COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES

DEPARTMENT OF ZOOLOGICAL SCIENCES

Ethno botanical Study and Conservation Status of Wild and Semi-wild edibles plant species in Meta Robi District, West Shewa zone Oromia Regional state, Ethiopia

By: Jebessa Jote Tulu

Advisor: Habte Jebessa Debella (PhD)

A thesis submitted to the Department of Zoological sciences in partial fulfillment of the requirement for the degree of Master of Science in Biology

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March, 2024

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DECLARATION

First, I declare that this thesis is my own work and that all sources of materials used for this thesis have been duly acknowledged. Also I declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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Submission date: _____

APPROVAL SHEET FORM

This Thesis has been submitted for examination with my approval as University advisor, Head department and Examiner

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March, 2024

Addis Ababa, Ethiopia

ACKNOWLEDGMENTS

Following God who really helped me to accomplish my work, I would like to convey my deepest thanks to my advisor Habte Jebessa Debella **(**PhD**)** for his unreserved guidance, kindly follow up and constructive comment with his precious time and energy devotion to shape the present structure of the paper starting from the proposal writing to the final thesis submission. Without his guidance and professional support, this thesis would not have been completed.

Furthermore, I am greatly indebted to all my respondents and participants in the study area who devoted their precious time to fill my questionnaires with the necessary information and to give me qualitative and quantitative responses that needed for my study.

At last but not least, I would like to express my deepest heartfelt to my parents, brothers, sisters and friends who wish my happiness and success throughout my life.

Thank you!

Jebessa Jote Tulu

March 2024

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LIST OF ACRONYMS AND ABBREVIATIONS

ASL	Above Sea Level
CBD	Convention on Biological Diversity
EBI	Ethiopian Biodiversity Institute
FAO	Food and Agriculture Organization
FRA	Forest Resource Assessment
GPS	Geographic Positioning Systems
IBC	Institute of Biodiversity Conservation
UNESCO	United Nation Economic Science and Cultural Organization
USA	United State of America
WEPs	Wild edible plants
WSEPs	Wild and Semi-wild plants

ABSTRACT

The term "wild edible plants" refers to plant species that can be obtained from their natural habitat and used as food sources but have not been domesticated or cultivated. From November 2022 to March 2024, the ethno botany of wild and semi-wild edible plants as well as the state of their conservation in the Meta Robi District West showa zone was the subjects of this study. It deals with identifying edible wild and semi-wild plants that the Meta Robi rural people gather and use, along with their conservation status, within the study area. A variety of methods were used to gather ethno botanical data, including guided field walks with informants, semi-structured interviews, group discussions, preference ranking, and field observation to obtain indigenous knowledge about wild and semi-wild edible plant species, local vegetation classification, threats, and conservation efforts. From the study area, 34 useful edible plants were identified. Five species (14.7%) from the Rosaceae family were the most, followed by three species (8.8%) each from Anacardiaceae and Solanaceae and two species (5.9%) each from Lamiaceae and Moraceae. Edible plants mature in various seasons; 10 (29.4%) plant species were able to reach maturity in both pre-rainy and dry seasons, 14 (41.2%) of the plant species reached maturity in the post-rainy season, 8 (23.5%) plant species mature in all seasons, and 2 (5.9%) plant species mature in the rainy season. The growth form distribution revealed that trees accounted for 38.2% of the species, with 13 species, followed by herbs 32.4% with 11 species, and shrubs 29.4% with 10 species. The study area's wild and semi-wild edible plants were primarily threatened by overgrazing, exotic species introduction, deforestation for agriculture, charcoal production, buildings, and furniture. Based on the study, edible plants that grow wild or semi-wild are important resources for increasing the income and food security of rural households. So, more investigation is required to evaluate their nutritional value and ecological, economic, and other contributions.

Key words: Meta Robi district, biodiversity, conservation, Ethno botany, wild and semi wild edible plants

1. INTRODUCTION

1.1 Background of the study

According to Martin (1995) and Balick (1996), ethno botany is the umbrella term used to describe the study of interactions between humans and plants. Plants are used in the economy for food, medicine, building materials, and other uses. According to Beluha and Ranogajec (2010), wild edible plants are those that are found in their natural habitat and are used as food sources even though they have never been domesticated or cultivated. For sustenance, food, and livelihoods, numerous cultures throughout the world gather edible wild plants. These plants are gathered from a range of locations, such as agricultural fields, roadsides, waste areas, and natural forests. Many studies have demonstrated that edible wild plants are often more nutrient-dense than crops farmed for human consumption and can be a potential source of nutrition (Grivetti and Ogle, 2000).

Indigenous knowledge is the body of knowledge, traditions, norms, skills, and way of thinking that people who live in a particular area have (Quanash, 1998). Indigenous people learned about the management of plant resources and the customary uses of edible wild plants in order to preserve long-term relationships with the natural world. Because of this, traditional medicine has used plants in its preparations for ages, treating and preventing diseases in both humans and animals. A large amount of the food and energy needed by rural residents comes from a variety of naturally occurring, non-cultivated trees and shrubs (Nair, 1989). According to Ruffo et al., (2002), wild food plants are cultivated or fallow land plants that naturally grow edible parts. For household food security and nutrition, they are crucial in some rural areas, particularly those with dry soils. They may serve as supplemental foods, act as emergency food during a famine, and fill in gaps in the food supply during certain seasons (FAO, 1989).

The indigenous populations, who have a wealth of knowledge regarding the practical uses of these wild plants, uses edible wild plants as part of their survival strategies, which are strongly linked to their strong traditional and cultural systems. Preserving these species ought to remain a primary concern since wild edibles often contribute significantly to the diet and economy of the surrounding community. Wild plant species will protect biological diversity, provide enough food, and strengthen the rural community's economy when they are incorporated into the agricultural system. A small amount of fruits, vegetables, and animal products are usually included in the diets of developing countries, which primarily consist of cereals.

A major contributing factor to the widespread prevalence of vitamin A deficiency is a diet very low in fruits and vegetables, especially those rich in pro-vitamin A. Wild vegetables often have nutritional values comparable to or even higher than those of cultivated species, and Turan et al., (2003) report that they are a rich source of micronutrients. Local knowledge has long recognized the role that plant foods from the area play in reducing health risks; this knowledge comprises a larger part of the complex cultural system. According to numerous research findings, a wide variety of edible plants are rich in specific components known as phytochemicals, which may have health-promoting properties.

According to Basu et al., (2007), major chemical groups derived from plants that are now known to have the potential to improve health, at least in some circumstances, include tannins, fatty acids, soluble and insoluble dietary fibers, flavonoids, alkaloids, carotenoids, pre- and pro-biotics, phytosterols, terpenoids, and saponins. For many ethno botanists, wild edible plants have become a focal point of research in recent decades, with a global interest in documenting ethno botanical information on underutilized wild edible food sources (Bharucha and Pretty, 2010). To preserve traditional knowledge of wild edible plants for future generations, it is imperative to support research on these plants, as acculturation, plant biodiversity loss, and the loss of indigenous people and their cultural heritage are all contributing factors to the erosion of wild edible plant knowledge (Asfaw Z, 2009).

According to studies carried out in East Africa, native populations supplement their diets with wild plant material that contains antioxidants to break down cholesterol found in their traditional foods of meat, milk, and blood (Johns et al., 1999). According to studies conducted in Northern Nigeria, people gather leafy vegetables and other bush foods to add on a daily basis to soups and relishes (Loghurst, 1986). In Swaziland, wild plant species continue to be extremely important and make up a larger portion of the yearly diet than domesticated crops. The numerous reports also mentioned how nutrient-dense many wild edible plant species are, and how they can help meet dietary needs, particularly for vitamins and micronutrients. Some wild food plants have been subjected to nutritional analysis, which shows that these plants' nutritional qualities are frequently on par with or even better than those of domesticated varieties (Kubaye, 1997). The remarkable agro biodiversity of Ethiopia is a result of the nation's diverse topography, strong food culture, ethnic groups, and climate (Edwards, 1997).

Ethiopia is also a country with a diverse ecology. In addition, Ethiopia has a remarkably diverse range of plants. The bulk of Ethiopia's fruiting species are edible wild and a semi-wild plant, which makes up the majority of the species that humans eat (Asfaw Z and Mesfin, 2001).
Millions of people in rural developing countries, like Ethiopia, cannot produce or get enough food with the current conventional methods. This is why, especially in times of food scarcity, they often rely on wild and semi-wild plants to augment and improve their diet (Effiong and Undo, 2010). Approximately 8% of Ethiopia's nearly 7000 higher plants are edible, of which 25% are grown. There are also many edible wild plants that produce large amounts of food. These findings are consistent with earlier research. Wild edible plants are those that can be taken from their natural habitat and used as a food source without having been domesticated or cultivated, according to Kelbessa E and Van Damme (2011).

In the year of 2010, as the publication authored by Demel and colleagues, a total of 378 species of wild plants were identified in Ethiopia, which were used as food in specific regions. These plants served various purposes and were consumed during different seasons. Although the earlier sources were not organized, they still provided information on approximately the same amount of species. Given the extensive flora of over 6000 species, unexplored cultures and regions in terms of ethno botany, it is anticipated that the current count of wild edible plants in Ethiopia is likely to be underestimated. In the subcontinent of Ethiopia, approximately 81 million individuals residing in rural areas rely on forest resources for their survival and income. This group represents 85% of the tribal population who live in forested regions. Nevertheless, as humans continue to populate areas close to forests and even within them, the negative impact on plant and animal populations has escalated, resulting in the deterioration of forests, the decline of biodiversity, and the reduction of forested areas.

To improve management and policy decisions, it is crucial to identify the reasons behind the loss and degradation of forests (Davidar et al., 2010). According to Getachew (2009), the amount of wild vegetables in different societies can be significant, and the level of consumption differs depending on the socio-cultural context. With the exception of a few communities in southern Ethiopia and a few others, the act of consuming underutilized edible plants, especially vegetables, has often been associated with poverty. This perception largely stems from a lack of understanding regarding the nutritional advantages these plants offer.

The ability of most vegetables to quickly grow back in dry soil conditions, combined with the fact that perennial species are available throughout the year, allows them to serve as a solution for rural communities facing food shortages and famines. Both domesticated and wild green leafy vegetables offer many nutritional and health advantages. They are affordable, simple to prepare, and contain significant amounts of both macronutrients and micronutrients. It is suggested to regularly consume vegetables as it can improve one's health and help manage chronic illnesses like heart problems, diabetes, and cancer (Thompson, 1993).

1.2 Statement of the problem

Indigenous knowledge of edible wild and semi-wild plants is passed down orally from generation to generation in developing countries such as Ethiopia. Given that the country's records and documentation on edible plants are lacking. Furthermore, there is a clear loss of biodiversity due to human impacts such as deforestation, overexploitation, agricultural expansion, and population growth in most of the country. These factors, along with migration from rural to urban areas, industrialization, and the expansion of modern education, indigenous knowledge about utilizing edible plants as food is also being erased. Generally Oromia Regional State, in particular Meta Robi Woreda, is one area of Ethiopia where these issues are present. This region is losing habitat and species because of ongoing deforestation, a loss of related knowledge, and a lack of documentation efforts. For conservation and community development initiatives, ethno botanical knowledge is essential. So far, Meta Robi Woreda has not been the subject of any ethno botanical research on edible wild and semi-wild edible plant species by other scholars. This study's findings will help to identify the edible wild and semi-wild edible plant species in the study area, which will help people to recognize the problems associated with these plants and pay attention to the threatened edible wild and semi-wild plants. Additionally, the documentation of indigenous knowledge about edible wild and semi-wild plants can be used as a source of information for people who wish to conduct further research in ethno botany, and this study was started to fill in the gaps in the documentation of knowledge that helps people live in the surrounding. As a result, the study was carried out to evaluate the people's traditional knowledge of the edible plants species in the study area.

1.3 Objectives of the study

1.3.1 The general objective of the study

The main Objective of the study was to identify Wild and Semi-wild plants species gathered and used by Meta Robi rural people with their conservation status in the study area.

1.3.2 Specific objectives of the study

The specific Objectives of the study were to:-

- identify Edible plant species in the study area.
- identify the habits and habitat distribution of these edible plant species.
- document the knowledge of indigenous people on edible plans species as regard to their seasonal use, formulation and parts of plants used.
- assess the current threats and conservation activities on edible plants species and recommend the possible management strategies in the study area.
- identify socio-economic aspects of the edible plant species.

1.4 Limitation of the study

The data gathering materials are mainly interviews and it might have limitation of bias and subjectivity. Therefore, the data gathering is supported with questionnaire, and document analysis. The main obstacle was that the study area did not have access to internet services during analyzing the data. Since the case is conducted on a limited amount of households live in Abocheru, Baka and Cancho Borche kebeles, the findings have no possibilities to be generalized in other areas of the community.

