chipeuke (Nyampande)	6	19
Katete	Kalonga (M’bangombe)	9	21
Katete	Kagoro	14	5
Chipata	Mbenjele	12	11
Chipata	Tazwela	34	29
Lundazi	Mtambalika	13	21
Lundazi	Kanchikota	8	14
Total		117	175

Source: Authors.

Figure 1. Food and Nutrition Security Framework



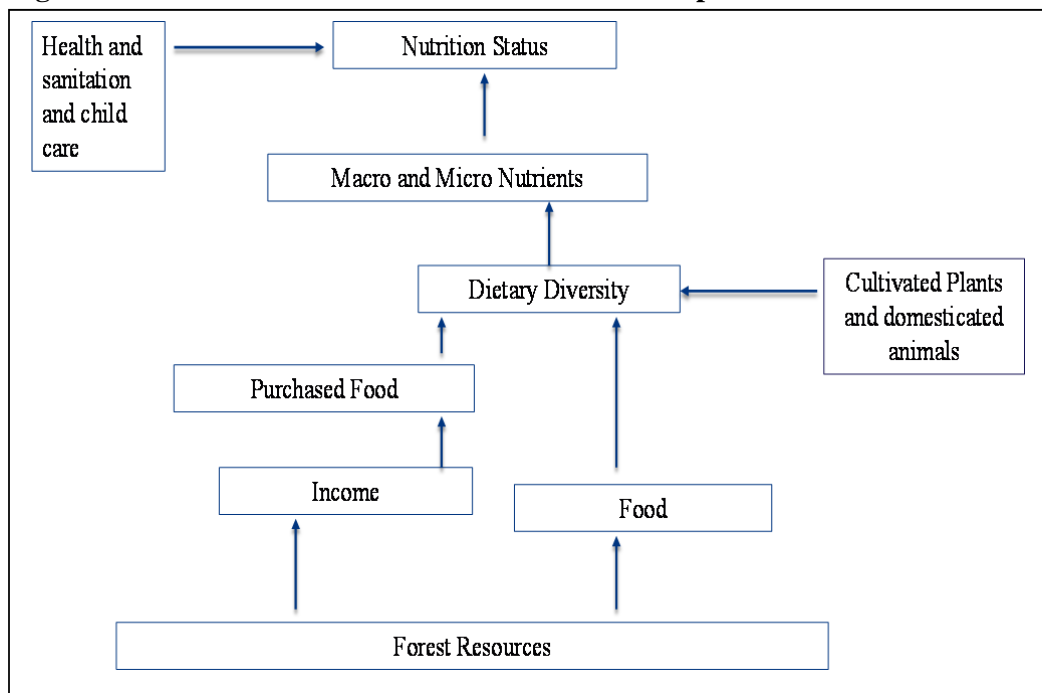
Source: Adapted from FAO 2000.

On the other hand child nutrition is assumed to be a function of a set of socio-economic factors including household food security, household income, crop and livestock production, parental education, and other demographic characteristics.

Maxwell et al. (2000) further link nutrition to livelihood where resources and assets tend to play a key role in nutrition. The forest, being an important source of livelihood for most rural communities, can therefore be linked directly to nutrition outcomes. According to Maxwell et al. (2000) the livelihood approach examines how households and individual decision makers within households organize and manage their labor-based, income-generating activities and other forms of income and assets. It further analyses the various means of coping with shocks such as formal safety nets or other household-based mechanisms. Most importantly, the livelihood-nutrition approach examines how to ensure food and nutrition security and their access to other basic necessities. Figure 2 shows the livelihood and food security linkages to nutrition.

Forest resources, especially in densely forested areas, tend to be available and accessible at no cost when they are in season. The question is whether they contribute effectively to improve nutrition. Most studies have alluded to the fact that, forest products are readily available and accessible to the local people although in most cases, availability varies with season (see for example Grivetti and Ogle 2000; Sunderlin et al. 2005). Given that forest foods form a large part of the rural diet, food security and nutrition analysis in the rural context cannot be complete without the analysis of the role of forest foods.

Figure 2. Forest Products and Nutrition Status Conceptual Framework



Source: Adapted from FAO 2000 and UNICEF 1990.

3.2. Study Limitation

This study has two notable limitations. First, data on forest cover were not available to enable us to analyze quantitatively the relationship between forest cover and nutrition status of individuals in the households. Second, establishing the botanical and common names of some of the fruits and vegetables that are known only by local names has been a challenge. Knowing botanical names would have allowed us to probe the unique nutritional contents of those foods. Otherwise, analysis is limited to nutritional properties of broad food classifications without additional information regarding distinctive characteristics of single forest foods. We know, for instance, that all green, yellow, or orange plant foods provide vitamin A, an essential vitamin for both children and adults. However, within this generalized color category, individual foods have other unique nutrients such as certain antioxidants that promote good nutrition in various ways. Knowing the exclusive nutritional traits of single foods may also help corroborate some of the medicinal roles certain foods are used for by the local communities in the areas we visited.

