



Addis Ababa University
College of Natural and Computational Sciences
Department of Zoological Science

**Assessments and identification of wild edible plants: the case of Sasiga District
in East Wollega Zone of Oromia Regional National State, Ethiopia**

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Lists of Abbreviations/Acronyms

FAO: Food and Agricultural Organization

GPS: Geographical Position System

m.a.s.l: meter above sea level

NFPAs: National Forest Priority Areas

NTFPs: Non Timber Food Products

PAs: Peasant Associations

SBARD: Sasiga Bureau of Agricultural and Rural Development

TVET: Technical and Vocational Education Training

WEPs: Wild Edible Plants

WHO: World Health Organization

Abstract

The study was conducted in East Wollega Zone of Oromia Regional National state, in Sasiga District to assess, identify, document and recommend for domestication of wild edible plant species. Data was collected using semi-structured interviews, observation based focus group discussions, and questionnaires with a total of 115 informants, where 15 informants were used as key informants based on their very rich experiences on using wild edible plants and assumed to provide factual information. Descriptive methods of data analyse was employed to analyse gathered information or data on wild edible plant species. A total of 13 wild edible plant species were founded of which edible berries account for 69.23%, leaves and shoots 15.38%, root tubers 7.69% and squashes 7.69%. Structurally, trees account for 53.85%, climbers for 23.08%, shrubs for 7.69% and herbs for 15.30% of the investigated wild edible plants whereby 69.23% are eaten fresh, the rest 23.08% are cooked and a few of 7.69% are either fermented or used fresh.

The abundance of wild edible plants in the study area now day is decreasing and threatened due to their multipurpose use, farm land expansion, over grazing, urbanization, timber production, deforestation, and the like. The oral based indigenous knowledge transfer about wild edible plants in the study area also leading to erosion of indigenous knowledge concerning wild edible plants along with declining of this edible plant species.

It was concluded that there was a need to domesticate these wild edible plants for food security, raise public awareness in the community through information exchanges and promote sustainable utilization and conservation of wild edible plant resource, Establishment of forest stands, protection and further research on wild edible plants were recommended as a result of this study.

Keywords: *Berries, Sasiga, Domesticate, Edible, Fruits, Root, Tubers and Wild.*

Chapter one

1. Introduction

1.1 Back ground of the study

The term wild edible plants refer to species that are neither cultivated nor domesticated, but are available from their wild natural habitat like in forests, wood lands, grasslands or in open ecosystems and used as a source of food particularly for forest dependent societies (Beluhan and Ranogajec,2010).

In the turning points of history of mankind, domestication of plants and animals was started during the Nilotic revolutions, 10000 years ago when people lived in caves and went out for collecting fruits and hunting animals that they brought their trophy to caves. Leftover of the trophies like fruits of some sweetly tasty fruits were selected and sew around caves by women whose duty was to care for children in caves and that women played pivotal role in domesticating wild plants and beginning of agriculture. The beginning of the agriculture in this era was due to scarce of hunting of animals because of population number increased. They were obligated to start domestication of plants species along with feeding of animal products because of insufficient products from animals which were not satisfied their requirements.

The increasing population coupled with poverty, natural and manmade crisis in rural part of the country poses challenges to the earning for their livelihoods and access to food. In addition, the traditional ways of farming and livestock rearing have further reduced the income opportunity of the local population (Afolayan and Jimoh, 2009).

Therefore, wild food resources reduce the vulnerability of local communities to food insecurity and provide a buffer in the times of food shortage. They also increase nutritional quality of rural diets for instance, micronutrients (vitamins and mineral) which are sometimes superior to these domesticated varieties (Agea *et al.*, 2007).

The current underutilization of wild edible plants was promoted by industrial revolution, life style changes, large scale cultivation of a limited number of crops (rice, sorghum, maize, wheat), and less contact with nature are among the other reasons (Zemedede Asfaw,2009).

Historically, humans may have utilized more than 7000 wild edible plants so far, but many such food resources and valuable plants are still to be explored. In the present scenario, the tradition and associated knowledge on wild edible plant is dwindling owing to developmental activities, migration from rural to urban areas for occupation, and education, changing cultural tradition,

attraction toward western ways of life, temptation of fast foods, declining natural resources, changing environmental conditions, deforestation (Bhattarai *et al.*, 2007).

It is the prime need of our generation to collect and document this valuable traditional knowledge for the betterment of humanity. Millions of people in many developing countries do not have enough food to meet their daily requirements and a further more people are deficient in one or more micro-nutrients. Amongst wild plant, in particular, wild edible plants, once the most important food source for the human population, along with domesticated plants. In recent years, there has been a growing interest in exploring the traditions of using wild edible plants beyond material and medicinal purposes and focus on wild edible, as their roles become better understand in terms of local nutrition, dietary diversity, income generation, health care, reduction of micro-nutrient deficiency, and food security through diversification (Termote *et al.*, 2009; De Caluwe, 2010a and 2010b)

Given the rapid development of food industries or increased reliance on processed food, documentation, evaluation on their use (usage), diversity and their status is crucial. There are many wild plant species believed to be edible are yet undocumented in the area where this research was conducted (Zemedu Asfaw, 2009).

1.2 Statement of the problem

Sasiga is one of the Districts of East Wollega Zone lies in connection to lowland areas of Dhidhessa River Valley, which is mostly covered by woodland, grasslands, thickets, bushy and shrubby tree diversity of vegetation compositions in which many species of edible plants are found.

The area is very rich in both edible and none edible wild plants hitherto unknown or not permanently domesticated by the indigenous people living surrounding, due to the reason that the area is not at the reach of researchers, basic researches were not conducted yet to my knowledge. The diversity of wild edible plants are growing in the District but were not well studied. The gap between human population and food availability in the present day is also another focus of the study where our country is no exception. The area must be studied and provide its edible wild plants to already identified wild edible plants in the country playing its role in insuring foods and livelihood securities for countless families and communities in the area or even around the globe.

In view of this, the researcher decided to study different wild edible plants of Sasiga District as natural resources of the area along with their identification, assessing and recommending for conservation and domestication for future food security.

1.3 Objectives of the study

1.3.1 General Objectives

The general objective of the study was to assess and identify wild edible plant species and recommend for domestication and uses in food security.

1.3.2 Specific Objectives

The specific objectives of the study are to:

1. Assess and identify wild edible plant species found in 5 selected study stations of Sasiga District,
2. Identify different mode of consumption of these plants for food sources,
3. Explore and document the indigenous knowledge of the local people associated with wild edible plant species for users and researchers.
4. Recommend the domestication and adoption of wild edible plant species of the study are for further uses.

1.4 Research questions

1. What wild edible plant species are found in Sasiga District?
2. How are the distributions of wild edible plants in this District?
3. What are the principles of collection, and usages of edible wild plants?
4. What is the social perception in the area on general using of wild edible plants?

