

Addis Ababa
University
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**COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES**

**POTENTIAL CONTRIBUTION OF WILD EDIBLE PLANTS TO
URBAN SAFETY NET BENEFICIARY HOUSEHOLDS AND
DETERMINANTS OF COLLECTION AND CONSUMPTION OF THE
PLANTS IN ADDIS ABABA.**

**BY
MARKISEW SHIFERAW ZELEKWE**

**JUNE 2020
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SCHOOL OF GRADUATE STUDIES

This is to certify that the thesis prepared by Markisew Shiferaw Zeleke, entitled '*Potential contribution of wild edible plants to urban safety net beneficiary households and determinants of collection and consumption of the plants in Addis Ababa*' submitted in partial fulfillment of the requirements for the Degree of Master of Science in Food Security and Development studies complies with the regulations of Addis Ababa University and meets the accepted standards with respect to originality and quality.

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Abbreviations

CBD :	Convention on Biological Diversity
CFSVA:	Comprehensive Food Security and Vulnerability Analysis
CITES :	Convention For International Trade in Endangered Species
CMS :	Convention on Migratory Species
CSA :	Central Statistical Agency
ENMA :	Ethiopian National Metrological Agency
FGD :	Focus Group Discussion
GBG:	Gulele Botanic Garden
GATC :	Germen Agency for Technical Cooperation
HFIS:	Household Food Insecurity Scale
IBC:	Institute of Biodiversity Conservation
LPM:	Linear Probability Model
MoLSA:	Ministry of Labor and Social Affairs
MSEs :	Micro and Small Enterprises
NGOs :	Non-Governmental Organization
NTFPs:	Non Timber Forest Products
PIM :	Program Implementation Manual
RAE :	Retinol Activity Equivalent
SPLM :	Sudanese People Liberation Movement
SPSS :	Statistical Package for Social Science
SRRA :	Sudanese Relief and Rehabilitation Association
TK :	Traditional Knowledge
UNEP :	United Nation Environmental Program
UNICEF :	United Nation International Children Education
UPSNP :	Urban Productive Safety Net Program
USA :	United States of America
USAID :	United States for International Development
WEFT:	Wild Edible Fruit Trees
WEPs :	Wild Edible Plants
WHO :	World Health Organization
WBISPP:	Woody Biomass Inventory and Strategic Planning Project

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Abstract

Globally, wild edible plants (WEPs) have remarkable contribution to poverty alleviation as well as food security. However, its availability is rapidly declining because of decreasing traditional knowledge. Forest related knowledge contributed for metropolitan cities to fight hidden hunger. Nevertheless, households' inadequate traditional knowledge and poor perception results underutilized and ignorance through urban dwellers. The objective of this thesis was to examine the factors affecting the households' decision to participate as collector of WEPs. The study was conducted between December 2019 and May 2020. Data collection tools such as focus group discussion, guided field walk, and semi-structured questionnaire were employed in order to collect primary data. Data was analyzed using constant comparison technique, descriptive statistics and probit model. In and around Gulele Botanic Garden, a total of 105 useful plants were identified and of whom 84 plants were edible while 21 plants were used for medicinal purpose. On the other hand, women were identified on average of 5 plant species while men were identified merely 1(one) plant species. Therefore, in this case, women respondents had better traditional knowledge than men. In the total households, 51% of respondents were agreed that wild edible plants can be used as an alternative food sources during food shortage. Of whom, WEPs' collectors were accounted as 96%. In a total of 145 households, 42 respondents were collector of WEPs in the study area. Compared with men, Female households had 20 % probability to participate in collecting WEPs than men. For every addition of one family member, the probably of households to collect edible plants was increased by 17 %. The probability of food taboos affected the informants' decision to collect WEPs by 15%. As recommendation, one important method of conserving such vital traditional knowledge in the new generation is through incorporating it to school curriculum or at least hosting the idea as an extracurricular school activity. It is important to design activities that would help in recovering the disappearing of traditional practices. Local associations, school clubs and societies of interested groups can contribute to that end;

Keywords: *Gulele, Safety net, Wild, Edible, Plants, Non- timber, forest, product*

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Wild Edible Plants (WEPs) are vital sources of foods and mostly they are not domesticated and cultivated by humans rather grow in the natural environments of forests, riversides, parks and gardens (Abraham, 2016; Shumsky, 2012, McLain, *et al.*, 2013; Cruz-Garcia & Price, 2014). Since in the ancient time, people were highly dependent on these edible parts of the plants to satisfy their nutritional as well as hunger. Globally, utilization of WEPs as a food source is linked with the culture of indigenous (Tilahun & Mirutse, 2010).

Despite WEPs have remarkable contribution to food security and economic growth in the world , but its availability is rapidly declining due to weak traditional knowledge on these plants (Dansi, *et al.*, 2012) and this brings and aggravates high prevalence of food insecurity problem in the most parts of the entire world (Brussaard, *et al.*, 2010). Current informations showed that more than 821.6 million (1 in 9 people) are hungry, and around 2 billion people are experience moderate or severe food insecurity due to lack of regular access to safe , nutritious and sufficient food (FAO, 2020).

Similarly in Ethiopia, high prevalence of food insecurity is one of the critical problem in the country, it is accounted that 26 million people are hungry and food insecure today (CFSVA ETHIOPIA, 2019). 35 % of households are food insecure (Birhane *et al.*, 2014). Specifically in the urban settings of Ethiopia such as Addis Ababa, high urbanization is brought economic and social challenges to the life of the dwellers. For instance 23.5 % of the population is unemployment, 22 % of the population is living under poverty line and 29 % of households are unemployed (World Bank Group, 2015).

WEPs have significant value for global food security (FAO, 2009). But studies addressing on the contribution and biodiversity to human diets are still more rare and there is deficit information related with nutritional characteristics. Even if WEPs have contribution to global food security but due to lack of food composition data on WEPs, many of them are underutilized in human diets and they are neglected by policy makers, researchers as well as nutritionists (Figuroa, *et al.*, 2009).

The food and Agriculture organization (FAO, 2009) report showed that, globally about 30,000 plant species are edible. However, of which only 7,000 plants are used as food sources to humans. Specifically in Africa, there are more than 6,376 edible plants (Smith & Eyzaguirre, 2007), but study confirmed that, only 90 to 100 WEPs are contributed in 22 African countries as food source. Especially in Kenya, Ethiopia and India on average 300 to 800 WEPs are used in the community for diet (Bharucha & Pretty, 2010). Beside, the global food supply is dependent on only small number of cultivated species, that is why among 7000 edible plant species, only 120 species are domesticated and of which, nine of them are contributed more than 75 % of human food (FAO, 2013a). Only 12 domestic plant species are contributed 80 % of global energy intake (Frison, *et al.*, 2006). Therefore, the high dependency on these small cultivated species can contribute to declining use of WEPs. In addition, ignorance in land use policy, conservation, and economic development, regional and national food balances that monitors policies on trade, aid and food shortage are the critical push factors to undermine those plants (Asfaw, 2009).

Worldwide, WEPs are a good solution to fight hidden hunger and improving food security for more than 1 billion people globally (Ong & Kim, 2016; Agbo, *et al.*, 2013; Jyotsna & Katewa, 2016). The UN estimated that, non-timber forest products including WEPs have an economic value of US \$ 11 billion in world trade (Shmsky, 2014), and the recent comparative evidence indicated that forests can be contributed 28% income for households living around the forest and mostly in developing countries, around 750 million people were relied on forest and wild resources (FAO, 2016).

In Ethiopia, enormous endemic WEPs are estimated to be more than 7,000, but only 8% of them are important as a food source (Mengestu, 2009). However, the left over plants were ignored and underutilized in the country due to gaps on research (only 5 % country district covered out of 494 district), documentation and traditional knowledge on use, identification, management and domestication of those wild foods (Ermiase & Zemedu, 2011). Nevertheless, those neglected wild foods have significance value as an input to the agriculture, food industries, and used to the urban societies to be lighten hunger, undernourishment and keeping the surroundings safe (FAO, 2014).

In the broader metropolitan cities, the appreciation on traditional forest related knowledge is growing and its practices can be contributed to sustainable development (Trosper & Parrotta, 2012). But, most of the time consumption of those plants are challenging because of poor attitude and mostly they are often considered as inferior; and there is also gaps in improving greater documentation of indigenous knowledge, awareness creation and conducive policies on WEPs (Vinceti, *et al.*, 2013). WEPs are negatively associated with hunger ((Carvalho & Morales 2013) and considered as “famine foods” (Kang, *et al.*, 2012; Nascimento, *et al.*, 2012). Moreover, in Africa and Asia, negative perceptions towards those plants are still a huge challenge (Bvenura & Afolayan, 2015; Panda, 2014). Despite these plants are necessary resources during acute food shortage, but people are exactly considered those plants as nourishment for women, children and the weak, natural disasters foods and tasteless and unappetizing (Addis, *et al.*, 2013).

WEPs are essential species specially to the poor and marginalized people so as to prevent them from falling deeper into poverty and from unexpected shocks and crises (Davenport, *et al.*, 2011). Specially, in the study *district*, those plants are rejected and underutilized by the community due to gaps in traditional knowledge and negative perception towards WEPs. So, this thesis was designed to fill households’ gaps related with their perceptions, traditional knowledge towards those plants and their determinants of collection and consumption of plants.

1.2 Statement of the problem

The subject matter of this thesis was to investigate the potential contribution of neglected and underutilized wild edible plants (WEPs) to food insecure households. Currently, those plants have a critical role in ensuring food security as well as improve livelihoods and filling the food gaps in time of food shortage for countless families and communities around the world (Farooq, 2017; Ahenkan and Boon 2011). Globally, they are used as dietary diversity and nutrition security for more than one billion people (Bharucha, *et al.*, 2010, Shumsky, 2014).

Notwithstanding, globally there are more than 250,000 edible plant species, but due to decline of traditional knowledge, merely 7000 plants are consumed regularly and the rest are ignored and underutilized (Salas, *et al.*, 2019). Specially in the urbanized world, traditional knowledge of those plants is in danger (Penafiel, *et al.*, 2011; Sneyd, 2013). However, those plants have potential contribution as supplementary food as well as fighting 'hidden hunger' during food shortage (Jyotsna & Ketewa, 2016).

Even though Ethiopia has more than 7,000 enormous endemic WEPs species, but merely 8% of them are used as edible plants (Mengestu, 2009), and the remaining plants were ignored and underutilized in the country due to gaps on documentation and traditional knowledge on use, management and domestication of those significant plants (Ermiase & Zemedu, 2011). But currently, those neglected plants have substantial input to the agriculture, food industries and as well as used for the urban societies to be lighten hunger, undernourishment and keeping the surroundings (FAO, 2014).

More specifically in the study area, there are 84 WEPs. However, most of them were neglected and underutilized by the communities because of poor perception and decline of traditional knowledge of those plants. So that the main determination of this thesis was to explore the possibility use of those underutilized and neglected WEPs as a food source to urban safety net beneficiary households living around Gulele Botanic Garden.

1.3 Objectives

1.3.1 General objective

The principal objective of this thesis was to explore the potential contribution of underutilized wild edible plants as a coping strategy to the urban productive safety net beneficiary households living around Gulele Botanic Garden.

1.3.2 Specific objectives

More specifically the study desired to:

- ✓ exploring the households' determinants of collection and consumption of WEPs in *and around Gulele Botanic Garden*.
- ✓ identify wild edible plants in and around *Gulele botanical Garden*.
- ✓ assess perceptions of urban safety net beneficiary households towards wild edible plants around Gulele Botanic Garden
- ✓ evaluate traditional knowledge of household heads by the recoded number of wild edible plants

1.4 Research Questions

This thesis was designed to answer the following research questions:

- ✓ Does households' socioeconomic characteristics affect consumption of wild edible plants?
- ✓ What are wild edible plants used for food by indigenous people living in and around Gulele Botanic Garden?
- ✓ What looks like the perception of households towards wild edible plants around Gulele Botanic Garden?
- ✓ What are the households' problems associated with traditional knowledge and culture of wild edible plants in the study area?

1.5 Scope and Limitation of the Study

The study was conducted in one of the attractive and the first oended plant conservation area called called “*Gulele Botanic Garden*”. The availability of WEPs in the garden was a good potential to food insecure households. Therefore, it was seletcted intentionally because it was good site to investigate the socioeconomic interactions of the households who are living around the forest. On the other hand, the study covered the time period between December, 2019 and July, 2020. The study had considered only urban productive safety net beneficiaries involved in public work packages and living proximate to the Gulele Botanic Garden, because those households are food insecure and are engaged in productive works such as buiding urbn gardening , planting seedlings around the road and riversides. Therefore, due to this reason, the main concern of the study was those households had better experience than others to participate in management and as well as utilization of those plants.

The scope of the study was to investigate the potential contribution of underutilized WEPs to urban safety net beneficiaries’ living around Gulele Botanic Garden .The study was focused on evaluating household’s perception and traditional knowledge towards those edible plants as well as measures their determinants of collection and consumption of WEPs .

During conducting the study, computing the actual amount of household’s ‘monthly income was a barrier. This was due to variation in the amount of monthly income obtained through casual wage, safety net and petty trading. Hence, to resolve this issue, the researcher has undertaken an estimation to calculate the households ‘monthly income to minimize the effect of this challenge on the validity and reliability of some of the data generated from sensitive questions in the study. Besides, there was limited access to secondary data from both government and non-government agencies. Hence, to solve this problem, the researcher has contacted some individuals as well as used online published materials.

Moreover, the researcher has faced challenges while conducting households’ surveys. Due to information gaps, households have shown negligence while filing the questionnaire. So that, it has influenced the validity and reliability of some of the data generated from questions in the study. Hence, mindset activities were undertaken to resolve this challenge. In addition, in the process of conducting this research, because of covid -19 pandemic, the researcher was encountered budget

hardships to collect primary data. Infact, to solve this issue, the researcher has borrowed and gets financial support from colleagues as well as family.

1.6 Significance of the Study

In Addis Ababa, high urbanization has brought economic and social challenges to the life of the dwellers, for instance 23.5 % of the population is unemployment , 22 % of the population is living under poverty line and 29 % of households are unemployed (World Bank Group , 2015) . Further more , because of high prevalence of unemployment and food insecurity in the city, the total estimated population living below poverty line (less than US\$ 1.25) is more than 766, 800 people (CSA, 2014). In this context, concentrating attention on neglected and underutilized species is an actual way to help a diverse and healthy diet and to fight micronutrient deficiencies, the so-called ‘hidden hunger’ particularly among the more vulnerable social groups in urban areas., where food insecurity is more acute (Kiran,*et al .*, 2019).

Hence, to reduce the problems mentioned above, there would be a research to identify the root causes and make new alternatives to the problems. Moreover, this study has had an input to Environmental Protection Authority, Federal Food Security and Job Creations Agency (FFJCA), and also used for Gulele Botanical Garden office (GBGO) to conserve and manage those resources for sustainable utilization. In addition, this study helped to formulate new land use policy on WEPs management in the municipality areas along the riversides. Furthermore, the study has offered important information regarding the contribution of those plants as food sources to the food insecure households (safety net beneficiaries). Besides, the thesis can be used as a reference material for academic researchers as well as policy makers who would like to do a more in-depth analysis about wild edible plants on urban food insecure households (safety net beneficiaries).

1.7 Ethical Consideration

In case of data collection, ethical considerations was seriously taken in to account in order to safeguard the protection, integrity consents, anonymity and other human elements of the respondents. In this study, the respondents were not identified by names and their consent was required during interviews and discussions. Accordingly, Kitchin and Tate (2000) showed that, researchers are morally and ethically responsible to his or her respondents, the sponsors and other concerned bodies. So that, by considering this, before conducting the study, the researcher

tried an ethical in a manner and not disappoints the respondents and officials of different government organizations. Basically, before proceeding to conduct the research, there would be improved initial contacts with those government officials and sample populations in order to introduce myself and explains about the research matter. Then after, before start interview as well as discussion with households, firstly their full agreement was checked. They were also informed that their information was for the purpose of research only and can be kept trustworthy. After all, the respondents and discussants asked their willingness to FGD and survey.

1.8 Organization of the thesis

The paper has a total of five chapters. The first chapter of the paper organizes to include introduction (background of the study), statement of the problem, objective of the study, significance of the study, scope and limitation of the study and organization of the paper. The second chapter is about literature reviews and the third chapter of the study is about research methodology of the study. The fourth chapter of the study presents all results and discussion based on the surveyed data. The last and fifth chapter of the research is building summary and conclusion as a base from the study results and then advancing the relevant recommendation based on the finding and therefore, this study will be finalize by promoting future strategy with respect to the study and perspectives for future study.

CHAPTER TWO: RELATED LITERATURE REVIEW

2.1 Concepts of wild edible plants

Wild Edible Plants (WEPs) are naturally available food sources (Teklit & Afework, 2015). In addition to the term "*Wild Edible Plants* ", "*Indigenous Plants*" and "*Traditional Plants*" are also used and these terms are described plants that are part of the food system since several generations (CARE- ETHIPIA, 2016). WEPs includes , roots, shoots, leafy greens, fleshy fruits, nuts, grains, seeds and other species are included under WEPs, and in order to harvest and prepare those plants, traditional knowledge is important (Turner, *et al.*, 2011). Indeed, wild' refers to non-cultivated plants collected in the field (Abraham, 2016). Likewise, WEPs are grow spontaneously in self-maintaining in natural or semi natural habitats, existing independently without human interference and provides significance as food system for human nutrition (Vinceti, *et al.*, 2013). Those plant have much implication to urban poor and marginalized communities as well (Termote, *et al.*, 2012b; Kaoma & Shackleton, 2015).

2.2. History and Development of Ethnobotany

Ethnobiology is the scientific and humanistic study of the complex set of relationships of the biota to present and past human societies (Martin, 1995; Cotton, 1997). The field can be divided into three major domains of inquiry: economic (how people use plants and animals), cognitive (how people know and conceptualize plants and animals) and ecological (how people interact with plants and animals, especially in an evolutionary and coevolutionary framework).

Ethnobiology encompasses two subdisciplines: ethnobotany and ethnozoology. Given the greater importance of plants than animals for most human societies, ethnobotanical studies form the vast majority of research within ethnobiology. Scholarship in all these areas has contributed to methodological advances (Alexiades, 1996; Stepp, 2005; Bridges and Lau, 2006; Gerique, 2006). The term ethnobotany deals with the dynamic relationship, interactions between human populations, cultural values and plants (Alexiades, 1996; Cotton, 1997). The relationship is obligating that it existed long before human civilization. However, the interaction of plants with

human society varies due to their uses, relative importance, varying social, cultural and ethnic factors (Panhwar and Abro, 2007).

The definition and scope of ethnobotany remained impressive even by the narrowest definition of the discipline. As Turner (2000, cited in Hamilton *et al.*, 2003) notes in her review of ethnobotany, the discipline still undertakes research on the relationship between people and plants in the areas of linguistics; cognition; education; healing; nutrition; archeology; paleology; resource tenure and management; agriculture and livelihood. “Ethnobotany is the part of ethnoecology which concerns plants (Martin, 1995)”. Whereas ethnoecology encompasses all studies which describe local people’s interaction with the natural environment, including subdisciplines such as ethnobiology, ethnobotany, ethnoentomology and ethnozoology (Martin, 1995; Balick and Cox, 1996; Cotton, 1997). Ethnoecology, as a significant discipline encompassing various fields of the study of indigenous people’s perceptions and interactions with their environment, has recently developed various theoretical and practical approaches that not only seek to document information on local classifications and taxonomies, but also to contribute to dynamic processes of community development and conservation programs (Martin, 1995; Alexiades, 1996).

Ethnobotany studies the relationship between humans and plants in all its complexity and is generally based on a detailed observation and study of the use a society makes of plants, including all the beliefs and cultural practices associated with this use (Alexiades, 1996). It is useful for ethnobotanists to live with indigenous people, to share the everyday life of their community and, of course, to respect the underlying cultures. Ethnobotanists have a responsibility both to the scientific community and to the indigenous cultures (Martin, 1995; Balick and Cox, 1996).

Ethnobotany focuses on all useful plants including other natural products derived from plants, such as food, plants used in rituals, coloring agents, fiber plants, poisons, fertilizers, building materials for houses, household items, boat, etc. (Cotton, 1997). Because plants play an important role in almost every realm of human activity, ethnobotany encompasses many fields including botany, biochemistry, pharmacognosy, toxicology, medicine, nutrition, agriculture,

ecology, evolution, comparative religion, sociology, anthropology, linguistics, cognitive studies, history and archeology (Martin, 1995; Balick and Cox, 1996; Cotton, 1997).

The multidisciplinary nature of ethnobotany allows for a wide array of approaches and applications and leaves the way open for many scientists to study the plant uses in different ways. But medicinal plants have always been the main research interests of ethnobotany and the study of these resources has also made significant contributions to the theoretical development of the field (Alexiades, 1996; Cunningham, 2001; Gerique, 2006; Kunwar and Bussmann, 2008). Moreover, ethnobotanical specialties, such as medical ethnobotany, require knowledge and skills in additional areas, such as chemistry, medical anthropology and pharmacology, in order to be sufficiently competent to define and undertake the more specialized ethnobotanical research. However, some skills transcend disciplines. Basic computer competence is needed in virtually all studies to organize and analyze research data (Bridges and Lau, 2006).

2.3 Diversity, Perception and Traditional Knowledge on WEPs

Globally , there are approximately 250,000 WEP species (Bharucha & Pretty, 2010), of this about 1000 species are identified in America, 1200 plant species in Africa, 800 species in Asia, 400 in Kenya, 700 from Tanzania, 300 from Cameroon, 675 species in India (Chakravarty *et al.*, 2016) . Whereas in Ethiopia, 220 edible fruit bearings were identified (Gebru, 2019). Even though, there is a good potential of edible plants worldwide, but due to decline of indigenous knowledge , merely 75,000 are estimated as edible while the other 7,000 (around 3%) species are regularly eaten (Salas, *et al.*, 2019). Especially in the urbanizing world, due to weak traditional knowledge of the people, management systems and biodiversity of those plants are threatened; this is critical point that deserves more attention (Penafiel, *et al.*, 2011; Sneyd, 2013).

Although in some extent, those plants are consumed by both developing and industrialized countries, but there are also clear signs of an accelerated decline of local knowledge and management practices (Carvalho, *et al.*, 2017). So that , to preserve this indigenous knowledge and investigating their potential for future generation, there must be systematically record those WEPs and efforts should be improve and educate the young generation about its importance on wild edible plants otherwise his/her knowledge will be lost in the near future.