4. RESULTS AND DISCUSSION

This section presents the findings from FGDs. The first part of the section gives an overview of the relationship between forest resources, household food security, and nutrition. In the second part, we discuss the differences in the availability of forest foods between densely forested areas and open forest areas. The later part explains the food groups available in the forests and their major nutritional content and medicinal uses.

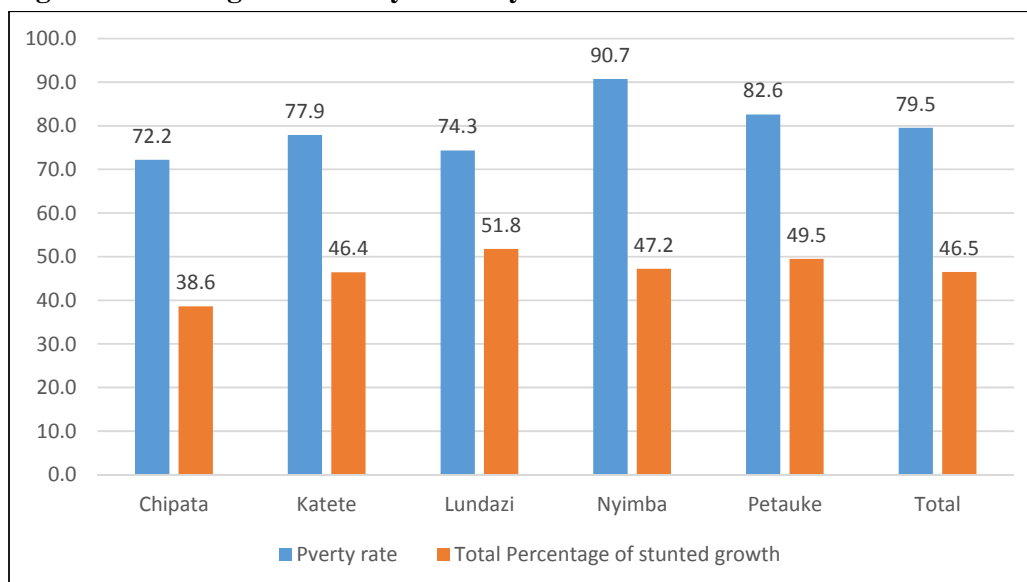
4.1. Relationship between Forest Resources, Food Security and Nutrition

This study found forest foods to be important especially to rural communities. This is because such foods filled the void especially among households with low incomes, low agricultural production, and other factors that lead to inadequate food supply. This is particularly important because Eastern Province is characterized by high poverty in all the districts with rates ranging from 64% to nearly 80% (Figure 3). Similarly, malnutrition rates are above the national average of 40% in all the districts apart from Chipata. This implies limited access to adequate amounts of food and forests providing foods that can be accessed even by the poorest households. .

The following were listed as the main benefits of forest resources during the FGD:

- Enhancing household income. Both edible and non-edible forest products are an important source of income for the households. Fruits, vegetables, grass, timber, charcoal, and honey were the main products collected for sale.
- Forest products supplement foods produced or purchased at household level as these are usually not adequate in all the five districts.
- Forest foods play a vital role in maintaining balance and variety in people's diets by providing foods of different food groups and supplying diverse foods within a food group. As there is at least one forest food in each meal in addition to the wild fruits consumed as snacks. Forest foods are not only obtained free, but they are also highly nutritious and contain some of the best nutrients required by humans.