1.5 Research questions

The following major research questions were considered in this study:

1. Which edible plant species are most frequently used by residents of the Meta Robi districts?
2. Which plant parts are more edible in the research area?
3. Which wild edible plant species are currently present in the study area and in what condition?
4. Which season is the edible plant species suitable for human consumption?
5. How is traditional botanical knowledge distributed and transferred among different classes of community members and social groups in the area?

1.6 Significance of the study

The study will have the following significances:

- Improves the conduct and morale of those who work with edible plant species
- Facilitates the easy access, preparation and use of edible plant species within society.
- Unveils to society and to higher researchers certain edible plant species that are hidden
- Might serve as a reference guide for species of edible plants

2. REVIEW OF LITERATURE

2.1 Status of wild edible plant species in the world

Several stages of cultivation will reveal various wild edible plants. These World Sustainable Eating Patterns consist of various types of plants such as roots, shoots, green leafy vegetables, juicy fruits, nuts, grains, seeds, and other similar plant species. Having an understanding of the culture is significant in the gathering and cooking of these indigenous edible plants. The research on WSEPs is distinguished by the involvement of various fields such as nutrition, ethno botany, medicine, anthropology, analytical chemistry, and phytochemistry (McBurney et al., 2004).

According to Myers and his colleagues, in the year 2000, changes in the way land is used, the overuse of resources, and the introduction of non-native species are usually the reasons for these disturbances of biodiversity. In addition to the phrase "Wild Edible Plants," the terms "indigenous plants" and "traditional plants" refer to plants that have been a part of the food system for many generations. In this work, "Wild Edible Plants" was primarily used to emphasize the aspect of not being cultivated rather than their long-term presence in the food system. Based on ethno botanical research, it has been found that over 30,000 types of plants can be consumed as food. Around 7,000 species have been utilized as food from this quantity according to Wilson (1990).

According to Smith and Eyzaguirre (2007), Africa is home to approximately 6,376 native plant species. Due to shifts in societal and economic factors, as well as the process of urbanization, the availability of food worldwide is becoming more limited. Out of the 7,000 plant species that have been historically used for food, only 120 species are currently grown through cultivation. According to Frison et al., (2006), nine species are responsible for producing over 75% of the food consumed by humans. Out of these nine, only maize, wheat, and rice account for more than 50% of the food supply. Only 12 species account for 80% of the total global energy consumption. This reliance on a small number of species has been leading to a decrease in the availability of WEPs and a lack of consideration for them in land use planning, biodiversity conservation, economic development, and official statistics (Asfaw Z, 2009).

2.2 Status of wild and semi-wild edible plant species in Ethiopia

Ethiopia possesses diverse geography and a wide range of ecosystems that support numerous unique plant and animal species found nowhere else. The nation contains approximately 6,000 different types of higher plant species, with roughly 10% being unique to the country (Hedberg et al., 2009).

Forests, grasslands, rivers, and wetlands in the country serve as habitats for a wide range of wildlife species and plant life. The people living in Ethiopia's local communities possess a variety of traditional knowledge that is connected to the country's abundant biodiversity. Even though there are many WSEPs in Ethiopia that are easily accessible and used, there is limited ethno botanical knowledge regarding the cultural, socio-economic, and nutritional significance of Ethiopian plants. Therefore, it is necessary to gather information, analyse the nutritional content, and domesticate WSEPs in order to support the country's efforts in addressing food insecurity and promoting varied diets. Wild food sources are essential components of the diets of numerous communities in various regions of Ethiopia. However, the consumption of plants that are naturally found in the wild is more prevalent in regions with limited access to food compared to other parts of the country. The Konso people in southern Ethiopia survived three consecutive years of crop failure due to severe drought from 1996 to 1999 by relying on the WEPs found in the area (Guinand and Dechassa, 2001).

Ethiopia has been experiencing environmental degradation and deforestation for several centuries. In the past century, Ethiopia has experienced a significant decrease in the size and quality of its forests and woodlands. In the early 1950s, the proportion of high forest areas had decreased to 16% of the overall land area. According to the study conducted by Million and Birhanu in 2001, it was calculated that the forested land area decreased to 3.6% in the early 1980s and further declined to around 2.7% by 1989. According to statistics, the forest area in Ethiopia has been steadily decreasing over the years. In 1950, the country had 35% forest cover, but by 1992, it had reduced to only 2.4%. The FRA states that Ethiopia is one of the countries with a forest cover of 10 to 30 percent of its total land area, and specifically, it has a forest cover of 12.4 million hectares, which accounts for 11.5 percent of the country's land. A tree-planting initiative has been carried out annually across the nation starting from 2008, resulting in a growth in forest coverage. From 2010 to 2015, there was a documented rise in the amount of forested land, with an approximate annual increase of 40,000 hectares, according to the FAO (2015).

Wild-food is seen as an extra component of farmers' regular food intake. "Wild-food" typically refers to fruits and berries from a variety of wild plants, as well as domestic livestock products and food purchases made on local markets, based on the crop harvest. Wild fruits and berries play a vital role in providing essential vitamins to the typically lacking Ethiopian cereal-based diet, especially for children (Bell, 1995).

2.3 Vegetation of Ethiopia

In simpler terms, vegetation refers to a group of plants that grow together in a specific place. It can be identified by the types of plants present or by the characteristics that make them unique. Vegetation structure refers to the spatial arrangement of individuals within a community, as well as the corresponding vegetation type or plant association. The arrangement of plant growth forms in a plant community, particularly in terms of their height, abundance, or coverage within each layer, is known as the spatial pattern of growth forms (Jennings et al., 2003).

According to Skarpe (1991), the changes can occur due to ecological or evolutionary processes, shifts in climate, human activity on the land, and the influence of both non-living and living factors. The most crucial elements for agricultural production in Ethiopia are temperature and precipitation levels. Altitude plays a crucial role in deciding the distribution of weather-related elements and land appropriateness. It impacts the types of crops that can be cultivated, the speed at which crops grow the variety of natural vegetation, and the diversity of species within that vegetation (Alemayehu, 2003).

Ethiopia possesses a wide variety of plant species, with around 6200 species out of a total of 7850 found in East Africa. This area is significant for its diverse range of altitudes and geographical features, such as tall and steep mountains, flat plateaus, deep gorges, winding river valleys, and vast plains, making it a vital hub for biological diversity in the region. These factors have a significant impact on Ethiopia's diverse land and water ecosystems, and have also led to a high level of unique species. Conservation strategies are aimed at preserving both domesticated and wild plants and animals in both natural and human-managed environments, while taking into consideration the genetic variation within and between species. In terms of plant life, Ethiopia ranks as the fifth largest country in tropical Africa (Kelbessa E and Demissew S, 2014).

The altitude ranges drastically, reaching as low as 110 meters beneath sea level and as high as 4620 meters above sea level. The amount and distribution of rainfall can differ significantly. These elements have a significant impact on Ethiopia’s wide variety of land and water ecosystems and have resulted in a high level of diversity and unique species found only in Ethiopia (Tesfaye et al., 2003).Ethiopia possesses an incredible indigenous knowledge system that enables people to endure and overcome challenging environmental circumstances, such as famine and poverty. The country has a wide range of climates, topography, and soil variations which allows for a diverse range of vegetation to grow, including tropical rain and cloud forests as well as desert scrubs (Demel et al., 2010).

2.4 History of edible plants species

Various sections of plants that grow in the wild, such as roots, tubers, rhizomes, stems, fruits, inflorescences, flowers, seeds, fruiting bodies, and fronds, are ingested in different ways, either in their natural state, roasted, fried, cooked, boiled, or as seasonings. According to Redzic (2006), wild plants are not only utilized by impoverished communities, but they are also frequently employed as dietary supplements in highly advanced regions worldwide. Ethiopia is a widely recognized area of immense biodiversity and is a primary source of many essential food plants. The local community's deep-rooted traditional knowledge regarding the use and consumption of wild edible plants (WSEPs) is an essential aspect of their dietary habits. In various regions of Ethiopia, the local fruits and tree and shrub seeds are often eaten as fresh food by children, herders, and hunters. This ensures that their nutritional and medicinal properties and worth are preserved. Wild fruits play a significant role in ensuring the nutritional and health well-being of people living in rural areas due to the presence of essential nourishing components such as proteins, vitamins, and minerals. Hence, consuming them in their natural state, without altering their nutritional composition, is more preferable. Cooking fruits generally alters certain portions or significant portions of the nutrients responsible for providing a well-rounded nutrient profile and maintaining overall bodily health.

Fentahun and Herbert (2009) provided an explanation that the rural population in Ethiopia possesses knowledge regarding the beneficial properties of wild fruits for preventing illnesses. However, due to their strong focus on raising livestock and utilizing livestock products, their inclination towards incorporating fruits into their culture is minimal. On the other hand, Europeans and Americans have extensively cultivated and enhanced the benefits of their indigenous fruits. They have come to understand that utilizing natural food sources from plants is more beneficial for their well-being and the environment compared to processed food.

Consuming fruits grown on trees, whether in the natural environment or on agricultural lands, has positive effects on human blood flow and reduces the chances of developing heart disease, diabetes, obesity, and cancer. In Ethiopia, insufficient research has been conducted regarding the sustainable utilization of these edible and medicinal wild plants. This is because humans paid less attention to wild plants and instead focused on domesticating edible wild plant species. The rise of modernity led to a decrease in the appeal of foods that provided important tastes and essential nutritional elements in the diet (Guinand and Dechassa, 2000).

2.5 The multiple benefits of edible plant species

2.5.1 Provision of Micronutrients

WEPs have a significant impact in providing essential nutrients to staple foods and improving nutritional quality for both rural and urban populations in sub Saharan Africa, according to Termote et al. (2011). Wild vegetables contain a high amount of micronutrients and their nutritional value is often similar to or better than cultivated vegetables (Guerrero, 1998). In Niger and Swaziland, wild fruits, vegetables, and other plants play a major role in providing essential micronutrients to the local population (Humphrey et al., 1993; Huss-Ashmore and Curry, 1991).

2.5.2 Security of food shortage

According to multiple research studies, populations can heavily depend on freely available and easily accessible WSEPs during periods of food insecurity caused by either natural or human-caused disasters (Muller and Almedom, 2008). This connection resulted in the creation of the concept of famine foods. The inherent ability of WSEPs to withstand short-term changes in climate adds to their potential significance, especially during periods of low agricultural productivity.

According to Shackleton et al., (2009), exotic vegetables frequently struggle to acclimate to their new surroundings and require specialized and rigorous methods of cultivation. Although wild edible plants alone are not enough to fully close the gaps between demand and supply, these gaps would be significantly larger in their absence. Nevertheless, the reliance on WEPs can also result in their exhaustion, particularly when combined with population expansion. Until this point, global food security policies have insufficiently recognized the importance of wild edible plants. This has frequently limited the ability to ensure the availability of food and preserve biodiversity (Dovie et al., 2007).

2.5.3 Source of income

Another benefit of wild edible plants is that they can serve as a backup source of income if they are collected promptly when they are safe to eat. This becomes particularly crucial in remote areas lacking insurance systems, yet facing significant risks related to cost, health, and the environment. Several studies have indicated that the commercialization of wild fruits serves as a significant source of income (Styger et al., 1999).

Although there is a lack of worldwide estimations regarding the financial worth of wild foods, it is undeniable that their utilization and commerce become significant in times of economic difficulty. In recent times, there has been a growing focus on the role of wild foods in improving the lives of people in rural areas and reducing poverty. In certain regions of southern Africa, the earnings from selling WSEPs can make up half of the overall net income, according to Wiesum and Shackleton (2005).

Income and employment can be generated through the trading of fruits, leaves, juice, and local beverages. Furthermore, the native species have evolved to suit the specific culture and surroundings of the region, making them capable of reproducing and thriving effortlessly with minimal need for external substances like fertilizers and pesticides. However, it can be easily incorporated into farming systems that promote sustainability (Ruffo et al., 2002).

2.5.4 Importance of forest and forest resources

The significance of forests and their resources Forests are essential for protecting and preserving soil and water resources, ensuring the safety of watersheds, recycling nutrients, enabling nitrogen fixation, providing habitat for wildlife, conserving genetic diversity, maintaining the balance of gases in the atmosphere for breathable air, and capturing carbon dioxide to mitigate its impact on the environment (Demel, 2001).

Non-wood forest resources consist of items such as coffee, spices, honey, medicinal goods, animal feed, and wild edible plants. Medicine is categorized as a non-wood forest product, and traditional medicine holds significant importance in the healthcare of Ethiopian citizens. It is estimated that 80% of the population in Ethiopia depend on traditional medicine for their main healthcare requirements. Ethiopia's diverse ecological and climatic conditions contribute to the presence of a wide range of plant and animal species, making it one of the countries with the highest biodiversity in Africa. Ethiopia has a significant capacity to produce a considerable amount of honey, particularly from the diverse plant species found in its forests and woodlands. These plants offer an abundance of nectar and pollen, which can be collected by bees for their honey production (Girma, 1998).