1.5 Limitation of the study

During the journey for data and sample collection the researcher lack access of transportation, problem of weather/rain which restrict journey in the forest, lack of accessibility of light for photo and video capturing, fearing of respondents to give accurate or appropriate responses for the questionnaires and interviews, and fear to wild animals especially venoms of biting snakes while journey in the forest.

1.6 Delimitation of the study

The study was not incorporating all the people and PAs in the Sasiga district rather it is limited to 5 PAs from a total of 32 PAs within the district. The scope of the study is also delimited to assess, identify, document wild edible plants in the area and putting references about these plants which simplify their availability for a future sudden happening of food scarcity. It was also delimited to some forest area based on information of residents because it is conflict area on the border between Benishangul Gumuz and Oromia Regional National State.

1.7 Significance of the study

The study is important for the following reasons:

1. It searches wild edible plants of the area, identifies each plant species with how the people of the area uses as a food source along with its documentation and adding onto previous work done
2. It collects and identifies different wild edible plants from the study area and tries to document for the emergency purpose of the food gap or food scarcity
3. It tries to identify the factors that affect or minimize the productivity of these wild edible plants
4. The study also point out and investigate the positive and negative social perception on collecting, processing, and consuming wild edible plants
5. To dig out and evaluate the indigenous knowledge of the people of the area on wild edible plants and passing the idea to the next generation
6. It helps to tell the importance of feeding wild edible plants and ensuring as a dietary supplement for community

7. Creating awareness for the people of the area (where such research is not done) about wild edible plants to understand its importance and then input the idea of conservation with inheriting the next generation.

Chapter two

2. Review of related literatures

2.1 Historical background of wild edible plants

It is remarkable that most food plants in use in the world today, as well as industrial plants, are of great antiquity. Most of our food plants were domesticated from wild ancestors long before the beginning of recorded history. All available records indicate that they were as familiar to the peoples of the ancient world as they are to us. Comparatively few new plants have been developed during the past 2,000 years, although the older ones have been greatly altered and improved in response to increasing complexity of the human existence. There have been many attempts to determine the age of our food plants and their place of origin as well as their cultural history.

The classic work dealing with this phase of botany is De Candolle's "*L'origine des plantes cultiveés*," appearing in 1883. This was a very careful piece of work of great accuracy. Only a few of his conclusions regarding geographic distribution have had to be altered in light of more recent studies. De Candolle based his conclusions on a variety of evidence, such as the works of Dioscorides, Theophrastus and other old historians; Chinese writings; archaeological and ethnological data such as the monuments in Egypt, the ruins in Pompeii and the remains of Lake Dwellers of Europe and the Inca ruins of South America. He also learned from philological indications involving the names of plants in Hebrew, Sanskrit and other ancient languages. His botanical conclusions were based on distribution, number of varieties, presence or absence of wild types, length of cultivation and similar matters. The issue is being even more serious in developing countries where such important information is not recorded in writing but passed on from one generation to the other orally.

The study is required to collect and assess wild edible plants, and adding onto the countries data base of wild edible plants and along with documenting indigenous knowledge of the people on how to collect and use.

According to the report of the Food and Agricultural Organization (FAO), a minimum of one billion people in the world utilize wild vegetables in their daily routine diet. In developing countries a significant problem to human survival is the increasing gap between the food availability and human population. So the research is based on the underutilized wild plants that can help to reduce the gap with in the food deficiency and ever growing human population.

Growing and using wild edible plants solves the problem of food insecurity and malnutrition. In recent years a growing interest has emerged to evaluate the nutritional analysis of wild edible plants. Ethno botanical information of wild edible plants and their nutritional analysis could be coupled to know the importance of these wild edible plants and to use these as food substitute. Increasing rate of population all over the world has reduced the resources of food especially. To fulfil such demands, it is necessary to search for those wild edible plants which can be used in the case of malnutrition, and fewer amounts are spent on them for their management. In case of natural disasters like famine, such plants can be helpful in fulfilling food demands. Hence a considerable attention is needed to explore, isolate, and document them.

2.2 Origin, nature and distribution of wild edible plants

2.2.1 Origin and distribution of edible plants

There appear to be four major centres in the world from which our economic plants originated and from where they were gradually dispersed. These are (1) Central or South-western Asia and the mountainous region from India to Asia Minor and Trans Caucasus; (2) the Mediterranean region; (3) South-eastern Asia; and (4) the highlands of the Neotropic. From earliest times humans had at their disposal various food plants on which they must have been dependent to a great extent for their existence. Early humans wandered from place to place being content to gather the edible fruits, grains, seeds and tubers when they were needed and to possibly to temporarily store them in small amounts. Primitive attempts at cultivation gradually progressed to sowing seeds in some favourable location. Whether these first attempts at agriculture were accidental or purposeful, they were of great importance for they changed the nature of human existence. Necessity caused humans to reduce their nomadic existence and to remain in one place at least long enough to harvest the crops. In this way the first step was taken toward civilization because agriculture is the only mode of existence that has enabled us to live together in communities and to accumulate the necessities of life. Agriculture was of the utmost importance and probably represents the most significant single advance in the human development.

Simple type of plant culture was gradually replaced with greater sophistication that led finally to the building of the great nations of antiquity. These ancient civilizations were restricted in area for they developed only in those regions where the useful plants were native. Therefore Asia Minor and adjacent areas in south western Asia, the Mediterranean region, south eastern Asia and the Neo-tropical American highlands were the locations of the older civilizations. The

presence of valuable agricultural plants in all these regions was the most important factor in the development of agriculture, although in all of these areas climate and soil conditions also were very favourable. The climate was equable, with little extremes of heat and cold; the soil was fertile; and there was either ample rainfall or irrigation possible (Vavilov, 1992).

Ancient agriculture was based principally on these cereals as it is true today as a core of interest. Their highly nutritious seeds were the staff of life 5-10, 000 years ago, and have remained so to present times. It was the cultivation of wheat in the fertile valleys of the Tigris and Euphrates rivers that made possible the great nations of Biblical time: Chaldea, Babylonia and Assyria. Egypt, Greece and Rome had both wheat and barley at hand. Rice was the basis of the restricted civilization that developed in the valley of the Hwang Ho and Yangtze Kiang rivers and led to the development of the Chinese empire. Maize was cultivated in the highlands of the Neotropics.

There is a great similarity in the history of agriculture in all these areas. First the gathering the edible portions of wild plants followed by the primitive cultivation of certain species best adapted to the human need; and finally the evolution of a high-grade agriculture that involved the breeding of new varieties, improvements in cultivation, irrigation and other aspects of agriculture (Wiersema, 2016).