Figure 3. Stunting and Poverty Rates by District in Eastern Province



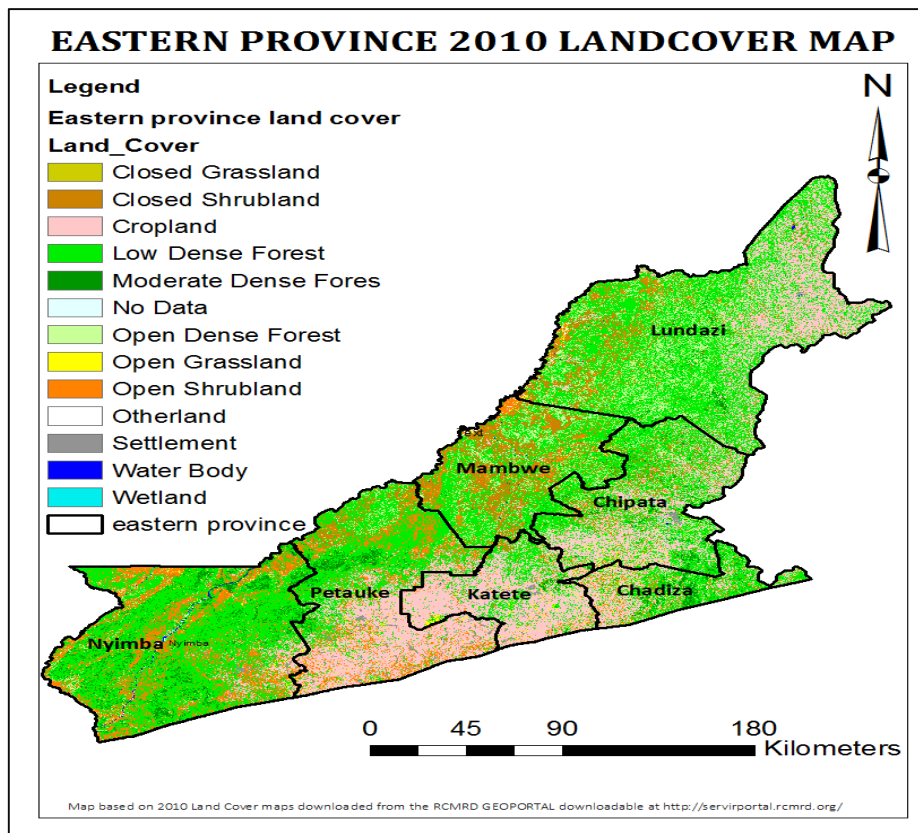
Source: IAPRI/CSO/MAL (2012); USAID FTF Zambia (2012).

One important aspect of forest foods is that they are consumed by all age groups including the infants as soon as they are able to eat. Children consume more wild fruits, which they also carry to school as snacks. In all the areas visited, there were no cultural norms that prevented any age group from consuming any product. Nevertheless, some foods mostly consumed by the elderly were increasingly being shunned by the younger generation. The tortoise is one such food.

4.2. Differences between Densely Forested Areas and Open Forest Areas

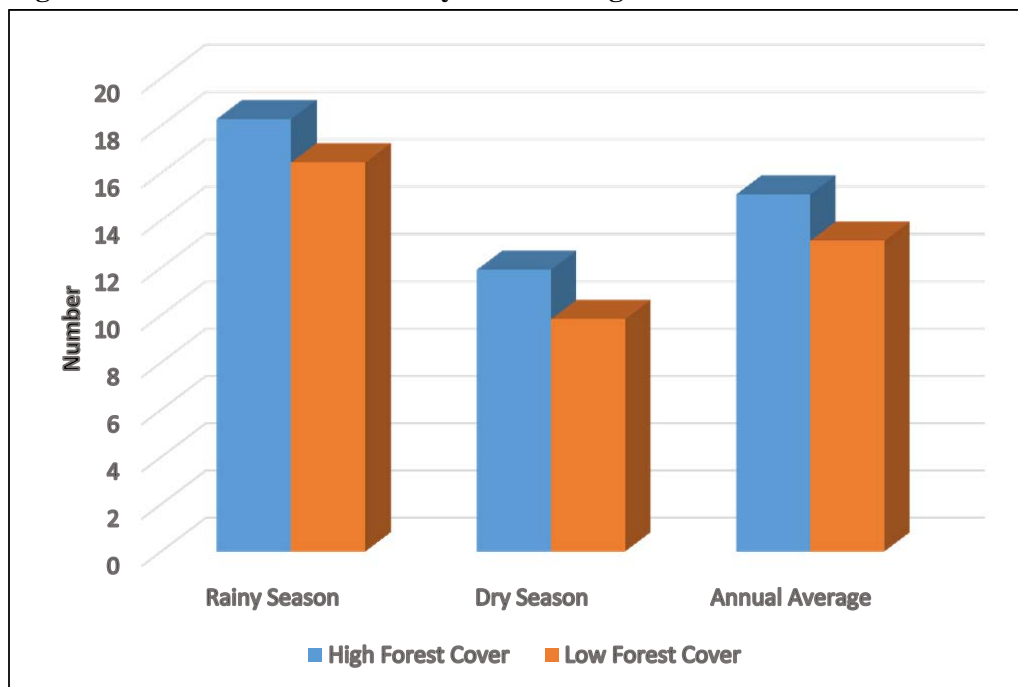
Figure 4 shows the differences in tree cover in Eastern Province. A comparative assessment was conducted on the supply of forest foods between areas that are densely forested and open forests (including areas marked as cropland on the map). There were notable differences in forest food supply between the two areas. Firstly, areas with denser forest cover have greater supply of forest foods although expanding population is having a negative impact. It was observed that growing demand driven by an ever-growing population in dense forests means declining forest foods per capita. Figure 5 shows the number of foods and the seasonal availability in both areas. Dense forest areas were found to offer slightly more numbers and variety of forest foods than the open forest. Additionally, areas of denser tree cover have a higher influx of settlers than areas with open forests. According to the FGDs denser forests still had more forest resources that attract immigration, as compared to open forest areas that have more residents emigrating than immigrating. In addition, the soils in areas of denser tree cover were perceived more fertile as most of it was newly cleared lands.