2.5.5 Useful plants and plant use categories

People obtain food, medicines, and various ecosystem services from plant diversity. These services include air purification, the creation and replenishment of water sources, nitrogen fixation, nutrient cycling, and various other products. The utilization of plants and their products for various needs, including food, medicine, wood, fiber, oil, livestock feed, fragrance, ornamental purposes, and other miscellaneous uses, has been observed since the earliest days of human civilization (Khanal, 2006).

The understanding and overall significance of beneficial plants are influenced by cultural aspects such as human actions, social and economic limitations, and various other factors. Furthermore, the ways in which human beings utilize plant species may vary based on environmental limitations. For instance, certain patterns may be connected to the number of species present in a specific area or to the overall prevalence of certain beneficial plants in a larger region (Toledo et al., 2007).

Plants play various roles, both directly and indirectly, in supporting the livelihoods of humans and animals. While a few of these plant species have been cultivated, the vast majority remain in their natural, wild habitats. Wild foods are a valuable source of various nutrients for many households in regions with both semi-arid and humid tropical climates. Plants play a crucial role during periods of food scarcity, serving as a means to cope and adapt to a changing environment. Many sources indicate that wild foods generally contain higher amounts of vitamins, minerals, and other nutrients compared to domesticated foods (Hinnawi, 2010).

Because of their beneficial characteristics, such as the ability to easily adapt and live for a long time, being able to resist diseases, and being tolerant to both drought and flood, these plants can become a valuable genetic asset for enhancing cultivation methods. In contrast to cultivated vegetables, wild and semi wild food plants species necessitate minimal upkeep, remain unaffected by pesticide contamination, and offer a plentiful supply of micronutrients (Ju et al., 2013).

The way indigenous people have relied on plants and the way they have utilized them in their daily lives is influenced by the historical context, as well as the physical and social surroundings, which in turn determines their relationship with plants. Ethno botany explores the interconnectedness between plants and humans within a dynamic ecosystem that encompasses natural and social elements. The function of plant species showcases the characteristics and traits relating to the biology and physical aspects of plants. Initially, plants were only utilized for nourishment, healing, and protection, however, as time progressed, humans began to discover the diverse capabilities and applications of plants (Alcorn, 1984).

2.6 The concept of plant biodiversity and their types

Biodiversity can be described as the range of different living organisms found in various environments, such as on land, in the ocean, and in other aquatic systems. It encompasses different levels of diversity, such as the variety within species, between different species, and among various ecosystems. The vast array of genes present in plant species, animal species, and microorganisms accounts for the immense diversity observed in these organisms. The Earth's diverse ecosystems, including deserts, rainforests, and coral reefs, contribute to its rich biodiversity. This particular type offers the necessary elements to adjust and thrive in upcoming shifts in the environment. Diversity also includes the variety of human cultures, which can be influenced by the same factors as biodiversity and may have effects on the variety of genes, species, and ecosystems. In general, the distribution of plant species diversity is affected by variations in latitude, altitude, and soil composition (Whittaker, 1975).

Biodiversity encompasses the wide range of natural diversity found in the world, including the different species on Earth, the genetic variations within each species, the various communities within ecosystems, and the diverse landscapes found on the planet. The preservation of various species is seen as an important measure of sustainable land use practices. Significant efforts and resources are dedicated to finding and implementing strategies to combat the current decrease in biodiversity at different levels - local, regional, and international (Shackelton, 2000). Therefore, the measurement of diversity involves tallying the species present and their respective populations. The two constituents can be independently analyzed using a method such as the Shannon diversity index. The distribution of plant species diversity has frequently been recognized as a factor to consider when deciding on conservation efforts, as it indicates the ecological processes that are essential for effective management. (Lovett et al., 2000)

In mountainous ecosystems, the rapid variations in altitude, slope, moisture levels, temperature, rainfall, and drainage can lead to significant changes in plant diversity even within a small area (Lovett, 1990). The study of species diversity and their distribution patterns is necessary to understand the range of plants in a specific area and identify the main factors that impact this diversity. Ethiopia possesses a range of ecological and climatic conditions that contribute to its status as a tropical country, enabling a wide array of plant and animal life to thrive within its borders. In most areas of Ethiopia, the comprehensive documentation of the country's significant biodiversity and the indigenous knowledge associated with it is lacking, despite a few previous efforts (Amare, 1974).

Ethiopia possesses a diverse array of vegetation formations, varying from afro-alpine to desert vegetation. These main types of vegetation consist of desert and semi-desert scrubland, forest areas such as Acacia-Commiphora woodland and bushland, a wooded grassland in the Western Gambela region, Combretum-Terminalia woodland and wooded grassland, dry evergreen Afromontane forest and grassland, moist evergreen Afromontane forest and bushland, transitional rainforest, ericaceous belt, Afro-alpine belt, riverine vegetation, and vegetation found in fresh water lakes and salt lakes (Friis et al., 2010).

The reason for the distribution and arrangement of different plants and animals in the forest can be explained by the diverse climate, soil, latitude, and topography of the area. These factors greatly impact the type and distribution of flora and fauna in the forest (Mueller-Dombois and Ellenberg, 1974). In general, Guinand and Dechassa (2000) categorized WEPs into four groups based on the specific parts of plants utilized, the circumstances of consumption (normal conditions versus during famine), and the different consumer groups (adults, children, women, and men). The WEPs can be divided into four categories: (a) plants that are commonly consumed during famines, (b) plants that are typically considered wild food but contain components that are consumed during famines, (c) plants that are considered wild food but attract more consumers during periods of food shortage, and (d) food crops grown on farms that have components that are consumed during famines.

2.7 Importance and trends in ethno botany

Ethno botany is a specialized field within the natural sciences that integrates several different areas of study, including anthropology, archaeology, botany, ecology, systematics, religious studies, forestry, agroforestry, economics, medicine, and cultural studies, among others. Ethno botany can be defined as the investigation of the connections between plants and humans, as stated by Balick and Cox in 1996.

Ethno botany assists in the identification of conservation concerns, such as situations where the rate of harvest surpasses the rate of regrowth. The preservation of over-harvested medicinal and wild food plants is crucial to ensure future generations can reap the benefits of these valuable gifts of nature (Qureshi et al., 2009). Due to the effects of acculturation and the decline of plant biodiversity, there is a diminishing traditional understanding of wild food plants and the indigenous cultures associated with them. Therefore, it is essential to prioritize research on these plants to preserve this knowledge for future generations (Ermias, 2011).

The species of WSEPs continue to be greatly overlooked when it comes to land use planning and implementation, economic development, and efforts to conserve biodiversity. The examination of wild and semi-wild plant species that are edible and their various uses is a major focus for humans and has been carried out by all societies for potentially thousands of years. As a result, the field of ethno botany is experiencing rapid growth and appealing to individuals with diverse academic backgrounds and interests. In the present era, there has been a rapid decline in the preservation of ethno botanical knowledge. Westernization, the erosion of traditional cultures, and even the elimination of entire tribal communities can be attributed to this phenomenon. The study of plants and their cultural importance is an essential field for the preservation and responsible advancement of the natural environment. There is a pressing need for capacity building programs related to applied ethno botany in developing nations. This is because of the close connection between rural communities and the plants found in their local areas. Ethno botanical studies are important because they document, analyze, and share the knowledge of local people regarding plants. These studies also reveal the connection between biodiversity and human society, including the different ways in which society's value biodiversity and how human activities impact it (Martin, 1995).

2.8 Indigenous knowledge related with edible plants

The disappearance of traditional cultural systems and the conversion of range lands and forest ecosystems into different forms of land use are resulting in the decline and erosion of the community's knowledge. For a long time, the significance of wild or semi-wild edible plant species in developing countries has been overlooked and underestimated by people. Research conducted in the Afar Region (Gelmesa, 2010) and in southern Ethiopia (Guinand and Dechassa, 2000) shows that people's ability and willingness to domesticate and grow wild edible food plants is limited by traditional customs, beliefs, and religious taboos. Consequently, Ethiopia has a rich tradition of indigenous knowledge, practice, and skill pertaining to wild edible plants; however, this valuable information remains inadequately researched and recorded. The urbanization, industrialization, and migration of young people from rural to urban areas are slowly causing the erosion and disappearance of indigenous knowledge, practices, and skills.

The primary providers of plant knowledge are the older members of the community and other well-informed individuals within the community. In rural parts of Ethiopia, especially among children, it is still quite prevalent to consume wild and semi-wild edible food. Children often eat the most commonly found wild and semi-wild edible fruits from plants. One can take the fruits that come from plant species such as Ficus spp, *Carissa edulis*, and *Rosa abyssinica* as an example. The national statistical reports often fail to recognize the significant role that numerous wild edible plants play in supporting the livelihoods of impoverished individuals (Poulton and Poole, 2001). This signifies that policy makers lack knowledge and interest regarding the resources of wild and semi-wild edible plant species. However, these overlooked categories of food plant species have the potential to play a role in alleviating poverty, ensuring access to food, promoting agricultural diversity, and generating income. The usage of wild and partially domesticated edible plants in the isolated regions of southern Ethiopia is prevalent during periods of abundance as well as scarcity of food, according to Getachew (2013).

2.9 Threats of vegetation in Ethiopia

The increasing worry in various regions of the world is the result of human activities causing the decline of forest cover and biodiversity (Abyot et al., 2014). The connection between the reduction of vegetation and the exhaustion of natural resources is strongly linked to droughts and food shortages, which are posing significant dangers to the lives of millions of individuals (Brook et al., 2006). The majority of highland areas have been affected by significant changes due to the declining biological potential of vegetation caused by human activities (Feyera, 2010).

The acknowledgment of the loss or threats to biodiversity has resulted in the development of conservation strategies on a global, regional, and national scale. The Millennium Ecosystem Assessment (MEA, 2005) highlights that habitat modification, climate change, the introduction of non-native species, excessive use of natural resources, and pollution are the main factors responsible for the decline in biodiversity. In recent times, the reductions of plant diversity and environmental deterioration have emerged as important concerns at both national and global levels, as stated by Motuma (2010). This is because the reduction of plant life and depletion of natural resources are closely linked to the issues of drought and food scarcity, which are posing a significant danger to people across the globe.

The absence of a policy to protect vegetation is allowing deforestation to occur quickly, particularly in countries such as Ethiopia (Haile et al., 2012) and the environmental degradation are all contributing to the current crisis we are facing. Dereje (2006) states that the depletion of forest resources in Ethiopia can be attributed to various factors, such as the conversion of forest areas into agricultural land, excessive grazing, the unsustainable use of forests for fuel wood and construction materials without adequate replanting efforts, and the absence of a suitable policy framework. The reasons for the deterioration of forests are complex and involve various factors. It is crucial to have accurate data on forest resources in order to effectively manage and plan for forests within the framework of sustainable development (FAO, 2007).

Despite being the primary hub of origin and diversity for numerous plant species, Ethiopia still possesses a remarkable variety of plant genetic resources. This resource is crucial for the country's economic, social, and environmental progress. However, like many other regions, the diversity of resources in this area is in danger because of poor management and environmental damage, resulting in the loss of genetic diversity both selectively and entirely. The lack of clear policy guidelines regarding plant genetic resources for an extended period of time has resulted in the depletion of valuable native genetic resources, the introduction of diseases, pests, and weeds, and the introduction of genetic material that is not suitable for the local agricultural and ecological systems. The forests and other vegetation formations are facing significant stress due to the increasing demand for farmland and grazing areas. There is a shortage of fuel wood in the country, which is causing the depletion of the available supply and resulting in further damage to the remaining forest areas. The depletion of forest resources is a significant problem in the elevated regions of the Ethiopian highlands, particularly in the mountainous areas located above 1500 meters in the central part of the country (Deriba, 2006).

2.10 Conservation Status of Biodiversity

The field of ethno botany has the potential to revolutionize scientific approaches by fostering collaboration between indigenous communities and researchers in order to preserve the Earth's biodiversity (Laird, 2002). One way to achieve this is by incorporating indigenous culture into sustainable conservation approaches. The main focus of this text is on the process of documenting, analysing, and utilizing the knowledge, beliefs, and practices of indigenous communities in relation to plant resources, as described by Martin in 1995. In summary, if ethno botany is strengthened and collaborates with the relevant parties such as local communities, governments, educators, NGOs, etc., it can effectively tackle forthcoming environmental deterioration as well as the decline in cultural knowledge and language (Hamilton et al., 2003).