Documenting indigenous knowledge on WEPs can help in identifying plant species for domestication and mass production systems in order to bring sustainable developments and utilization (Biswakarma, *et al.*, 2015). Indeed, in the case of developing world such as Africa and Asia, there is rich traditional knowledge on those plants but it is found as largely oral traditions. However, in India particularly and Asia in general, traditional knowledge is found not only in oral traditions but also as classical literature that is written down in their own theoretical framework (Nene, 2012).

In Ethiopia there is estimation of 7000 WEPs and of which, 10-12 % are endemic to the country (Negash, *et al.*, 2017). Even if there is availability of those plant species, but only 5 % of them are used as food source in the country (Getnet, 2011), this is because of very limited ethno botanical information in nutritional analysis, use, taxonomy, diversity, documentation and domestication activities (Ermias, *et al.*, 2011). According to the findings of Getachew and his colleagues (2013), only in *Konso*, 127 species were identified and out of those 62 % are constituted shrub and trees, 28% were herbs, 10 % were vines.

Until very recently, many cultures protected a prejudice against WEPs and this leading to a weakening of demand and these foods are negatively associated with hunger (Carvalho & Morales, 2013) and considered “famine foods” (Kang, *et al.*, 2012; Nascimento, *et al.*, 2012). Studies in Africa (Bvenura & Afolayan 2015) and Asia (Panda 2014) still reported about negative perceptions on those plants, which are exactly considered as “nourishment for women, children and the weak,” natural disasters foods (e.g. flood or drought), and tasteless and unappetizing but necessary resources during acute food shortage (Addis, *et al.*, 2013).

In Southern Sudanese, fifty workshop discussants were reflected their positive and negative perceptions in the utilization of WEPs (See **appendix 8**). Hence, some participants had mentioned that WEPs are good source of income, have medicinal values, they are famine foods and also used to diversify household diets etc. While some other participants were also mentioned negatively as wild edible plants are foods for the poor, they are sign of uncivilized, toxic and non-palatable etc (Brigitta & Caroline, 2000).

In the broader metropolitan cities, the appreciation on traditional forest related knowledge is growing and its practices can be contributed to sustainable development (Trosper and Parrotta, 2012). The report by Vinceti and his colleague (2013) recommended that, in the urban areas due to poor attitude on WEPs, consumption of those plants is challenging; so that, there must be improve scientific knowledge on nutritional values, greater documentation of indigenous knowledge, awareness creation and conducive policies towards wild edible plants .

2.4 Contribution of Wild Edible Plants to Food Security

Since in the ancient times, WEPs have played a very important role in human life and they have been used for food, medicines, fiber and other purposes. Currently, those plants have play a critical role in ensuring food and livelihood security as a complementary and filling the food gap in time of food shortage for countless families and communities around the world (Farooq, 2017; Ahenkan and Boon 2011). That is why globally those plants are used as dietary diversity and nutrition security for more than one billion people (Bharucha, *et al.*, 2010, Shumsky, 2014). The UN report showed that non-timber forest products (NTFPs) including WEPs are contributed US \$ 11 billion in world trade (Shmsky, 2014), and recent comparative evidence indicated that forests contributed 28% income for households living in or around the forest, mostly in developing country around 750 million people are reliance on forest and wild resources (FAO, 2016).

In Africa, non-timber forest products (NTFPs) including wild edible fruit trees (WEFT) are considered as famine foods in the time of shocks and they constitute an important for food and income source for local populations in rural communities. For instance in the case of Nigeria, around 80% of the rural household's income was generated from NTFPs and their daily consumption was 27.5 million kg/day (Suleiman, 2017). The study conducted by WHO (2013), Podulosi, *et al.*, (2013) and Ahenkan (2010) indicated that, in developing countries around 80 % of the population was dependent on use of NTFPs to meet their need for health, nutrition and in general they are essential food sources for food insecure families. In sub Saharan African countries, when there is a decline of crop yields, NTFPs are contribute to food security of about 12 million people (Moseley, 2012).

In the urban communities, WEPs still play an important source of income, medicine and food supply, but there is a limit sources of those plants in fact some authors has discuss sources of such plants outside of the market such as collecting in the garden and forest around the living area (Mollee, et al., 2017). The study conducted by Bharucha & Pretty, (2010) indicates that, in Zambia and Mozambique, urban households are willing to pay 43 to 157% for bush meat and other wild edible plants while in Alaska, 80 % of the population is urban and they consuming regularly the wild edible games and plants.

In South Africa, the study done in three small towns had been shown that, up to 70% of poorer urban households collect at least one tree products such as fire wood, herbal medicine, fodder and consumptive tree products, which can be good sources for cash income as well as they would be important to fight hidden hunger in the time of hardship (Kaoma & Shackleton, 2014). Qualitative evidence from Yaoundé, Cameroon, shows that WEPs are important ingredients for the preparation of commonly-prepared traditional dishes and make a significant contribution to diets and diet diversity complement with wheat, corn and rice. Cameroonians living around the forest will collect forest foods such as fruits, vegetables and spices to combat food crises (Sneyd, 2013).

Urban collection of NTFPs can be considered a “*deeply relational practice connecting humans with nature, other humans and their inner selves*” (McLain, et al., 2013, p. 12). Hence, it is a form of preserving cultural identity and offers free medicines and adds to food security as a safety net preventing people from falling deeper into poverty in times of hardship (e.g. unexpected shocks and crises) (Davenport, et al., 2011). Furthermore, different studies point out that there is only little empirical evidence on urban wild plant collection (Furukawa, et al., 2016; Kaoma, et al., 2014; McLain, et al., 2013; Schlesinger, et al., 2015), (Davenport, et al., 2011) and this entails that in an urbanizing world, traditional knowledge and biodiversity are threatened and it needs more attention. In urban areas of the world, most people are dependent in some domesticated plant species for their daily nutrition, 20 % of domesticated species are supply up to 85% of world’s food base (Nancy, et al., 2011). Hence, in order to domesticate further and use intensively, widely diversify wild growing plant species is needed.

WEPs are important sources of proteins and micronutrients and they can be used as primary food sources for many poor communities worldwide (Ermias, *et al.*, 2011). The recent work in Tanzania indicates that, those plants are used to all informants and contributed 31% of vitamin A (RAE), 20% of vitamin C and almost 20% of iron (WHO, 2013). Similar in Tanzania, 38 traditional vegetables were identified and of which 63.2% of them were wild species and contributed 35% of vitamin A (RAEs), 26% of iron, 23% of calcium and 20% of vitamin C (Powell, *et al.* 2012). Worldwide, forests and wild edible products have daily contribution to household food and nutrition security because those traditional foods both cultivated and wild have low fat and refined sugar content and also have high protein and micronutrients as compared to imported and processed conventional food items (Angelsen, *et al.*, 2014).

In Madagascar, loss of wild meat from the diet of their children will result 29% increase the number of children affected by anemia, whereas in Nigeria, during drought season 83% of informants were resilient from the shock (Golden, *et al.*, 2011). Since WEPs have low sugar, salt and high in micronutrients and fibers, they would play significantly to mitigate obesity, cardiovascular disease and type II diabetes in developing nations (Jain & Tiwari, 2012). To complement staple foods such as wheat, rice and maize, people living around the forest will collect wild foods and these are contributed to combat “hidden” hunger for household through providing essential micro nutrients and minerals such as vitamin A, B, C, D and E, iron and iodine (Sned, 2013).

2.5 Overview of Plant Resource in Ethiopia

In the country, reliable information on the vegetation resources such as their spatial coverage, distribution, changes over time etc. are difficult to get because it is scattered and inconsistent (Demel, *et al.*, 2010). According to the World Bank-funded Woody Biomass Inventory and Strategic Planning Project (WBISPP) indicated that, Ethiopia owns a total of 59.7 million ha covered by woody vegetation among which: 3.56% is high forest, 49% woodland and 44.2% shrubland or bushland and plantations cover was estimated 955,705 ha (WBISPP, 2004; Sisay *et al.*, 2010; Wubalem, 2012). According to the report by FAO (2010) showed that Ethiopia puts among countries with forest cover of 10-30%. According to this report, Ethiopia's forest cover is

12.2 million ha (11%). The report further indicated that the forest cover shows a decline from 15.11 million ha in 1990 to 12.2 million ha in 2010, during which 2.65% of the forest covers was deforested.

Diverse physiographic, altitudinal, climatic and edaphic resources, enables Ethiopia to have various types of vegetation ranging from alpine to desert plant communities (Demel, 2005) which provide economical, socio-cultural and environmental benefits (CBD, 2009). Ethiopia is among the African countries known for endemism of wild plant and animal species and about 10% of Ethiopia's flora is considered to be endemic (Ensermu and Sebsebe, 2005). Endemism is reportedly high on the plateaus, mountains, in the Ogaden region and in the southern woodlands (Vivero *et al.*, 2006). On the other hand, empirical evidence from developing countries indicates that almost a quarter of a billion rural poor people live in or around the dry forests of Sub-Saharan Africa (CIFOR, 2008) and they are depend on the forests for building materials, food, cropland, fuel wood, non-wood products and many other things (Abebe, 2011; Adugnaw , 2014).

In sub-Saharan Africa, deforestation and population have gradually increased together, with the heaviest forest losses coming in areas where wood is needed for fuel or where forest land is needed for growing crops (FAO, 2010). For instance, it is estimated that between 2000 and 2008, 80% of new agricultural land was converted from forests, woodlands or shrub lands. In Ethiopia, 90% of the country's total energy for household cooking is derived from biomass fuels, of which 78% come from fire wood (USAID, 2008). Reports show that around 1850 ha per year of *Boswellia* wood land is converted in to agricultural land (Wubalem, 2012). The institutional arrangements in the forest sector have been unstable, suffering from frequent restructuring. Hence, this instability in the sector's organizational structure is often mentioned as one of the major bottlenecks for the lack of coordinated, effective and long term management in Ethiopian forestry (Million, 2011).

2.5.1 Wild edible plants in Ethiopia

Utilization of wild edible plants (WEPs) as a food source is an integral part of the culture of indigenous people that dwell in the rain forests of Africa and South America who gather and consume WEPs as snacks and at times of food scarcity (Getachew, 2009; Tilahun and Mirutse, 2010; Assegid and Tesfaye, 2011; Ermias,*et al.*, 2011). WEPs provide staple and supplement

foods, as well as cash income to local communities, thus favouring food security (Sansanelli and Tassoni, 2014). Nevertheless, WEPs are largely ignored in land use planning, economic development and biodiversity conservation (Uprety, *et al.*, 2010). Indigenous people, from their own experience, know about the importance and contribution of WEPs to their daily diet (Getachew, *et al.*, 2013).

The existence of diverse farming systems, socio-economics, cultures and agro-ecologies has endowed Ethiopia with a diverse biological wealth of plants, animals and microbial species, specially crop diversity (IBC, 2008). It is also stated in ENBSAP (2005) that crops such as tef (*Eragrostis tef*), noug (*Guizotia abyssinica*), Ethiopian mustard (*Brassica carinata*), enset (*Ensete ventricosum*), oromo-dinich (*Plectranthus edulis*), anchote (*Coccinia abyssinica*) and coffee (*Coffea arabica*) have great diversity and believed to have originated in Ethiopia (IBCR, 2001). Due to this vast genetic diversity there are many wild plants which are used for food, especially during periods of food shortages. The majority of such plants are those used as leafy vegetables, edible fruits, tubers and roots. *Corchorus olitorius* for example has nine species which are found in Ethiopia and collected at a young stage and eaten as cooked vegetable, especially in lowland parts of the country like Afar Region and sold in the supermarket and dried leaves are sent to Djibouti for sell, but still, none of them is cultivated. Some of the domesticated plants still also occur with their wild relatives in some parts of the country (Diress, *et al.*, 2007). Examples are *Thymus spp.* in the Afro-alpine regions of the country; *Ensete ventricosum*, which occurs both in wild and cultivated state in the medium to higher altitudes; *Gossypium spp.* in the lowlands, as wild and cultivated; and *Sesamum spp.* which is found both cultivated and wild at an elevation below 1800 meters above sea level (Mirutse and Tilahun, 2013). There are other wild plants currently attracting attention as potential crops, primarily for their use value. *Cordeauxia edulis* which is used in the arid areas as both feed and food source; *Amaranthus spp.* found as common weed in some parts of the country of which young plants are cooked as vegetable and seeds used for porridge and local beer, are among few of them (IBC, 2008).

On the other hand, the report showed that WEPs are the cheapest source of vitamin A, C, minerals and fiber; still people fail to consume enough to meet their nutrient requirement due to lack of knowledge in the nutritional value and production of those vegetables in the easiest way

(Dandena, 2010). In Ethiopia, WEPs are sources of income and they can be consumed to supplement the staple food as well as to enhance nutrition, and fill the gap of the food shortage during famine, drought, war and other hardships. For instance *Dovyalis abyssinica*, *Mimusops kummel*, *Ximenia americana*, *Adansonia digitata*, *Annona senegalensis*, *Balanites aegyptiaca*, *Flacourtia indica*, *Oncoba spinosa* and *Syzyguim guineense* sold at local market and while *Mimusops kummel* and *Ziziphus spina-christi*, are sold at national market whereas *Balanites egyptiaca* and *Tamandus indica* are marketed at international level (CARE- ETHIOPIA,2016).

In Ethiopia, WEPs have a good profile as an integral part to complement the diet of many food insecure households. For instance in the case of Konso communities, they were experienced three severe drought seasons due to crop failure in between 1996 and 1999 and at that time those people were resilience by consuming wild edible plants (Tilahun ,2010). Related with the culinary uses of wild edible plants in Ethiopia, most of the fruits are consumed raw while vegetables are eaten by boiling, roasting and baking (Gebru, *et al.*, 2019). The WHO report of 2015 showed that in Ethiopia, around 85 % of the population had zero servings of fruits and vegetables and less than 2% are meet the recommendation of 3-4 servings per day while 1.5 % are met the WHO recommendation of serving more than 5 servings per day (Gelibo, *et al.*, 2017).

Fruits and vegetables contributed 1 % energy supply and this leads to high price inflation and poor supply as a national level (Baye, *et al.*, 2013).The consequence is low or almost zeros consumption of fruits and vegetables in the country and causes for death of 86 people per 100,000 people (Misganaw, *et al.*, 2017; Melaku, *et al.*, 2016). In Ethiopia, studies on WEPs have not covered three regions such as Somalia, Harare and two Administrative states. However, in the six regions of Ethiopia, more than 365 wild edible plants species identified and of which , 220 (60.3%) species were reported as fruits, while 118 (32.4%) as vegetables and the remaining are categorized under spices, herbs, fruit and vegetables (Gebru, *et al.*, 2019).

Currently, there is renewed global interest in documenting ethnobotanical information on neglected wild edible food sources (Bharucha and Pretty, 2010). Since traditional knowledge on WEPs is being eroded through acculturation and the loss of plant biodiversity along with indigenous people and

their cultural background, promoting research on wild food plants is crucial in order to safeguard this information for future societies (Zemedu, 2009; Tena, *et al.*, 2014).

A major objective of ethnobotanical investigation into WEPs is the documentation of indigenous knowledge associated with these plants. Comparative studies on WEPs in different cultures or ethnic groups of a country or among different countries, may contribute to the identification of the most widely used species for further nutritional analysis (Termote, *et al.*, 2009; De Caluwé, 2010a, Beluhan and Ranogajec, 2010). Nutritional analysis results provide clues to aid the promotion of those species that have the best nutritional values which helps to ensure dietetic diversity and combat food insecurity (Tardio, *et al.*, 2006; Ermias, *et al.*, 2011).

2.6 Factors Affecting the Households' decision to Collect WEPs

Some authors mentioned that, different demographic and socioeconomic factors were affecting the households' decision to participate in WEPs as collector or consumer. And those factors were more likely to affect the households' decision either positively or negatively in WEPs as collector or not. Therefore, in this study, the factors affecting the households' decision to collect edible plants were categorized as demographic and socioeconomic factors; their expected effect was explained below.

2.6.1 Demographic factors affecting the households' decision to participate in WEPs

Sex of household heads

In Ethiopia compared with women, men were taking the risks in forest and they are more likely to go to the forest and collect non timber forest products (Campbell, 1991). As a contrast, in Nigeria, women were more likely to collect NTFPs than men (Opaluwa, *et al.*, 2011). So that in this thesis, sex of household was negatively affects the households' decision to participate in WEPs as collector or not in Addis Ababa.

Age of household heads

Since collection of NTFPs is labor demanding, therefore, young generations may be more dependent on forest products than elders (Mamo, *et al.*, 2007). In contrast, in India, elder people are more likely to collect NTFPs as compared with young people (Rodriguez (2009). Other researchers such as Hedge and Enters, (2000), Shone and Caviglia-Harris (2006) found a positive

association between age and household decision in NTFPs participation as collector. Therefore, in this study age was negatively affects the household decision to participate in WEPs as collector or not.

Household size

The larger household size, the more demanding of NTFPs for firewood for cooking foods; hence they are more likely to collect NTFPs (Adikhari, et al., 2014). In addition, the study by Rodrigez (2007), in India, the presence of additional individual in the household has the probability to collect NTFPs. Therefore, in this study, household size was hypothesized negatively affects the households' decision to participate as WEPs collector or not

Urban or rural background

Collection of wild plant is more common in rural area than urban (Davenport, *et al.*, 2011; Shackleton, 2014) and people with rural background will have better traditional knowledge than urban people; this enable to decline collection of such plants by the urban natives (Tabuti, *et al.*, 2012). As a result, household's background will be hypothesized positively affects the decision of households to participate in wild foods collection.

2.6.2 Socio- economic factors affecting households' decision to participate in WEPs

Household income

Households having higher income has no interest to collect WEPs compared to lower income households (Ndayambaje, et al., 2012; Angelsen, *et al.*, 1999, Tabuti, *et al.*, 2003a). However, those plants have the potential to mitigate urban poverty (Davenport, et al., 2011). Low income households are more dependent on wild plant sources (Jagger, 2012; Kaoma, et al., 2015; Shackleton, *et al.*, 2011 Therefore in this study wealth status was hypothesized positively or negatively affect the household's decision to participate in forest food collection or as well as consuming. But, income level in the household had no show any significant effects in the households' decision to consume or collect WEPs in the forest.

Education of household heads

Education is good instrument to measure the socioeconomic developments. In this context, education was negatively influenced the households' decision to participate as collector of

plants. In Nepal, higher level of education in the households provides good opportunity for better job and income; hence, this reduces the households' dependency on NTFPs as collector and they are less interested to collect WEPs (Adhikari, *et al.*, 2004). Therefore, in this research education was negatively affects the households' decision of participating in collector of WEPs.

Cultural habits (Food taboos)

The qualitative study by CARE-Ethiopia (2016) showed that, most elder respondents were mentioned at least one food type, which is culturally unacceptable to infants and young children. However, in contrast, within Africa and Asia, edible plants are considered foods for only women, children and weak people (Bvenura & Afolayan, 2015; Panda 2014). Use of such plants is integrated directly with traditional knowledge of the people and it is linked with their land of origin (Pretty, 2007; Pilgrim and Pretty, 2010). Hence, in this study, cultural habits (food taboos) was negatively affects the households' decision to participate as collector or consumer of plants.

Distance to source of non-timber forest products

A study conducted by Opeluwa, *et al.*, (2011) on the determinants of NTFPs collection and utilization in Nigeria discovered that, distance to the source of NTFPs has negatively affected the households' decision to collect wild foods. Therefore it is suggested that households residing close to the source of NTFPs are more likely to collect NTFPs. In Eastern Uganda households closer to high and middle agro-ecological zones i.e. they are near to the forested areas and hence they have better access to the resources (Paumgarten, 2007). Based on this finding, it was hypothesized that households living around high and middle agro ecological zone had the probability to participate in collecting or consuming as well as make coice the garden as main source of collection of wild foods. So that, distance was hypothesized negatively affects the household's decision to collect or consume WEPs.

Employment

Labor wage employment is one of the important income sources to poor households. This due to not only that food insecure households seek for any labor employment varying from unskilled daily labor to highly skill professional jobs to cope with their food security situations but also the prospect for them to get employed is low (Torosyan, 2018). Therefore, employment was hypothesized negatively affects the households decision to collect or consume WEPs.

2.7 Conceptual Framework

The conceptual framework for this research was illustrated in the following Figure 2.1. In the figure below, socio-economic factors that affecting the households' decision to participate in collecting WEPs were organized. Therefore, in this framework, the household variables such as income, distance, source of NTFPs, household's background, sex, age, job, perception, education, food taboos and family size were investigated their effects on the participation of households' to collect or consume WEPs. Therefore, these factors together had a negative consequence to reject and underutilize of WEPs in and around the study area. In addition to that, due to the ignorance of those potential plants in the study area, had results high food gap, high vulnerability to different shocks and high prevalence of food insecurity. In fact, those factors also had brought high dependency on small number of cultivated plants and food poverty. Generally speaking, most of those factors have had the ability to restrict the household's decision to participate in collecting as well as consuming WEPs in the local area.

So that, in order to reduce the above negative consequences, investigating the potential use of underutilized and rejected WEPs as food source and diet diversity complement with domesticated crops is enabled to combat food related shocks of the urban safety net beneficiary households. Therefore, to see the real contribution of such important plant species, activities such as promoting edible plants as food sources, education and creating awareness, investigate the nutritional analysis of those species, domestication, improved seed, improve local knowledge on use management and identification of WEPs and building positive perception were important tasks. Hence, applying those practices are important tool to improve the food security as well as livelihoods of the urban poor and marginalized dwellers, specifically the urban productive safety net beneficiary households. Therefore, the good maintenance of WEPs in turn has positive effects in achieving the availability of WEPs to the households. Finally, those managed WEPs have positive role to improve an access of edible plants through production and purchase for household consumption.