Figure 4. Eastern Province Map Showing Tree Cover



Source: CIFOR 2010 using data from the Regional Center For Mapping Resource for Development.

Figure 5. Forest Foods Availability between High and Low Forest Cover Areas



Source: Authors.

During the study, it was observed that Kanchikota village, in the open woodland zone of Lundazi district, had sparsely distributed trees. The residents of Kanchikota indicated that many people were leaving the area to go to other places. Severe reduction in tree cover and lack of space to expand agricultural activities had contributed to forcing people out of the area. In Mtambalika village, which lies in a high tree density zone in the same district, there is a continuous influx of people from different areas and as a result, the area under tree cover is decreasing due to land clearing for agricultural activities.

The increasing rate of population growth coupled with dwindling forest cover means that there is overall decline in the amount of forest resources available to meet the demand of an ever-growing population. This scarcity of forest resources even in densely forested areas means that even though the amount of forest resources available to each person is greater in densely forested areas than is the case where there is open forest, this difference in the availability of forest resources is getting smaller.

The movement of people out of open woodlands and influx of new residents in locations of densely forested areas is likely to affect variations of malnutrition rates between heavily treed and lightly treed locations considering that rural households depend highly on forest resources for a large portion of their diets.

4.3. Food Groups and Nutrients Available in the Study Area

Data collected shows that forest foods are concentrated in certain food groups while lacking in other food groups. From the discussions, it was established that all the wild products that are available in sufficient amounts fall under only three of the six food groups.

Table 2. Food Groups and Availability in the Forests

Food groups found in the forests in sufficient amounts	Food insufficient or not found in the forest
Non starchy vegetables	Starchy foods e.g., grains, pumpkins, potatoes, and cassava
Non starchy fruits	Legumes, nuts, and seeds
Meat/Insects	Eggs and Dairy

Source: Authors.

The food groups that forest foods supply at adequate levels are:

- Non starchy fruits for example Baobab Fruits, Masuku, Mangos, and Tamarind;
- Non starchy vegetables for example, Amaranth leaves and Black Jack leaves; and
- Meat/insects such as rodents and caterpillars.

Food groups found to be scarce among forest foods were starchy foods such as grains; legumes, nuts, and seeds; dairy; and eggs. Respondents did mention eating eggs from different wild birds but these eggs were usually in very low supply and in amounts too small to meet people's nutritional requirements. Table 2 shows the food groups that are available in the forest in sufficient quantities and those that are unavailable but are obtained through purchasing or producing them by the household.

4.4. Forest Foods' Nutrients

Non-starchy fruits and vegetables, bush-meat, and insects found in the areas surveyed are rich in several nutrients that contribute to a significant share of critical nourishment that helps address malnutrition. Fruits and vegetables provide fiber, vitamins, antioxidants, minerals, and various micronutrients, while bush meats and insects supply mainly protein and fats. Typically, forest foods are combined with other agricultural foods, thus this mixture of different foods creates diets that are nutritionally balanced and varied. Table 3 shows the nutrients that are in the food groups found in the forests of the study area.

4.4.1. Vitamin A, Folate, Iron, Zinc, and Protein

This section profiles the three nutrients that are found in forest foods and have significant impact in reducing child stunting in Zambia. These nutrients are vitamin A, vitamin B9 (folate), iron, zinc, and protein according to the NFNC 2014; UNICEF 1990; WHO 2009b.

Table 3. Key Nutrients Found in the Forest Foods

Food group	Nutrients
Non-starchy fruits and vegetables	Vitamins, Fiber, Antioxidants, Minerals, Protein, Phytonutrients, Fats, Several other micronutrients
Meat/Insects	Protein, Fats, Minerals, Vitamin B12

Source: Simoloka 2008.