The distribution of biodiversity on Earth is not uniform. Some areas, such as moist tropical forests and coral reefs, have a high abundance of different species, while others like deserts and Polar Regions have very few living organisms. Most areas fall somewhere in the middle. Although the local residents recognize the significance of preserving wild and semi-wild edible plant species, only a few conservation techniques that involve planting within the natural environment, such as using fences and protected areas in places of worship (such as churches and mosques) and on the edges of their farmland, are being utilized in the area being studied. This suggests that the area is not implementing the required conservation actions, resulting in wild edible plants being at risk and not adequately protected. Focusing on preserving and controlling the growth of natural edible plants will contribute to the enhancement or growth of the area's diverse plant life without negatively affecting it, thereby sustaining the region's biodiversity. In Ethiopia, about 14% of the country's total area is designated as protected areas, which play a crucial role in conserving the environment, promoting ecotourism, providing recreational opportunities, and creating employment opportunities (EBI, 2014).

3. METHODES AND MATERIALS

3.1Descriptin of study area

3.1.1 Location

Meta Robi District is one of the West Shoa Zonal administration districts, which is located on 102km away from the capital, Addis Ababa towards western Ethiopia. It is enclosed by Adeaberga District in the east, Jaldu and Abuna Gindbarat District in the west, Meta Walqite District in the north and Ejere District in the south.

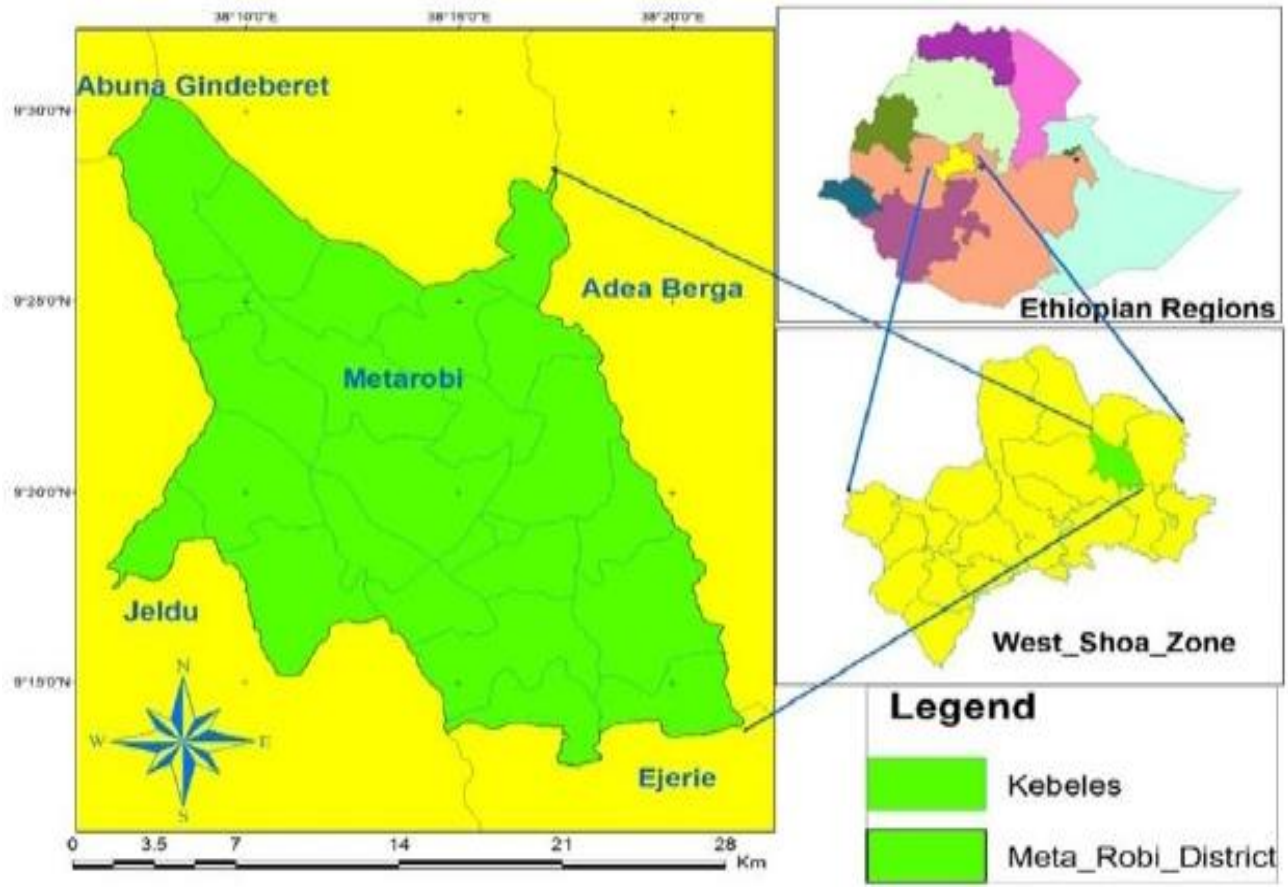

Figure 1 : Map of study area showing Meta Robi District

(Source: Zonal Report- Meta Robi District Agriculture and Forest Development, 2022).

Figure 2 : Topography of the area (photo: by Jebessa Jote, 2022)

3.1.2 Topography

Meta Robi Districtis located between latitude of 9^{o}, 13'N to 9^{o}, 42'S and longitude of 38^{o}, 8'E to 38^{o}, 22'W with 1500 up to 3000m.a.s.l.elevation range. It is characterized by mountainous, plateaus and sloppy land. The district has three agro-ecologies, namely: Dega(30%), Weinadega (45%) and Kola (25%).

3.1.3 Climate

Climate of the area is characterized by agro-climatic zones. The annual rain fall ranges between 950-1000 mm, 800-950mm and 750-800mm in Dega, Wainadega and Kolla, respectively. The district is characterized by heavy rainfall in months like July and August. In addition, there is a medium rainfall in May, June and September (Figure 3).

According to the district agricultural Office, the mean annual temperature of the district varies between 15^0Cto 24^0C (Figure 3).

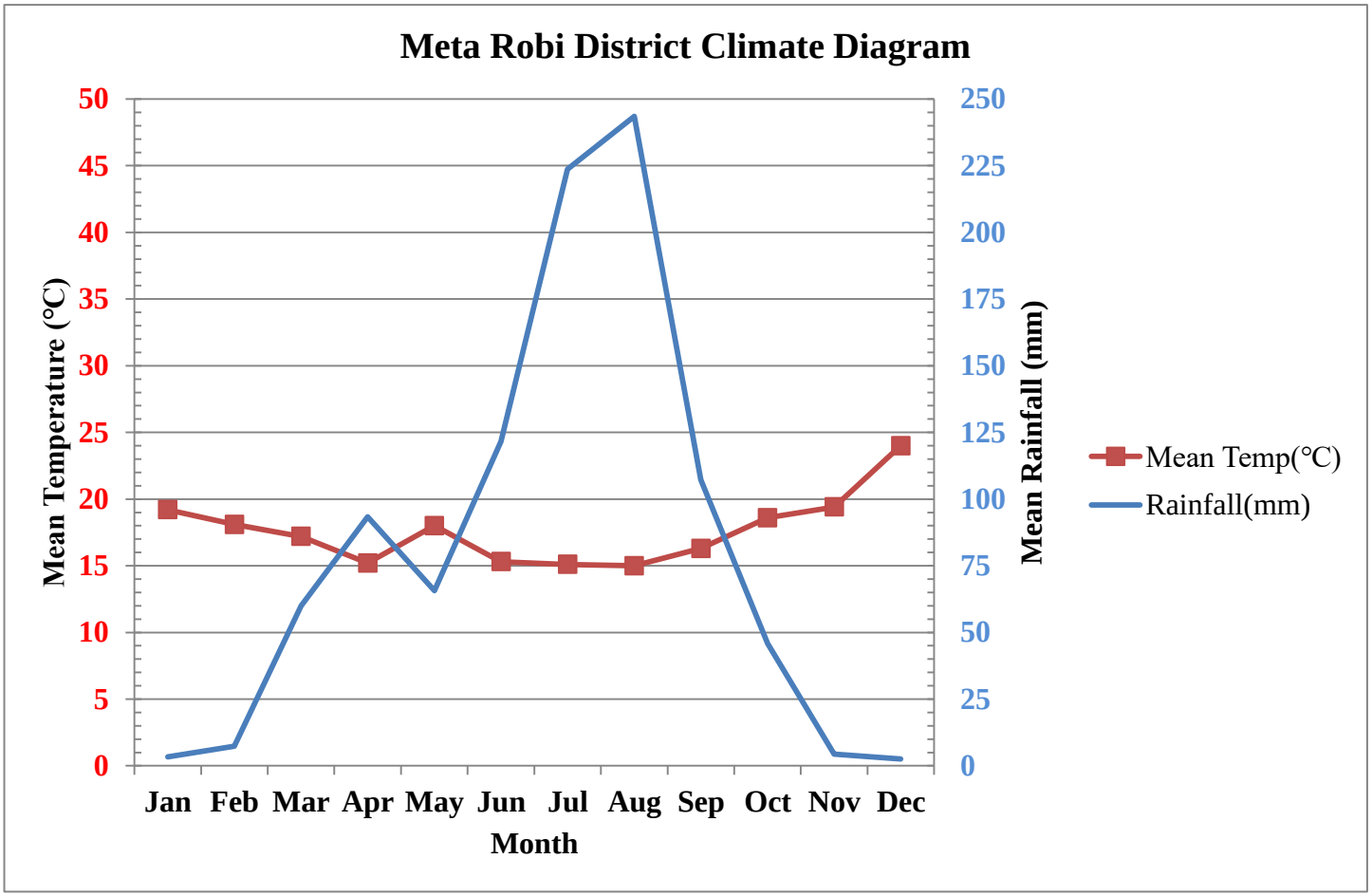

Figure 3 : Means of monthly rainfall and Temperature distribution of the study area from 2019-2023 (Source: National Metrological Agency, 2023)

3.1.4 Population of the area

The total number of populations of the district was 121,983 (males 62,169 and 59815 females) with a total households of 20,330. Of this total population, 77% were rural dwellers and 3% were urban dwellers. With regard to ethnic group, the district is inhabited by Oromo ethnic group speaking Afan Oromo (85%) language in rural area, but very small population of others like Amhara (10%) and Gurage (5%) lives in the district towns. In terms of religion, almost half (49%) of the population were Orthodox, followed by protestant (42%). The remaining of population (9%) was Wakeffata(District Administration Office, 2022).

3.1.5 Soil types and agriculture

The total land area of Meta Robi District covers about 45,104 square kilometers, which represented by cultivated land, grazing land, forest areas and others. The soils types in the district are predominantly red (49%) followed by black (32%) and mixed (19%) soil types. Subsistence mixed farming of crops and livestock production takes the largest part in economic activity of population in the area. Crops such as millet, sorghum, teff, wheat, barley, bean, pea, and oil seeds (Nigerseed and linseed) are cereal and grain crops providing highest consumption and income generation of the households.

3.2 Sampling Methods

3.2.1 Materials

The materials used during the study include camera, field guide book, binder, video recorder, bag, notebook, ruler, pen, pencil, GPS data, meter, plant press etc.

3.2.2 Site selection and survey reconnaissance

In order to illustrate the various vegetation types, natural resource management, and indigenous knowledge related to the use of wild edible plant species, a reconnaissance survey of the study area was carried out from November 1 to November 10, 2022. After the survey, a focus group discussion was held in one of the study locations that serve as the hub for the entire research area. Following the discussion, out of the district's total of 23 kebeles, three that border the forest were specifically chosen as study sites. Based on their closeness to the remaining remnant forest resources, the study villages and the representativeness of the various agro ecologies were selected.

Table 1: The description of kebeles selected that bound the forest

NO	Kebele name	Size of population	Number of house hold	Number of informant Involved in the study area
1	Abocheru	4968	727	71
2	Baka	4794	617	60
3	Cancho Borche	3849	541	53
	Total	13611	1885	184

3.2.3 Sampling of Informants

A Simplified Formula for sampling informants:

The study population used for questionnaire survey was household heads living in the three selected kebeles. The cross sectional based systematic random sampling procedures were used for selection of household heads from the three selected kebeles. The sample size of the population involved in primary data (for questionnaires survey) collection was determined by Yamane (1967) formula which is described as:

$$n = \frac{N}{1+N(e^2)}$$

Where, **n** is sample size

1 represents probability of the event occurring (constant)

N stands for population size (sampling frame) and

e is the maximum variability or margin of error 7% (0.07).