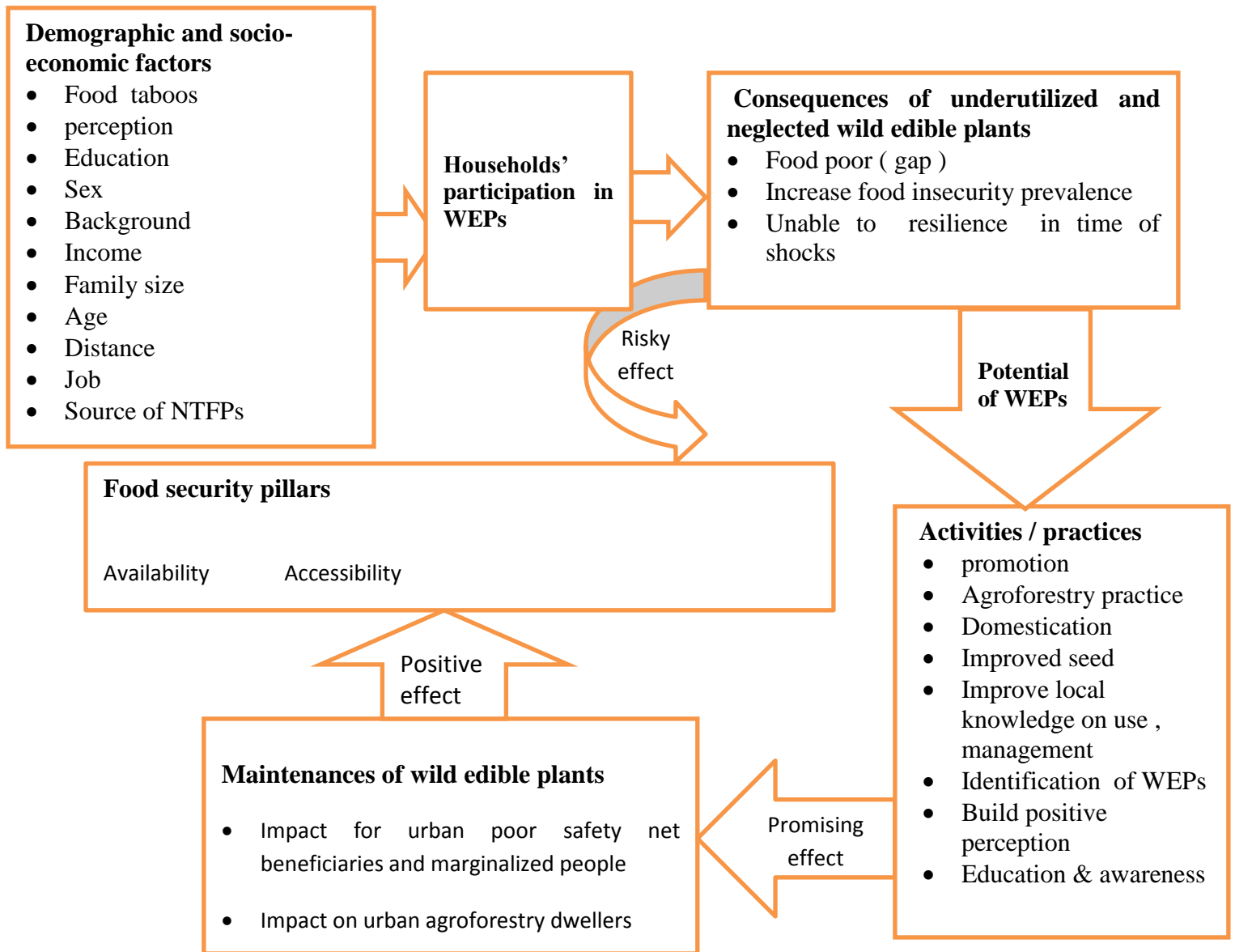


Figure 2.1: Conceptual Framework (Source: Constructed by own from reviewed literature, 2019)

CHAPTER THREE: DESCRIPTION OF STUDY AREA AND RESEARCH METHODS

3.1 Description of study area

3.1.1 Demographic features

Gullele can also spell as Gulele, which is one of the ten sub-cities of Addis Ababa and it is located in the northern part of the city. It has estimated a total population of about 327,426, of which, female=170,115 and male=157,311. The sub- city accounts 9.3 percent of the total population of Addis Ababa and covers an area of 31.19 kilometer square. The population density per square kilometer was 10497.7 persons (Andualem, 2018). The sub city covered 6 % land area of Addis Ababa and it makes the sub city the sixth largest in Addis Ababa (Bezawit, 2015).Gulele sub- city shares border with five sub cities such as Yeka and Kolfe Keranyo bordered to the west and east direction respectively while Arada and Addis ketema sub city shares boarder to the south east and south west respectively (Azeb, 2011). Accordingly, Addis Ababa City Administration Integrated Land Information Center report (AACCA-ILIC, 2014), Gulele sub –city is divided in to 10 woredas, 73 sub woredas, 200 Sefers and 546 blocks.

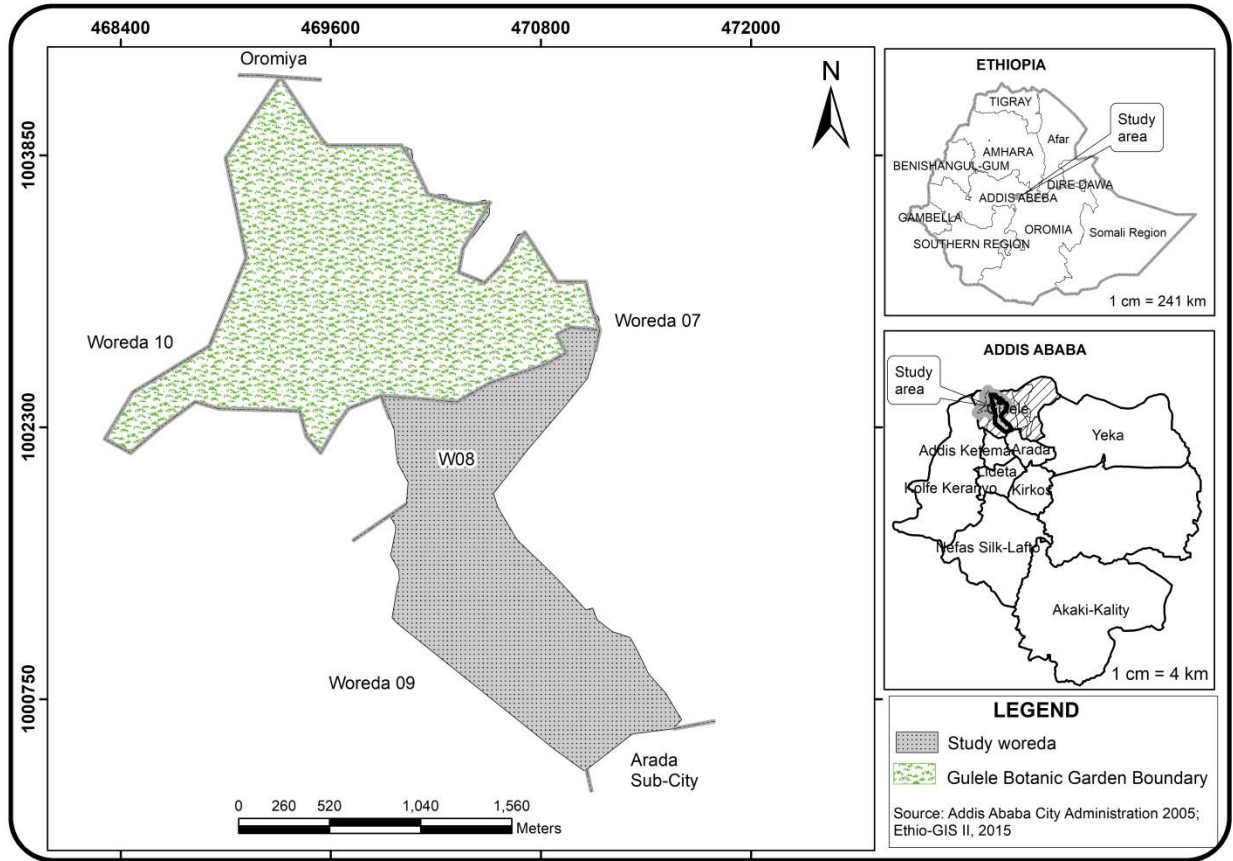
More specifically, in Gulele sub -city, there are a total of 10 woredas, among those districts, woreda 08 is one of the area under Gulele sub city administration. Hence, this district was the study area. According to the woreda 08 health office information, the district had a total population of 42,590; out of this, female accounted as = 21, 721, while male covered =20,869. In addition, the total number of household heads in the study area was 8,518 households.

3.1.2 Climate, rainfall and Vegetation situation

Whne the Gulele sub city is compared with other sub cities, it is found at high altitude geographical areas and it has relatively evergreen and cold climatic condition. This is due to the existence of Entoto Mountain and Gullele Botanic Garden around the city. The ten years mean annual rainfall of the area was 12226 milliliter and the area received maximum rainfall in between June and July (*kirmet*) season while the average temperature in the area was 14⁰c (EMA, 2017).

In addition to Entoto Mountain, Gulele Botanic Garden is found in the sub city and it was selected as the study site during the study period between 2019 to 2020. Gulele Botanic Garden is the first opened ever botanic garden focusing on conservation. According to Gulele Botanical Garden office report, the garden is lying on 705 hectares of land and approximately 100 hectares of cultivated gardens having around 1600 indigenous plants species and 65 critically endangered plant species. Gulele Botanical garden is located on the northern periphery of the capital city of Addis Ababa. The southern boundary of the gardens is located at 9°6' S, and 9°3'36"N, 38°44'24"E, and 38°42'W make up the extent of the boundary from north, east, and west, respectively (Tegegn, 2015).

Accordingly, the data obtained from the website of the organization (<https://www.bgci.org> retrived on june, 2019), "*Gulele Botanic Garden*" is the first compassionate in the horn of Africa, which was officially recognized on July 7th 2010 by Addis Ababa city declaration 18/2013. The area has significant environmental value since it lies on both the upper urban watershed for the Akaki River and the expanse of the metropolitan area. The protection area is projected to be an economically competitive marginal to urban expansion and serve as a station for ecotourism. The public impacts of the project are estimated to take several forms including educational outreach, public works projects and the establishment of the gardens as a center for research. To line up coming objectives and goals for the area, the régime of Addis Ababa decided on the subsequent four obligations, for GBG: (1) innate species conservation, (2) education, (3) ecotourism, and (4) research.



(Source: Addis Ababa city administration, 2005; Ethio GIS II, 2015)

Figure 3.1: Location of Woreda 08 and Botanic Garden in Gulele sub city in Addis Ababa, Ethiopia.

3.1.3 Socio- economic characteristics

The sub city is among the poorest cities in Addis Ababa. It is estimated that, more than 55% of the total population in the sub city are engaged in the informal sector (GSC, 2011). The sub city is characterized by high unemployment and high prevalence of HIV/ AIDS. The communities are engaged in various economic activities such as *Shema* work, daily labor, firewood collection and sale, pottery, *gullit* and road-side petty trade (UN, 2013)..

The government of Ethiopia has launched Productive Safety Net Program as one of the food security strategy to safeguard food insecure households from shocks and other hazards through transferring cash and food ((MoLSA, 2012). Since 2017, the program has been implementing in eleven cities including Addis Ababa and it is benefiting around 190,000 urban poor people,

specifically only in Addis Ababa , there was more than 415, 923 safety net beneficiaries. So, Gulele sub city is one of the beneficiaries of the program and more than 5072 households are benefited from the program (PIM, 2016). More specifically, the report by woreda 08 office shows that, there are more than 2800 safety net beneficiary households in the district.

3.2 Research Design and Methodology

3.2.1. Reconnaissance survey

Before the start of the actual research work for this study, a reconnaissance survey was carried out in November 2019 in order to gain a general understanding of the characteristics of the study areas and to identify the different forest sites in the different plant community types. It made bases for selection of specific research sites and data collection techniques. Following the reconnaissance survey, the following appropriate design and methodologies were developed for in-depth data collection.

3.2.2 Sampling techniques and sample size determination

The study site was *Gulele Botanic Garden* (GBG), which is found in woreda 08. Accordingly, GBG was selected following purposive sampling method, because those who are living around the forest have direct interference in the protected forest. Moreover, the selection of this study area was influenced by the fact that they had better vegetation coverage and it could be representing the physical, socioeconomic and cultural background of the community. In the study district, there are six *ketenas*, following stratified random sampling technique, based on the score level of household heads *ketenas* were categorized in to three as highest (*ketena* 1 and 2), medium (*ketena* 3 and 6) and lowest (*ketena* 4 and 5). Therefore, in each category, using random sampling technique, *ketena* 2, 3, &5 were selected. According to woreda 08 administration data, these three *ketenas*' were contained a total of 561 household heads. Hence, the total sample size was distributed to the three strata (*ketenas*) relative to their size of household heads. Lastly, the study units were selected using systematic random sampling technique based on the list of households' heads available in woreda 08 food security office. Household heads that were not volunteer in the study were substituted by the next household heads.

According to Kothari, C.R (2004), the sample size should neither excessively large nor too small. It should be optimum. An optimal sample is one which fulfills the requirements of

representativeness and reliability. Therefore, due to resource and time constraints, it was not possible to have large sample size.

Therefore, the total study population in the three ketenas of wored 08 was 561 households'. The overall sample size was determined by the formula adopted from Cohen. The researcher used a level of significance of 0.05 and a margin of error of 5%. Z_{α} is a value from the normal distribution related to and representing the confidence level (equal to 1.96 for 95% confidence). Using these inputs and the standard sample size calculation formula, the sample size calculated for this study was 145.

$$a) N_0 = z^2 pq / d^2$$

$$b) n = N_0 / (1 + N_0 - 1 / N)$$

Where: N_0 - desired sample size when population size is $> 10,000$

n - Desired sample size when population size is $< 10,000$

$Z_{\alpha/2}$ - Value of standard score at a desired confidence limit (in this case 95% i.e. 1.96)

p - Intended proportion of the population to be included in the sample (assumed to be 0.1 in this case; because of limitation of time & budget this would provide the minimum sample size).

$q = 1 - p$ (0.9 in this case)

N = size of total population

D =error margin (0.05 in this case 95% confidence interval)

$$N_0 = Z_{\alpha/2}^2 * pq / d^2$$

$$= (1.96)^2 * (0.1) (0.9) / (0.05)^2$$

$$= 138$$

$$n = N_0 / (1 + N_0 - 1 / N)$$

$$= 138 / (1 + (138 - 1) / 561)$$

$$= 138.167 = 138.$$

.

Adding 5% contingency for expected non-response rate, the final sample size of beneficiary households for the household survey was 145.

Table 3.1 Sample size of the study

Gulele sub city (Woreda 08)	Beneficiary household heads			Samle size
	Female headed	Male headed	Total	
<i>Ketena 2</i>	177	73	250	57
<i>Ketene 3</i>	174	38	212	48
<i>Ketene 5</i>	85	14	99	40
Total	436	125	561	145

Source: Gulele woreda 08 Food security office, 2020.

Therefore, presently **561** active households became the real study population to undertake the sample size determination

3.2.3 Data collection tools and techniques of analysis

Household survey

In order to get relevant, direct and detailed information about the study topic, survey technique is an acceptable (Denscombe, 2003), this is because of questionnaires are important tool to get quantitative data as well as for qualitative data. Moreover, questionnaires are convenient to respondents, cheap and easy to administer. In addition, since there is no personal influence by the researcher, respondents has fair chance to provide true reply (Walliman, 2011). Hence due to the above reasons, questionnaire selected as main instrument in this study to conduct survey research.

Data was collected using semi- structured questionnaire directed for 145 households those who were living around Gulele Botanic Garden in between March 2020- May 2020. Among the total households, 64 male and 81 female household heads were selected during household survey following the method described by (Krejcie & Morgan 1970). Mostly, in urban safety net program, female headed households were more targeted beneficiaries than male. That it is why in the survey, large number of female respondents were participated than male .Moreover, traditionally, women are good collector of wild edible plants than men (Barirega, *et al.*, 2012; Ojelel, *et al.*, 2015), hence in this study more women were the key respondents than men.

The questionnaire covered demographic and socio-economic characteristics on wild edible plants. For the purpose of simplicity and to make easy the communication between the respondents and enumerators, it was translated in to Amharic. Before start collecting data, enumerators oriented on the issue how to collect and follow the data collection procedures and ethics. Two Enumerators selected based on their educational background; knowledge of the local language, and experience on similar engagement. 50 cases of pilot study (reconnaissance survey) undertaken to get the general understanding of the study site. In addition, it is important to pre-testing the questionnaire for estimate the total time needs to complete it. Therefore after pilot study, the questionnaire edited lightly according to the result of pilot. After obtaining the consent of the respondents, based on semi structured questionnaire, face to face household survey was administered in order to generate relevant information. For maintaining the quality of data, scientific principles and guidelines in questionnaire design, collection, data filling, encoding, entry and processing was applied.

Field observation

Field observation was another tool of qualitative data collection. So that according to Kitchen and Tate, (2000), observation is a systematic noting and recording events, artifacts and behaviors in social and physical settings. Therefore, structured interview is important field method during field observation that is important to obtain ethno- botanical information (Martin 1995; Alexiades and Sheldon 1996). So, well statured checklist was applied during the interview. During guided field walk, the researcher had a chance to see the actual situation of the wild edible plants in Gulele Botanic Garden with the assistance of Gardners and informants.

Filed observation was taken with the help of Security Guard of the garden and other 5 informants with mixed group of male and females. Those who are elders, rural migrants and had local knowledge were selected to gather an ethno botanical information through identify and list all uncultivated and underutilized plant species by type, local name, habits, harvesting time and parts used for food in GBG based on checklist of questions prepared. In the study site, picture of wild edible and medicinal palnt species were well for the purpose of documenting ethnobotanical information for future use. The exact scientific name of species were found in the

catalog of (<http://www.catalogueoflife.org/>) whereas the global conservation status was found in IUCN Red List of Threatened Species (<https://www.iucnredlist.org/>) (Ojelel, *et al.*, 2019).

Focus Group Discussions (FGDs)

Mostly in qualitative research approach, focus group discussion is one of the best data collection tools and it is important to get more comprehensive formation about the purpose of the research. According to cook (2007), FGD is one of the best data collection tools in which groups of people meet together to discuss each other and reflect their experiences and thoughts about the specific objectives of the research. Therefore, during FGD, participants can be categorized in to two based on their age status; as middle aged (26-42 years) and elder (43-59 years) (Ty-Jour, et al., (2002).From the discussion, it was expected to get sufficient information and good idea sharing by the groups.

Thus, based on this age category, to assess ethnobotanical knowledge of the participants, two focus group discussions were carried out with representatives from different economic status such as religion, gender, age group i.e. (middle aged and elder). This technique has been used to extract information in a participatory manner so that the perceptions and views of the community was captured and interpreted. Hence, a total of 12 discussants were selected purposively. On this ground, their readiness of participants of FGD was asked and based on their consent time, schedule was arranged for FGD. During ethno- botanical data collection, detail discussion was made with informants with the main discussion topics such as; function of wild edible plants as a food supply, local name of species , life form of species , perception, cultural habits on WEPs, local knowledge in identification, use and management of WEPs were recorded.

3.2.4 Techniques of data analysis

Quantitative data analysis

Data were entered, cleaned and organized using Microsoft Excel 2007. Quantitative data was analyzed using the STATA version 13 applications for analysis the determinants of safety net beneficiary households' to collect or consuming WEPs as well as their perceptions towards those plants. Besides, Chi-square statistics was employed to check the model is wheather fit or unfit before regress and analysis began. Two tailed t- test was employed to identify the significance

variables, and used to compare and analysis the indigenous knowledge of some categorical variables such as sex and age groups of households'. The significance difference of such variables was confirmed if P- value < 0.05 and 95% of confidence interval was used to determine significance difference in all statistical analysis.

To check the completeness, consistency, accuracy, and to identify errors occur during data collection or processing, computer based data cleaning technique was carried out. Heteroscedasticity and multicollinearity tests were approved to ensure whether the econometric model is fitted or not. Heteroscedasticity test was completed using Breusch-Pagan and Cook-Weisberg test and the test was employed using estat hettest command in STATA software version 13. The results of heteroscedasticity tests of the household heads decision to participate as collector of WEPs or not were given below.

```
chi2 (21)    =    90
Prob > chi2 =  0.00
```

This result showed that, $\chi^2 = 90$ was large and it was significant at 5 percent. This indicates that heteroscedasticity had any problem and the null hypothesis is rejected. Therefore to resolve this problem, made a choice another fit model was the solution.

Moreover, , to understand the existence of linear relationships between explanatory variables, multicollinearity test was used in a model. According to Gujarati (2003), if individual parameters are not significant in the existence of multicollinearity, the model can be yields wrong signs coefficients, high R² value and high standards of errors. Therefore to check multicollinearity tests, the variance inflation factor (VIF) was applied in STATA software version 13. Therefore, if VIF value of variables is exceed 10, it shows there is high collinear and the variable must be excluded from the model (Appendix 1). The result showed that, none of the variables in the probit model had VIF values of greater than 10. Hence, this indicated that, there were no serious multicollinearity problems among the explanatory variables. After employed those tests, descriptive statistics was employed using probit model.

The main variables of interests such as: socio-economic characteristics, demographic factors and ethno-botanical data were analyzed quantitatively using frequencies, percentages; mean tables and figures through applying the STATA software and Microsoft Excel 2007. Furthermore, using probit model, household perception data was analyzed using frequencies and tables.

Households were employed free listing technique to capture data on plant identification, mode of consumption, availability situation, and mode of harvesting (Ojelel, *et al.*, 2019). Therefore, during household survey, using free listing technique, respondents identified wild and semi-domesticated plant species and data was summarized and recoded using descriptive statistics such as tables, figures, percent and frequencies. Then summarized in to botanical families, habitats, use parts, use categories (Cotton 1996, Martin 1995).

Econometric Model

Different researches are used probit model alone as well as using two stage models to predict households' decision making technique. For instance, in Eastern Uganda, in order to analyze the factors that affect the small holder farmers' decision in participating potato market, the researcher used probit model in the first stage to determine factors influencing household decision to participate in potato market (Sebatta, *et al.*, 2014). Moreover, in Nigeria, in order to analyze women participation in agricultural production from government area, probit model was applied to analyze their decision to participate in the production process (Oladejo, *et al.*, (2011). so that to analyze the determinants of market participation, the researcher had used probit model in the first stage whereas double-hurdle, Heckman and Tobit models were used at the second stage.

Therefore, in this study, household decision to participate in collecting WEPs was taken as dependent variable and modeled with discrete choice models. So that, the most commonly used approaches to estimate such models are Linear Probability Model, Logit and Probit model (Gujarati, 2003). In this case, household heads were categorized as either participants or non-participants as collector. So in this case, the dependent variable was taken the value 1 for participants and 0 for non-participants as collector. Although, Linear Probability Model is used to analyze binary outcomes for the discrete dependent variable, nevertheless, LPM is

encountered by numerous problems such as heteroscedasticity and non-normality error terms and also the possibility of the probability that an alternative j selected is greater than 1.