2.2.2 The nature of edible plants

The various materials that make up the food of plants and animals are used either in the formation of the living protoplasm, the building up of their bodily structure or as a source of energy. Humans and other animals are not able to manufacture their own food, as are plants. Therefore, they must obtain their food readymade and so are dependent, either directly or indirectly, on plants. Plants manufacture much more food than they can utilize immediately and they store up this surplus as a reserve supply for future use. It is this supply of reserves that is used by animals.

The essential foods produced by plants are carbohydrates, fats and proteins, each being of value in its own way to animal metabolism. There are also mineral salts, organic acids, vitamins and enzymes that are required for general health. It is thus possible for us to live entirely on a vegetarian diet (Debela Feyssa *et al.*, 2011).

Plants store food in various ways, either in roots, stems, leaves, fruits or seeds. The most important of these for humans are fruits and seeds. In this category are found the cereals and small grains, the legumes and the nuts. All contain large amounts of nutritive material and have proportionately low water content, which enhances their value for they can be stored and transported with ease. Roots, tubers, bulbs and other vegetables from the soil are next in importance as sources of our food and the lower animals as well. Their value is less because they contain much water.

The leafy parts of plants, the greens, salad plants and other herbage vegetables contain comparatively little stored food. But they are necessary because of the vitamins and mineral salts they contain and the mechanical effect of their indigestible cellulose. This is true also of the fleshy fruits that may also contain various organic acids. There are hundreds of species of plants, both wild and cultivated, that are used only by primitive peoples or in restricted areas of the world.

2.3 Nutritional and economic value of wild edible plants

2.3.1 Nutritional value of wild edible plants

Leaves, stems, fruits, flowers, tubers, barks, seeds, roots, and so on, of lots of wild edible plants are still consumed for their dietary value in many communities around the globe. Some of these wild edible plants are used as primary food sources while others are used as secondary condiments in dishes prepared from domesticated cultivars (Lockett and Grivetti, 2000). These plants play an important role as a source of energy and micronutrients (Afolayan and Jimoh, 2009; De Caluwé, 2010a and 2010b). In addition, Becker (1983) reported the presence of vitamins A, B2, and C in wild edible plants of Senegal. Research on six wild edible plants from Spain also confirmed the occurrence of lipids, fatty acids and carotenes in the leaves of these species (Guill-Guerrero and Rodriguez-Garcia, 1999). Protein content in a proportion that is comparable to the amount in domesticated plants was also reported from a nutritional study of wild edible plants in South Africa (Afolayan and Jimoh, 2009).

A study on the dietary value of eight wild edibles in Iran and India also showed the presence of sodium, calcium, potassium, iron, zinc, protein, and fat in a ratio comparable to that found in cultivated plants (Aberoumand, 2009). Many wild leafy vegetables of Poland are also mentioned for their rich source of vitamin C, natural antioxidants, carotenoids and folic acid (Luczaj, 2010).

2.3.2 Economic value and marketing of wild edible plants

A number of wild-food plants are of economic value and are traded on markets in certain areas of Ethiopia. One of the most prominent examples is coffee: in the western part of Ethiopia, in Illubabor and Jimma zones, part of the coffee production is still being harvested from 'wild', non-domesticated coffee trees growing naturally in the forests. Less prominent fruits and seeds from wild-food plants are mainly traded on local markets. Nevertheless, in Southern Ethiopia, wild-food plants are mostly used for home consumption and if traded on the market, they are most likely not traded for money but exchanged for other goods and foodstuff. In Western Ethiopia (Jimma and Illubabor) as well as in remote areas in the Tekeze River lowlands and in the Simien Mountains of North Gonder and Wag Hamra, a considerable variety of wild-food plants are offered on local markets. These marketed wild-food plants include a couple of *Eragrostis teff* like grassy plants and seeds. An example of a traded and exchanged wild-food plant is *Opuntia ficus indica*, a cactus plant. Its fruits are traded for cash on markets in Tigray Region during the rainy season. Also, the fruits of *Borassus aethiopum*, the African Fan Palm, are marketed in Afar Region.

The fruits and pulp produce oil that has an economic value. The fruits themselves also represent a considerable economic value in the lower Afar Region near Awash town. Local traders are buying the fruits from Afar and Karayu people to sell them on the market in Awash town. The leaves, stalks and seeds of *Brassica carinata* are traded on remote markets such as in Jana Mora Districts in North Gonder. Fruits of *Cordia africana* and *Ziziphus spina-christi* are also offered on markets in Jana Mora District (Kebu Balemie and Fassil Kibebew, 2006).

2. 4 Wild edible plants in Ethiopia

Ethiopia is a country with varied a topography and a wide spectrum of habitats presenting a large number of endemic plants and animals. The country has about 6000 higher plant species of which about 10% are endemic (Hedberg *et al.*, 2009).

Ethiopia also harbours two of the 34 global biodiversity hotspots (CI, 2004) and is recognized as a Vavilov centre of origin and diversification for many food plants and their wild relatives (Edwards, 1991). Forests, grasslands, reverie environments and wetlands are home to numerous wild edible plants in the country (Zemedu Asfaw, 2009).

Local communities in Ethiopia are also endowed with diverse indigenous knowledge, related to the rich biodiversity of the country. In most parts of Ethiopia, wild edibles form integral parts of

the feeding habits of many communities (Kebu Balemie and Fassil Kibebew, 2006). However, consumption of wild edibles is more common in food insecure areas than in other areas in the country (Tilahun Teklehaymanot and Mirutse Giday, 2010).

For example, the Konso people in southern Ethiopia managed to endure three severe drought seasons of crop failure between 1996 and 1999 by consuming wild edible plants available in the region (Guinand and Dechassa Lemessa, 2000).

Despite the wide availability and utilization of wild edible plants in Ethiopia, ethno botanical information on cultural, socio-economic and nutritional values of Ethiopian plants is limited. Hence, there is still a need for identification, characterization, domestication and documentation of wild edible plants to assist in the national wide effort to combat food insecurity and ensure dietetic diversity.

2.4.1 Wild edible plants and their function in combating food scarcity

Wild-food plants are able to fill a variety of food gaps. If, for example, the previous crop harvest was not able to provide enough food to last through to the next harvest, wild leafy vegetables, cabbage and tuber-type famine-food plants will be consumed to fill the gap after the first rains, when farmers are preparing their fields. These typical famine-food plants grow fast after the first rain showers and can be consumed shortly after. Wild tree fruits usually mature only once a year, mostly were coinciding with the growth cycle of cereal food crops. Therefore, in a situation where a dry spell exacerbates serious crop losses or even complete harvest failure, wild fruits will help fill the immediate food gap after a failed harvest (Guinand and Dechassa Lemessa, 2000).

According to FAO (2010), more than 35% of Ethiopian people are food unsecured. The country's ever increasing population along with recurrent drought, war and poor agricultural practices with low productivity, have pulled the country into a vicious circle of food insecurity. In addition, over dependence on a limited number of food sources and poor efforts to diversify dietary sources aggravate the country's food insecurity problem.