It is common to use 95% of confidence interval (precision level of 0.05) to determine sample size, however, this study has taken 93% of confidence interval (0.07 precision level) considering the price and time constraints without sacrificing the likelihood of producing a representative sample that can accurately reflect the study's population. Therefore, the required sample size at 93% confidence level with degree of variability of 7% was used to obtain a sample size required which represent a true population. Totally, there were 1885 household heads in the three kebeles (727, 617 and 541 household heads in Abocheru, Baka and Cancho Borche Kebele respectively). Then, $n=1885/1+1885(0.07)^2= 184$

Accordingly, about 184 samples of household heads were selected from 1885 total household heads of the three selected kebeles. According to Kothari (2004), the number of respondents of each kebeles was taken by probability proportion;

$$\mathbf{R = n_i^{th} * n/ N;}$$

Where, $\mathbf{n_i^{th}}$ stands for sample size taken by Yamane formula

n represents number of households in each kebeles

N stands for total number of households of the selected kebeles of the district.

R stands for the number respondents of each kebeles

Accordingly, 71 households from Abocheru, 60 from Baka and 53 from Canco Borche Kebeles were selected for the present study (Table 1). When this formula is applied to the above equation we got, a total of 184 informants‟ from the study areas (135 men and 49 Women) in the age of 20 and above were selected from three kebeles that clearly mentioned in the above Table 1. Out of these, 36 Key informants (nine from each study site) were systematically selected from the study site by using information and recommendations from the local kebele administrators and recommendations from the local kebele administration and local community members, religious leaders and knowledgeable elders in the kebeles are the agricultural official. To obtain an overall picture of the indigenous knowledge about edible wild and semi-wild plants, the remaining 148 informants were selected at random from the local population of the study area.

3.2.4 Ethical consideration

Permission was first obtained from the district and kebele administrative offices to conduct the study by showing different official letters wrote from the academic department and presenting the purpose of the study. Informants were informed that the purpose of the research is for educational purpose, compiling and documenting edible plant species of the study area but not for commercial purposes. In addition, discussions were made with the informants in each selected area and they were used as entry doors for development of positive relationships with the local people. During data collection, an effort was made to encourage the informants that their cooperation was of great benefit to the country. Furthermore, the participants' informed consent was acquired to confirm their willingness.

3.2.5 Data Collection

Many data collection techniques were employed, including field observations, discussions with informants, Interviews with informants, preference ranking, pair-wise comparisons, and direct matrix ranking, in order to gather indigenous knowledge of the local community about wild edible plants, local classification, vegetation, threats, and conservation of wild and semi-wild edible plants. According to their individual preferences and tastes, informants were also given the opportunity to rank and score a few edible wild plants. I asked the key informants to rank the attributes of five distinct types of wild plants based on their personal preferences. The highest score was ranked first after the scores assigned to each species were added together. With tastings, the majority of informants attested to knowing what they liked better.

Combining quantitative and qualitative methods, the data collection techniques provided a broad understanding of the research location and population, as well as the causes and rationale behind the phenomenon being studied. The former helped with data triangulation and made statistical inference easier to apply. All semi-structured interviews, key informant interviews, and group discussions followed a pre-prepared list of subjects or questionnaires that were translated into Afan Oromo from English. These conclusions were made by the investigator in Afan Oromo directly using key informants and informants chosen at random from a given population.

Information was gathered technically by maximizing the number of sources used, having informal conservations with the villagers, and having reachable informants. Socio demographic data (date, kebele, age, gender, marital status, religion, education, and occupation) served as the basis for the interview. All known edible plants growing in the study area were asked to be listed by informants. At the location, information was noted about the local names of edible wild and semi-wild plants, the parts used the conditions under which they were gathered and prepared, the application route, any negative effects, uses other than edible uses, and management techniques. In order to verify the accuracy of the information gathered and to document the information, duplicate inquiries were made twice about the local names of plants with some of the same informants. To learn more about the people's wild and semi-wild edible plant system and how it is managed, as well as how knowledge is passed down through families and younger generations, a group discussion involving six to eight informants and residents was held in each kebele.

3.2.6 Description of most frequently used plant parts

Following the identification of edible plant species by informants, the plant parts that were most commonly used were described in terms of habit, habitat, part uses, and preparation method in the study area. Plant species use reports were logged and assigned use categories

3.2.7 Analysis of the data

The data were analyzed using direct matrix ranking, informant consensus, paired comparison, preference ranking, and descriptive statistics. Excel spreadsheet 2010 and analytical tools were used to perform a qualitative and quantitative analysis of ethno botanical data. To ascertain multipurpose uses, proportions of various variables such as growth forms (habits), plant families, plant parts used, and methods of preparation for uses as edibles, the spreadsheet data filter facility was utilized.

3.2.8 Descriptive statistics

To analyze and compile the data on the use of edible plants that are wild or semi-wild, as well as related indigenous knowledge, a descriptive statistical method was used, such as percentage and various charts and tables. Peoples provided the most valuable information on edible plants; descriptive statistics were used to analyze the edible value, application, methods, route, parts used, side effects, and habit. In order to create basic information, calculate proportions, and summarize in various graphs and tables, Microsoft Excel spread sheet capabilities were used.

3.2.9 Preference ranking

In order to determine which plants are more preferred based on various criteria, a list of all possible combinations for pairs of selected items was presented to chosen informants. Their responses were noted, and the total value was summed up.

4. RESULT AND DISCUSSION

4.1 Results

4.1.1 Informants background

In the study area, most people either directly or indirectly depend on edible wild and semi-wild plants. Social norms, taboos, and beliefs all work against the benefits of biodiversity preservation. Peoples commonly believed that *Ficus sur* supplies surface water from below and that *Acacia abyssinica* is used as a spiritual plant in the environment. Because of this favorable perception, people in Meta Robi areas have a tendency to support the plant's conservation. Leaders from the woreda and kebele may punish someone physically or financially if they are found cutting *Ficus sur*. Cutters also risk social exclusion. Furthermore, elders bless their loved ones beneath acacia trees, and the recipients pay particular attention to the wisdom they impart.

4.1.2 Informants socio-demographic characteristics

The socio-demographic characteristics of the research participants and their households are enumerated in Table 2. Out of the 184 respondents, 139 were male and 49 were female. Participants in the research ranged in age from 20 and above years old and came from 53 to 71 households per research kebele. Of these, the majority (76.1%) had never attended formal school, and 23.9% had.

Table 2: Informants socio-demographic character

no	Character informants' information				
1	Age	Male	Female	Total	Percent
	20-30	60	20	80	43.5
	31-40	40	15	55	27.1
	41-60	21	10	31	16.8
	>60	14	4	18	9.8
	Total	135	49	184	100
2	Marital Status				
	Married	98	39	137	74.5
	Unmarried	27	6	33	17.9
	Divorced	10	4	14	7.6
	Total	135	49	184	100
3	Religion				

	Orthodox	88	33	121	65.8
	Muslim	2	1	3	1.6
	Protestant	32	10	42	22.8
	Wakefata	13	5	18	9.8
	Total	135	49	184	100
4	Educational Status				
	Can't Read and Write	40	15	55	29.9
	Can Read and Write	65	20	85	46.2
	Elementary School	15	9	24	13
	Secondary School	10	3	13	7.1
	Above Grade 12	5	2	7	3.8
	Total	135	49	184	100
5	Residence				
	Rural	123	45	168	91.3
	Semi-Urban	12	4	16	8.7
	Total	135	49	184	100
6	Gender	135	49	184	100
	%	73.4	26.6	100	

4.1.3 Specimen collection and identification

The plant species in the study area were arranged alphabetically according to the following criteria: scientific name, family name, vernacular name, growth form, parts used, methods of preparation and application, route of administration, and state of use of plant parts. Younger, mostly male cattle herders took comparatively more edible wild plant parts, mostly fruits, even during times when food was available. Two trees and five herbs out of the 34 edible plant species that are found in the study area are used for food production as well as a source of income.

Table 3: List of edible species plants with their scientific Name, Family Name, Vernacular Name, Habitat and Habit

No	Scientific Name	Family Name	Vernacular Name	Habitat	Habit
1	*Acacia abyssinica* Hochst et Benth	Fabaceae	Laaftoo	Wild	Tree
2	*Acanthus senni* Chiov.	Acanthaceae	Sokorruu	Wild	Shrub
3	*Brassica carinata* A.Braum	Brassicaceae	Raafuu daggalaa	Wild	Herb
4	*Carrisa spinarum* L.	Apocyanaceae	Agamsa	Wild	Shrub

5	*Catha edulis* Forssk.ex Endl	Celastraceae	Jimaa	Semi-wild	Herb
6	*Citrus simensis* (L.) osbeck	Rutaceae	Burtukaana	Semi-wild	Tree
7	*Cordia african* Lam	Boraginaceae	Waddeessa	Wild	Tree
8	*Cucurbita pepo L.*	Cucurbitaceae	Dabaaqula	Semi-wild	Herb
9	*Dovyalis abyssinica* E.Mey.ex Arn.	Flacourtiaceae	Koshommii	Wild	Shrub
10	*Ensete ventricosum* (welw.)cheesman	Musaceae	Warqee	Semi-wild	Herb
11	*Opuntica ficus-indica* (L.)miller	Cactaceae	Adaamii	Wild	Shrub
12	*Ficus sur* Forssk.	Moraceae	Harbuu	Wild	Tree
13	*Ficus sycomorus* L.	Moraceae	Luugoo	Wild	Tree
14	*Grewia ferrugineae* Hochst. Et *A. Rich.*	Tiliaceae	Dhoqonuu	Wild	Tree
15	*Hagania abyssinica* (Bruce) JF.Gmel	Rosaceae	Heexoo	Semi-wild	Tree
16	*Impatiens paucidentata* De Wild.	Balsaminaceae	Burii	Wild	Herb
17	*Lippia adoensis* Hochst.Ex walp	Verbenaceae	Kusaayee	Wild	Shrub
18	*Nicotiana tabacum* L.	Solanaceae	Tamboo	Semi-wild	Herb
19	*Ocimum lamifolium* Hochst. Ex Benth.	Lamiaceae	Damaakasee	Wild	Shrub
20	*Persea americana* Mill.	Lauraceae	Avokaadoo	Semi-wild	Tree
21	*Phoenix reclinata* Jacq.	Arecaceae	Meexxii	Wild	Tree
22	*Physalis peruviana* L.	Solanaceae	Haawwuxii	Wild	Shrub
23	*Prunus africana* (hook.f.) kalkman	Rosaceae	Kookii	Semi-wild	Tree
24	*Rhus glutinosa* A.Rich.	Anacardiaceae	Xaaxessaa	Wild	Tree
25	*Rhus natalensis* Berth.ex krauss.	Anacardiaceae	Labbobessaa	Wild	Shrub
26	*Rosa abyssinica* R.Br,ex Lindl.	Rosaceae	Goraa	Wild	Shrub
27	*Rubus apetalus* Poir.	Rosaceae	Altufa	Wild	Shrub
28	*Rubus steudneris* Schweinf.	Rosaceae	Goraa arbaa	Wild	Shrub
29	*Rumex nervosus* Vahl.	Polygonaceae	Dhangaaggoo	Wild	Herb
30	*Schinus molle* L.	Anacardiaceae	Qundi barbaree	Semi-Wild	Tree
31	*Solanium indicum* L.	Solanaceae	Samaree	Wild	Shrub
32	*Thymus schimperi* Ronn.	Lamiaceae	Xoosinyii	Wild	Shrub
33	*Utrica Simensis* steudel.	Utricaceae	Doobbii	Wild	Shrub
34	*Ximenia americana* L.	Olaceae	Hudhaa	Wild	Tree

4.1.4 Taxonomic diversity of edible plant species

The majorities of the plant species in the study area were diverse and have various functions for the local communities. 34 species of useful WSEPs were identified from the study area, representing 24 families and 32 genera, with 5 species (14.7%), the Rosaceae family had the most number of species, followed by the Anacardiaceae and Solanaceae families (8.8% each with 3 species), and the Lamiaceae and Moraceae families (5.9% each with 2 species). (Table3)

4.1.5 Traditional knowledge associated with edible plant species

To gather and eat wild and semi-wild edible plant foods, communities around the forest must learn about them. Most local communities have positive opinions of WSEPs because they are safe, easily accessible, produced organically, and provide a variety of foods. When it came to knowing which wild plants were edible, the elderly were better able to discriminate between using them for food and other uses. Wild edible plants are consumed by the general public as snacks, drinks, and supplements. Fruit is typically eaten raw because it's the most edible part of the plant. It was found that general public knowledge regarding WSEPs and edibility can be transmitted orally, both directly and indirectly, to future generations. Older people impart knowledge directly to children, who then add to it through observation, imitation, and free-flowing information within the community, oral history transmission, and mythology.