Due to these reasons, Probit and Logit models are favored; this is because of the probabilities are nonlinearly related to the independent variable. For these reasons Probit and Logit models are preferred because the conditional probabilities are nonlinearly related to the independent variables and have the characteristic to not exceed 0 and 1 asymptotically. Logit model is based on cumulative logistic probability distribution while probit model is based on cumulative normal probability distribution (Greene, 2008). Logit model have limitations because it does not assume normality, linearity and homogeneity of variance for the independent variables. These assumptions are important because Logit model cannot represent the variation of the random taste (Train, 2003). Probit model deals with this problem, hence it was preferred for this study.

This section defines variables mentioned in equation 5 that are used to estimate equations for this study:

Y_i = dependent variable for the participation decisions

j = *alternative decisions*

The decisions to participate in WEPs as collector or not is then stated as:

$$j = \begin{cases} 1 & \text{if the household decide to participate as collector} \\ 0 & \text{otherwise} \end{cases}$$

X_i = the vector of the independent variables for each objective as defined in tables 3.1 below

β_i = vector of coefficients to be estimated

ε = the normally distributed error term.

Given the above, the probability that a household belongs to a group j is function of the independent variables X_i and the normally distributed error terms ε , hence following Greene (2008) equation (5) is rewritten as:

$$Prob (Y_i = 1) = U_{ij} = (\beta_i X_i)_{j=0 \text{ and}} \quad (6)$$

According to Jones (2009) probit model assumes that F represents the cumulative distribution function (Φ) of a standard normal variable. The cumulative distribution function (Φ) is then expressed as follow:

$$Prob(Y_i = 1) = \Phi(\beta_i X_i) = \int_{-\infty}^{X_i} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{t^2}{2}\right) dt \quad (7)$$

The inverse of equation (7) provides the linear form of the probit model and this equation was also estimated by the studies of Oladejo *et al.*, (2011) and Sebatta *et al.*, (2014).

Hence, it is specified as:

$$\Phi^{-1}(p_{ij}) = Y_i^* = \beta_i X_i + \varepsilon \quad (8)$$

The parameter estimates of the Probit model offer lonely the direction of the outcome of the independent variables on the dependent variable nevertheless they do not represent the actual magnitude of change (Demeke, *et al.*, 2014). The magnitudes of the coefficients of the probit model can be achieved by calculating partial effects of the explanatory variables that is separating equation (8) with respect to each explanatory variable.

Qualitative data analysis

Qualitative data captured during focus group discussion were analyzed using an approach of constant comparison technique (Glaser and Strauss 1967), which is applied by creating groups of events. Therefore for this study, discussion topics and the responses given by participants were categorized and analyzed. In addition, narrative analysis technique was employed with participants related with the issue of identifying WEPs, use, cultural habits and perception of households.

Moreover, qualitative and quantitative data on wild edible and medicinal plants were collected using the method given by Martin (1995), Cotton (1996), and Alexiades (1996). So that, ethnobotanical information was captured using semi-structured interview, FGD and guided field walks. Informants' ethnobotanical data was entered in to Excel spreadsheet software (Microsoft soft word corporation, 2007). Then after, this ethno-botanical data was summarized and analyzed using simple frequency tables, percentages and figures (Martin, 1995 and Cotton, 1996). Generally speaking, descriptive statistics were applied to identify the number and percentage of

species, and families of WEPs, used parts, their growth forms, and proportions of parts harvested, modes of preparation and consumption patterns, habitat, main gatherers and consumers in the same manner. Described by Agea, *et al.*, (2011).

As defined by Creswell (2017), in series or single studies, to recognize a research problem carefully, employing both quantitative and qualitative methods are important to realize more strong findings. Therefore, to answer the determinants of households in collecting and consumption of WEPs as well as evaluating households' perception in WEPs, descriptive research design was employed. Primary data sources can be records by those who are actually witnessed an event or entail personal experiences about the event itself (Kitchin and Tate (2000), so that ,urban productive safety net beneficiary household who are elders , young and adults living around the forest were the original primary data sources. Whereas, secondary data was obtained from written materials such as books, articles, journals, reports, empirical findings. The most important secondary data sources are office of Gulele Botanic Garden and woreda 08 administration.

In order to capture Ethno -botanical data including use, perceptions and identification of WEPs, semi –structured interview was employed (Knapp & Fernandez-Gimenez, 2009; Martin, 1995; Cotton, 1996; and Alexiades 19960), and that was monitored during filed observations. In addition, as recommended by Alexiades (1996), two FGDs were carried out with representatives from different economic status such as religion, gender, age group i.e. (middle aged and elderly) consisting of 12 individuals were used to prove the reliability of the data collected through semi-structured interviews.

3.2.5 Study population

The study population was urbn safety net beneficiary households that are participated in public works and living around and proximate to the Gulele Botanic Garden were selected as sources of population. In addition, among the total of six *ketenas*, based on the households proximity to the Garden, three *ketans* were selected as source of population.

Table 3.2 Total population in the study area

Gulele sub city (Woreda 08)	Beneficiary household heads		
	Female headed	Male headed	Total
<i>Ketena 2</i>	177	73	250
<i>Ketene 3</i>	174	38	212
<i>Ketene 5</i>	85	14	99
Total	436	125	561

Sources: Gulele Woreda 08 Food Security Office, 2020.

3.2.6 Eligible criteria

Households who are urban productive safety net beneficiary households that are participating in public works were part of the study because those households' have the capacity and the experience in engaging in productive activities in the urban areas.

3.2.7 Definition of variables and hypotheses

Investigating the upsets of explanatory variables in the decision of households' to collect and consume WEPs was an obligatory. Hence different variables were expected to affect the households' decision to be collect or not. Therefore, the major hypothesized variables were explained below.

Dependent variable

“Households' participation” as collector of WEPs was the dependent variable for probit analysis. It was dichotomous dependent variable in the model and taking the value 1 if the household is participated as collector and 0 otherwise. Therefore, in this case, households having willingness to participate in WEPs were considered as participants. Nevertheless those who are not in a position to participate in collection and consumption of edible plants were considered as non-participant.

The independent variables

Sex of household heads (x1): it is a dummy variable taking the value 1 if the sex of household is male and 0, otherwise. According to the findings by Baten and Khna (2010), female headed

households are more at risk than men in order to gain an access to valuable resources, which helps them to improve their income and production; hence this in turn increases the probability of being food insecure. They do not actively participate in developmental and labor market or other livelihood activities. However, in contrast to this finding, the study by Barirega and his colleagues (2012) , Ojelel and Kakudidi (2015), showed that, in Uganda, traditionally women are more wild edible plants collector than men. Therefore, in this study gender of households was affects negatively the households' decision to participate as WEPs collector or not.

Age of the household head (X2): It is a continuous variable measured in years. Many studies argued that elder people have more time and better knowledge on wild food collection than younger people (Ojelel, et al., 015; Tabuti, et al., 2012; Tugume, et al., 2016), this implies young people will have negative relation with perception as well as indigenous knowledge on wild edible plants. Young households' heads are stronger and energetic than elderly households as they are expected to engage in various farm and non-farm activities to earn more direct food production or income that increase households' access to food (Abafita and Kim, 2014). Hence, in this study age of the household was hypothesized negatively affect the households' decision to participate in WEPs as collection or not. However, in this thersis, the final resut showed that, age of households was affects negatively the households' decision to participate as WEPs collector or not.

Family size (X3): It is a continuous variable measured in the number of people in the family. Households having large family size will more likely to collect wild plants (Sewanyana, 2009), that means family size expected to effect the probability of households decision to participate in WEPs as collector or not. To compromise this, studies argued that larger family size tends to exert more pressure on household consumption than the labor it contributes to production (Stephen and Samuel 2013; Muche, Birara & Tesfalem, 2014). Therefore, in this study, larger household size is expected to affect extent of households' deciosn in participating WEPs collector or not. Therefore, family size was affected positively the households' decision to participate as WEPs collector or not

Education level of the household head (X4): It is a continuous variable measured in years of schooling of the household head. Education, which is a social capital, has a positive impact on household ability to take good and well-informed production and nutritional status (Babatunde 2007). People with higher education level have less likely to collect wild plants for medicinal use (Pouliot, 2011). The study in South Africa indicates that, level of education is significantly correlated with wild edible plant collection in two to three towns studied (Davenport et al., 2011). Besides, Amaza, Umeh, Helsen & Adejobi (2006) argued that households with higher years of schooling are less likely to be food insecure as it enables them to produce more and consume more. Therefore, higher years of schooling affected negatively the households' decision to participate as WEPs collector or not

Perception (X5): it is categorical variable. Wild edible plants are mostly considered as foods for women, children and weak persons (Getachew, *et al.*, 2013). In order to measure perceptions, the most simple technique is based on three scale, which takes the value 1 if they are agree, value 2 if they are uncertain, value 3, if they are disagree. Therefore, perception affects negatively the households' decision to participate as WEPs collector or not

Food taboos (X6): it is dummy variable taking the value 1 if the household accepts and 0, otherwise. Most elder respondents were mentioned at least one food type, which is culturally unacceptable to infants and young children (CARE-Ethiopia, 2016). In contrast, in most studies of Africa and Asia, wild edible plants are considered foods for only women, children and weak people (Bvenura & Afolayan, 2015; Panda 2014). Therefore food taboos were affects negatively the households' decision to participate in WEPs as collector or not.

Urban or rural background (X7): it is a dummy variable taking the value 1 if the household has urban / semi – urban background and 0, otherwise. Collection of wild plant is more common in rural area than urban (Davenport *et al.*, 2011; Shackleton, 2004) and people with rural background will have better traditional knowledge than urban people. Therefore, in this case, household's background affects negatively the households' decision to participate in WEPs as collector or not.

Household income (X8): it is categorical variables and measured in number of Ethiopian Birr per month. Households having higher income has no interest to collect WEPs compared to lower income households (Ndayambaje, *et al.*, 2012; Angelsen, *et al.*, 1999). Low income households are more dependent on wild plant sources (Jagger, 2012; Kaoma, *et al.*, 2015; Shackleton, *et al.*, 2011), which can potentially help mitigate urban poverty (Davenport, *et al.*, 2011), while wealthier households have better access to markets to buy commodities due to higher income (Tabuti, *et al.*, 2003a). Therefore in this study wealth status was negatively affects the household's decision to participate in forest food collection or as well as consuming.

Distance to source of non-timber forest products (X9): it is continuous variable measured in kilometers. Distance from homestead to source of wild food will have negatively and significant relationship with household decision to collect or consume non timber forest products. A study conducted by (Opeluwa, *et al.*, 2011) on the determinants of NTFPs collection and utilization in Nigeria discovered that distance to the source of NTFPs has negatively affected the households' decision to collect wild foods. Therefore it is suggested that households residing close to the

source of NTFPs are more likely to collect NTFPs. A study by (Paumgarten, 2007) indicates that in Eastern Uganda there are three agro-ecological zones which are high, middle and low agro-ecological zones. So that households are closer to high and middle agro-ecological zones i.e. they are near to the forested areas and hence they have better access to the resources. Based on this finding, it was hypothesized that households living around high and middle agro ecological zone will have probability to participate in collecting or consuming as well as choose the garden as main source of collection of wild foods. However, in this thesis, this variable did not show any significant value in the decision of households to collect and consume edible plants.

Employment (X10): It is a dummy variable, which takes the value 1 if the household had access to labor wage employment in the last 30 days or 0 otherwise. Labor wage employment is one of the important income sources to poor households. This due to not only that food insecure households seek for any labor employment varying from unskilled daily labor to highly skill professional jobs to cope with their food security situations but also the prospect for them to get employed is low (Torosyan, 2018). It was expected that employment affects the households' decision in collection of WEPs negatively.

3.2.8 Expected variables affecting households' decision making process

The table below indicates the independent variables hypothesized in affecting the household decision in participating as a collector of WEPs or not. Therefore, in this case, the independent variables such as household background, sex of households and family size has been positively affects the probability of households decision on participating in collecting wild edible plants in the study area. However, perception, income, education, age and cultural habits (food taboo) were expected to negatively affect the households' decision in participating as collector of wild edible plant.

Table 3.3: Expected influence of variables in household heads decision to participate in collecting WEPs.

Variable defined	Variable type	Variable unit	Expected sign
Dependent variable			
Participation in collection WEPs or No participation	Dummy	1 =household participated or 0=not participated	

Independent Variables

Age of household head	Continuous	Number of years	--
Household income	Continuous	Number of Birrs per month	--
Sex of household	Dummy	1= male , 0= female	--
Family size of household heads	Continuous	Number of persons in a family	+
Job	Dummy	1= employed, 0 otherwise	--
Household perception	Continuous	1= agree ,2= uncertain 0= disagree	--
Education of household heads	Continuous	Number of years of school	--
Food taboos	Dummy	1= yes ,0= otherwise	--
Household background is rural	Dummy	1 =urban (semi-urban),0 = rural	--
Distance from homestead to NTFPs sources	Continuous	Kilometers	--

Source: survey data, 2020

CHAPTER FOUR: RESULT AND DISCUSSION

4.1 Demographic and Socio-economic Characteristics of Households

In the total of 145 household heads, female respondents represented 56% while male household heads were 44%. In average each respondents had four family members. From the total respondents, 29 % were collector of NTFPs including wild edible plants. All respondents had an average age of 44 years. The average years of schooling for all households were found to be five years and this means that the majority of household heads had learned elementary school.

Table 4.1: Demographic characteristics of respondents

Variables	Total interviewed (n=145)	Collector (n=42)	Non collector (n= 103)
	Means		
Age of household head(number of years)	42.45	42.12	42.38
Education (number of years)	4.87	4.78	4.81
Household size (number of persons)	4.0	4.	4.02
	Percentage		
Sex of household heads			
Female	56 %	55%	56%
Male	44%)	46%	44%)
Background			
urban/semi- urban	28%	12%	34%
rural	72%	88%	66%
Job			
Employed	32 %	36%	30%
Unemployed	68%	64%	70%

Source: survey data, 2020

Among the total of 81 female household heads, 36 were collectors of those plants. However, in the total of 64 male respondents, only 6 male household heads were collector of such plants. Therefore, this finding showed that, in the study area female households were superior collector of WEPs than male households. In many situations, women are good collector of non-timber forest products than male (Ibnouf, 2009; Shackleton, *et al.*, 2011; Westholm, 2016; Sunderland, *et al.*, 2014). In Africa and Asia, women were found to be dominant than men in collecting non timber forest products and they are more dependent in income sources from NTFPs than male (Mai, *et al.*, 2011)

In the total respondents, 27% had urban and or semi- urban background and of whom, only 8 repondnets were collector of NTFPs. On the other hand, 73% of respondents had rural background and out of this, 34 households were collector of NTFPs. Thus, this finding entailed that, those who have rural background were participated more during NTFPs collection than those who have urban background.

Besides, in this study finding, 68% of respondents were unemployed. Of whom, 27 repondnets found to be collector of NTFPs. However, 32 % repondnets were employed (i.e they were engaged in the informal sectors) and of which 15 respondents were found to be collector of NTFPs.

4.2 Diversity and Sources of Plant Speies in the Study Area

A total of 41 plant species (both edible and medicinal) were identified and documented in the entire study area. These are belongs to 34 families (Appendix 9). Among those plant species, 66% accounted as edible plants. The left 34% of plant species categorized under medicinal plants. The local names, scientific names, used parts as well as their life forms were recoded well. Generally, in the study area, because of good management system by the government, there is a potential amount of useful plants for food and health to the communities living around the district.

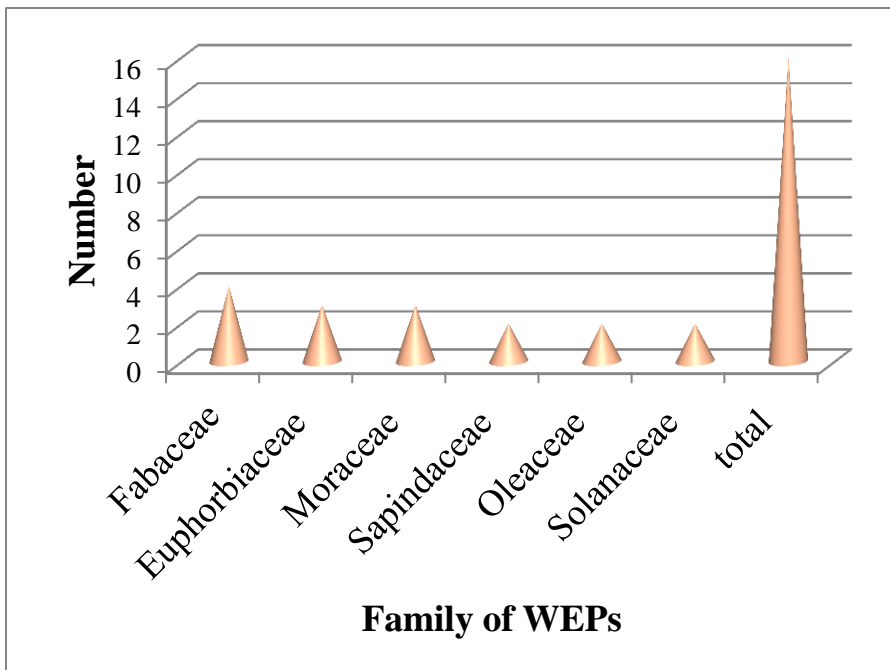


Figure 4.1 Families represented by higher species in the study area

The most commonly cited plant families were Fabaceae, Euphorbiaceae, Moraceae and Oleaceae. Based on flora of Ethiopia and Eritrea, those plant families have existed largely. In addition, comparable study by Getnet (2011) and Desalegn (2017) indicated that, Fabaceae family of plant species were explained largely in their study. The family fabaceae was represented by the highest number of species (4 species, 12%) followed by Moraceae (3 species, 9%) and Euphorbiaceae (3 species, 9%). Sapindaceae, Oleaceae and Solanaceae were represented by 2 species (6% each). Therefore, 18% of plant families were represented 16 plant species while the rest of 52% families were represented by single species (1.04%)

Concerning with their habitat, 36% of plants were represented under trees, and of whom 29% of them were edible trees. The rest 7% plants were categorized under medicine (Figure 4.3). 41% plant species were categorized under shrubs, of which, 24% plants were edible while the rest 17% of plants were also categorized under medicinal plants. Similar study by Ermiase and Zemedu (2011) showed that, 30 % trees and 32% shrubs were recorded. This means, trees were the dominant growth form next to shrubs in their study report. In addition, 23% of those plant species were categorized under herbs. Of whom, 13% of these plants were edible while the rest 10% plants were represented by medicinal plants.

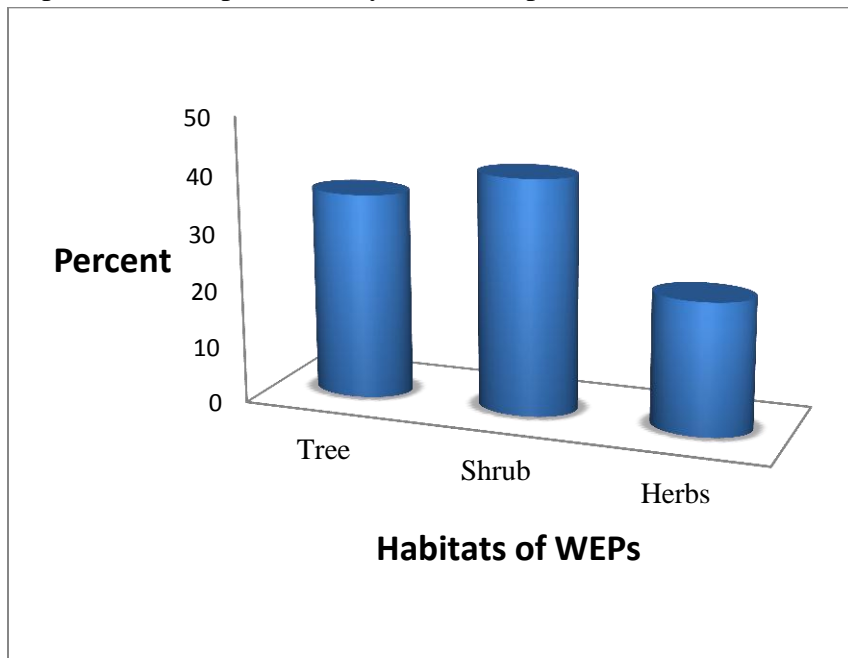


Figure 4.2 Life forms of plant species in the study area

In the total of WEPs, fruits were represented 44% (see figure 4.4). However, stem, flower, seed and roots were represented 5%, 4%, 2%, and 2% respectively. Generally speaking, fruits were predominantly identified edible plant species in the study area. To compliment this finding, the study done by Desalegn and Deressa, (2017) showed that, 80% of identified WEPs were

Botanic Garden and forest are the main sources of non-timber forest products to the households. So that, 10 households heads were collector of NTFPs in the botanic garden, while 32 respondents were collected NTFPs in the forest near to their locality. However, in the study sample size, 71 % of respondents were non collector of forest products.

4.2.1.1 Forest products collected from the forest and botanic garden

The different non timber forest products collected by households from botanic garden and forest were listed below in the table 4.3 below. In the total of 42 collectors, 75 % were collected the firewood in the forest while the rest 25% were collected in the botanic garden.

Table 4.3 Non timber forest products collected by households

NTFPs	Total collectors of NTFPs n= 42	
	Percent of collectors	
	Botanic garden	Forest
Firewood	25	75
Fruits	25	75
Medicinal plants	65	35
Herbs & Spices	45	55

Source: survey data, 2020

On the other hand, 65 % of NTFP collectors were gather their medicinal plants in the botanic garden whereas the left 35% were collected those useful plants in the forest. Besides, 75% of NTFPs collectors were got their wild edible fruits in the forest while the rest 25 % were collected those fruits in the garden. 55% of collectors were acquired herbs and spices in the forest whereas the left 45 % were collected those plants from the garden.

4.3 Traditional Knowledge on Useful Plant Resources in the Study District

During household survey, 60 % respondents were reported or identified both edible and medicinal plants in the study area. Hence, more information described in detail below table 4.10.