Many wild edible plants in Ethiopia were reported as emergency, supplementary or seasonal food sources to avert food insecurity in households of Ethiopian cultural groups. The fruit of invasive *Opuntia ficus indica* (L.) in the family of Cactaceae was found to be widely exploited and sold for its fruit in many parts of northern Ethiopia, particularly in many local

markets of Tigray Region with other cultivated food sources such as potatoes, carrots, bean and maize playing a significant role in food source diversification (Addis, 2009).

Amorphophallus gallaensis and *Caralluma sprengerim* were also reported for their role in fighting food insecurity during periods of drought and famine in Konso district (Guinand and Dechassa Lemessa, 2000).

This shows that the roles of wild edible plants play at least at local levels to combat food insecurity and their potential to address existing food insecurity at national level is important if properly managed. Wild edible plants in Ethiopia like the species of *Adansonia digitata* L., *Tamarindus indica* L., and *Ziziphus mauritiana* Lam are reported to have valued nutritional and commercial properties, but misused or underutilized in the country.

2.4.2 The potential roles of wild edible plants for food security

When compared to domesticated plant food sources, wild plant foods tend to be overlooked. However there is substantial evidence that indicates the importance of wild edibles in terms of the global food basket. Since wild edible plants are freely accessible within natural habitats, indigenous people have knowledge of how to gather and prepare the foods (Somnasang and Moreno-Black, 2000).

According to Abermound (2009), about one billion people in the world use wild foods (mostly from plants) on a daily basis. Moreover, over 300 million people obtain a substantial part of their livelihood in the form of non timber Forest Products (NTFPs) from wild forests (Belcher *et al.*, 2005).

The dependence on a few domesticated species limits dietetic diversity and leads to over dependence on limited resources. By contrast, ethno botanical investigations on wild edible plants suggest that more than 7,000 species have been used for food in human history (Grivetti and Ogle, 2000).

In countries such as China, India, Thailand and Bangladesh hundreds of wild edible plants are still consumed along with domesticated species (Mazhar *et al.*, 2007).

The species *Ximenia americana* L. in the family of Myrtaceae found in the study area is a popularly known as edible and medicinal plant that has cultural, forage and economic values (Johns *et al.*, 1996; Ogle *et al.*, 2003; Reyes-Garcia *et al.*, 2005; Shrestha and Dhillon, 2006).

2.5 Indigenous knowledge and wild edible plants

Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area (Quanash, 1998). It is the result of many generations' long years' experiences, careful observations and trial and error experiments (Martin, 1995).

Traditional people around the world possess unique knowledge of plant resources on which they depend for food, medicine and general utility including tremendous botanical expertise (Martin, 1995). Over centuries, indigenous people of different localities have developed their own specific knowledge on plant resource use, management and conservation (Cotton, 1996). Systematic application of indigenous knowledge is important for sustainable use of resources and sustainable development (Thomas, 1995).

This close interaction and dependency of humans on plants is studied under the field of ethno botany. Indigenous knowledge on remedies in many countries including Ethiopia passes from one generation to the other generation verbally with great secrecy. Such secrete makes indigenous knowledge of the people vulnerable to distortion and in most cases, some of the lore is lost at each point of transfer; hence, there is a need for systematic documentation of such useful knowledge through ethno botanical research.

2.6 Local traditions, believes and religious constraints on feeding wild plants

Unlike other many other African countries and especially many Southeast-Asian and Asian countries in general, most of Ethiopian people do not consume animals like ducks, pigs, donkeys, horses, snakes, rabbits, rats, cats and dogs. Religion represents a major constraint to the use and consumption of wild plants and animals. For the believers, the consumption of wild plants and animals does not conform to their system of traditional and religious beliefs. This means that the range of food available to people during times of stress is narrowed considerably despite Ethiopia's rich biodiversity.

Ethiopians generally are constrained to the consumption of the commonly cultivated crops and neglect wild plants like *Amaranthus sp.* and *Solanium sp.* that have clearly demonstrated their production potential in pocket areas of the country. These and other similar plants could have been fully domesticated and cultivated like any other food crop. Strong traditions, beliefs and religious taboos still obstruct people's psychological and mental willingness to domesticate and cultivate wild-food plants.

This is a reality that cannot be denied and has to be confronted if the full potential of the indigenous Ethiopian flora as a source of food is to be effectively exploited. In the southern part of Ethiopia, where there are many different tribes still living with their indigenous beliefs and traditions, there are fewer religious and external constraints than in other parts of the country. In some of the areas studied the daily diet of most people still comprises an element of wild food, both animals and plants, during certain periods of the year.

2.7 Consumption of wild edible plants

Fruits from wild plants are usually consumed raw as they are picked, but 'edible' does not always mean 'palatable'. Leaves and other tender parts of wild plants are prepared like cabbage and other vegetables chopped into small pieces and boiled in water. Roots are either eaten raw or cooked. Some wild tubers are first dried and then crushed. Root parts are usually more complicated and need a longer preparation time and process, especially those which are stayed underground for many years was assumed to be toxic and need special treatment. Kernels, seeds and nuts are also mostly cooked for a fairly long time before consumption. The consumers revealed that, whenever possible, they need to use more salt to mask the distasteful feature of the foodstuff prepared.

In semi-arid areas, where basic resources such as food are scarce anyway, people may have been under pressure to adapt to the harsh conditions of life and discover a greater variety of edible wild plants and their respective parts. In highly populated areas where intensive cultivation is the norm, biodiversity is considerably reduced and the possibility of finding wild-food plants minimised compared to the lowland areas (Zemedu Asfaw, 2009).

2.8 Conservation of wild edible plants

Despite their importance, wild edible plants face serious anthropogenic and environmental threat. Many threats are similar to those that affect plant diversity as a whole.

The most common threats reported were agricultural expansion, overgrazing/overstocking, deforestation and urbanization (Ensermu Kelbessa *et al.*, 1992; Addis, 2009; Zemedu Asfaw, 2009; Tilahun Teklehaymanot and Mirutse Giday, 2010). The reported anthropogenic pressures in the country have resulted in a loss of thousands of hectares of forest that harbour useful wild edible plants. This loss was also reported to limit benefits gained from the plants and indigenous knowledge associated with these plants.

The continuity of knowledge on the utilisation of wild edible plants has also faced problems because of change in the feeding culture of the people (Tilahun Teklehaymanot and Mirutse Giday, 2010).

The reviewed research outputs on wild edible plants of the country indicate the need for conservation as well as documentation (Kebu Balemie and Fassil Kibebew, 2006; Addis, 2009; Zemedede Asfaw, 2009; Tilahun Teklehaymanot and Mirutse Giday, 2010; Fantahun Mengistu and Hager, 2010).

Conserving Ethiopian wild edible plants in situ (in their natural habitat as in nature reserves and parks) or ex situ (gene banks, botanic gardens, herbarium) is mandatory (Tilahun Teklehaymanot and Mirutse Giday, 2010).