Vitamin A: A number of foods providing sufficient amounts of vitamin A are widely available in the forest areas visited. The availability of these foods varies with the density of the forest. In highly forested areas, the foods are available in wider varieties and larger quantities than in low forest density areas. Green, yellow, and orange fruits and vegetables all contain beta carotene that is converted by the body into vitamin A. Sources of vitamin A found in the forest areas of the villages visited include guavas, masuku (*uapacakirkiana*), mangoes, and amaranth leaves (*bondwe*).

Folate: Considering the various forest foods that were listed during focus group discussions, it is obvious that forest foods provide a reliable source of folate and even if most forest foods are seasonal, there are various wild fruits and vegetables in each season that supply it. Folate is widely present in fruits and vegetables found in forests in the five districts. A wild vegetable known as amaranth, and locally referred to as *bondwe*, is known for its high folate content. This precious vegetable grows abundantly in the forest and like all other wild food products, the local communities collect it at no cost. Other sources are black jack, guava, and mango.

Iron: Several forest foods consumed by the households in the areas studied contain iron. These foods include fruits such as guavas and mangos, a wide variety of vegetables such as amaranth leaves, jute leaves and the small flowered kenaf. The only limitation is that these foods are seasonal and preservation is limited.

Zinc: Amaranth leaves, mushrooms, and several wild small animals and insects appear to be the main source of zinc. However, similar to iron, not all zinc-rich forest foods are available throughout the year. As shown in Table 4, it is mostly the small animals that are available throughout the year and from the FGDs, these have been declining in most areas.

Protein: According to data collected during FGDs, bush meats appeared to be the predominant source of protein among forest foods. Flying termites (*inswa*), mopani worms (*vinkubala*), rodents, different wild birds, and wild pigs are some of the wild animals included in the diets. Among all these, wild rodents and caterpillars were favorites, probably due to their abundance. Considering that meat is an expensive commodity far beyond the means of rural households, these bush meats provide the households with affordable sources of protein. Households also get protein from eating eggs from small wild birds and guinea fowl but the level of availability of these is rather low. In addition to these protein sources, a number of fruits and vegetables from the forest supply protein, including amaranth leaves and mushrooms.

4.4.2. Wild Honey

Honey is a top income generating commodity and it allows rural households to obtain important food groups that are lacking among forest foods such as grain foods (and other starchy foods) and legumes. Households are able to use income derived from selling honey to purchase foods belonging to other food groups. This helps them achieve nutritionally complete diets that are necessary for fighting malnutrition. The economic value of honey is yet another way forests offer a solution to malnutrition.

Table 4. Forest Foods Available in Sufficient Amounts and their Nutritional Content

Common/Botanical Name	Local Name	Nutrient	Period Available
Fruits			
Guava (<i>Psidium guajava</i>)	Ma Guava	Folate, Vitamin A, Iron	February to May
Mango (<i>Mangifera Anacardiaceae</i>)	Manga	Vitamin A, Folate, Iron	Rainy Season
Wild loquant (Uapaca Kirkiana)	Masuku	Vitamin A, Iron	Rainy Season
Vegetables			
Black jack (<i>Bidens pilosa</i>)	Kanunka	Folate, Vitamin A	All year round
False Sesame (<i>Ceratotheca sesamoides</i>)	Katate	Folate, Vitamin A, Iron	All year round
Amaranth leaves (<i>Amarathus</i>)	Bondwe	Folate, Vitamin A, Protein, Zinc, Iron	Rainy Season
Small-flowered kenaf (<i>Hibiscus meeusei</i>)	Lumanda	Folate, Vitamin A, Iron	All year round
Jute leaves (<i>Corchorus olitorius</i>).	Tindingoma	Folate, Iron	Rainy Season
Horned Melon (<i>Cucubitus</i>)	Suntha	Vitamin A, Iron	
Mushroom	Bowa	Protein, Iron, Zinc	Rainy Season
Roots			
Cat whisker's (<i>Cleaome gynandra</i>)	Munkoyo	Folate, Iron	All year round
Wild Animal and Insects			
Guinea fowl eggs	Mazila	Protein, Iron, Zinc	All year round
Wild rodents	Mbeba	Protein, Iron, Zinc	All year round
Rabbit	Kalulu	Protein, Iron, Zinc	All year round
Mopani worms (caterpillars)	Vinkubala	Protein, Iron, Zinc	All year round
Flying termites	Inswa and Fulufute	Protein, Iron, Zinc	Rainy Season
Grass hoppers	Tete	Protein, Iron, Zinc	All year round
Guinea fowl	Nkhanga	Protein, Iron, Zinc	All year round
Other wild birds	Tunyioni	Protein, Iron, Zinc	All year round
Wild pigs	Ngulube	Protein, Iron, Zinc	All year round
Antelope	Insa	Protein, Iron, Zinc	All year round

Source: Authors.