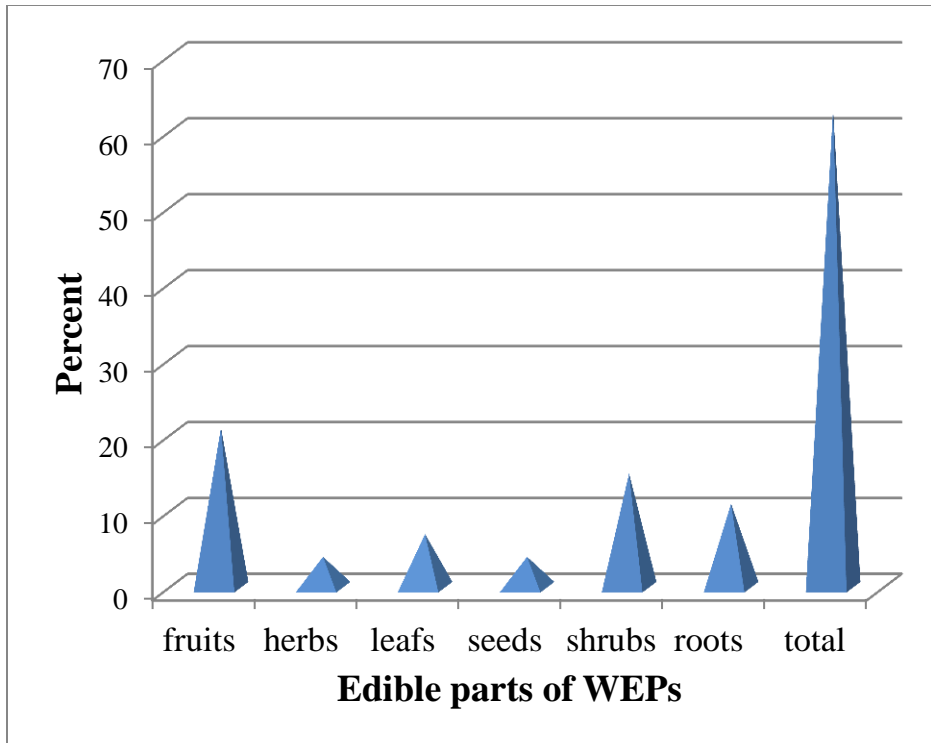
Table 4.4 Traditional knowledge of household heads

Variable	Total households n= 145	Those who identified WEPs (n=87)	Identified average no.of WEPs	Those who did not identified WEPs n= 58
Households				
Female	81	59	2	22
Male	64	28	1	36

Sources; survey data, 2020

In the study area, 59 female respondents were reported on average two plants. 28 male respondents were reported one plant species. This result showed that female respondents had better traditional knowledge on WEPs than male respondents. The rest 58 respondents (female = 22 and male = 36) did not report any edible and medicinal plants during household survey. Generally, based on the above finding, among the total of 145 respondents, 87 household heads had better local knowledge on WEPs compared with the rest 58 households.

During household survey, respondents were identified and reported 24 plant species outside the botanic garden (figure 4.5). Among these, fruits dominated and it accounted 21%, next by shrubs (15%). However, the rest herbs, leaf seeds and roots were accounted 4%, 7%, 4%, 11 % respectively



Source: survey data, 2020

Figurer 4.4 Edible parts of wild species cited by household heads

4.3.1 Relationship between age, gender and knowledge of WEPs

The average plant species reported by elders were greater than those reported by middle aged groups. Similarly, there was a significant difference ($P < 0.05$) in the number of WEPs reported by elder repondnets (43–59 years old) compared to those reported by the middle aged members (26–42 years old) (Table 4.8). More number of WEPs was reported by the elderly (>45 years old) than middle aged responndnets.

Table 4.5 Two tailed- t-test comparison result between age and traditional knowledge on WEPs.

Group	Observation	Mean	Std.Err
Elders	6	4.5	.7187953
Middle aged	6	2	.6324555
Combined	12	3.25	.591928
Difference		-2.5	.9574271
Ha: diff != 0	Pr(T > t) = 0.0260	df=10	t = -2.6112

Source: survey data, 2020

The two – tailed t-test comparison result between middle aged (26-42 years old) and elder (43-59 years) showed that elders were found to be good reporter of WEPs in average (4.5 ± 0.72) than middle aged (2 ± 0.63). Hence the result showed that elder respondents were more knowledgeable than those who are relatively middle aged households (Table 4.8).

However, as a contradiction, the study by Fentahun, et al., (2008) showed that, young generations were more knowledgeable than elders. But , the result of Tabuti and Damme (2012) and Tugume , *et al.*, (2016) indicated that , elder people are more collector and have more knowledge on wild edible plants than young people .

During FGD, even though, most of elder discussants had knowledge about WEPs but they were not in a position to utilize these food sources present in their local areas. This merans that, there is a problem of implementation. From all participants, 7 elder houserholds and collector of NTFPs shared their experience that WEPs are important for health and good source of foods. Most elder participants' belived that WEPs are fully gifted by nature and they are important to human health. They also recommended that, if WEPs can be properly managed, they can contribte to food security. From the respondents, one of the elder repondnet mentioned that since WEPs are not demanding any input to grow and because of their ability to resistance drought in nature, they can be good solution as food sources in time food shortage or drought.

Likewise, there was a significance difference between gender and traditional knowledge on WEPs. In the case of gender, women were recognizing more WEPs ($p < 0.05$) than men (see table 4.9).

Table 4.6 two tailed- t-test comparison result between gender and traditional knowledge on WEPs.

Group	Observation	Mean	Std.Err
Men	6	1.333333	.2108185
Women	6	5.166667	.1666667
Combined	12	3.25	.591928
Difference		-3.833333	.2687419
Ha: diff	!= 0	Pr (T > t)=0.0000	df= 10
			t = -14.2640

Source: survey data, 2020

The study conducted by Barrirega, *et al.*, (2012) and Agea, *et al.*, (2011) indicated that, women are more collect of WEPs than men in Uganda. Hence, the two- tailed t-test result showed that, women respondents were reported more number of WEPs on average (5.16 ± 0.17) than men (1.33 ± 0.21). Traditionally, women are good collector of NTFPs including edible plants (Molee, *et al.*, 2017). Moreover, the study finding by Tena and his colleagues (2014) showed that, women were reported more number of WEPs on average (6 ± 2.07) than men (5.63 ± 1.93). Hence, those findings presented that, female repondnets had better local knowledge on WEPs than male. In the study area, women and children were the main collectors of wild edible plants. Fruits such as *Rosa abyssinica Lindley*, *Carissa spinarum L.* and *Solanum nigrum L.* were the dominant fruits found in the study area and it was more likely by the respondents.

4.3.2 Food taboo/ cultural habit / on WEPs

24% of respondnets were mentioned that some WEPs are culturally restricted for pregnant and infants (Table 4.5). The study report by CARE-ETHIOPIA, (2016) showed that about 34.7% of respondents mentioned that some WEPs are not culturally acceptable to infants and pregnant women. Majority of the respondents believed that consuming those plants is the cause for abortion to pregnant women. Besides, they believed that such plants can be caused to

constipation by the infants. In the total of 145 respondents, 21 female and 14 male respondents were perceived that those plants were culturally restricted to infants and pregnant women

Table 4.7 Food taboos of households

Variable	Total respondents	Food taboos (culturally restricted)
	<i>n = 145</i>	n = 35
Household's food taboos	Frequencies	Percentage
Female	21	14%
Male	14	9%

Source: survey data, 2020

During FGD, elder women participants believed that those plants are not good for pregnant women because they are the cause for abortion. Other elder women also mentioned that eating those plants is culturally stigma in the community. One participant mentioned that, there is availability of “*Sama*” in the local area that is very important for soup and sauce preparation but due to cultural barriers in the community, it was rejected. Most elder participants were mentioned that even if there is a demand to use WEPs but unavailability of those species and lack of market access, stigma, seasonality problems, and poor local knowledge were mentioned as challenges.

4.3.3 Perception of household to WEPs

There was no any significance difference (P- value > 0.05) between the perception of collectors and non-collector households (Table 2). Therefore, among the total respondents, 63 % respondents were agreed that wild edible plants have significance value to household health. Similarly 71% collectors were also agreed in this statement (statement 3). Around 61% informants were agreed that those plants have essential nutrients for health, similarly 66% of collectors agreed by this statement (Statement 7). Besides, 35 % respondents believed that those edible plants are only foods for the poor people, but 58% of collectors also disagreed on this statement. The rest households had uncertainty about the issue. 11% of households believed that those plants are tasteless and unappetizing. However, there were no any collectors who agreed that wild edible plants are tasteless and unappetizing.

Table 4.8: perceptions regarding wild edible plant collection

Statements	Agrees with the statements	
	All household (n=145)	Urban collector (n=42)
Eating wild foods are harmful for humans	5%)	0%
Wild edible plants are tasteless and unappetizing	11%	0%
wild edible plants have significance to household health	63%	71%
Wild edible plants are foods for the poor people?	35%	58%
Wild foods can be an alternative food source during food shortage	51%	96%
Wild plant is not healthy because of pollution	11%	9%
Eating wild edible plants will have essential nutrient for health	61% %	66%

n= number of household heads

(Source: survey data, 2020)

In addition, 51% of the respondents agreed that WEPs can be used as an alternative food sources during food shortage. However, 96% collectors were agreed in this statement. 5% informants were sagreed that eating wild edible foods are harmful to humans. But, there were no one collector of plants agreed on this statement. Moreover, 11% households agreed that wild edible plants are not healthy because of pollution. Similarly, 9% collectors were agreed bt the statement six. This was due to dust and other pollutants.

Furthermore, during focs group discussion, most discussants were believed that WEPs have good taste, while few women participants were mentioned that those plants have less taste and poor quality. Some younger participants believed that eating those plants is shameful in the community, and they also argued that some plants may not be an alternative food source because

they are polluted by dusts and drainage. Majority of the respondents believed that WEPs are not foods for poor people; instead they can be used as an alternative food sources for poor people.

4.4 Household heads’ Decision to Participate in Collecting WEPs.

About 80 household heads were showed their willingness to participate for collecting as well as consuming those plants in the study area (Table 4.7). Of whom, 55 households were female while 25 households were male. Therefore, sex of household has significant effect (P-value < 0.05) in the decision process of households to collect those plants. On the other hand, the rest 65 respondents (39 male and 26 female) did not show their willingness to collect those edible plants in the study area.

Table 4.9 Household decision based on sex

Decision based on sex	Willingness to collect WEPs	
	Yes	No
Female	55	26
Male	25	39
Total	80	65

Source: survey data, 2020

4.5 Factors Affecting Households’ Decision to Participate in WEPs as Collector

Probit model was preferred to identify the determinants of households’ to collect and consume WEPs (Table 4.12). The Probit model was fit to this study since likelihood ratio test was 125.33 and it was significant at 5 percent and the log-likelihood showed the correct negative sign. In addition, Pseudo R² of 0.56 showed that the model was fit at 56%.

Table 4.10: Result of the probit model for the determinants of households' decision to collect WEPs

Dependent variable : households' participate or not in WEPs collector				
(1= Yes, 0= No)				
Variables	Coefficients	<i>Std. Err</i>	P> z	<i>Marginal effect</i>
Sex of households (1= male , 0= female)	.7785049	.0629982	0.001	.2063765
Age of households (years)	-.0712141	.0290485	0.007	-.027826
Education (years)	-.1939795	.0708078	0.006	-.0324233
Food taboos	-.3713986	.1626644	0.022	-.1481426
Sources of WEPs (forest & garden)	-.4819277	.2137447	0.024	-.0102127
Distance (kilometers)	.1398141	.1018586	0.170	.0162762
Job	.2116391	.1608222	0.692	.0842059
Household size (numbers)	.6256036	.020855	0.000	.1753657
Income	.0001019	.0002764	0.712	-.0000737
Perception	-1.252942	1.031246	0.224	-.4570845
Background	-.0672789	.1707175	0.694	-.026834
Constants	-1.947465	.9483502	0.040	
Significant at 5 percent				
LR chi2(26) =125.33				
Prob > chi2 =0.0000				
Log likelihood = -133.10773				
Pseudo R2 = 0.56				

Sources: survey data, 2020.

The variables such as sex of households and family size were positively affected the households decision to collect WEPs. Age, education, food taboos and sources of WEPs were negatively affected the households' decision to collect WEPs in the study area. However, variables such as distance, job income, perception and background of households had no significant effect in the households' decision to collect those plants.

For one unit increase in the age of household heads, the probability of collecting WEPs was reduced by 28 percent. This means that young households' heads are stronger and energetic than elderly households as they are expected to engage in various farm and non-farm activities to earn more direct food production or income that increase households' access to food (Abafita & Kim, 2014). This may be due to the fact that younger household heads are motivated to collect NTFPs because it is source of income. Similarly McElwee (2008) also found that elderly people are less

likely to collect or produce NTFPs because they may not have the strength to carry out forest-related activities. In this study, age has negative relation with wild edible plant collection.

For a unit increase the household's cultural restriction (food taboos), the probability to collect edible plants were decreased by 15 percent. In most communities of Ethiopia, often traditionally, children are forbidden to eat certain food materials. Similarly, adults drop some food materials which they ate when they were younger (Guinand, et al., 2000). This indicated that as people get older and are more exposed to the culture of their society, they avoid certain foods. Besides, the study report by CARE-Ethiopia (2016) showed that about 153 (34.7%) of the total respondents named at least one food type that is not cultural acceptable to be given to at infants and young children.

Source of WEPs had negatively affected the households decision to collect NTFPs. Hence, the probability of households' to collector NTFPs from forest was decreased by 1%. Besides, the study conducted by Moubarakatou (2017), showed that among 227 respondents, 39.7 % were collected wild fruits on farm; while, 19.4% respondents were collected those edible fruits in the forest. Hence, this indicated that, most households preferred on farm rather than forest to collect WEPs, this was due to government prohibited the households to use in forest.

For one unit increased the household size, the probability to collect WEPs was increased by 18 percent. Households having large family size will be more likely to collect wild plants (Sewanyana, 2009). Similarly, a study conducted by Rodrigez (2007) on the determinants of NTFPs collection revealed that, the presence of an additional individual in the household will increase household probability to collect NTFPs in India. To compliment this finding, larger family size tends to exert more pressure on household consumption than the labor it contributes to production (Stephen and Samuel 2013; Muche, Birara & Tesfalem, 2014). Therefore, in this study, larger household size has positively affected the households' decision to collect WEPs.

For a unit increased the education level of household heads, the probability of collecting WEPs decreased by 4 %. Households with higher years of schooling are less likely to be food insecure as it enables them to produce more (Amaza, Umeh, Helsen & Adejobi, 2006). Thus, based on the finding of this study, higher years of schooling positively affected the households' decision to collect WEPs. Regardless of education, in the study area, the illiterate informants were better

knowledgeable on WEPs ($P < 0.05$) than literate informants. The result of Pouliot (2011) showed that, people with higher education level are less likely to collect and use both medicinal and wild edible plants.

Female respondents had 20 percent probability of collecting WEPs than men. Many studies argue that, traditionally women are good collector of wild edible foods than men (Barirega, et al., 2012; Ojelel, et al., 2015). On the other hand according to the findings of Baten and Khan (2010), female-headed households can find it difficult than men to gain access to valuable resource, which helps them to improve production and gain more income, this in turn increases their probability of being food insecure.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In the study area, a total of 105 plant species (86 WEPs and 19 medicinal plants) belonging to 32 families were reported. The most commonly cited plants were *Fabaceae*, *Euphorbiaceae*, *Moraceae* and *Oleaceae*. More number of species per household was reported for the *Moraceae Urtica simensis* and the *Oleaceae* family.

Traditional knowledge of WEPs is directly proportional to the age of the respondents in that elder household members had more knowledge of WEPs ($p < 0.05$) than younger people. Regardless of their sex, women knew more number of WEPs ($p < 0.05$) than men. Women were the main collectors of WEPs followed by men and all household members. Fruits were the most predominantly consumed plant parts in the study area.

Therefore, it is not merely vital to keep such a wealth of traditional knowledge on WEPs hidden among the local people but also to implement them to modern knowledge of science and technology to meet the ever increasing requirement of people. Moreover, protection of these biological resources is very important to poor households because the wise use of these resources can improve the livelihood of households, specially generate an income and use as supplementary food sources.

The most WEPs were collected from forest habitats and this calls for urgent research on the possibility of growing and intentionally managing some of the commonly consumed WEPs such as *Morsmesozygia*, *Capparis tomentosa* Lam, *Carissa spinarum* and *Ficus sur*. Furthermore, further research on the poisonousness and nutritive conformation of the reported WEPs is recommended to ensure healthy for consumption.

Moreover, the study variables such as age, sex, level of education, food taboos and sources of plants were important variables, which affected the households' decision negatively to collect and consume wild edible plants in the study area; especially age of the households had a predominant negative effect on households' decision to collect and consume WEPs in the study area. Finally, this study can be used as an input to formulate new land use right policy along forests and riversides related with wild edible plants. It has also an implication for policy makers who needs in depth analysis about WEPs.

5.2 Recommendations

Regarding the findings of the study; household perception, traditional knowledge on WEPs and household determinants to consume WEPs are the major gaps in the study district. Therefore, the following are suggested for subsequent actions:

- Greater effort should be devoted to documentation and conservation of WEPs and medicinal and the associated traditional knowledge in the remaining districts of Entoto forest and other areas to have a better understanding in the wealth of the information available and serious actions has to be taken to restore and preserve the left over vegetation with special regard to the key WEPs and medicinal and preserve the traditional knowledge;
- One important method of conserving such vital traditional knowledge in the new generation is through incorporating it to school curriculum or at least hosting the idea as an extracurricular school activity. It is important to design activities that would help in recovering the disappearing of traditional practices. Local associations, school clubs and societies of interested groups can contribute to that end;
- Wild habitats were the main source of gathered WEPs and this call for urgent research on the possibility of adapting, growing and managing some of the commonly consumed WEPs such as *Syzygium guineense*, *Urtica simensis Steudel* and *Morusmesozygia*. Moreover, further research on the toxicity and nutritional composition of the reported WEPs is recommended to ensure safety of consumption;
- The finding of this study can assist in domestication specially *Urtica simensis*, which are presented in most seasons of a year, to be grown in home gardens as alternative vegetable sources. If Some of these wild edible plants cultivated well, they may have the potential to be a valuable food source and could be part of a strategy in combating food insecurity;

- The local community utilizes WEPs and medicinal plants without attainment of planned training, which is a risk to the sustainability of these plants. Accordingly, offering training by the districts, sub city and NGOs for different management activities and the application of this training to projects that seeks to maximize the value of WEPs and medicinal plant species to local community is needed.

- Family size, gender, income, cultural habits (food taboo), age and education of households were found to be important variables in determining the households' decision in participating wild edible plant collection and consumption in the study area. Hence, the woreda offices, sub cities and NGOs at federal and regional level are recommended to improve these variables

- Regarding with traditional knowledge on WEPs, elders could be transferred their knowledge to the younger generations unless otherwise this important indigenous knowledge might be disappeared through short time. Hence, integrated works such as awareness creation and providing training, especially for young dwellers in terms of use, management and domesticate those useful plants for sustainable utilizing as a major crops to the urban food insecure households. Hence, food security and job creation offices, and technical vocational and educational training colleges at federal levels are the most responsible organs to run this job.

References

AACA-ILIC, Addis Ababa City Administration-Integrated Land Information Center. (2014). *Gulele Sub City Atlas*. Addis Ababa City Administration, Land Development and Management Bureau.

Abafita, J., & Kim, K. (2014). Determinants of household food security in rural Ethiopia: an empirical analysis. *Journal of Rural Development*, 37(2):129–157.

Abebe Damte (2011). Non-Timber Forest Products Dependence, Property Rights and Local Level Institutions: Empirical Evidence from Ethiopia. University of Pretoria Steven F. Koch University of Pretoria Working Paper, 2011-11.

Abraham Demekristos (2016). Collection and Identification of Wild Fruits Tree/Shrub Species in Amhara Region, Ethiopia. Hawasa University, Ethiopia. *Journal of Natural Sciences Research*, 6(11), p.26

Acipa, Mugisha, M.K., Origa, H.O., (2013). Documentation and Nutritional Profile of Some Selected Food Plants of Otwal and Ngai Sub counties Oyam District, Northern Uganda, *African Journal of Food, Agriculture, Nutrition and Development*, 13(2), PP.7430- 7447.

Adhikari, B., Di Falco, S., & Lovett, J.C. (2014). House-hold Characteristics and Forest Dependency: Evidence from Common Property Forest Management in Nepal. *Ecological Economics* 48: 245-257.

Adugnaw Birhanu (2014). Environmental degradation management in Ethiopian highlands: Review of lessons learned. *International Journal of Environmental Protection and Policy*, 2: 24-34.

Agbo, O. J., Shomkegh, S.A., & Mbakwe, R. (2013). Local perception and proximate analysis of some edible forest plants around university of agriculture wildlife park, Benue State, Nigeria

Ahenkan (2010). Assessing the Impact of Forest Policies and Strategies on Promoting the Development of Non-Timber Forest Products in Ghana. *Journal of Biodiversity*, 1(2), P.85

Alemayehu, Getu. Asfaw, Zemed. & Kelbessa, Ensermu. (2016). *Cordia africana* (Boraginaceae) in Ethiopia: A review on its taxonomy, distribution, ethnobotany and conservation status. *International Journal of Botany Studies*, 1(2):38–46.

Amaza, P., Umeh, J., Helsen, J., & Adejobi, A. (2006). Determinants and measurement of food insecurity in Nigeria: some empirical policy guide. Presented at international association of agricultural economists annual meeting, Queensland August 12-18.

Andel, T.V., Carneiro, L.G. (2013). Why Urban Citizens in Developing Countries Use Traditional Medicines: The Case of Suriname, Paramaribo, pp.1-3.

Angelsen, A., & Kaimowitz, D. (1999). Rethinking the Causes of Deforestation: Lessons from Economic Models. *The World Bank Research Observer* 14: 3-98.

Angelsen, A., Jagger, P., Babigumira, R., Belcher, B., Hogarth, N.J., Bauch, S., Börner, J., Smith-Hall, C. & Wunder, S. 2014. Environmental income and rural livelihoods: a global-comparative analysis. *World Dev.*, 64: S12–S28, p.18.

Assegid Assefa & Tesfaye Abebe. (2011). Wild Edible Trees and Shrubs in the Semi-arid lowlands of Southern Ethiopia. *Journal of Science and Development*, P.5-6.

Azeb Negash (2011). Contribution of Cobble Stone Enterprises to Urban Household Food Security: The Case of Gulele Sub-city. [Unpublished graduate thesis]. Addis Ababa University, P.21

Babatunde, R. (2007). Factors influencing food security status of rural farming household in north Central Nigeria. *Journal of Agriculture*, 2(3):351–352.

Barirega, A., Agea, J.G., Van Damme, P. (2012). Prioritizing wild medicinal and food plants with potential for commercialization and value chain improvement for livelihood enhancement and poverty reduction in Uganda. *Research Journal of Environmental and Earth Sciences* 4, 668–673.

Baten, M.A. & Khan, N.A. (2010). Gender issue in climate change discourse: theory versus reality. Unnayan Onneshan, Dhaka.