Chapter three

3. Research methods

3.1 The study area

The study was conducted in Sasiga District found in East Wollega Zone of Oromia Regional National State. The area of the District is 97,319,000 M² composing of 32 PAs categorized into 27 rural and 5 urban dwellers areas. It is located in geographical position systems (GPS) between 09°29' North latitude and 37°26' East longitudes found 18 km North west of Nekemte town and 345 km West of Addis Ababa.

The District was with the total population of 100,143 (57,407 males and 42,736 females) where 18,785 were urban and 81,358 were rural dwellers according to population and housing census of 2007 ^{E.C}. Unlike other Districts of the zone, Sasiga District is dominated by the rural population. It is bordered in the North West by Haro Limu, in the East by Guto Gida, in the South by Diga District and in the West by B.Gumuz Regional National State (SBARD, 2008).

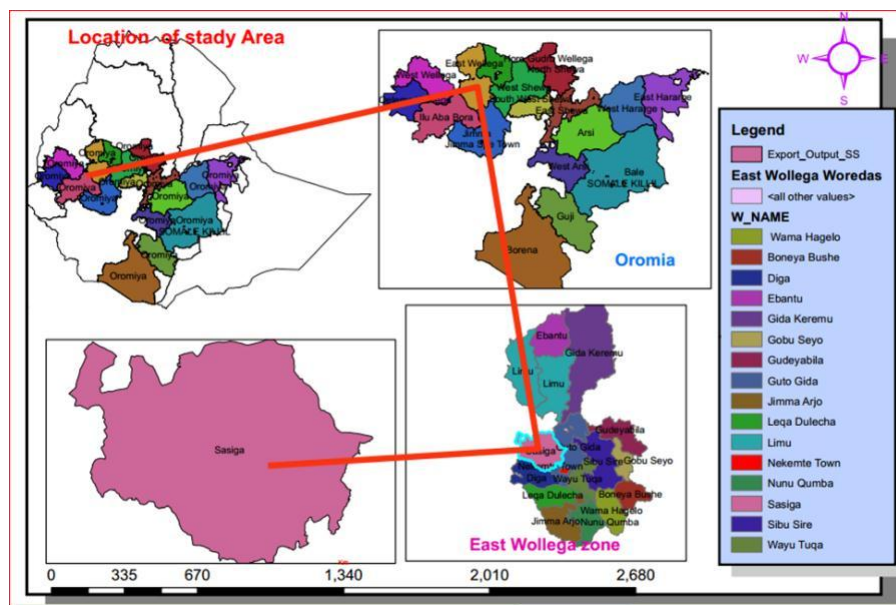


Figure 1 Location of the study area on map

Source: Google map (2019)

3.1.1 Climatic condition of the study area

The District lies within the altitudinal range of 1500 to 1960 m.a.s.l and has a tropical climate influenced by altitudinal changes from 23 c to 32° c.

The rain fall pattern of the district ranges from 1200mm to 1800 mm with four distinct seasons (SBARD, 2008).

The climatic condition of the area is mild to hot that enable to grow woody grassland area with variety of vegetation cover including law land bamboos (*Oxyterantera abyssinica*) with rocky ragged terrain and inclined escarpments of which floristic compositions are no yet studied completely.

About 65% of the climatic condition is mild climate and 35% of low land whereby the high land shows relatively cold.

The area is also known for its fruit tree growing like Mangoes, Banana, Orange, Gishta, Papaya, Avocados, *Psidium guajava* and the like.

Soil type is mostly red soils, crystalline sandy soils, brown forest soils and camisoles. The forest area of the District includes Dambi, LagaAyya, Balo, Bareda, Gumbi and Tsige state forest areas whereby local land marks include Kolobo Cave, Bareda and Gumbi falls.

3.1.2 Economic condition of the study area

In Sasiga District, the dominant economic sector primarily is agriculture followed by service. The agriculture is dominantly relied up on the seasonal rainfall and uses old traditional method of farming which limit the people of the area to produce enough food plants which satisfy their life. The farmers making their livelihood by producing food crops are leading their lives with poverty. So, most of the people relies on feeding undomesticated wild plants during long dry seasons and food scarcity periods. Those who are engaged in producing cash crops and cattle rearing are somewhat better in their lives.

3.2 Methods and Research design

Data collection tools are observations, interview questions and questionnaires. Population size of the study were 40 elder informants for identification of wild edible plant species through observation, 15 dwellers to interview questions as a key informants and 60 respondents for questionnaires selected from 5 study stations. Informants were purposely selected based on their experiences and very rich in indigenous knowledge on using wild edible plants for many years according to information obtained from local authorities, Abba Gadas and other famous peoples who were thought as knowledgeable person in the area by local communities.

Procedurally, data were collected from 5 PAs (3 rural and 2 urban like settlement areas) among 32 PAs based on the preliminary survey.

3.3 Data collection instruments

3.3.1 Observation

In order to assess and identify the existing edible wild plant species, checklist tables were set to list the species of wild edible plants by the guide and support of 40 indigenous elder informants whereby pictures and GPS records of each plant at wild conditions were taken at IN-SITU conditions.

3.3.2 Interviews

Structured interview questions were set to collect information from 15 urban and rural dwellers selected from 5 study stations. The interviewees are elders who have rich experience on wild edible plant species and assumed to provide factual information but those are aged and not able to walk in the forest with researcher.

3.3.3 Questionnaires

The prepared questionnaires were distributed to 60 indigenous respondents selected from 5 study stations that all distributed questionnaires were returned back promptly.

3.4 Data collection procedures

The procedure of data collection is listed as follows.

1. Assessments and identification of wild edible plants in the selected study stations at the IN-SITU condition were applied using observations methods through 40 indigenous elder informants who have long traditional and practical experiences who travelled to the field with the researcher and assisted throughout the field works. In view of this, 40 informants (8 from each PAs) were selected to travel to the wild edible plants area and practically show and inform the species edible aiding with focal group discussion. Agenda were also set to give direction for the focal group discussing.
2. For interview questions, 15 elder dwellers (3 from each PAs) were selected to discuss the structured interview questions on each wild edible plant species.
3. Totally, 60 questionnaires were distributed to selected informants from 5 PAs (12 people per PAs) in the study station.

4. All Informants used their rich experiences, identified, showed and explained all about wild edible plants to the researcher and provided with adequate information on naming in vernaculars, utilities, parts used, seasonal availability, habits and sample collections.

3.5 Data sampling techniques and sample size

Data collection techniques and the uses of tools of the study were structured as follows.

Table 1 Data source sample size

No.	Data collection tools	Number of respondents
1	Observation based group discussion	40 informants
2	Questionnaires	60 informants
3	Interview based discussion	15 interviewees(elder) as key informants
	Total	115

3.6 Data analysis

Data was analysed using both qualitative (descriptive method) and quantitative (percentage and tabulation) methods. Close ended questions were analysed through tables and percentage to compare the results while open ended questions like interview and observations were analysed using descriptive methods.