In fact, honey is mostly sold for cash and used to a lesser extent as a food item. Since poverty is a key issue among communities, any forest commodity that brings in income creates a substantial improvement in local people's diets. Focus group members explained how honey really keeps them going during hard times. According to the FGDs honey has several advantages, including the following:

- Unlike many other foods, honey has a long shelf life and the households are able to store it and sell when need arises;
- In all the communities visited, honey is widely used for treating various illnesses especially high blood pressure;
- Honey is consumed by all age groups directly or as substitute for sugar in beverages and foods; and
- Honey has a high market value compared to other forest products.

4.5. Methods of Food Preparation and How They Affect Nutritional Value of Food

How food is prepared weighs heavily on its ability to nourish the body. For instance, over-cooking most green vegetables and adding bicarbonate soda to food severely deteriorates the nutritional content of food. This factor was taken into consideration and respondents were asked about the food preparation methods that they used on a regular basis.

Overall, most food preparation methods preserved vital nutrients of forest foods. The only problem noted was the use of bicarbonate soda and ash in preparing some of the vegetables as a way of softening them during cooking. This specifically applies to mucilaginous vegetables such as jute leaves, locally known as Tindingoma. Adding bicarbonate soda and ash to vegetables severely degrades nutritional content of these foods that happen to be rich in B vitamins, beta carotene, and other essential nutrients. The locals are actually oblivious to the nutrient depleting effect of ash and bicarbonate soda on food.

4.6. Forest Foods with Medicinal Properties

Participants of the FGDs mentioned some of the medicinal properties they believe certain forest foods possess. Interestingly, some medicinal properties mentioned by locals are strongly corroborated by science. For instance, amaranth leaves referred to as bondwe contain lots of iron and folate, nutrients that boost blood content and work effectively to treat anemia (Stoltzfus and Dreyfuss 1998). The rich content of iron and folate makes amaranth leaves particularly important for pregnant women (McGarel et al. 2015; Berger et al. 2011). Respondents consistently stated that they used amaranth leaves for the prevention and treatment of anemia. Table 5 below shows the forest foods and their medicinal uses as indicated by FGD members. The table explains the various forest foods used by locals for treating multiple illnesses. According to FGD members, these forest foods have proved to be effective for addressing certain health problems.

4.7. Other Non-Timber Forest Products

Non-food forest products are used for obtaining income and meeting other basic necessities of rural households. During FGDs, respondents mentioned that wild grass is used for thatching houses as well as deriving income. Rural households also utilize firewood for their energy needs and earn considerable income from selling charcoal.

Nevertheless, wild bamboo, an important forest resource found in Mbenjele and Tazwela villages in Chipata District, was never mentioned by respondents during FGDs. Bamboo trees grow plentifully in these two areas and it was observed that a number of households use bamboo for fencing. However, the greater value of bamboo lies in its economic worth because bamboo can easily be used to make several products that are lucrative such as

Table 5. Medicinal Uses of Forest Foods

English or/and Scientific name	Local Name	Medicinal Uses
Fruits		
African ebony (<i>Diospyros mespiliformis</i>)	Mchenja	Treating diarrhea
Baobab fruit (<i>adasonia digitata</i>)	Mubuyu	Treating diarrhea
Wild custard apple (<i>Annona senegalesis</i>)	Mkonokono	Treating stomach pains
Tamarind (<i>tatarindus indica</i>)	Mwemba, wembewembe	Steering appetite
Chelembusha		Treating diarrhea
Governor's plum (<i>Flacourtia indica</i>)	Nthudza, Thumbuzga	Easing diarrhea
Camel's foot (<i>Piliostigma thonningii</i>)	Msekese	Treating bilhazia, diarrhea
Mobola plum (<i>Parinari curatellifolia</i>)	Mupundu	Easing diarrhea
	Mbulumbushe	Easing diarrhea
Vegetables		
Amaranth leaves (<i>Amarathus</i>)	Bondwe	Provide adequate blood
Black Jack (<i>Bidens pilosa</i>)	Kanunka	Treating mouth ulcers, measles, sore throat, anemia
False sesame (<i>Ceratotheca Sesamoides</i>)	Katate	Treating stomach ulcers, body building
Mushrooms	Bowa	Promoting heart health, Treating high blood pressure
Baobab leaves (<i>adasonia digitate</i>)	Mubuyu	Treating sexually transmitted diseases, Increasing blood levels.
Not known	Sope	Treating measles
Tubers		
Terrestrial orchids (<i>Orchidaceae</i>)	Chikanda	Preventing Obesity

Source: Authors.

as building materials, flooring, table mats, door mats, tooth picks, and cutlery. During the FGDs, there was no indication that respondents were aware of the income generating potential of bamboo.