Baye Kaleb., Hirvonen K., Dereje Mekdim. & Remans R. (2019) Energy and nutrient production in Ethiopia, 2011-2015: Implications to supporting healthy diets and food systems. *PLoS ONE* 14(3):e0213182. <https://doi.org/10.1371/journal.pone.0213182>

Bekele, Tesemma. (2007) Useful trees and shrubs of Ethiopia: identification, propagation and management in 17 agro-ecological zones. *RELMA in ICRAF Project*, 1–559.

Beluhan, S. and Ranogajec, A. (2010). Chemical composition and non-volatile components of Croatian wild edible mushrooms. *Food Chemistry*, **124**: 1076-1082.

Berihun, Tariku. & Molla, Eyayu (2017). Study on the Diversity and Use of Wild Edible Plants in Bullen District Northwest Ethiopia. *Journal of Botany*, 2017, 1–10. <https://doi.org/10.1155/2017/8383468>

Bharucha, Z., & Prett, J. (2010). The roles and values of wild foods in agricultural systems. University of Essex, Essex, UK, 2916- 2917. Doi:10.1098/rstb.2010.0123

Campbell, J. (1991). Land or peasant?. The dilemma confronting Ethiopian resource conservation. *Afr. Aff.* 90, 5–21.

CARE ETHIOPIA (2016). Potential Contribution of Neglected and Underutilized Wild Edible Plants to Pregnant, Lactating Women's & Under Two Children Diet in CARE-Ethiopia Project Areas of South Gender. Bahirdar University. Final report, pp.14-52.

CBD (2009). Diversity (CBD) Ethiopia's 4th Country Report, Institute of Biodiversity Conservation. Addis Ababa, Ethiopia.

CFSVA ETHIOPA (2019). Food security analysis report. www.wfp.org or www.csa.gov.et (retrieved on July 2019).

CIFOR (2008). Thinking beyond the canopy, Annual Report.

Chakravarty, S., Bhutia, D.K., Suresh, P.C., Shukla, G., Pala, A.N., (2016). A review on diversity, conservation and nutrition of wild edible fruits. *Journal of Applied and Natural Science*, 8 (4), PP 2646-2347

Cotton, C.M. (1996). *Ethnobotany: Principles and Applications*. John Wiley and Sons Ltd., Chichester, England.

Cruz-Garcia, G.S., & Price, L.L (2011). Ethno botanical investigation of 'wild' food plants used by rice farmers in Kalasin, Northeast Thailand. *Journal of Ethno biology and Ethno medicine*, P.2.

CSA (2007). Central Statistics Agency. Population and Housing Census of Ethiopia, Analytical Report at National level, CSA, Addis Ababa.

CSA (2014). Central Statistical Agency. Urban Employment and Unemployment Survey, CSA, Addis Ababa.

Dandena Gelmesa (2010). Shifting to alternative food source: Potential to overcome Ethiopians' malnutrition and poverty Problems) (Debela Hunde Feyssa, Njoka, J.T., Zemedu Asfaw & Nyangito, M.M., 2010. Analysis of multipurpose uses and management of *Zizphus spina-christi* (L.) desf. in semi-arid Ethiopia: Implications for food security. Second RUFORUM Biennial Meeting 20 - 24 September, 2010, Entebbe, Uganda).

Dansi, A., Vodouhe, R., Azokpota, P., Yodomonhan, P., Asogba, P., Adjatin, A., Loko, Y.L., & Akpagana, K (2012). Diversity of neglected and underutilized crop species of importance in Benin. *The scientific Journal*, p. 1. <https://doi.org/10.1100/2012/932947>

Davenport, N.A., Gambiza, J., Shackleton, C.M., 2011. Use and users of municipal commonage around three small towns in the Eastern Cape, South Africa. *Journal of Environmental Management* 92, 1449–1460. Doi:10.1016/j.jenvman.2010.11.003.

De Caluwé, E.; Halamová, K. and Van Damme, P. (2010a). *Adansonia digitata* L.– A review of traditional uses, phytochemistry and pharmacology. *Afrika Focus*, **23**: 11-51.

Demeke, Leykum and Haji, Jimma (2014). Econometric analysis of factors affecting market participation of smallholder farming in Central Ethiopia. *Journal of Agricultural Extension and Rural De Muro, P. & Mazziotta, M. (2010/11). Towards a Food Insecurity Multidimensional Index, Napoli, 9.*

Demel Teketay (2005). Seed and Regeneration Ecology in Dry Afromontane Forests of Ethiopia: II. Forest Disturbances and Succession. *Tropical Ecology*, **46**: 45-64.

Demel Teketay, Feyera Senbeta, Maclachlan, M., Million Bekele and Barklund, P. (2010). *Edible Wild Plants in Ethiopia*. Addis Ababa University Press, Addis Ababa. 575p.

Dessalegn Ayele and Deressa Negasa (2017). Identification, Characterization and Documentation of Medicinal and Wild Edible Plants in Kashaf Kebele, Menge Woreda, Benishangul Gumuz, Ethiopia. *International Journal of Advanced Research*, P. 194.

Denscombe, M. (2003). *The Good Research Guide for small-scale social research projects* Second edition. Library of Congress Cataloging-in-Publication Data

Diress Tsegaye, Mulubrhan Balehegn, Kindeya Gebrehiwot, Mitiku Haile, Girmay Gebresamuel, Mohammed Tilahun and Ermias Aynekulu (2007). The Role of *Garsa (Dobera glabra)* for Household Food Security at Times of Food Shortage in Aba`ala Wereda, North Afar: Ecological Adaptation and Socio-economic Value. Drylands Coordination Group Report No. 49. URL: <http://www.drylands-group.org>.

Ejigayhu, Sisay & Abdi, Khalil (2012). Determinants of Food Insecurity in Addis Ababa City, Ethiopia. *Journal of Economics and Sustainable Development*, 3(3).

EMA, Ethiopian Metereology Agency, Addis Ababa, Ethiopia,
2017.

ENBSAP, (2005). Ethiopian National Biodiversity Strategy and Action Plan. Institute of Biodiversity Conservation, Addis Ababa, Ethiopia

Ensermu Kelbessa (2005). Plant conservation strategy in Ethiopia. First meeting of the Global Partnership for Plant Conservation, National Botanic Gardens, Glasnevin, Ireland.
<http://www.botanicgardens.ie/gspc/gppc/dbnpresent/summary.htm>

Ermias Lulekal, Zemedede Asfaw, Ensermu Kelbessa and Damme (2011). Wild edible plants in Ethiopia: a review on their potential to combat food insecurity, pp. 71-73.

FAO (2004). Website for Gender, Agro biodiversity and Local Knowledge: www.fao.org/sd/links

FAO & GTZ (2005). Right to food – putting in to practice .Rome. www.fao.org/righttofood

FAO (2010). Global forest resources assessment 2010, main report. FAO forestry paper 163, Food and Agriculture Organization of the United Nations, Rome.

FAO(2014). Promotion of underutilized indigenous food resources for food security and nutrition in Asia and the Pacific, p.1. www.fao.org/publications

FAO (2017). The future of food and agriculture: Trends and challenges Rome.

FAO, IFAD, UNICEF, WFP and WHO. 2019. The State of Food Security and Nutrition in the World 2019. Safeguarding against economic slowdowns and downturns. Rome.

FAO (2020) .News Article.www.fao.org/story/en/item / 1200484/icode/

Feyssa, Debela. Hunde. Njoka, J. T., Asfaw, Zemedede. & MM, N. (2011a). Seasonal availability and consumption of wild edible plants in semiarid Ethiopia: Implications to food security and

climate change adaptation. *Journal of Horticulture and Forestry*, 3(5): 138–149. Retrieved from [http://www.academicjournals.org/jhf/PDF/pdf2011/May/Feysa et al.pdf](http://www.academicjournals.org/jhf/PDF/pdf2011/May/Feysa%20et%20al.pdf)

Furukawa, T., Kiboi, S.K., Mutiso, P.B.C., Fujiwara, K.(2016). Multiple use patterns of medicinal trees in an urban forest in Nairobi, Kenya. *Urban Forestry & Urban Greening* 18, 34. Doi:10.1016/j.ufug.2016.05.003

Gebru Mestawet, Oduor, F., Lochetti, G., Kennedy, G. and Baye, K. 2019. Ethiopia's Food Treasures: Revitalizing Ethiopia's underutilized fruits and vegetables for inclusion in the Food-Based Dietary Guidelines for improved diet diversity, nutrition and health of the population. Bioversity International. Rome, Italy and Addis Ababa, Ethiopia

Gelibo, T., Amenu, K., Tadele, T., Getnet, M., Getachew, T., Defar, A., et al. (2017) Low fruit and vegetable intake and its associated factors in Ethiopia: A community based cross sectional NCD steps survey. *Ethiopian Journal of Health Development*, 31(Special issue1):355–361.

Getachew Addis (2009). Wild and semi-wild edible plants of Hamar and Konso (South Ethiopia) with emphasis on their ethnobotany and nutritional composition of selected Species. Unpublished PhD thesis. Addis Ababa University.

Getachew Addis, Zemedet Asfaw & Zerihun Woldu (2013). The Role of Wild and Semi-wild Edible Plants in Household Food Sovereignty in Hamar and Konso Communities, South Ethiopia. *Journal of plants, people and applied research*, p. 251.

Getne Chokole, 2011. An Ethnobotanical Study Of Plants Used In Traditional Medicine And As Wild Foods In And Around Tara Gedam And Amba Remnant Forests In LiboKemkem Wereda, South Gonder Zone, Amhara Region, Ethiopia (published thesis)

Gerique, A.2014. An Introduction to Ethnoecology and Ethnobotany: An Introduction to ethnoecology and ethnobotany. Theory and Methods - Integrative assessment and planning methods for sustainable agroforestry in humid and semiarid regions. *University of Giessen, Germany*, pp.1-3.

Golden, C. D., L. C. H., Fernald, J. S., Brashares, B. J. R., Rasolofoniaina, & Kremen, C. (2011). Benefits of wildlife consumption to child nutrition in a biodiversity hotspot. *Proceedings of the National Academy of Sciences* 108 (49): 19653–19656.

Greene, W. (2008). *Econometric Analysis*; 6th edition. *Pearson International Edition, NJ, Prentice Hall*.

Guyu Ferede (2016). Household Resilience to „Green Famine“: Dimensions, Magnitude and Ethno-culture Disparity in Belo-Jiganfoy district, Benishangul-gumuz region, Ethiopia.[Unpublished PHD Thesis], PP.181-204

Hamad, H.J. & Khashroum, A. (2016). Household Food Insecurity (HFIS): Definitions, Measurements, Socio-Demographic and Economic Aspects, 66.

Hedge, R., and Enters, T. (2000). Forest products and household economy: a case study from Mudumalai Wildlife Sanctuary, Southern India. *Environmental Conservation* 27, 250–259.

IBC (2008). Institute of Biodiversity Conservation. Ethiopia: Second Country Report on the State of PGRFA to FAO, January, 2008. Addis Ababa.

IBCR (2001). Institute of Biodiversity Conservation and Research (Now called IBC). Twenty Five Years of Biodiversity Conservation and Future Plan of Action, publication.

Jagger, P., 2012. Environmental Income, Rural Livelihoods, and Income Inequality in Western Uganda. *Forests, Trees and Livelihoods* 21, 70–84. Doi:10.1080/14728028.2012.698846.

Jain, A.K., Tiwari, P. (2012). Nutritional value of some traditional wild edible plants used by tribal communities during emergency with reference to central India, *Indian Journal of Traditional Knowledge*, 11(1),pp.51-52.

Jones, B. (2009). *Logit and Probit*. Department of Political Science, University of California, Davis.

Jyotsna, Katewa (2016). A review: Underutilized Wild Edible Plants as a Potential Source of Alternative Nutrition. *International Journal of Botany Studies*,1(4), pp.32-33.

Kaoma, H., & Shackleton, C.M (2014). Collection of Urban Tree Products by Households in Poorer Residential Treas of Three South African Towns, Rhodes University. *Urban Forestry & Urban Greening*, 13, 244–245. doi:10.1016/j.ufug.2014.02.002.

Kaoma, H., Shackleton, C.M., 2015. The direct-use value of urban tree non-timber forest products to household income in poorer suburbs in South African towns. *Forest Policy and Economics* 61, 104–112. Doi:10.1016/j.forpol.2015.08.005.

Kiran, K.C., Dhanush, C., Gajendra, C.V., & Reddy, B.M., (2019). Diversity and Seasonal Availability of Potential Wild Edible Plants from Vidarbha Region of Maharashtra State, India. *International Journal of Current Microbiology and Applied Sciences*, 8(2), PP.1434-35. <https://doi.org/10.20546/ijcmas.2019.802.167>

Kothari, C.R., 2004. *Research Methodology; Methods and Techniques*. India. New Age International Publishers.

Mamo Getachew, Sjaastad, E., and Vedeld, P. (2007). Economic dependence on forest resources: a case from Dendi District, Ethiopia. *Forest Policy Econ.* 9 (8), 916–927

Martin, G.J.(1995).*Ethnobotany : A conservation Manual* . – Chapman & Hall , London.

McElwee, P.D. (2008). Forest Environmental Income in Vietnam: Household Socioeconomic Factors Influencing Forest Use. *Environ. Conserv.* 35, 147–159.

McLain, R.J., Hurley, P.T., Emery, M.R., Poe, M.R., 2013. Gathering “Wild” Food in the City: Rethinking the Role of Foraging in Urban Ecosystem Planning and Management. *Local Environment* 1–21. Doi:10.1080/13549839.2013.841659.

Mekuannet Tabkew (2015). Wild and semi wild edible plants in Chilga District, Northwestern Ethiopia: Implication for Food security and Climate change Adaptation. *Global Journal of wood Science, Forestry and Wild Life Science*, University of Gondar, 3(3), p.72

Melaku Yohannes, Temesgen Aweke, Deribew Amare, Tessema Gizachew, Deribe Kebede, Sahle, B. W., et al. (2016). The Impact of Dietary Risk Factors on the Burden of Non-communicable Diseases in Ethiopia: Findings from the Global Burden of Disease Study 2013. *International Journal of Behavioral Nutrition and Physical Activity*, 13(1):8–10. <https://doi.org/10.1186/s12966-016-0447-x>

Menen Melese (2019). An Assessment on the Practices and Challenges of Urban Productive Safety Net Program in Addis Ababa city Administration. [Unpublished graduate thesis] Addis Ababa University, p.3-8. www.edt.aau.et –(acceded on 2019-10-17).

Million Bekele (2011). Forest plantations and woodlots in Ethiopia. *African forest forum*, 1:12.

Mirutse Giday, Zemedet Asfaw, Elmqvist, T. and Zerihun Woldu (2003). An ethnobotanical study Of medicinal plants used by the Zay people in Ethiopia. *Journal of Ethnopharmacology*, 85: 43–52.

Mirutse Giday and Tilahun Teklehaymanot (2013). Ethnobotanical study of plants used in management of livestock health problems by Afar people of Ada'ar District, Afar Regional State, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 9:8.

Misganaw Aweke., Haregu Tilahun, Deribe Kebede, Tessema Gizachew, Deribew Amare, Melaku Yohannes, et al., (2017) National Mortality Burden due to Communicable, Non-communicable, and Other Diseases in Ethiopia, 1990-2015: Findings from the Global Burden of Disease Study 2015. *Population Health Metrics*, 15(1). <https://doi.org/10.1186/s12963-017-0145-1>

Mohammed Chilalo & Wiersum, K.F. (2011). The role of non-timber forest products for livelihood diversification in Southwest Ethiopia. *Ee-JRIF*, 3(1), p.45.

Mollee, E., McDonald, M., & Pouliot, M. (2017). Into the Urban Wild: Collection of wild urban plants for food and medicine in Kampala, Uganda. *Land Use Policy*, 63(April), 4-7. <https://doi.org/10.1016/j.landusepol.2017.01.020>- (accessed on 01/04/2017).

MoLSA (2012). Ministry of Labor and Social Affairs. Addis Ababa, Ethiopia.

Mossu Gebru (2017). Households Poverty and Livelihoods Nexus in Small Towns of East Gojjam, Amhara Region, Ethiopia. Doctoral Dissertation Submitted to the Department of Geography and Environmental Studies, Addis Ababa University, Addis Ababa, Ethiopia

Moubarakatou.T (2017). Factors Affecting Household Participation in Non-timber Forest Products Market in Eastern Uganda.

Muche Mequanint, Birara Endalew. & Tesfalem Koricho. (2014). Determinants of Food Security Among Southwest Ethiopia Rural Households. *Food Sci Technol* 2(7):93–100.

Negash Aregay, Getachew Hruy, Tesfakiros Semere (2017): Potentials and Constraints of Under-Utilized Tree Fruits and Vegetables in Tigray, Northern Ethiopia. *Journal of the Drylands*, 7(2): 194.

Ndayambaje, J.D., Heijman,W.J.M., and G.M.J. Mohren (2012). Household Determinants of Tree Planting on Farms in Rural Rwanda. *Small-scale Forestry*, 11 (4), 1–32

Nene, Y.L.(2012). *Asian Agri- history*, 16(1), 45-46.

Ojelel, S., Kakudidi, E.K., 2015. Wild Edible Plant Species Utilized by a Subsistence Farming Community in Obalanga Sub-county, Amuria District, Uganda. *J Ethnobiology Ethnomedicine* 11. Doi: 10.1186/1746-4269-11-7.

Oladejo, J. A., Olawuyi, S., and Anjorin, T. D. (2011). “Analysis of Women Participation in Agricultural Production in Egbedore Local Government Area of Osun State, Nigeria”, *International journal of agricultural economics and rural development*, vol 4 n01, 2011.

O’Leary Z. (2014). *The Essential Guide to Doing Your Research Project* (2nd ed.). London: SAGE.

Ong & Kim (2016). *The Role of Wild Edible Plants in Household Food Security Among Transitioning Hunter-gatherers: Evidence From the Philippines*. DOI: 10.1007/s12571-016-0630-6, 9(1), p. 11.

Padulosi, S., Thompson, J., Rudebjer, P. 2013. *Fighting poverty, Hunger and Malnutrition with Neglected and Underutilized Species (NUS): Needs, Challenges and the Way Forward*. Diversity International, Rome, p.18, 28.

Parrotta, J.A. & R.L. Trosper (2012). *Introduction: The Growing Importance of Traditional Forest-Related Knowledge*. (Ed). *Traditional Forest-Related Knowledge: Sustaining Communities, Ecosystems and Biocultural Diversity*, World Forests 12, P.3-4. DOI 10.1007/978-94-007-2144-9_1.

Pathak RR.(2013).*Sample Size From Formula to Concepts - II*. *International Journal of Basic & Clinical Pharmaceutical* ;94-5.

Paumgarten, F. (2007). *The Significance of the Safety-net Role of NTFPs in Rural Livelihoods, South Africa*, Environmental Sciences. Rhodes University, Grahamstown, South Africa.

Penafiel, D.D., Lachat, C.C., Espinel, R., Van Damme, P.P., Kolsteren, P.P.2011. *A systematic Review on the Contributions of Edible Plant and Animal Biodiversity to Human Diets*. *Eco Health* 8, 381–399. Doi: 10.1007/s10393-011-0700-3.

Pilgrim, S., Pretty, J. (eds.) (2010). *Nature and culture. Rebuilding lost connections*. London (UK), Washigton D.C.: Earthscan

PIM, Ministry of Urban Development and Construction, *Project Implementation Manual*, 2016.

Pouliot, M., 2011. Relying on Nature's Pharmacy in Rural Burkina Faso: Empirical Evidence of the Determinants of Traditional Medicine Consumption. *Social Science & Medicine* 73, 1498–1507. Doi:10.1016/j.socscimed.2011.08.037.

Powell, B., Herforth, A., Johns, T. & Oluoch, M. 2012. Traditional Vegetables and Nutrition in the East Usambara Mountains, Tanzania. In *Poster presentation at the International Congress of Ethnobiology*, Montpellier, France, p.452-53

Pretty, J. (2007). *The earth only endures. On reconnecting with nature and our place in it.* London (UK): Earthscan.

Rodríguez F.Z. (2007). Socio - economic determinants of Non-Timber Forest Products Collection. A case study among indigenous people in Karnataka, India. Universitat Autònoma de Barcelona, Spain.

Salas, J.B., García, L.G., Moreno, J.L., & T.R., Téllez (2019). Wild Plants Potentially Used in Human Food in the Protected Area “Sierra Grande de Hornachos” of Extremadura (Spain), Spain, *Sustainability* **2019**, 11, 456; doi:10.3390/su11020456.

Sansanelli and Tassoni (2014). Wild food plants traditionally consumed in the area of Bologna (Emilia Romagna region, Italy). *Journal of Ethnobiology and Ethnomedicine*, **10**:69.

Sebatta, C., Johnny, M., Enid, K., Apolo, K., and Kyomugisha, H. (2014). Smallholder Farmers' Decision and Level of Participation in the Potato Market in Uganda. *Modern Economy*, 2014, 5, 895-906. Published Online July 2014 in SciRes.

Sewanyana, S.N. (2009). *Chronic Poverty and Household Dynamics in Uganda* (No. 139).

Shackleton and Shackleton, S. (2004). The Importance of Non-timber Forest Products in Rural Livelihood Security and as Safety nets: a Review of Evidence from South Africa. *Journal of Science*. 26(2004):364-381.

Shackleton, S., Paumgarten, F., Kassa, H., Husseelman, M., and Zida, M. (2011). Opportunities for enhancing women's economic empowerment in the value chains of three African non-timber forest products (NWFPs). *International Forestry Review*, special issue, 13 (2).

Shackleton, S., Shackleton, C., Shanley, P., 2011. *Non-Timber Forest Products in the Global Context*. Springer.

Shumsky (2013). *Wild edible plants and their Contribution to Food Security: an Analysis of Household Factors, Access and Policy in the Semi-arid Midlands of Kenya*. McGill University, Montreal, P.3-77.

Shumsky, S. A., G. M. Hickey, B. Pelletier, and T. Johns. (2014). Understanding the Contribution of Wild Edible Plants to Rural Social Ecological Resilience in Semi-arid Kenya. *Ecology and Society* 19(4): 34. <http://dx.doi.org/10.5751/ES-06924-190434>.

Sisay Nune, Menale Kassie and Mungatana, E. (2010). *Forestry resource accounting: the experience of Ethiopia*. CEEPA Discussion Paper No 47, Centre for Environmental Economics and Policy in Africa, University of Pretoria, South Africa.

Sneyd, L. (2013). *Wild Food, Prices, Diets and Development: Sustainability and Food Security in Urban Cameroon*. University of Guelph, Canada. Doi: 10.3390/su5114728, p.4729.