Chapter four

4. Results

A total of 13 wild edible plant species were identified from the study area out of which 7 were trees, 1 was shrub, 3 were climbers and 2 were herbs.

Concerning the uses of wild edible plant species, berries (fruits) accounted for 69.23%, young leaves or shoots 15.88%, squash in podium 7.69% and root tubers 7.69% and most of species provide food eaten without cooking at fresh (69.23%), cooked (23.08%), and eaten either fresh or fermented (7.69%). The study was also founded that about 46.15% of the wild plant species are collected during dry seasons, 38.46% of the species are in rainy season, 7.69% *are available in both seasons with limited periods based on habitat and distributions while 7.69% are collected all the months of seasons* (Table 2).

Table 2 Lists of identified living wild edible plant species in the study area

No	Vernacular names	Scientific names	Parts used	Status	Seasonal availability
1	Agamsa	<i>Carissa edulis</i>	Berries	Shrub	Rainy
2	Baddeessaa	<i>Syzygium guineense</i>	Berries	Tree	Both dry and Rainy with limited months
3	Burii	<i>Discorea sp.</i>	Root tubers	Climber	Both seasons with all months
4	Buruurii	<i>Vanqueiria ariseppala</i>	Fruits	Tree	Dry
5	Dhangaggoo	<i>Rumex nervosus</i>	Leaves	Herb	Rainy
6	Goosuu	<i>Syzygium sp.</i>	Berries	Tree	Dry
7	Goraa	<i>Rubus apetalus</i>	Berries	Climber	Dry
8	Hudhaa	<i>Ximenia americana</i>	Berries	Tree	Rainy
9	Keelloo	<i>Bidens prestinaria.</i>	Leaves	Herb	Rainy
10	Qillimmee	Unidentified	Berries	Climber	Rainy
11	Qoqoraa	<i>Vitex doniana</i>	Fruits	Tree	Dry
12	Raamsoo	<i>Senna prestinia</i>	Seeds with podium	Tree	Dry
13	Waddeessa	<i>Cordia africana</i>	Berries	Tree	Dry

Life forms of identified wild edible plant species in the study area.

The pie chart shows diversity of wild edible plant species in the study area. The study carried out in the sampled study area founded 13 wild edible plant species comprising 4 life forms like trees (53.85%), climbers (23.08%), herbs (15.38%), and shrubs (7.69%).

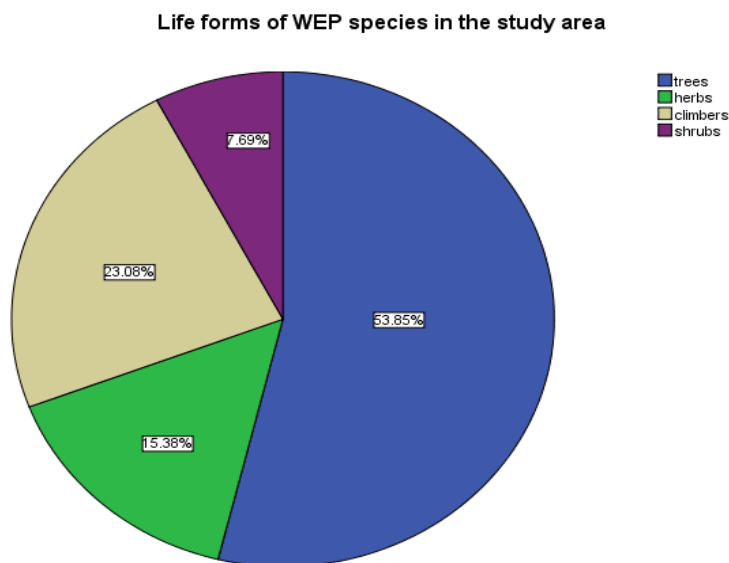


Figure 2 Pie chart showing the distribution of wild edible plant species in the study area

Based on table 2, identified wild edible plant species are described in detail as follows:

1. The species *Carissa edulis* (Agamsa – Oro.)

It is a spiny shrub or small tree growing upto to 5 m found in the study site. It grows in Dry and Midland climatic zones. The picture of plant was shot at IN-SITU condition of GPS of N=09°12'0.524'' and E=036°25'0.744''.

Bark is grey, smooth with straight woody spines to 5 cm, often in pairs, rarely branching and milky latex. Leaves are opposite, leathery, shiny dark green to 5 cm, tip pointed, base rounded, stalk very short. Flowers are fragrant, in pink-white terminal clusters, lobes overlap to the right. Flowering begins in March and fruit ripen in May. Fruit rounded berries about 1 cm, purple-black when ripe, sweet and edible, 2-4 seeds.

The product of flower is berry which is edible by local people particularly for shepherd and young people as an additional food staff and carry important food berries and can be used as medicinal

plant for anti *Ascaris* (root) in Ethiopia. In addition it is also used for fire wood, ornamental and live fence. Propagation is by seeds and wildings.



Figure 3 The species *Carissa edulis* with berries

Source: Photo by Gemechu Waktola (2019)

2. The species *Discorea* sp. (Buri- Oro.)

The plant is a climber with edible root tuber located in the study site at GPS of N=09°12'0.979" and E=036°25'0.679". It is available in low and midlands of the area all the year remaining under soil but do not give up shoot until rainy season comes. Is eaten after cooked but some time grinded and after made dough can be prepared as bread.



Figure 4 The species *Discorea* spp.

Source: Photo by Gemechu Waktola (2019)

3. The species *Vanquerialine ariseppala* (Buruurii –Oro.)

It is a medium tree with about 9 meters height bearing edible sweet fruits. The picture was taken at GPS of N=09°12'0.514" and E=036°25'0.766" in the study area. Young shoots, leaf and flower stalks covered with red-brown hairs, found in semi-arid low land wood land in Dry and midland climatic zones in the study station. Used as food (flowers between May and June which results edible ripened fruit after October), firewood, timber (local construction, farm tools), fodder(leaves), rope (bark).Leaves are long oval, tip pointed or rounded,base often rounded to a short stalk,edge toothed, veins from the base and which is clearly network. Flowers are yellow, purple or white, solitary or in twos or fours, in a terminal head,Fruit in 4parts, each rounded and fleshy. Propagated by Seeds.The fruits are in uses by everyone who comes across and wild animals including birds too when ripen.



Figure 5 The species *Vanquerialine ariseppala*

Source: Photo by Gemechu Waktola (2019)

4. The species *Rumex nervosus* (Dhangaggoo-Oro.)

It is an annual shrubby plant whose leaves are chopped, cooked and eaten with cabbages as sources of vitamin and laxative supplements as shown in the pictures. Annual plant harvested for using after germinated in raining season (June-August). The picture of the plant serving as food sources and medical purposes was taken at the GPS of N=09°12'0.370" and E=036°25'.488". The plant grows in cold and mild climatic zones and could be propagated from seeds and perennial root tubers remain at underground for more than two years.