The income derived from selling non-food forest products plus the money households saved when they use various non-food forest products that are free, undoubtedly help increase the amount of income at the disposal of rural households, and this can translate into increased food and nutrition security.

4.8. Limiting Factors to Full Utilization of Wild Products

From the diverse range of forest foods, it is clear that there are excellent nutritional qualities. The problem is that the supply of various forest foods is far less than the demand (i.e., nutritional requirements of local people). This study found a number of factors that limited the utilization of the forest products and these are discussed below.

Most wild foods are seasonal and the rainy season seems to provide the greatest variety and supply. A number of foods can be preserved by sun drying, the most common method of preservation. However, some foods such as mangoes are difficult to preserve through drying because they are only available during the rainy season when it is impossible to successfully dry these fruits.

Some cooking methods prevent the full utilization of micronutrients. For example, a common practice is the use of bicarbonate soda or in its place, ash from firewood or charcoal, in vegetables. Adding these ingredients to food kills B vitamins, severely downgrading the nutritional content of food. Evidence also shows that taking food that contains bicarbonate of soda further depletes B vitamins that are already in the body (Garden-Robinson 2010). From the FGDs that were held, it is clear that local people lack information on the detrimental effects of bicarbonate soda or ash and as far as we know, there has not been any intervention to discourage people from adding bicarbonate soda and ash to food. These two additives destroy important micronutrients, especially B vitamins (Garden-Robinson 2010).

In addition, a lack of continuous adequate supply of food appears to be an underlying reason for malnutrition. Things get even worse when climate is not consistent with expectations at that time, for example drought. Respondents pointed out that seasonality greatly determines the supply of forest foods. During drought for instance, respondents said there is scarcity of forest foods that are usually available during rainy season. Unfortunately, apart from sun drying, they indicated that households have limited options for preserving forest foods.

Apart from problems with steady supply of forest foods, not all food groups can be found in the forests. No matter how nutritious and abundant, forest foods do not contain all the food groups necessary for proper nutrition, therefore there is a need for households to obtain the remaining food groups from other sources. Failure by communities to access other food groups that have to be purchased or grown greatly increases the likelihood of malnutrition.

The situation observed in Eastern Province is that human activities such as farming and construction have significantly contributed to the reduction in forest cover that has subsequently led to a reduction in availability of forest foods. Additionally, population growth resulting from immigration and increasing family size has led to the scarcity of forest products in forest dense areas. Another problem the local communities were facing was that various wild animals feed on several plant and animal foods that are also needed by communities and this drastically reduces the amount of forest foods available to communities.

There appears to be misunderstanding of some forest management practices by the local communities. For example, while the Forest Department forbids burning of bushes to collect wild rats, in Mbenjele village, Chipata, respondents stated that this department also prohibited the hunting of rats completely as well as rabbits, wild Guinea fowl, and eggs from this bird. According to the respondents, such restrictions severely limit the amount of forest foods available to locals.

5. CONCLUSIONS AND RECOMMENDATIONS

This study examined the role of forest resources in household food and nutrition security. It focused on how the households in the Eastern Province utilize the forest resources for food, nutrition, and income generation. With particular attention to child nutrition, the study discussed three main nutrients found in forest foods that are critical for reducing child stunting—vitamin A, folate, and protein.

From the findings, it can be concluded that inasmuch as the forests have continued to play a key role in the livelihoods of the rural households in Eastern Province, forest food availability varies according to the density of the forest. The densely forested areas have more food and variety although this situation is changing as more people migrate to these areas and clear forests for settlements and other livelihood activities. Throughout the survey, respondents pointed out that forest land was declining and this has led to diminishing levels of food and non-food forest products available to them. It is, therefore, important for forestry policies to be directed towards strategies that preserve forests, as well as attending to current needs of rural communities that economically empower the households.

With regards to food and nutrient composition, forest foods were found to be composed mainly of fruits, vegetables, and bush meat while lacking in foods such as grains, starchy tubers, legumes, nuts, and seeds. However, there are many products that are consumed whose nutritional composition is not yet documented. The households are supposed to purchase or grow foods that contain the missing nutrients, but are limited from doing so by their low incomes. This limitation in accessing foods not obtained from the forests is a contributing factor to the high malnutrition levels in the area.

It is evident that forest foods form a significant portion of rural people's diets and any measures that keep forests in a vibrant state eventually work to improve the nutritional status of rural households. If forests are to sustainably contribute to food and nutrition security, the following are recommended.