Stephen F. & Samuel A. (2013). Comparative Study of Determinants of Food Security in Rural and Urban Households of Ashanti region, Ghana. *Int J Econ Manage Sci* 2(10):29–42

Tabuti, J.R.S., Dhillion, S.S., Lye, K.A., 2003a. Traditional Medicine in Bulamogi County, Uganda: Its practitioners, Users and Viability. *Journal of Ethno pharmacology* 85, 119–129. Doi: 10.1016/S0378-8741(02)00378-1.

Tabuti, J.R.S., Damme, P.V., 2012. Review of indigenous knowledge in Uganda: Implications for its promotion. *Afrika Focus* 25, 29–38.

Tardio, J.; Pardo-de-Santayana, M. and Morales, R. (2006). Ethnobotanical review of wild edible plants in Spain. *Botanical Journal of the Linnean Society*, **152**: 27-71.

Tatek Dejene, Mohamed Samy Agamy, Dolores Agúndez, and Pinto, P.M. (2020). Ethnobotanical Survey of Wild Edible Fruit Tree Species in Lowland Areas of Ethiopia, PP.1-2

Tegegn Argaw (2015). Opportunities of Garden in Environmental and Developmental Education to Support School Based Instruction in Ethiopia. *Journal of Biology, Agriculture and Healthcare*, 5(15), P.9.

Tena Regassa, Ensermu Kelbessa and Zemedede Asfaw (2014). Ethnobotany of Wild and Semi-Wild Edible Plants of Chelia District, West-Central Ethiopia. *STARj. Sci. Technol. Arts Res.J.*, **3**:122-134.

Tesfay Birhane, Solomon Shiferaw, Seifu Hagos & Mohindra, K.S. (2014). Urban Food Insecurity in the Context of High Food Prices: a Community Based Cross Sectional Study in Addis Ababa, Ethiopia. *BMC Public Health*, p.2

Termote, C., Meyi, M., Ndjango, J., Van Damme, P. and Dhed'a Djailo, B. (2009). *Use and socioeconomic importance of wild edible plants in tropical rainforest around Kisangani District, Tshopo, DR Congo*. In: Systematics and conservation of African plants (Van der Burgt, X. J., Van der Maesen and Onana, J. M. (eds.)). pp. 415-425. Royal Botanic Gardens, Kew.

Tilahun Teklehaymanot (2009). Ethnobotanical study of knowledge and medicinal plants use by People in Dek Island in Ethiopia. *J. Ethnopharmacol.*, **124**:69–78.

Tilahun Teklehaymanot and Mirutse Giday (2010). Ethnobotanical study of wild edible plants of Kara and Kwego semi-pastoralist people in Lower Omo River Valley, Debub Omo Zone, SNNPR, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, **6**:23.

Tinsae Bahru, Zemedede Asfaw, & Sebsebe Demissew (2013). Wild Edible Plants: Sustainable Use and Management by Indigenous Communities in and the Buffer Area of Awash National Park, Ethiopia. *SINET: Ethiopia, Journal Of Natural Science*, P.94-5.

Torosyan, K., Pignatt, N. & Obrizan, M. (2018). Job market outcomes for IDPs: The case of Georgia. *Journal of Comparative Economics*. Volume 46, Issue 3, September 2018, Pages 800-820

Tugume, P., Kakudidi, E.K., Buyinza, M., Namaalwa, J., Kamatenesi, M., Mucunguzi, P., Kalema, J., (2016). Ethnobotanical Survey of Medicinal Plant Species Used by Communities around Mabira Central Forest Reserve, Uganda. *J Ethnobiology Ethnomedicine* 12, 5. Doi:10.1186/s13002-015-0077-4

Uganda Bureau of Statistics, 2014. National Population and Housing Census 2014, Kampala.

UNEP. Indigenous Knowledge in Africa. Available at: <http://www.unep.org/IK>. Accessed 20th Sept. 2011.

United Nation report (2019). Africa Regional Overview of Food Security and Nutrition. www.fao.org/news/story/en/item/1180443/icode/

Uprety, Y.; Asselin, H.; Boon, E.K.; Yadav, S. and Shrestha, K.K. (2010). Indigenous use and bio-efficacy of medicinal plants in the Rasuwa District, Central Nepal. *Journal of Ethnobiology and Ethnomedicine*, 6:3.

USAID)/Ethiopia (2008). United States Agency for International Development (Ethiopia Biodiversity and Tropical Forests 118/119 Assessment.

Van Anandel, T., Carvalheiro, L.G., 2013. Why Urban Citizens in Developing Countries Use Traditional Medicines: the case of Suriname. *Evidence-Based Complementary and Alternative Medicine* 2013, 1–13. doi:10.1155/2013/687Charlie197 .

Vinceti, B., Termote, C., Ickowitz, A., Powell, B., Kehlenbeck, K., Hunter, D., (2013). The Contribution of Forest Foods to Sustainable Diets. *Sustainability*, 5, pp.55,56. Doi: 10.3390/su5114797.

Vivero J.L.; Ensermu Kelbessa & Sebsebe Demissew (2006). Progress on the Red list of Plants of Ethiopia and Eritrea: Conservation and Biogeography of Endemic Flowering Taxa (eds.). Kew, London

Yohannis Teklu and Abdulaziz Abduljabar.(2019). Ethnobotanical Study on the Diversity and Utilization of Wild Edible Plants in Majang Zone of Gambella Region, Southwest Ethiopia. *International Journal of Innovative Science and Research Technology*, 4(7).

Walliman, N. (2011). *Research Methods: The Basics*. Routledge. Taylor & Francis. London

World Bank Group (2015). *Resilience Cities Program*. Addis Ababa Ethiopia.

Wubalem Tadesse (2012). The status of forestry development in Ethiopia: Challenges and Opportunities. National Dialog On Sustainable Agricultural Intensification in Ethiopia and its role on the climate resilient green economy initiative in Ethiopia July 23rd and 24th, 2012, ILRI Campus, Addis Ababa.

Zemedet Asfaw (2009). The future of wild food plants in southern Ethiopia: ecosystem conservation coupled with enhancement of the roles of key social groups. *Acta Hort (ISHS)*, **806**:701-708.

APPENDIXES

Appendix 1: Semi- structured questionnaire

Addis Ababa
University
(Since 1950)



Appendix 1: Data Collection Tool – Focus Group discussion Guides to ‘Potential Contribution of Wild Edible Plants to Urban Safety net Beneficiary Households and Factors Affecting their Participation in Collecting Wild Foods in Woreda 08, Gulele Sub -city, Addis Ababa.

Dear respondent,

My name is **Markisew Shiferaw**. I am graduate student in Addis Ababa University in the department of food security and development studies. The main purpose of this FGD Guide is to collect primary data to carry out an assessment on potential contribution of wild edible plants to urban safety net beneficiaries and identifying the factors affecting household participation in collecting wild foods in wereda 08, Gulele sub city. Your responses to the questions are valuable and will be held in greatest confidentiality to be used only for the analysis of this research. In any cases without your permission, your name will not be identified. If you agree to participate in this research, you will be doing so voluntarily and there will not be any monetary returns. You are also free to oppose to respond to any questions you do not feel comfortable answering or to withdraw from the research all together. This discussion maybe will take around 1-2 hour of your time to respond to the questions.

Thank you for your cooperation

Qualitative Guidelines / FGD Guide/ English

Part 3: Evaluating the local knowledge of households towards WEPs

1. Focus group number: Two 2. Date of focus group: April 10/2020
3. Meeting place: Gulele-Woreda 08
4. Moderator’s name: Ashenafi Sewmehon (religious leader) 5. Note taker’s name: Bayu Asmamaw

6. Start time: 3:30. End time: 5:30

7. Topics to be cover during FGD
 1. How do you and any one of your family member evaluate the contribution of WEPs to the diet of households ?
 2. What is your knowelegde about WEPs
 3. If you get the chance, do you eat wild edible plants? Why?
 4. What are the Wild fruits you know?
 5. What are the wild vegetables you know?
 6. What are the nuts, tubers spices or other food plants you know?
 7. How do you judge the contribution of WEPs in relation to health, nutrition and safety in your family?
 8. Are there some wild edible plants you know, which is toxic?
 9. How do you judge the contribution of wild foods in diet diversity and disease protection?
 10. Do you observe some wild edible plants such as fruits, nuts, roots spices etc. in the riversides , roads and gardens ?
 11. If your answer is yes for Q.10. please list out and fill in the table below

No.	Local name	Used part	Preparation techniques	Harvesting month	Preservation	Storage
1						
2						
3						

Thank you!

Addis Ababa
University

(Since 1950)



Appendix II: Data collection tool – Field survey Guide on the title- ‘wild edible plants: potential contribution to urban safety net beneficiary households and socio - economic determinants for consumption in wereda 08, gulele, Addis Ababa, Ethiopia

Dear respondents

My name is Markisew Shiferaw. I am from graduate student at Addis Ababa university in the department of food security and development studies .The main purpose of this field survey Guide is to collect ethno botanical primary data through identifying wild edible plants by scientific names, families, local names, parts used and categories of the plant will be recorded well inside the Gulele Botanic Garden so as to carry out an assessment on ‘Wild edible plants: potential contribution to urban productive safety net beneficiary households and their consumption determinants in wereda 08, Gulele Sub city . Your responses to the questions are valuable and will be held in greatest confidentiality to be used only for the analysis of this research. In any cases you will not be identified by name. If you agree to participate in this research, you will be doing so voluntarily and there will not be any monetary returns. You are also free to oppose to respond to any questions you do not feel comfortable answering or to withdraw from the research all together. This task maybe will take around 4-6 hour to complete the job.

Thank you for your cooperation

Checklist of semi-structured interview question for collecting ethnobotanical data from Gulele Botanic Garden

1. What is the local name of this plant?
2. Categories of the plant? Categorize as 1) Root crops, (2) Leaf crops, (3) Flowers, fruits and seeds,; (4) Fresh fruits, (5) Flavorings
3. What is the form of habitat? (fruit , stem , Gum, Tree, Shrub, Herb, medicine)
4. Which part is used for food and or medicine? (Leaves, Stem, Roots, Fruit, Seed)
5. What is its mode of consumption or utilization? (Raw, Frying ,boiling , salad , Added to recipe, As spices)
6. In which month it will be available for utilizing /consumption?

Table 1. Checklist for identify wild edible plants in Gulele Botanic Garden

SNo.	Local name of edible plants	Category	Plant parts used	Harvesting season	Mode of consumption (preparation)
1					
2					
3					
4					
5					
6					
7					
8					

Reminding: categories 1) medicinal plants, 2) leafs, 3) spices, 4) fruits, 5) stem, 6) shrub, 7) gum 8) root, 9) tree

Thank you for your time and sharing your knowledge

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Appendix -II: Consent form for Field Survey Guide - Amharic Version

እንደምን አደሩ/ ዋሉ (ሰላምታ)

እኔ ስሜ ማርክሳው ሽፈራው እባላለሁ። የመጣሁት ከአዲስ አበባ የኒሽርሲቲ ከሃገር ልማት ጥናት ኮሌጅ በድህረ ምረቃ ትምህርት ፕሮግራም የምግብ ዋስትና እና ልማት ጥናት ዲፓርትመንት ተማሪ ነኝ ። የዚህ ጥናት አላማ በከተማ የምግብ ዋስትና ፕሮግራም ላይ ለተሰማሩትና በከፍተኛ ደረጃ የምግብ ዋስትና ችግር ያለባቸውን ቤተሰቦች ከጫካ ምግቦች ጋር በተያያዘ አማራጭ ምግብ ምንጭ ሊሆንላቸው ይችላል ወይንስ አይችልም የሚለውን ለማወቅ ይህችን አነስተኛ ጥናት ለማድረግ ተነሳሳሁ።

ስለሆነም የአረስዎ ተሳትፎ የሚሆነው በጉለሌ የእጽዋት ማዕከል ውስጥ ምልክታ በማድረግ ለምግብነት የሚውሉ እጽዋቶችን ኢትዮ ቦታኒካል መረጃ ማለትም በሳይንሳዊ ስም ፣ በአካባቢ ስም ፣ የሚጠቅመውን የእጽዋቱን ጠቃሚ ክፍል፣ የሚሰበሰብበት ወቅትን ወዘተ. የመለየት ስራ ይሰራሉ። በጥናቱ ላይ ለመሳተፍ የአረስዎ ፍላጎትና ፍቃደኝነት ወሳኝነት አለው ። በመጀመሪያ በጥናቱ ላይ መሳተፍም ሆነ አለመሳተፍ ይችላሉ። ካልተስማማዎት በመሆን የማድረግ መብትዎ ሙሉ በሙሉ የተጠበቀ ነው። ያልገባዎትን መረጃ ለመመለስ አይገደዱም። ስምዎት ከመረጃው ጋር አይካታትም። የሰጡኝን መረጃ ሁሉ በሚስጥር እንደምጠብቅልዎ ቃል እገባለሁ። ለተሳትፎዎት ምንም አይነት የገንዘብ ክፍያ የለውም። ስራው የሚወስደው በአማካይ 4 —6 ሰዓት ብቻ ነው። ይህ ጊዜዎትን የሚይዝ ቢሆንም እርስዎ ሚስጡት መልስ ከጥናቱ አላማ አንጻር ትልቅ ሚና ያለው በመሆኑ እንድትባቡኝ እጠይቅዎታለሁ። በመጨረሻም ስላዳመጡኝ ክልብ አመሰግናለሁ።

ፈቃደኛ ነኝ ፈቃደኛ አይደለሁም

ፊርማ ----- ቀን: -----
አድራሻ:-ኢ-ሜል: markisews@gmail.com
ማርክሳው ሽፈራው (ስልክ:093745184)

1. የዚህ እጽዋት አካባቢያዊ ስያሜው ምን ይባላል?

2. የእጽዋቱ ምድብ ? 1) ስር , (2)ቅጠል, (3) አበባ, ፍሬ እና ዘር .; (4) ጥሬ , (5) ቅመም እና ኃርብ

3. የእጽዋቱ አይነት? (ፍሬ , ግንድ , ሙጫ, ዛፍ, ቁጥቋጦ, ቅመም , መድሃኒት)

4. ለምግብነት የሚውለው የእጽዋቱ ክፍል የቱ ነው ? (ቅጠል, ግንድ, ስር, ፍሬ, ዘር)

5. የምንመገብበት ሁኔታ ? (ጥሬውን , መጥበስ , መቀቀል , ሰላጣ , ርስፒ ውስጥ በመጨመር , እንደ ቅመም)

6. እጽዋቱ በየትኛው ወቅት/ወር ያፈራል (ለምግብነት የውለላል ?

ሰንጠረዥ 1. በጉለሌ እጽዋት ማዕከል ውስጥ እና በአካባቢው ለሰው ልጅ ጥቅም ሊሰጡ የሚችሉ የጫካ እጽዋትን ለመለየት የተዘጋጀ ቼክ ሊስት

ቁጥር	የእጽዋቱ ስያሜ	ምድብ	ጠቃሚው የእጽዋቱ ክፍል	የሚሰበሰብበት ወራት	የአጠቃቀም / አበሳሰል / ዘዴ
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

ማስታዎሻ: ምድብ 1) መድሃኒት፣ 2) ቅጠላቅጠል፣ 3) ቅመማቅመም፣ 4) ፍራፍሬ፣ 5) ግንድ፣ 6)

ቁጥቋጦ፣ 7) ሙጫ፣ 8) ስር ፣ 9) ዛፍ

ለጊዜዎትና ለሚያካፍሉን እውቀት ከልብ እናመሰግናለን

Addis Ababa
University

(Since 1950)



COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR FOOD SECURITY STUDIES

APPENDIX-III: SEMI- STRUCTURED QUESTIONNAIRE FOR THE
SELECTED HOUSEHOLDS IN WEREDA 08- GULELE SUB CITY.

Code/ID: _____

Dear respondent

My name is Markisew Shiferaw. I am graduate student from Addis Ababa University in the department of food security and development studies .The main objective of this questionnaire is to investigate the potential contribution of wild edible plants to urban safety net beneficiary households and their consumption determinants in wereda 08, gulele sub city, Addis Ababa, Ethiopia. I'm interviewing to assess the perception and consumption determinants of safety net beneficiary households in the study wereda. So that I would like to ask you a few questions related with perception towards wild foods and factors affecting households' decision to consume them in wereda 08. You are also free to refuse to respond to any questions you do not feel comfortable answering or to withdraw from the research at any time. If you accept to participate in this research, you will be doing so voluntarily and there will not be any monetary returns. However, your honest response to these questions supports us to investigate the potential contribution of wild edible plants as an alternative food sources and filling the food gaps in time of food scarcity to the households and identify associated factors affecting the households' decision to consume wild edible plants and to improve the food security status of households in the future. All information given by you will be strictly confidential. Your name will not be recorded in this form and will never be used in connection with any information you tell us. This questionnaire may take 15-20 minutes and I greatly appreciate your cooperation in responding to this study. Would you be willing to participate? (If yes, proceed. If no, thank and stop here).

Please sign here to affirm your consent.

Agree

Disagree

Thank you in advance for your cooperation

No.	Questions	Response category	Code	
Part 1 : Demographic characteristic				
1	Sex of household head	1. Male	1	
		2. Female	0	
2	Age of household head	Write your age -----		
3	Level of education of household head	1. Illiterate	1	
		2. Read and write	2	
		3. Elementary school	3	
		4. High school	4	
		5. College/ university and above	5	
4	Household size	1. Low (0-2)	1	
		2. Medium (3-5)	2	
		3. High (> 6)	3	
5	Household background	1. Urban/semi urban	1	
		2. Rural	2	
6	Employment of households	1. Employed	1	
		2. Unemployed	0	
Part 2: Household determinants of collecting wild edible plants.				
1	Monthly income of the household is -----Birr?			
2	In your locality, is there some WEP culturally not allowed to children and pregnant women?	1. Yes	1	
		2. No	0	
3	If your answer is yes for Q. 2, what is the reason?			
4	Do You and or any one of your family member collected firewood in the last 12 months?	1. Yes	1	
		2. No	0	
5	If your answer is yes for Q.4, do you collect wild edible plants when collecting firewood?	1. Yes	1	
		2. No	0	
6	If your answer is yes for question no.5, list atleast 3 plants			
	No.	Plant names	Category	Parts used
	1.			
	2.			
	3.			
Category: 1 Medicinal 2. Edible plants				

7	What look like the infrastructure from homestead to the forest and or the garden?			
	What is the commonest mode of transport used to reach the nearest to forest (Garden)? 1= Walking 2= (car) 3Other (Specify	How long does it take you to travel to the nearest of forest -----WRITE IN A MINUTES	What is the distance from your household to the nearest of forest in kilometers? -----kilometer	Is the road usable during rain seasons? 1=Yes 0=No
8	Where do you get those plants?	1. Botanic garden 2. Forest		

Part 3 : Household perception on wild edible plants

1	Eating wild foods are harmful for humans?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
2	Wild edible plants are tasteless and unappetizing?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
3	Eating wild edible plants will have essential nutrient for health?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
4	Wild edible plants are foods for the poor people?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
5	Wild foods can be an alternative food source during food shortage?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
6	Wild plant is not healthy because of pollution?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3
7	Wild edible fruits are healthy, tasty, nutritious and important to me and my household?	1. Agree	1
		2. Uncertain	2
		3. Disagree	3

Appendix -III: Participants Consent form Amharic Version

እንደምን አደሩ /ዋሉ (ሰላምታ)

እኔ ስሜ ማርክሰው ሽፈራው እባላለሁ። የመጣሁት ከአዲስ አበባ የኒቨርሲቲ ከሃገር ልማት ጥናት ኮሌጅ በድህረ ምረቃ ትምህርት ፕሮግራም የምግብ ዋስትና እና ልማት ጥናት ዲፓርትመንት ተማሪ ነኝ ። የዚህ ጥናት አላማ በከተማ የምግብ ዋስትና ፕሮግራም ላይ ለተሰማሩትና በከፍተኛ ደረጃ የምግብ ዋስትና ችግር ያለባቸውን ቤተሰቦች ከሚበሉ የደን እጽዋቶች ጋር በተያያዘ አማራጭ ምግብ ምንጭ ሊሆንላቸው ይችላል ወይንስ አይችልም የሚለውን ለማወቅ ነው ። ስለሆነም በዚህ መጠይቅ ውስጥ የምግብ ዋስትና ተጠቃሚዎች ለሚበሉ የደን እጽዋቶች ያላቸውን አመለካከትና አንዳይጠቀሙ ተጽእኖ የሆኑ ምክንያቶችን ለማወቅ ይህችን አነስተኛ ጥናት ለማድረግ ተነሳሳሁ። ስለሆነም በጥናቱ ላይ ለመሳተፍ የእርስዎ ፍላጎትና ፍቃደኝነት ወሳኝነት አለው ። በመጀመሪያ በጥናቱ ላይ መሳተፍ ሆነ አለመሳተፍ ይችላሉ። ካልተስማማዎት በመሆን የማቋረጥ መብትዎ ሙሉ በሙሉ የተጠበቀ ነው። ያልገባዎትን መረጃ ለመመለስ አይገደዱም። ስምዎት ከመረጃው ጋር አይካታትም። የሰጡኝን መረጃ ሁሉ በሚስጥር እንደምጠብቅልዎ ቃል እገባለሁ። ለተሳተፎዎት ምንም አይነት የገንዘብ ክፍያ የለውም። ጥያቄው የሚወስደው ጊዜ በአማካይ 15 -20 ደቃ ብቻ ነው። ይህ ጊዜዎትን የሚይዝ ቢሆንም እርስዎ ሚስጡት መልስ ከጥናቱ አላማ አንጻር ትልቅ ሚና ያለው በመሆኑ እንድተባበሩኝ እጠይቅዎታለሁ። በመጨረሻም ስላዳመጡኝ ክልብ አሰግናለሁ። (ለመሳተፍ ፍቃደኛ ነዎት ? ከሆኑ ይቀጥሉ ።ካልሆኑ ያቁሙ) አመሰግናለሁ።

ፈቃደኛ ነኝ ፈቃደኛ አይደለሁም

ፊርማ ----- ቀን: -----
አድራሻ:-ኢ-ሜል: markisews@gmail.com
ማርክሰው ሽፈራው (ስልክ:093745184)