Figure 6 The species *Rumex nervosus*

Source: Photo by Gemechu Waktola (2019)

5. The species *Syzygium* sp. (Goosuu-Oro.)

The species of *Syzygium* is a tree growing to 12 m in favourable conditions, but remain at 5 to 8 m producing edible berries that was pictured at GPS of N=09°09'0.909" and E=036°28'0.057". Berries are deliciously eaten by monkeys, apes, birds or other wild animals including humans. Shepherds collect, eat and take home to share the trophy with family members and friends in the seasons. Flower in February and give blue black ripen berry fruit in April and May which eaten fresh and propagated from seeds.



Figure 7 The species *Syzygium* spp.

Source: Photo by Gemechu Waktola (2019)

6. The species *Syzygium guineenses* (Baddeessaa-Oro.)

An ever green plant that grows to height of 15-25m with huge dense foliage and heavy round crown canopy cover of 20m bearing edible berries and popularly distributed in the study area and pictured at GPS of N=09°10'0.435" and E=036°28'0.170".

It is commonly named as foods for shepherds since it is easily accessible and available for all consumers freely. The opposite paired leaves are oval in shape with long tips and smooth shiny surfaces. They are purple-red when young and become dark green as they mature. The yellowish white flowers grow densely at the ends of the long branched stalks in February to March and ripen in June and July. But those grown near river bank can give ripen fruit even in dry season. The fruits which grows in bunches of 20-30 are globose or oval, reddish black when ripe, fleshy and edible with one seed inside. Water berry grows well in moist and wet and climatic zones. The hard and strong wood is good for wood work, fire wood, and charcoal. It is propagated from seedlings or by direct sowing.



Figure 8 The species *Syzygium guineenses*

Source: Photo by Gemechu Waktola (2019)

7. The species *Rubus apetalus* (Goraa-Oro.)

A shrub creeping or often climbing, sometimes forming small tree 0.5 to 7 meters prickles usually slightly curved from a wide bell. It grows in mild climatic zone of the study station. Harvesting of edible berry fruit is in dry season (March-May). Leaves evergreen somewhat leathery leaflets usually 7 shortly petiolets and picture was taken at GPS location of N=09°12'0.224" and E=036°25'0.415."



Figure 9 The species *Rubus apetalus*

Source: Photo by Gemechu Waktale (2019)

8. The species *Ximenia americana* (Hudhaa-Oro)

An evergreen shrubby plant or small tree growing to height 8m with dark brown barks. The twigs have small scales and leaves usually grow in tuff, have green colour, and are oblong in shape. The edge is entire, the tip round or notched and they usually fold upwards along the midribs. The fruit have a yellow or bright red skin which is edible with sour taste. Thorny tree having similar morphology with orange and lemon, was photographed at GPS location of N=09°11'0.886" and E=036°24'0.941" in the study station. Flower between April and June which ripened after September.



Figure 10 The species *Ximenia americana*

Source: Photo by Gemechu Waktola (2019)

9. The species *Bidens prestinaria* (Keello-Oro.)

It is herb growing up to 2 meter high and like cabbage fresh leaves and terminal parts are cooked and eaten with bread. Photographed at GPS of N=09°12'0.389" and E=036°25'0.559" in the study station. It is very abundant and distributed flowering plant in the area which starts germination in April as rain rains and drops its flower and dies at the end of September. It prefers to grow in cold and mild climatic zones.



Figure 11 The species *Bidens prestinaria*

Source: Photo by Gemechu Waktola (2019)

10. The species Qillimmee-Oro.

Climber plant with very sweet and drinkable juice (black colour) used at fresh. Grow at cold and mild climatic zone in the study area. Flowering is during summer (June-July) bearing very delicious fruit in August on which other animals also compete with all age people to feed. The species are declining now day and are not seen well comparing with other edible plant species in the study area. It was pictured at GPS of N=09°12'0.649" and E=036°25'0.817" in the study site.



Figure 12 The species Qillimmee-Oro

Source: Photo by Gemechu Waktola (2019)

11. The species *Vitex doniana* (Qoqoraa-Oro)

A deciduous tree, usually 4-8m high, occasionally up to 15m, with a dense rounded crown. Its bark is light grey with numerous vertical fissures. Branchlets not hairy. Leaves are long stalked with 5-7 leaflets. Leaflets are usually widest towards the tip, more or less hairless. Flowers are numerous, white, tinged purple, usually borne in short, stout axillary cymes on a long stalk, Calyx and pedicels densely hairy. The fruits are ellipsoid to oblong, up to 2.5cm long, clasped by a calyx cup, green turning black on ripening. The ripe black fruit pulp is eaten raw. It has a sweet taste. Mostly children collect and consume the fruit but adults may also come in as consumers during food shortage periods.

The species is found in coastal woodlands and savannah, at low altitude in wetter areas and in upland grassland, and is also riverine plant. It is found in dry, moist and wet lowlands (0 - 1,800m). Propagation is by Seedlings, wildlings, and direct sowing but germination takes a long

time. The tree produces a teak-like, termite resistant timber that is used as poles and other purposes in house building. The species is further used as a source for firewood, livestock fodder (leaves & fruits), as bee forage, for shading. Bark, leaves, roots and fruits have medicinal value. It flower in March and April and ripen in January to March. Pictured at GPS location of N=09°12'0.350" and E=036°25'.368."



Figure 13 The species *Vitex doniana*

Source: Photo by Gemechu Waktola (2019)

12. The species *Senna perestinia* (Raamsoo-Oro)

It does not reach great size but contains seeds in the pods along with edible fruit like substances which is very sweet when eaten and also for making local alcoholic drinks. Grow up to 8m in Dry and Midland climatic zones. Flower starts at end of August and matured after November which lasts long months. The GPS location for the plant is N=09°12'0.408" and E=036°25'0.360" in the study station.



Figure 14 The species *Senna perestinia*

Source: Photo by Gemechu Waktola (2019)

13. The species *Cordia africana* (Waddeessa-Oro.)

Trees common in forest, forest remnant, cultivated areas, and is used in coffee plantations. It grows well in Dry, Moist and Wet mild climatic zones. Fruit is yellowish, hairy cups, flesh sticky which is edible and the plant also serves for firewood, timber (furniture, beehives, boxes, mortars), medicine (bark, roots), fodder (leaves), bee forage, mulch, soil conservation, ornamental, shade. A much branched deciduous tree with rounded crown and often crooked trunk, to 25 m, from a short bole. The bark is grey or pale brown, finely grooved but rough with age. Leaf is large, oval, 20x15cm, base rounded, veins prominent below; young shoots, leaf stalks, underside of leaves covered with soft brown hairs. Flower is showy; funnel shaped, thin white petals, sweet scented and attractive to many animals. Fruit is yellowish, hairy cups, flesh sticky and edible. Propagation is from seeds with slow germination rate. Flowering starts at the end of August and fruit ripen in November. The picture was taken with GPS location of N=09°12'0.582" and E=036°25'0.881" in the study station.