4.1.6 Availability of edible plant species in different seasons

According to key informants, the availability of edible plants and their parts determines the frequency, time, and season of harvesting required for each plant. It varied depending on the location due to ecological and geographic factors. They were most abundant from February up to April in short rainy season arfaasaa (belg) and dry season bona (bega) in Oromo and Amharic languages respectively and less abundant in main rainy season, ganna (kiremt) (June to August). Why there were fewer during rainy seasons overall may be confusing to readers and researchers. This may be the case because, following the notable but brief rainy season, plants store water and energy for growth and development during the dry season, which helps them get ready for fruit and flowering. Out of all the plant species, about 14 (41.2%) were ripe in the post-rainy season, about 8 (23.5%) were found in all seasons, 2 (5.9%) were ripe in the rainy season, and 11 (32.4%) were reached in both the rainy and dry seasons (Fig. 4).

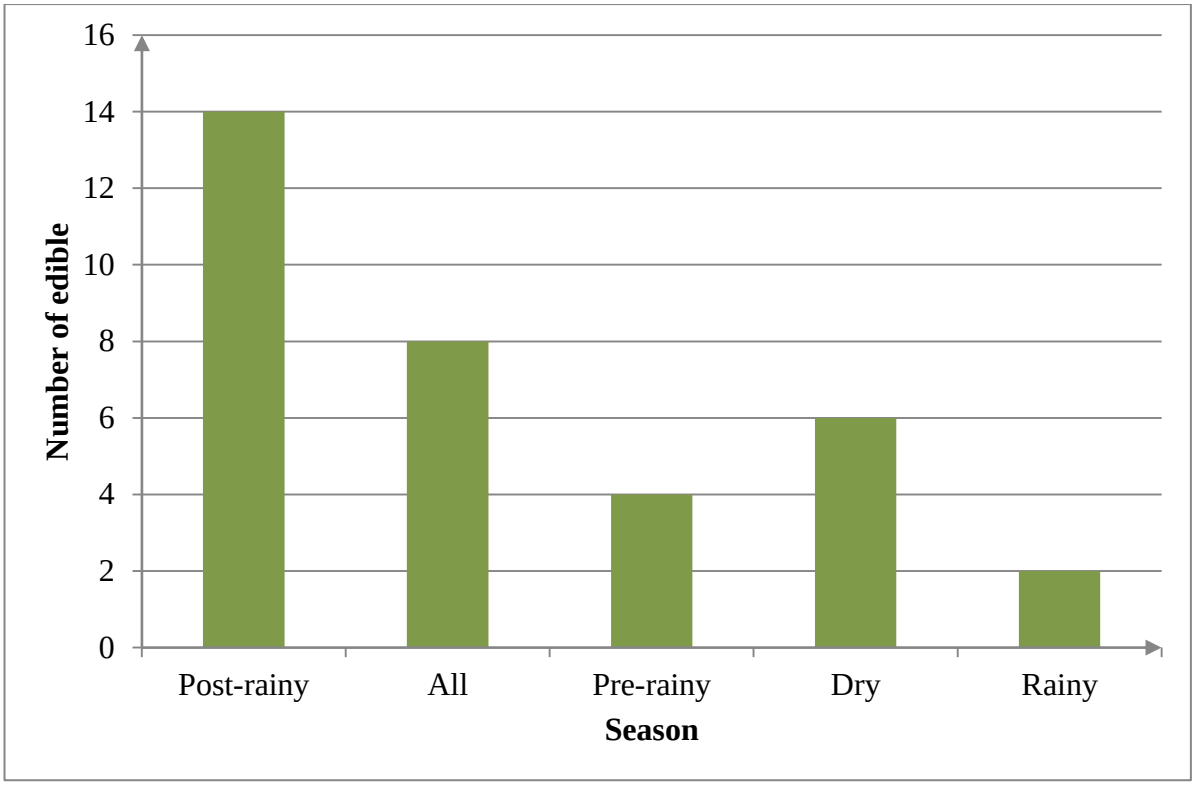

Figure 4: Number of edible plant species with their maturity seasons

4.1.7Mode of consumption, part utilized and growth form of edible plants

Trees accounted for 38.3%, 13 species) of the total species, followed by herbs (32.4%, 11 species) and shrubs (29.4%, 10 species), according to the growth form distribution (Fig. 5). The reason why the sites had the highest recorded abundance of woody species is that these species have adapted to the highland environment more so than shrubs and herbaceous species have.

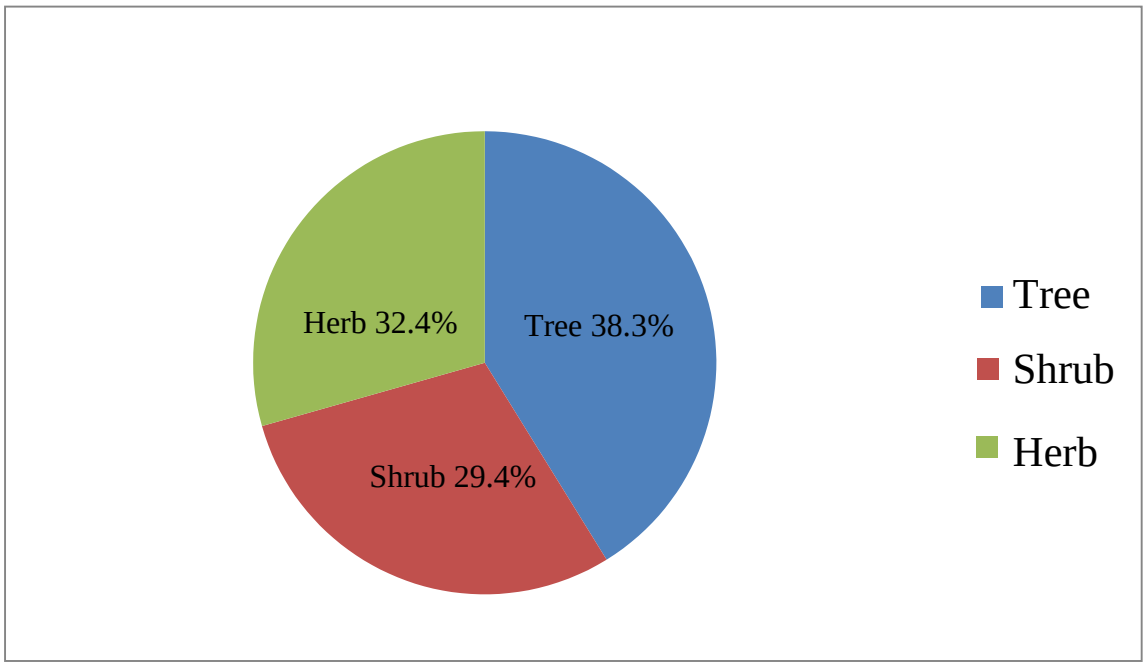

Figure 5: Growth habit of edible plants species

Table 4: Name of plant species with their season maturity, mode of preparation and parts utilized

No	Scientific Name	Part of edible plants used	Maturity seasons	Mode of preparation
1	*Acacia abyssinica* Hochst et Benth	Gum and Bark	All season	Children chewed gum and bark
2	*Acanthus senni* Chiov.	Leaf and Fruit	Post-rainy	Liquid absorbed from nectar
3	*Brassica carinata* A.Braum	Leaf and Fruit	Dry and Post-rainy	roasted and cooked
4	*Carrisa spinarum* L.	Fruit	Post-rainy	Eat ripe fruit
5	*Catha edulis* Forssk.ex Endl	Leaf	All season	Chewing the leaf
6	*Citrus simensis* (L.) osbeck	Fruit	Dry	Eat the fruit
7	*Cordia african* Lam	Fruit	Dry	Eat ripen and raw
8	*Cucurbita pepo* L.	Fruit	Pre-rainy	Cooking and eat as wat by injera
9	*Dovyalis abyssinica* E.Mey.ex Arn.	Fruit and Stem	Post-rainy	Eat the fruit
10	*Ensete ventricosum* (welw.)cheesman	Stem and Fruit	All seasons	Fruit and stem eaten with the other food
11	*Opuntica ficus-indica* (L.)miller	Fruit	Dry and Post-rainy	Eat the ripe fruit
12	*Ficus sur* Forssk.	Fruit	Post-rainy	Eat ripe fruit
13	*Ficus sycomorus* L.	Young shoot	Post-rainy	Eat fruit when it ripe
14	*Grewia ferrugineae* Hochst. Et A. Rich.	Fruit	Post-rainy	Eat ripe fruit
15	*Hagania abyssinica* (Bruce) JF.Gmel	Leaf and Fruit	Post-rainy	Eat ripe fruit, raw and chewing leaf
16	*Impatiens paucidentata* De Wild.	Nectar	Rainy	Liquid absorb from nectar
17	*Lippia adoensis* Hochst.Ex walp	Leaf and Stem	All seasons	Used as condiments in spice preparation
18	*Nicotiana tabacum* L.	Leaf	Pre-rainy	Chew leaf and grinding it

19	*Ocimum lamifolium* Hochst. Ex Benth.	Leaf	All season	Leaf chewing or liquid with water
20	*Persea americana* Mill.	Fruit	Post-rainy	Eat the fruit
21	*Phoenix reclinata* Jacq.	Fruit	Post-rainy	Eat the fruit
22	*Physalis peruviana* L.	Fruit	Dry	Eat ripen fruit
23	*Prunus africana* (hook.f.) kalkman	Fruit	Dry	Eat ripen fruit
24	*Rhus glutinosa* A.Rich.	Fruit	Post-rainy	Eat raw and ripen fruit
25	*Rhus natalensis* Berth.ex krauss.	Fruit	All seasons	Eat raw and ripen fruit
26	*Rosa abyssinica* R.Br,ex Lindl.	Fruit	Post-rainy	Eat raw and ripen fruit
27	*Rubus apetalus* Poir.	Fruit	Dry	Eat ripen fruit
28	*Rubus steudneris* Schweinf.	Fruit	Pre-rainy	Eat ripen fruit
29	*Rumex nervosus* Vahl.	Young shoot	All seasons	Stem pilled
30	*Schinus molle* L.	Fruit	Pre-rainy	Used as pepper and spice
31	*Solanium indicum* L.	Fruit	Post-rainy	Eat ripe fruit
32	*Thymus schimperi* Ronn.	Leaf and Stem	Rainy	Used for tea and as spice
33	*Utrica simensis* Steudel.	Leaf and Stem	All season	Roasting the leaf and eat by injera
34	*Ximenia americana* L.	Fruit	Post-rainy	Eat the ripen and unripen leaf

Regarding to part's used; there were seven documented edible parts. Of them, 2.9% was gum and bark, 5.9% was stems and fruits, 2.9% was nectar, and 55.9% was made up of fruits, 5.9% of young shoots, 8.8% leaves, 8.8% leaves and stems, and 8.8% leaves and fruits. (Table5). This indicated the possibility that people may have consumed multiple plant parts in the study region. About the way they were consumed, most of the plants were eaten raw, but a tiny portion were cooked, chewed, and absorbed. The habitats in which the WSEPs of the study area were found included home gardens, farmlands, natural forests, grazing areas, and riverine areas. They were also consumed cooked, dried, fresh, and in a variety of other forms.

Table 5: Plant parts used as food

Part of edible plants used	The number of edible plants species	Percentage
Leaf and Stem	3	8.8%
Leaf and fruit	3	8.8%
Fruit	19	55.9%
Young shoot	2	5.9%
Nectar	1	2.9%
Leaf	3	8.9%
Gum and Bark	1	2.9%
Stem and Fruit	2	5.9%
Total of edible plants	34	100%

4.1.8 Preference of edible parts

There were no significant differences in the three kebeles species preferences, which are nearly identical throughout the kebele. This could be because they share the same wild edible plant usage culture, have comparable ethnic compositions and reside in the same woreda. The majority of respondents in all Kebeles named *Rosa abyssinica* as their favorite edible plant, with *Rubus steudneris* coming in last. In the research area, different plants had different preferences for different parts of wild food plants. Plants that were consumed during a famine, for example, there were not consumed at other times. The fruits of *Ficus sur* were the most favored wild 44 food fruits over the other, according to the results of the pair wise ranking in Table 6. Not all species of edible plants are equally attractive to eat. While some species have been reported to have good palatability, others have been classified as medium or low grade.

Table 6:-Top five WSEPs fruit taste quality depends on five criteria (1= Least, 2= Less, 3=Good, 4= Very good and 5= Excellent)

Key informants (K1 to K7 with the ranks they gave									
Edibles plants fruit	K1	K2	K3	K4	K5	K6	K7	Mark	Rank
Cordia africana	2	2	3	1	2	2	4	15	4th
Fiscus sur	3	4	2	2	2	3	4	20	1st
Physalis peruviana	2	3	3	1	2	3	3	17	2nd
Rubus apetalus	2	1	2	2	3	1	2	14	5th
Ximenia americana	1	2	3	3	2	2	3	16	3rd

4.1.9 Multipurpose of edible plant species

Apart from being sources of food, the documented edible wild plants have multiple purposes. A direct matrix ranking was carried out to evaluate the relative importance of plant species to the community, their multipurpose use, and the level of threats currently associated with their use values. Because *Cordia africana* is used for a multitude of purposes in the study area, including construction, firewood, fencing, and other uses, it was ranked first in the uses diversity results. This demonstrates that people gather edible wild plants not only for food but also mainly for furniture, firewood, and building materials.