ተ.ቁ	ጥያቄ	መልስ	ከድ
ክፍል 1. Demographic Information			
1	ጾታ	1. ወንድ	1
		2. ሴት	0
2	እድሜ	----- አመት	
3	የትምህርት ደረጃ	1. ማንበብና መጻፍ የማይችል/	1
		2. ማንበብና መጻፍ የሚችል/	2
		3. አንደኛ ደረጃ	3
		4. ሁለተኛ ደረጃ	4
		5. ኮሌጅና ከዚያ በላይ	5
4	የቤተሰብ መጠን	1. ዝቅተኛ (0-2)	1
		2. መካከለኛ (3-5)	2
		3. ከፍተኛ (>6)	3
5	የቤተሰብ መነሻ (Background)	1. ከተማ	1
		2. በከፊል ከተማ	2
		3. ገጠር	3
6	የስራ ሁኔታ	1. ስራ ያለው	1
		2. ስራ ፈላጊ	2
ክፍል 2 : ቤተሰቡ(የቤተሰቡ አባል) ጫካ ውስጥ የሚበሉ እጽዋቶችን ለመሰብሰብ ተጽእኖ የሚያሳድሩ ምክንያቶች			
1	ቤተሰቡ በወር የሚያገኘው ገንዘብ በብር ምን ያህል ነው ? ----- ብር		
2	ህጻናት እንዲሁም ነብሰጡር ሴቶች የጫካ ፍራፍሮ ፤ወይም አትክልት እንዳይመገቡ የሚከለክል ልማዳዊ ባህል አለ ?	1. አዎ	1
		2. አይ	0
3	በተራ ቁጥር 2 መልስዎ አዎ ከሆነ ምክንያቱ ምንድን ነው	3.	
4	ባለፉት 12 ወራት የቤተሰብ አባል የማገድ እንጨት ለቅመዋል?	1. አዎ	1
		2. አይ	0
5	በተራ ቁጥር 4 መልስዎ አዎ ከሆነ እንጨት በሚለቅሙበት ወቅት የሚበሉ የዱር እጽዋቶችን ለቅመው ያውቃሉ?	1. አዎ	1
		2. የለም	2

6	ለጥያቄ 5 መልስዎ አዎ ከሆነ ፤ ቢያንስ 3 ይዘርዝሩ			
	ተ.ቁ	የእጽዋቱ ስም	የእጽዋቱ ክፍል	ጠቃሚው የእጽዋቱ ክፍል
	1.			
	2.			
	3.			
7	ከቤትዎ እስከ ጫካው ድረስ ያለው የመሰረተ ልማት ሁኔታ			
	ለእርስዎ እንጨት ለመልቀም ሲሄዱ ተስማሚው የትራንስፖርት አይነት የቱ ነው ? 1= በእግር 2= ታክሲ 3= አውቶን 4= ሌላ ካለ	ለመድረስ ምን ያህል ደቂቃ ይፈጃል ? -----በደቂቃ ይጻፉ	ከቤትዎ ጀምሮ እስከ ጫካው ድረስ በግምት ምን ያህል ኪሎሜትር ይሆናል -----ክ.ሜትር	መንገዱ በዝናብ ወቅት አስቸጋሪ ነው ? 1=አዎ 0=አይደለም
8	እጽዋቶችን የሚያገኙት ከየት ነው ?	1. እጽዋት ማዕከል 2. ጫካ ውስጥ		
ክፍል 3: የጫካ ምግቦችን በተመለከተ የቤተሰቡ መሪ አመለካከት				
ተ.ቁ	ጥያቄ	መልስ		ኮድ
1	የጫካ ምግቦችን መመገብ ለሰው ልጅ ጎጂዎች ናቸው?	1. እስማማለሁ 2. እርገጠኛ አደለሁም 3. አልስማማም		1 2 3
2	ጫካ ውስጥ ያሉ የሚበሉ ተክሎች ጣዕም አልባ ናቸው ?	1. እስማማለሁ 1. እርገጠኛ አደለሁም 2. አልስማማም		1 2 3
3	የጫካ ምግቦች ጠቃሚ ንጠረ ነገር ስለያዙ ለቤተሰቤ ጤና ጠቀሜታ አላቸው ?	1. እስማማለሁ 2. እርገጠኛ አደለሁም 3. አልስማማም		1 2 3
4	ጫካ ውስጥ የሚበሉ ተክሎች የድሃ ሰዎች ምግቦች ናቸው ?	1. እስማማለሁ 2. እርገጠኛ አደለሁም 3. አልስማማም		1 2 3
5	በቤተሰብ ውስጥ የምግብ እጥረት በሚፈጠር ወቅት ጫካ ውስጥ ያሉ ለምግብነት የሚውሉ ተክሎች እንደአማራጭ የምግብ ምንጭ ሆነው ያገለግላሉ ?	1. እስማማለሁ 2. እርገጠኛ አደለሁም 3. አልስማማም		1 2 3
6		1. እስማማለሁ		1

	ጫካ ውስጥ ለምግብነት የሚያገለግሉ ተክሎች የተበከሉ ስለሆኑ ለጤና ጠንቅ ናቸው ?	2. እርገጠኛ አደለሁም	2
		3. አልሰማማም	3
7	የጫካ ፍራፍሮዎች ጥሩ ጣዕም ፣ ጤናማ፤ እንዲሁም ጠቃሚ የምግብ ይዘት ስላላቸው ለኔም ሆነ ለቤተሰቤ ጥቅም ይሰጣሉ ;	1. እስማማለሁ	1
		2. እርገጠኛ አደለሁም	2
		3. አልሰማማም	3

Appendix 2: Variance inflation factors for explanatory variables used to model household decision to collect WEPs

Variables	VIF
Household heads sex	1.45
Household heads age	1.20
Household heads education	1.07
Household heads family size	1.09
Household heads marital status	1.04
Household heads background	1.07
job	1.04
Sources of NTFPs	1.07
Income	1.04
Dostance	1.02
Food taboos	1.05
Mean VIF	1.13

Appendix 3. Benefits and hazards of wild edible plants

Benefits of wild edible plants	Hazard of wild edible plants
<ul style="list-style-type: none"> ➤ They play major role in meeting the nutritional requirement (vitamins, carbohydrates, proteins, fibers and minerals) of the tribal population ➤ WEPs provide in particular vitamins A and C, zinc, iron, calcium, iodine, thiamine, riboflavin, niacin, and folacin ➤ Important for food security and nutritional balance especially for women, children, and the poor, who heavily rely on them ➤ They can be used as coping strategy for poor households and marginalized societies in time of drought, war, and other hardship periods ➤ Have enormous medicinal potential ➤ Offer an alternative source of cash income 	<ul style="list-style-type: none"> ➤ If the area sprayed with pesticides or herbicides ➤ If the area close to a busy road or other source of pollution? ➤ It is also wise to start off eating very small quantities of wild edible plants, especially those you have not tried before, in case of potential allergic reactions. Test them before you collect or eat large quantities ➤ If the plant you are harvesting is rare, is the only one of its kind on the location you are harvesting or especially if it is endangered, leave it alone!

Sources: (Farooq, 2017, shumsky, 2014)

Appendix 4. Nutritional analysis reports on WEPs in some countries

No.	WEP species	Family	Nutritional value	Where?	Sources
1	<i>Abrus precatorius L.</i>	<i>Fabaceae</i>	Protein, Ca, Fe, K, Na, Mg, Mn and Zn	Cameroon	Glew, et al., 2010
2	<i>Burnatia enneandra Micheli</i>	<i>Alismataceae</i>	Protein, Ca, Fe, K, Na, Mg, Mn and Zn		
3	<i>Cadaba farinose</i>	<i>Capparidaceae</i>	Protein, fat, Ca, Fe, K, Na, Mg, Mn and Zn		
4	<i>Agave salmiana Otto</i>	<i>Agavaceae</i>	Protein	Mexico	Lopez- Garcia & Basurto- Pena, 2007
5	<i>Aloe vera L.</i>	<i>Aloaceae</i>			
6	<i>Arbutus xalapensis Kunth</i>	<i>Ericaceae</i>			
7	<i>Erythrina Americana Mill.</i>	<i>Fabaceae</i>			
8	<i>Euphorbia radians Benth.</i>	<i>Euphorbiaceae</i>			
9	<i>Borassus aethiopum Mart</i>	<i>Arecaceae</i>	Protein, zn	Sahel region	Glew, et al., 2005
10	<i>Tamarindus indica L.</i>	<i>Fabaceae</i>	Carbohydrate, protein and fat		
11	<i>Portulaca oleracea L.</i>	<i>Portulacaceae</i>	Protein and fat	India, Iran	Aberoumand & Deokule, 2009
12	<i>Moringa oleifera Lam</i>	<i>Moringaceae</i>	vitamin A and vitamin C	Malawi	
13	<i>Ficus sycomorus</i>		Protein , dietary fiber ,iron , calcium phosphorous	Uganda	Acipa, 2013
14	<i>Cucumis figarei</i>		Protein ,vitamin c, iron ,dietary fiber, calcium		
15	<i>Crotalaria brevidens</i>		Protein , berta carotene , vitamin c.		

Appendix 5. Identified wild edible plants in some regions of Ethiopia

Region	Districts	No. of WEPs	No. of families
Afar	Yalo	16	13
Amhara	Adiarkay, Chilga, Delanta, Simada, Yilmanadenssa, Dejen, Debark & Ebinat	101	48
Benishangul-Gumuz	Bullen	69	36
Oromia	Benna Tsemay, Burji, Cheha, Hamar, Hula, Kara, Konso, Maale, Kwego, Debub Ari	226	70
SNNPR	Dheera, Fantalle, Goma, Guna, Yayu, Ziway, Sivo, Chora, Boosat, Hurumu, Tiyo, Doreni	121 (+6 unidentified)	57
Tigray	Alamata	29 (+3 unidentified)	20
Amhara	Adiarkay, Chilga, Delanta, Simada, Yilmanadenssa, Dejen, Debark & Ebinat	101 (+13 unidentified)	48
Benishangul- Gumuz	Bullen	69	36

(Source: Gebru, et al., 2019)

Appendix 6: Some potential and smart wild edible plants in the future

No.	Species name	English name	Local names	Edible parts	Profile and uses	References
1	<i>Mimusops kummel</i> <i>Bruce ex A.DC.</i>	mimusops, red milkwood	Eshe (Amharic), Kolati (Afan Oromo)	Fruits	it is a bright orange yellow color and has a single seed.it can be used as raw	Teklehaymanot, T. (2017)
3	<i>Rosa abyssinica R.Br.</i>	Abyssinian rose	Qega (Amharic); Qaqa (Tigrigna) , Otila (Sidama)	Fruit	It is an evergreen shrub or climber and it is fragrant and white-pale yellow. Fruits are used raw	Mengistu & Hager(2009)
4	<i>Ziziphus spina-christi</i> (L.) Desf.	Christ's Thorn Jujube	Gava (Amharic), Sirah (Gumuzegna)	Fruit	It is hardy and when ripe, it is sweet and consumed raw. It is Source of income sold 2.5 birr / kg	Feysa, Njoka, J. T., Asfaw & MM, N. (2011a)
5	<i>Cordia Africana Lam.</i>	large-leaved cordia	Wanza (Amharic), Otayita (Konsogna), Waddessa (Oromiffa)	Fruit	It is yellowish fruit and it has jelly and sticky nature and juices can be cure diseases such as coughs, wounds influenza and stomach ache,	Alemayehu, Asfaw, &Kelbessa,E. (2016)
6	<i>Dovyalis abyssinica</i> (A.Rich.) Warb.	Abyssinian gooseberry, tropical apricot	Koshim (Amharic), Ongolatz (Somalгна), Aihada (Tigrigna)	Fruit	Mostly eaten raw and has sweet-sour flavor. The roots and stems are used for medicinal purposes, as a tonic, cooked and eaten as a soup	Bekele-Tesemma, A. (2007)
7	<i>Balanites aegyptiaca</i>	bush fig	Cape fig, broom cluster fig	fruits and young leaves	It has fragrant and yellow-green clustered flowers and consume raw	Bekele-Tesemma, A. (2007)
8	<i>Solanum americanum</i>	desert date	Kudekuda (Amharic), Meki (Tigrigna), Domoko (Hamar)	Fruit and leaves	the leaves are effective for abdominal pain and malaria	Berihun & Molla, E. (2017)
9	<i>Ximenia americana L.</i>	hog plum, wild plum, yellow plum	Inkoy (Amharic)	Fruit	The fruits have a pleasant, plum-like flavor. Widely sold at the market	Bahir Dar Institute of Technology (2016)

(Sources: Guyu, *et al.*, 2019)

Appendix 7: Nutritional analysis of some edible plant species

No.	WEPs species	Family	Local name	Used part	Nutritional information / 100 gm
1	<i>Acacia aibida Del.</i>	<i>Fabaceae</i>	Grar	Seed	Nuts and seeds
2	<i>Acacia etbaica Schweinf</i>	<i>Fabaceae</i>	Girar	Gum	All Starchy staple foods
3	<i>Arundinaria alpina K. Schum.</i>	<i>Poaceae</i>	Kerkeha	Young shoots	Other vitamin A rich vegetables and fruits
4	<i>Capparis decidua (Forssk.) Edgew</i>	<i>Capparidaceae</i>	Gumero	Fruit	Other vitamin A rich vegetables and fruits
5	<i>Carissa spinarum L.</i>	<i>Apocynaceae</i>	Agam	Fruit	All Starchy staple foods & Beans and peas
6	<i>Cordia afikana Lam.</i>	<i>Boraginaceae</i>	Wanza	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
7	<i>Douyalis abyssinica (A. Rich.) Warb.</i>	<i>Flacourtiaceae</i>	Koshim	Fruit	Vitamin A rich vegetable and fruits
8	<i>Euclea racemosa Murr</i>	<i>Ebenaceae</i>	Dedaho	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
9	<i>Ficus mucuso Ficalho</i>	<i>Moraceae</i>	Shola	Fruit	Other Vitamin A rich vegetables & fruits , Beans & peas
10	<i>Ficus ovata Vahl</i>	<i>Moraceae</i>	Warka	Fruit	380 mg calcium , 22 gm Iron ,4.7 crude protein ,13.6 carbohydrate
11	<i>Rosa abyssinica Lindley</i>	<i>Rosaceae</i>	Kega	Fruit	Other vitamin A rich vegetables and fruits
12	<i>Syzygium guineense (Willd.) DC</i>	<i>Myrtaceae</i>	Dokma	Fruit and Leaf	Other vitamin A rich vegetables and fruits
13	<i>Urtica simensis Steudel</i>	<i>Urticaceae</i>	Sama	Leaf and stem	Vitamin A-rich dark green leafy Vegetables
14	<i>Ximenia amerkana L.</i>	<i>Olacaceae</i>	Inkoy	Fruit	Other vitamin A rich vegetables and fruits
15	<i>Ziziphus spina-christi (L.)</i>	<i>Rhamnaceae</i>	Gava	Fruit	269.3 kcal, 363 calcium ,24 mg iron , 6.5 protein, 55.4 carbohydrate
16	<i>Ficus carica L.</i>	<i>Moraceae</i>	Beles	Fruit	167.5 kcal energy ,28.8 cho,8.6 protein ,
17	<i>Mimusops kummel</i>	<i>Sapotaceae</i>	Esheh	Fruit	143.8 kcal energy ,355 mg calcium ,24 mg iron ,2.7 % protein
18	<i>Physalis peruviana L</i>	<i>Solanaceae</i>	Kemidero	Vegetable	4% crude protein , 77.7 kcal energy, 380 mg calcium ,23 mg iron ,

(Sources: CARE ETHIOPIA, 2016)

Appendix 8: Work shop participants perception on wild foods

Positive		Negative	
<ul style="list-style-type: none"> ➤ Available for children ➤ Food diversity ➤ Income generating ➤ Long shelf life storage ➤ Seasonal ➤ Famine food ➤ Medicinal value ➤ Are good for soil and water 	<ul style="list-style-type: none"> ➤ Diversity of usage ➤ Freely available ➤ No pesticides or other chemicals necessary ➤ Easy digestible ➤ Nutritious ➤ Low cost ➤ Tasty ➤ Better adopted to the environment 	<ul style="list-style-type: none"> ➤ Uncivilized ➤ Famine food ➤ Poor peoples' food ➤ Toxic ➤ Labor intensive ➤ Long distance and dangerous animals 	<ul style="list-style-type: none"> ➤ Low production ➤ Poor quality ➤ Cultural stigma ➤ Low nutritional values ➤ Not palatable ➤ Seasonality (not available within certain times

Sources: (Brigitta & Caroline, 2000)

Appendix 9. List of wild edible and medicinal plants

No.	Scientific name of species	Local name (Amharic)	Family	Habit	Category	Parts used
1	<i>Acacia abyssinica Hochst,ex Benth</i>	Girar	Fabaceae	Tree	Food	Gums
2	<i>Aloe macrocarpa Tod.</i>	Eret	Aloaceae	Herb	Medicine	Leaf
3	<i>Arenga pinnata</i>	Zenbaba	Arecaceae	Tree	Food	Stem tip
4	<i>Bersana abyssinica Fresen.</i>	Azamir	Meliantaceae	Shrub	Medicine	Leaf
5	<i>Buddleja Polystachya Fresen.</i>	Anfar	Loganiaceae	Shrub	Medicine	Leaf
6	<i>Calpurnia aurea (Ait.)Benth</i>	Zikita	Fabaceae	Shrub	Medicine	Leaf
7	<i>Carissa spinarum L.</i>	Agam	Apocynaceae	Shrub	Food	Fruit
8	<i>Cordia africana Lam.</i>	Wanza	Boraginaceae	Tree	Food	Fruit
9	<i>Datura stramonium L.</i>	Astenagirt	Solanaceae	Herb	Medicine	Leaf
10	<i>Dodonaea angustifolia L.f</i>	Kitkita	Sapindaceae	Shrub	Medicine	Leaf
11	<i>Dovyalis abyssinica (A. Rich.) Warb.</i>	Koshim	Flacourtiaceae	Shrub	Food	Fruit
12	<i>Ferula communis L.</i>	Dog	Apiaceae	Herb	Food	Stem –tip
13	<i>Ficus sur Forssk</i>	Sholla	Moraceae	Tree	Food	Fruit
14	<i>Ficus vasta Forssk.</i>	Warka	Moraceae	Tree	Food	Fruit
15	<i>Grewia ferruginea Hochst. ex A. Rich.</i>	Lenquata	Tiliaceae	Shrub	Food	Fruit
16	<i>Jasminum abyssinicum Hocest. ex DC.</i>	Tenbebel	Oleaceae	Shrub	Medicine	Flower
17	<i>Kalanchoe laciniata L.</i>	Endahula	Crassulaceae	Herb	Medicine	Leaf
18	<i>Millettia ferruginea (Hochst.) Bak.</i>	Birbira	Fabaceae	Tree	Medicine	Leaf
19	<i>Olea europaea subsp.cuspidata L.</i>	Woirra	Oleaceae	Tree	Medicine	Flavorant
20	<i>Opuntia ficus-indica (L.) Miller</i>	Beles/kulkual	Cactaceae	Shrub	Food	Fruit
21	<i>Phytolacca dodecandra L'Herit.</i>	Endod	Phytolaccaceae	Shrub	Medicine	Flower
22	<i>Ricinus communis L.</i>	Gulo	Euphorbiaceae	Shrub	Medicine	Root
23	<i>Rosa abyssinica Lindley</i>	Kega	Rosaceae	Shrub	Food	Fruit

24	<i>Rumex abyssinicus Jacq.</i>	Mekmoko	Polygonaceae	Herb	Food	Stem
25	<i>Sida tenuicarpa Vollesen</i>	Chifrig	Malvaceae	Shrub	Medicine	Leaf
26	<i>Solanum nigrum L</i>	Awut	Solanaceae	Herb	Food	Fruit
27	<i>Syzygium guineense (Willd.) DC.</i>	Dokima	Myrtaceae	Tree	Food	Fruit
28	<i>Urtica simensis Steudel</i>	Sama	Urticaceae	Herb	Food	Leaf
29	<i>Vernonia amygdalina Del</i>	Girawa	Astraceae	Shrub	Medicine	Leaf
30	<i>Ziziphus spina-christi (L.)</i>	Gava	Rhamnaceae	Tree	Food	Fruit
31	<i>Morusmesozygia</i>	Injori	Moraceae	Shrub	Food	Fruit
32	<i>Rhus vulgaris Meikle</i>	Kimmo	Anacardiaceae	Shrub	Food	Fruit
33	<i>Arundinaria alpina K. Schum.</i>	Kerkeha	Poaceae	Tree	Food	Young shot
34	<i>Laetporus sulphureus</i>	Enguday	Boletaceae	HERB	Food	Sporephore
35	<i>Diospyros abyssinica (hiem)</i>	Serkin	Ebenaceae	Tree	Food	Fruit
36	<i>Origanum vulgare</i>	Tosign	Lamiaceae	Shrub	Spice	Leaf
37	<i>Allophylus abyssinicus (Hochst.) Radlk.</i>	Imbis	Sapindaceae	Tree	Food	Fruit
38	<i>Croton macrostachyus</i>	Bisana	Euphorbiaceae	Tree	Flavorant	Leaf
39	<i>Elettaria cardamomum</i>	Korerima	Zingiberaceae	Shrub	Spice	Seed
40	<i>Capparis tomentosa Lam.</i>	Gimero	Capparidaceae	Shrub	Food	Fruit
41	<i>Ziziphus mauritiana</i>	Qurqura	Rhamnaceae	Tree	Food	Fruit

Appendix 10: Picture of wild edible plants in the study area



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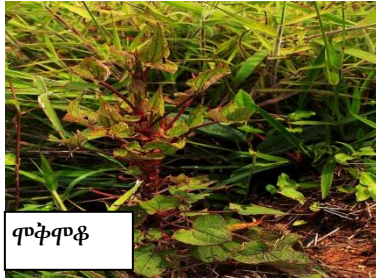
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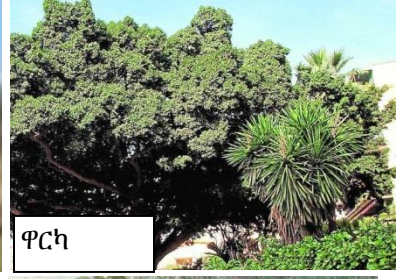
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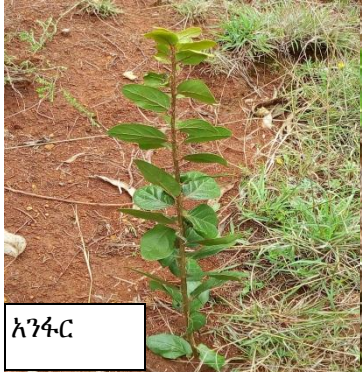


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APPENDICES 11: Picture of Medicinal Plants identified in the study area



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