5.1. Research into Nutritional Values of Forest Food

So far the current national food composition tables do have information on forest foods. There is urgent need to carry out research on the nutritional values of forest foods and update the food composition table to include these products given the evidence that forest foods are highly consumed in the rural areas.

5.2. Sustainable Forest Use and Management Strategies

5.2.1. Participation of Local Communities in Forestry Management

Encouraging community participation in the process of formulating forestry legislation has the potential to contribute to the legislation's successful implementation and outcome. The current forestry policy in Zambia strongly emphasizes the need to engage local communities at all levels of forestry management, thus it is important for rural communities to be made aware of this part of the forestry policy. This study confirmed that local communities have great knowledge about medicinal and nutritional properties of forest resources (see Kajembe et al. 2000; Sraku-Lartey 2014). The input of the communities can help create forest policies that yield better results. Even though Zambia's forestry policy encourages active participation

of local people, during the FGDs there was no indication that communities are aware that the country's forestry policy encourages their active involvement in forestry management issues. Together with the communities, it is important that the government identifies and effectively implements strategies that simultaneously improve welfare and nutrition of the local communities and promote conservation.

SADC 2002 also advocates allowing local communities to fully participate in forest management activities as well as taking into consideration traditional knowledge related to forests, while the World Bank also strongly recommends that local communities be actively involved during the formulation of forestry policies. Furthermore, FAO (2014) has asserted that creating a good understanding of forest policy by different stakeholders encourages people who have a direct relationship with forests to actively participate in a way that contributes to successful management of forests.

5.2.2. Practicing Forest Resources Sensitive Agriculture

Land clearing continues to be a leading cause of deforestation, leading to fewer forest resources. It is important to continuously educate communities about sustainable methods of farming such as minimum tillage or agro-forestry in order to preserve as much forest volume as possible. Furthermore, there is need to continue delivering the message to communities about the importance of maintaining high tree population.

5.2.3. Tree Planting

One interesting activity that focus group members of Kanchikota village in Lundazi mentioned was that community members in that area do a great deal of tree planting after being encouraged by their chief to do so. This is a positive development and the idea can be applied to other areas. Even areas that are considered to be under heavy tree cover have experienced massive reduction in tree population; therefore, planting trees can undoubtedly help sustain the forests. The World Bank has firmly stated that resuscitating degraded forest land can have several positive effects including improved rural livelihoods, enhanced food security, greater climate resilience, and greenhouse gas mitigation (World Bank 2015).

5.3. Poverty Reduction

First and foremost, poverty reduction is key to improving household food and nutrition security. Higher income levels can help rural households purchase or produce foods to make up for forest foods they might not be able to obtain in adequate amounts. Addressing poverty is especially important, because all villages that were studied are experiencing shrinking forest volumes, resulting in a reduction in forest resources that are available. In areas where there is high density tree cover, rapid population growth has considerably reduced the amount of forest resources available to each person. Additionally, most of the forest foods are seasonal and there is need to ensure that people are empowered to find alternative sources of food when forest foods are in low supply. Moreover, even though forest foods form a sizable amount of people's diets, they do not supply all the food groups necessary for proper nutrition; forest foods have to be combined with other foods that are purchased or grown in order to form balanced diets. This means that communities should be able to afford other food groups such as legumes and grains in order to maintain optimum nutrition.

5.4. Making use of Underutilized Forest Resources

Bamboo is extremely versatile and can be used for making a wide variety of products that have the potential to generate income for the households. Sensitizing communities about the economic value of bamboo products and imparting skills necessary for making these products can undoubtedly provide income for rural households. In addition, this strategy may help preserve forest land that would otherwise be cleared for income related activities like charcoal burning and agriculture. What makes bamboo special is that it is an environmentally sustainable plant; it grows quickly and generates plenty of oxygen, up to 35% more oxygen than regular trees (Pathak et al. 2014). The economic value and sustainability of bamboo was demonstrated by Hogarth and Belcher (2013) who examined the contribution of bamboo to household income and rural livelihoods in a poor and mountainous county in Guangxi, China. Bamboo was found to be an excellent pro-poor resource, especially in remote, mountainous areas with limited off-farm income opportunities.

5.5. Increased Sensitization on Benefits of Indigenous Foods

Nutrition programs must include forest foods when sensitizing people about children's nutrition. Though most of the rural households are aware of benefits of certain forest products, they are not fully aware of the nutritional value of many other forest foods. Since forest foods are rich sources of vital nutrients such as vitamin A, folate, and protein, they provide rural households with nutrients that help fight malnutrition, promote maternal health, and contribute to child development. For example, vitamin A dietary interventions by Government and other stakeholders should also encourage the consumption of forest products such as guavas, wild loquats, and green fruits and vegetables.

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