Table 7: Five rank of WEPS respondents based on five criteria (1=Least, 2= Less, 3=Good 4=Very good and 5= Excellent)

Key respondents (K1___K5) Edible plants species with their ranks they gave					
	Cordia africana	*Ficus sur*	*Carrisa spinarum*	*Acacia abyssinica*	*Hagenia abyssinica*
K1	4	4	2	2	5
K2	5	3	4	3	3
K3	4	4	4	3	4
K4	4	4	4	4	2
K5	5	5	3	4	5
Total mark	22	20	17	16	19
Rank	1st	2nd	4th	5th	3rd

4.1.10 Threats of Edible plant species and their habitats

All the Kebeles respondents mentioned that a number of factors added to the risk that the beneficial plants in their area faced. It's currently hard to find these wild or semi-wild edible plant species in the area due to a combination of man-made and natural factors. Factors like deforestation, increased agricultural activities, grazing, planting eucalyptus around or in that forest, insect infection, and house construction are all contributing to the drastic decline of wild edible plant species in the study area. Among these concerns, the majority of informants thought that agricultural expansion which includes both land cultivation and livestock production was the main factor endangering wild food plants. Plants have been overused and overgrazed as a result of human demands for food, medicine, housing, cosmetics, building materials, charcoal, and animal feed.

The majority of the plants used as livestock feed in the study areas indicate that overgrazing was a major factor. Because most wild edible plants could be used for more than one purpose, habitat destruction and overharvesting posed a serious threat to their survival. This has made the majority of edible wild plants rare. It was discovered that the region hardly ever saw wild edible plants like *Rubus steundneris* and *Ximenia americana*, based on information acquired from semi-structured interviews and group discussions along landscapes. Certain species of nutraceutical plants, like *Hagenia abyssinca*, *Ociumum lamifolium*, *Acacia abyssinica*, and *Utrica simensis*, are only found in or near human settlements, farm borders, remnant forests, steep, rugged hillsides, deserted woodlands, remote areas, and spiritually safe places. Thus, key informants in the study area enumerated and ranked the five main threats to wild edible plants during group and individual discussions. The elements that have the biggest effects on plant resources were therefore prioritized in order of importance. The most significant threat was identified as agricultural expansion, which was followed by for construction the numerous applications of these resources, the extensive occurrence of wild edible plants in farmlands (like *Acacia abyssinica* and *Carissa spinarum*), farm boundaries, and 46 watershed areas. Some species that are often used as shade (*Ficus sur*). Cutting valuable trees and shrubs, especially for charcoal, is strictly prohibited due to established customs. Furthermore, the region's shifting and unstable climate made the threat factors more severe. All environmental and social issues are therefore made worse by the effects of climate change. Even with the pressure of a growing population, the locals in the study area know how to stop long-term threats to wild edible plants. The local population made recommendations for mitigating the plant community in the study area.

Table 8: Priority ranking of factors threat edible plant species by eight respondents on six factors depends on five criteria (1=Least destructive, 2= Less destructive, 3=Medium destructive and 5= Most destructive)

The respondents (K1 to K8) with their total marks and Ranks										
Factors (threats)	K1	K2	K3	K4	K5	K6	K7	K8	Total mark	Rank
By over grazing	4	3	2	4	3	4	2	2	24	4th
For fuel woods and fire	4	3	1	4	5	3	2	3	26	3rd
For construction	3	4	5	3	4	5	3	3	30	2nd
For agriculture	5	4	3	3	3	5	4	4	32	1st
By exotic species	2	2	2	3	2	4	2	2	19	6th
Extended species	4	3	3	1	3	2	2	2	20	5th

4.2 Discussion

4.2.1 The overall discussion of WSEPs of the study area comparing with other studies in different areas.

Several edible wild and semi-wild plants that are used for a variety of purposes in the area made up the food plant species that were documented in this study. In Ethiopia and other parts of Africa, the majority of the identified trees and shrubs are reportedly edible in other places. Comparable to Mekuanent (2015), who identified 33 wild and semi-wild edible plants in Chilga District, Northwestern Ethiopia, and Getachew et al. (2013), who identified 15 wild edible trees and shrubs, as well as Atinafu et al. (2017), who identified 22 wild species, the study area had a fairly high number of WSEPs species recorded. However, higher WSEPs than the current study were reported by Rajeswar et al. (2013) in India and Dessalegn (2017) in Ethiopia. In the study area, trees dominated the growth forms of edible wild and semiwild plants, followed by herbaceous plants and shrubs. According to reports by Fantahun and Herbet (2008) in the Amhara region and Tilahun and Mirutse (2010) in the Debub Omo Zone's lower river valley, trees were the predominant growth form. However, according to Ermias (2011), shrubs predominate in Ethiopia, with trees, herbs, and climbers following in order of importance. In the research area, fruits were the most often consumed edible components. Corresponding to this conclusion, fruits were identified by Ermias (2011) and Dessalegn (2017) as the most commonly used parts.

The majority of edible plants are documented elsewhere in Ethiopia; for example, Berehet District, North Shewa Zone, Amhara Region, documents 16 species of WSEPs in plant diversity and ethno botany, with a focus on wild edible plants. In northern Ethiopia's Tigray, ten species of underutilized tree fruits and vegetables are found in the potentials and constraints (Getu, 2015). Negash et al. (2017); nine species in the Chilga districts, North Western Ethiopia Mekuanent (2015); ten species discovered in an ethno botanical survey of wild edible plants and their contribution to food security used by Gumuz people in Kamash Woreda, Benishangul Gumuz Regional State Dessalegn (2017). In the research area, all informants nearly uniformly stated that agricultural expansions came first, as shown by the results of paired comparison factors affecting plant resources. Assegid and Tesfaye (2011), Kebu and Fasil (2006), and Debela et al. (2011) have also reported on the aforementioned results in several fields.

The majority of edible wild and semi-wild plants are grown or cultivated along transect walks, which were used for repeated field observations. The goal of the field observation was to gather factual data regarding the existence, growth pattern, habitat features, and identification of the edible plant species that were discussed in the interviews. At every study site, a group discussion involving six to eight key informants was held in order to confirm the data and plant identification. Idiosyncratic ideas (ideas solely raised by one person and rejected by the group discussion) were eliminated from the data, and all wild and semi-wild edible plants listed in the socioeconomic survey were confirmed. Field observation logs and interviews with key informants have demonstrated that the area's native vegetation has suffered greatly over the past 15 years. Therefore, both natural and man-made factors are causing the vegetation to deteriorate. This was partially attributed to pressures from livestock and population growth that led to the recent adoption of crop production. Climate change has exacerbated and reinforced the acceleration of environmental degradation that has followed changes in land use. According to key informants, gathering more fuel wood and building materials cannot be prevented unless a suitable alternative energy source is developed and implemented. By doing this, anthropogenic activities' detrimental effects on nutraceutical WSEPs will be lessened, maintaining their abundance for use in food, medicine, and other multipurpose applications.

The various uses of plants, particularly the beneficial ones (medical, edible, and forage plants), have been identified as posing a threat to plant species in regions where conservation efforts have not been given priority. On the other hand, a small number of farmers have begun to manage *Ficus sur* and *Hagenia abyssinica* on their farms. This demonstrated how the management of such species and the obtaining of their economic benefits might encourage locals' interest in the preservation and upkeep of such locally significant plants. Sharing such experiences with neighbors can encourage conservation and good land management practices. Again, the majority of WSEPs offer food value in addition to various service categories. Multiple purposes, including the preparation of remedies, fuel wood, fencing, construction, timber, farm and household implements, and livestock fodder, were also noted by various researchers in other parts of Ethiopia (Kebu and Fasil, 2006; Tilahun and Mirutse, 2010; Fantahun and Herbert, 2008).

The majority of respondents throughout the study areas voiced complaints regarding the consumption of WSEPs in relation to mode of consumption and challenges with collection and use; this was because the majority of edible plants were trees, and some of them were thorny, making it difficult to climb or collect when reaching for edibles. The people's second and third concerns with WSEPs were the decline of easily and cultural ignorance. Considering that the majority of plant parts; fruits and leaves perishable and quickly deteriorate when consumed raw. The general consumption of WSEPs appears to be completely depressed by the taboos in the area. Previous research conducted in Ethiopia has also revealed that the use of WSEPs has been associated with issues similar to those being studied in this area (Fantahun and Herbert, 2008). An accurate record of the edible plant species including their existence, growth habitat, habitat characteristics, and identification was the aim of the field observation. A confirmation of the data and plant identification was done through group discussions with six to eight key informants at each study site. All wild or semi-wild edible plants mentioned in the socioeconomic survey were verified, and information containing odd suggestions (ideas put forth by a single person and rejected by the group) was removed. According to field observation records and informant interviews, the area's natural vegetation has declined significantly during the past 15 years.

It can be concluded that both natural and man-made factors are to blame for the decline in vegetation. Increased livestock and population growth have been identified as contributing factors to the recent adoption of crop production. Climate change has intensified and expedited the environmental degradation that has followed changes in land use. The development and implementation of a suitable alternative energy source is necessary to prevent the gathering of more building materials and fuel wood, as stated by key informants. By doing this, human activity's negative effects on nutraceutical WSEPs will be mitigated; preserving their abundance for use in food, medicine, and other versatile applications.

Numerous respondents from the study area voiced their displeasure with the mode of consumption in addition to the difficulties in obtaining and applying WSEPs. The two additional issues that the public had with WSEPs were the loss of easily obtainable knowledge and cultural ignorance. Moreover, it appears that employing WSEP is typically discouraged by industry taboos.

4.2.2 Status and Conservation activities for Edible plant species

The study area has experienced a decline in plant life over the past ten years due to a variety of factors, including both natural and anthropogenic causes. As reported by numerous informants, particularly the elderly who are more knowledgeable than the others and who live in the Meta Robi districts, there are no edible wild or semi-wild plants in the study area. Informants state that, in comparison to previous eras, the conservation status of edible wild and semi-wild plants in the study area has drastically declined. To conserve them, local communities in the study area use a variety of indigenous management strategies. These include erecting fences, pollarding, pruning, and borders for home gardens. They also involve preventing native cultures from harvesting plants they depend on for daily sustenance, such as *Acacia* and *Ficus* species.

The factors that affect plant resources in the research area are reduced by using techniques for conserving forests and other naturally occurring plant resources. Research suggests that a home garden is an excellent and clever farming system for preserving important indigenous knowledge about these plants, in addition to growing, improving, and conserving wild food plants. Farmlands and home gardens were planted with the same wild edible plants that are used locally for food, building materials, medicine, fuel, and animal fodder. A rich diversity of plant species covered the study area before the last ten to fifteen years, according to community, especially the older informants. The study area was surrounded by natural vegetation, such as farms, forests, and riverbanks. Many in situ (in original/natural habitat) conservation techniques exist in the study area's farm fields and farm margin, as well as in different places of worship (churches and mosques). This is true even though the indigenous people recognize the value of protecting wild food plants.

Figure : *Hagenia abyssinica* planting as fence and for edible.

5. CONCLUSION AND RECOMMENDATION

5.1Conclusion

Every household in the study area collected and consumed edible plant species. The community uses the majority of the wild edible plant species found in the study area for purposes other than food and medicine. In addition to using edible wild and semi-wild plants for food, the locals also gather them for building materials, furniture, firewood, and animal feed. The indigenous people make use of these plant species, especially *Hagenia abyssinica* and *Cordia africana*, as multipurpose implements. The edible plant species in the study area were therefore under a lot of threat. Additionally, it is discovered that a significant portion of the study area's edible wild or semi-wild plants are under increasing pressure from anthropogenic and socioeconomic factors. As a result, wild edible plant species are going extinct, along with the related indigenous knowledge. This knowledge appears to have survived because it was passed down orally from elders to younger community members. Wild plants that are edible are still used by the local people. Data analysis showed that most edible plants were used by all study communities. Unfortunately, a number of factors are contributing to the region's gradually declining wild edible plant variety, which is also causing a decline in the amount of indigenous knowledge about the plants in the study area.

5.2 Recommendations

The following suggestions were sent out in light of the study's findings:

- It is recommended that professionals start collecting germplasm as soon as feasible for conservation in Ex-situ, and that non-governmental organizations and government agencies at all levels support community-based management and public awareness.
- The study suggests that there's a good chance local wild edible plants could be used for human benefit, though it's unclear exactly how much, how often, and exactly what kind of edible foods are available. Further studies on nutritional screening are needed to bolster the validity of traditional wild and semi-wild foods.
- A number of factors, including modernization, are causing indigenous knowledge to be passed down from one generation to the next. Consequently, it is important to teach by legally the next generation about the benefits of using and preparing edible wild and semi-wild plants for food.
- The government should develop and implement a cultural strategy for the long-term management of a specific wild edible plant conservation plan.
- In order to prevent negative effects, teaching the next generation about wild edible plant protection and related knowledge.
- The knowledge and practice of using edible wild and semi-wild plants, which are part of indigenous knowledge, must be supported and preserved. Ensuring the survival of adaptable, widely used wild and semi-wild edible plants in the study area requires the establishment of conservation strategies and plans.

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APPENDICES

APPENDIX 1:- Major name edible plants in the study area with their pictures


Carrisa spinarum


Rosa abyssinica


Opuntia ficus indica


Cucurbita pepo


Nicotiana tabacum


Hagania abyssinica

Some common edible plants in the study area (photo: by Jebessa Jote, 2023)

APPENDIX-2

A. Background of the respondents and Ethno botanical data

Direction – please would you give your answer by writing/encircling to the appropriate letter of given alternatives for identify more information?

1. Date_____

2. Name of the Edible plants species practitioner _____

3. Your kebele_____

4. Residence A. Rural B. Town

5. Age A. 20__ 30 B. 31___ 40 C. 41__ 60 D. above 60 years old

6. Sex A. Male B. Female

7. Religions A. Protestants B. Orthodox C. Muslim D. Wakefata

8. Marital status A. Unmarried B. Married C. Widowed D. Divorced

9. Educational back ground A. Elementary B. High school C. Diploma D. Frist degree E. Uneducated

10 .Occupation A. Government employee B. Private Employee C. Farmers D. others

B. Ethno botanical data

1. What are the local names of the plants used?
2. from where plant is collected? A. Wild B. Semi-wild
3. In which season the edible plant species harvested (access)?

A. Dry season B. Rainy season C. Per-rainy season D. Post-rainy season

4. What is the habit of the plants used?

A. Tree B. Shrub C. Herbaceous D. Epiphyte parasites

5. Part (structure) of the plant used for food in the study area A. Leaves B. Root C. Stem D. Fruit E. Flower F. Seed G. Latex H. Whole plants

6. If prepared from two and above plants list their local /vernacular name of the plants and the structure of the plant used for edibles

Local/ vernacular name	Structure (part) used
i. _____	_____
ii._____	_____
iii._____	_____

7. Which age group of the local peoples uses the edible plant species frequently?

_____

8. Is there side effect of the Edible plant species? Mention

_____

9. If yes how can you solve the side effect (the problem) explain

_____

10. Are there conditions which restrict the edible plant species ?

_____

11. Are there edible plant species easily accessible?

_____

12. Either any marketable traditional edible plants A. Yes B. No

12.1 If there are marketable cultural edible plants species list them

a._____

b. _____

c._____

13. How is the effectiveness of the edible plants?

A. Excellent B. very good C. Good D. unsatisfactory

14. How is the knowledge traditional edible plants passed to a family member /younger generation? _____

15.Are there existing problems on traditional knowledge transfer ? List them

_____

16. What are the major threats to edible in the study area? _____

17. Is there any effort made to conserve edible plant in the study area?

_____

18. What are the traditional practices used by the local people to conserve and manage the edible plant specifies? _____

Appendix iii

This is translated into Afaan Oromoo to smooth commutation with edible plants practitioner in study area.

Gaaffin Kun kan qophaa'e qoranno barumsa digirii lammaffaa Yuuniversiitii Finfineetti guuttachuudhaaf odeffannoo waa'ee biqilootaa Bosonaa fi kan bosonaa ta'ee namaan dhaabbatani nyaaataf oolan Aanaa meettaa Roobii keessatti argaman irratti walitti qabachuuf qofa kan oolu maalee daldalaaf miti.Bargaaffiin kun kan guuttamu namoota muraasa Aanaa kana keessatti argaman keessaa kan waa'ee biqiloota nyaatamaan irratti odeeffannoo quubsaa kennuu danda'aniin ta'a.

A. Odeeffannoo deebii kennaa(gaafatamaa)

Kallattii deebii gaaffii armaan gadiif barressudhaan yookiin filannootti maruudhan deebii sirrii ta'ee deebisaa.

1. Guyyaa _____
2. Maqaa nama odeeffannoo kennuu_____
3. Gandi keessan _____
4. Bakki jireenya keessanii A. Baadiyyaa B. Magaalaa
5. Umuriin keessan A. 20___ 30 B. 31____ 40 C. 41___60 D. 60 ol
6. Saala A. Dhiira B. Dhalaa
7. Amantaan keessan A. Pirotestaantii B. Ortodoksii C. Musliima D.Waaqeffataa
8. Sadarkaa barnoota A. Sadarkaa 1ffaa B. Sadarkaa 2ffaa C. Dippiloomaa
   D. Digirii fi isaa ol E. hin baranne
9. Haala gaa'elaa A. hin kaadhimamne B. kadhimmadheera C. Gaa'elattin jira
   D. hiikeera
10. Haala hojii A. Qonnaan bulaa B. Hojjetaa mootummaa C. Dhunfaaf qacarameen hojjadha D. Kan biroo

B. Odeeffannoo haala biqilaa nyaatamuu

1. Biqiloonni nyaataf oolan naannoo keessan jiru? A. Eeyyen B. Lakki

2. Biqiloota kana eessaa funaannattu/argattu? A. Bosona B.Oomishnee C. iddoo lamaanuu

3. Waqtiilee isa kam keessa Biqiltoonni nyaataf gargaaran salphaatti argamu?

A. Bona B. Ganna C. Arfaasaa D. Birraa

4. Caasaa biqiltuu isa kamtu nyaata qopheessuf funaannama?

A. Baala B. Hidda C. Jirma D. Firii E. Daraaraa F. Haphee G. guutummaa biqiltichaa

5. Amalli guddina biqiltuu kanaa maali? A. Muka dheeraa B. Miciree

C. Muka biro irratti han biqilan D. Maxxantuu

6. Yoo biqiloota lama fi isaa ol irraa qophaa'a ta'e maqaa fi qaama nyaaatf oolan tarressi

Maaqa biqiltichaa akka naannotti	caasaa isaa nyaataf oolu
i. _____	_____
ii._____	_____
iii._____	_____

7. Biqiloonni nyaataf oolan kana garee umurii isaan kamtu irra dedebi'uudhaan fayyadama?

_____

8. Yeoo nyaatan kana miidhaa fayyadamtoota irraan ga' u qaba yoota' ibsaa?

_____

9. Midhaa geessisa yoo ta'e midhaa isaa kana akkamiin salphiftu? ibsaa

10. Biqilaa kana fudhachuu haalli daangessu ni jiraa? adda baasaa

_____

11. Biqiloonni bosonaas ta'ee kan namaan dhaabbamanii nyaattaf oolan salphaatti kan argaman jiruu? _____

12. Biqiloonni bosonaas ta'ee oomishamanii nyaataf gargaaran gabaa irratti gurguraman ni jiru? A. eeyyeen B. lakki

12.1 Biqiloonni Kun kan gurguraman yoo jiraatan tarreessaa?

i. _____

ii._____

iii._____

13. Haalli fayyadama biqiloota kana hangam amansiisa dha?

A. Baay'ee Baay'ee gaaridha B. Baay'ee gaaridha C. gaaridha D. quubsaa miti

14. Beekumsi biqiloota namaan nyaataman haala kamiin dhaloota irraa dhalootatti/ dargaggotatti daddarba jira? _____

15. Haala daddarbu biqiloota namaan nyaatamanii irratti rakkon jira?

Tarreessaa_____

16. Wantoonni gurguddoon biqiloota kana balleessan maal faadha?

_____

17. Biqiloota nyaataf oolan kunuunsuf yaalin taasifamu akka naannotti jiraa? ibsaa

_____

18. Haala aadatiin shaakalli(barsiifanni) ittiin biqiloota nyaataf gargaaran hawaasni kunuunsu/too'atu jiraa? tarressaa _____

Appendix IV

Semi- structure interviews for collecting ethno botanical data

A. General information

1. Date _____
2. Kebele_____
3. Name of respondent _____ Sex_____ age_____
4. Occupation_____ marital status_____ religion _____ and Educational back ground_____

B. Ethno botanical data

1. Is there any plant species which you use for eating?

Yes/No List them_____

2. What is the local name of the plants you use? _____
3. from where the plants harvested? Cultivated/Wild _____
4. Part of plant harvested for edible in the study area _____
5. Habitat of the plants (tree, shrub, herb, liana, epiphyte, parasite and Other category) _____
6. Which group of the local people uses the edible plants frequently?

_____

7. In which season it reach for edible? _____
8. What are the major threats and their conservation for edible plants in the study area?

i._____

ii._____

iii._____

Appendix V

A. Gaaffilee afaaniffaa (aaf-gaaffii) armaan gadiif afaanin deebisaa

1. Guyyaa_____
2. Ganda _____
3. Maqaa gaafatamaa _____ saalaa_____ umurii
4. Hojjin keessan _____haala gaa'elaa_____haala barnootaa_____ amantaan keessan_____

B.Odeeffannoo waa'ee biqiloota nyaatamanii

1. Sanyiin biqiloota bosonaa nyaataf oolan naannoo keessan jiruu? Eeyyee/lakki yoo jiratan tarressaa_____
2. Maqaan biqiltichaa/tootaa akka naannotti maal jedhama/muu? _____
3. Biqiltuu kana eessaa funaannattu/argattu? Bosonaa/oomishnee
4. Caasaa biqiltuu isa kamtu nyaataf oola? deebii_____
5. Amalli guddina biqiltuu kaanaa maali? (Muka dheeraa, miciree, muka biro irratti kan biqilan, maxxantuu, liilaanaa)
6. Biqiloota nyaataf oolan kana namoota umurii kamiitu irra deddeebin fayyadata? _____
7. Waqtiilee kam keessa nyaataf ga'u? _____
8. Wantoonni biqiloota kana balleessan maal fa'a? akkasumas haalli kunuunsa isaa maal ta'uu qaba jettu? tarreessaa

i._____

ii._____

iii._____

Appendix VI

A. Group discussion for ethno botanical data collection

Date_____ section _____kebele _____ merital status_____

1. Name_____ age___ sex__ religion _____occupation _____
2. Name_____ age___ sex__ religion _____occupation _____
3. Name_____ age___ sex__ religion _____occupation _____
4. Name_____ age___ sex__ religion _____ occupation _____
5. Name_____ age___ sex__ religion _____ occupation _____
6. Name_____ age___ sex__ religion _____ occupation _____
7. Name_____ age___ sex__ religion _____ occupation _____
8. Name_____ age___ sex__ religion _____ occupation _____

B. Ethno botanical data

1. Is there plant species which you use for eating? Yes/No___ if yes list them

_____

2. What is the local name of the plant you use? _____

3. from where the plant is harvested? Cultivated/Wild_____

4. Part of the plant harvested for edible in the study area_____

5. Habitat of the plants (tree, shrub, herb, liana, epiphyte, parasite and

Other category) _____

6. Which group of the local people uses the edible plants frequently?

_____

7. In which season it reach for edible? _____

8. What are the major threats and their conservation for edible plants in the study area? List them

i._____

ii._____

iii._____

10. Additional information related with edible plants/suggestion by informants

i._____

ii._____

Appendix VII

A. Marii garee waa'ee biqiloota nyaatamanii irratti odeeffannoo walitti qabachuuf

Guyyaa_____ Garee _____ Ganda_____

1. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
2. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
3. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
4. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
5. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
6. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
7. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____
8. Maqaa_____umrii___ saalaa____amantaa_____ ga'ee hojii_____

B.Odeeffannoo waa'ee biqiloota nyaatamanii

1. Sanyiin biqiloota bosonaa nyaataf oolan naannoo keessan jiruu? Eeyyee/lakki yoo jiratan tarressaa_____

2. Maqaan biqiltichaa/tootaa akka naannotti maal jedhama/muu? _____

3. Biqiltuu kana eessaa funaannattu/argattu? Bosonaa/oomishnee

4. Caasaa biqiltuu isa kamtu nyaataf oola? deebii_____

5. Amalli guddina biqiltuu kaanaa maali? Muka dheeraa, miciree, muka biro irratti kan biqilan, maxxantuu, liilaanaa

6. Biqiloota nyaataf oolan kana namoota umurii kamiitu irra deddeebin fayyadata? _____

7. waqtiilee kam keessa nyaataf ga'u? _____

8. Wantoonni biqiloota kana balleessan maal fa'a? akkasumas haalli kunuunsa isaa maal ta'uu qaba jettu? tarreessaa i._____

ii._____

iii._____

9. yaada dabalataa waa'ee biqiloota namaan nyaatamanii irratti kunnuu barbaaddan yoo jiraate

i. _____

ii._____