Figure 15 The species *Cordia africana*

Source: Photo by Gemechu Waktola (2019)

Analysis on questionnaire distributed to respondents

According to questionnaire distributed, 60(100%) respondents agreed the presence of wild edible plants in their area, listed the species vernacular names and parts used in table 2. Based on this, response of respondents in table 3 on parts of wild plant used were fruit/berries (43.33%), young shoot (36.67%), Leaf (10%), root (6.67%) and squash in pods (3.33%). Majority of respondents said that, fruit/berries were mostly used in the area followed by young shoot while stems and whole plant part were not used as source of food generally.

Table 3 Response of respondents to questionnaires on parts of wild edible plants consumed.

Parts mostly consumed	Respondents	Percentage
Root	4	6.67
Stem	0	0
Leaf	6	10
Fruit/berries	26	43.33
Young shoot	22	36.67
squash in pods	2	3.33
Whole plant	0	0
Total	60	100

Response of respondents in table 4 shown that the reason of consumption was 7(11.67%) for medication, 33(55%) for food, 10(16.67%) for refreshment, 5(8.33%) for both the reason it was found freely and easy to collect respectively. Majority of respondents responded that they were used for food sources followed by additional diet along with domestic foods as refreshment.

Table 4 Responses on why wild edible plants are consumed

Purposes of using the plants	Respondents	Percentages
Medicinal purposes	7	11.67
Food sources	33	55
For refreshment	10	16.67
Because it is free of costs	5	8.33
Available and easy to collect	5	8.33
Total	60	100

According to table 5, the response of respondents to abundance of wild edible plants in the area now day comparing to the past is decreasing 31(51.67%), no change 15(25%), nearer to extinction 12(20%), and increasing 2(3.33%). Most of the respondents believed that, the abundance is decreasing followed by those who said it is as previous and no any change happened to them.

Table 5 Response of respondents on abundance of wild edible plants

Current abundances	Respondents	Percentages
Decreasing	31	51.67
Appears as previous/ no change	15	25
Increasing	2	3.33
Enormously nearer to extinction	12	20
Total	60	100

According to response of respondents in table 6, the abundance is decreasing due to agriculture 21(35%), overgrazing 14(23.33%), deforestation 14(23.33%), charcoal production 5(8.33%), urbanization 4(6.67%), and to some extent plant disease 2(3.33%). This showed the major factors for disappearing of wild edible plants were agriculture, overgrazing and deforestation.

Table 6 Responses to the disappearances of edible plants

Causes of disappearing of plants	Respondents	Percentages
Deforestation	14	23.33
Plant diseases	2	3.33
Urbanization	4	6.67
Charcoal production	5	8.33
over grazing	14	23.33
Agriculture	21	35
Total	60	100

According to table 7, the conservation taken to minimize challenges to wild edible plants were keeping the surviving plants from danger 32(53.33%), restoration collaborating with concerned body 12(20%), replanting the damaged area by using indigenous knowledge from elders

11(18.33%), some said that no measurement was taken 5(8.33%). Majority of respondents said that they were keeping the previous existed plants from danger rather than planting new plants while some were tried to plant collaborating with concerned body.

Table 7 Responses on conservation

Restorations activities planned	Respondents	Percentages
Replanting the deforested areas by traditional way	11	18.33
Keeping survived plants from danger only	32	53.33
Restoring in collaboration with community and youth	12	20
Plants exist naturally and no need of conservation	5	8.33
Total	60	100

According to table 8, most of respondents responded that they were not tried to domesticate the wild edible plants with about 53(88.33%) but some had tried 7(8.67%).

Those who were not tried to domesticate put out reasons like lack of enough farm land along with domesticated plants 12(22.64%), slow growth rate 11(20.75%), long productivity period 9(16.98%), not give much yields 8(15.09%), not as much marketable 7(13.21%), no appropriate ways of preservation 2(3.77%).

Others 4(7.55%) also pointed out climber wild edible plants affects domestic plants and attract snakes to home, some plants contains thorn which pain children, no need to plant because they get freely and also they fear negative social perceptions comparing with domestic plants.

Table 8 Responses on domestication of wild edible

Reason for not domesticating	Respondents	Percentages
Slow growth rate	11	20.75
Long productivity cycle	9	16.98
Lack of convenience to domestic plants	12	22.64
Plants yield less	8	15.09
Not marketable	7	13.21
Cannot preserved for long time	2	3.77
Other reasons	4	7.55
Total	53	100

The analysis from group discussion and interview on positive and negative social perception of using wild edible plants also summarized as followings:

A) Positive aspects

1. Wild edible plants are useful in balancing diet along with crop plants, serve as sources of nutrients like vitamins and carbohydrates.
2. Consuming wild edible plants supports to resist famine, cope up with drought-born disasters in the spot of ripening and shortage of domestic crops yielding.
3. Wild edible plants are important in protecting soil from erosion; provide shades, shelter, feeds and oxygen for all.
4. Beside humans, wild edible plants are feeds and foods for animals
5. The root tubers of wild edible plants stay too long in the soil and helpful in needs.
6. Berries and fruits provide tasty sweet containing fructose and the like.
7. Some of the wild edible plants have medicinal values, fresh and free of pollutions.
8. Wild edible plants minimizes consumption of domesticated grains
9. Its diversity makes the user to have a multiple choice for feeding

B) Negative aspects

1. Very difficult to pick up or dig out edible root tubers that are deep in the ground.
2. Wild edible plants are seasonal, not available in need
3. The products are shared by many animals

4.1 Discussion

In the study site, most of the people were using variety of edible plants from forest which is yet continuing. They were using roots or tubers, leaves, young shoots, fruit or berries and other parts as a source of nutritional and medicinal values for many years. But now day those plants are threatened comparing to the past by many factors. Most of the informants stated the major factors for disappearing of wild edible plants were agriculture, overgrazing, deforestation, charcoal production and urbanization. Due to these reason, many wild edible plants were highly over-harvested and became scarce in the study area. This finding was in agreement with the report by Beyafer Tamene (2000) and Tigist Wondimu *et al.* (2006). It is also similar with results obtained in different investigation by Endashew Amenu (2007) which showed agriculture and population pressure severely threatened plant species in general. This is also similar to the a report which states the most common threats reported to wild edible plants were agricultural expansion, overgrazing/overstocking, deforestation and urbanization (Ensermu Kelbessa *et al.*, 1992; Addis, 2009; Asfaw Zemedu, 2009; Tilahun Teklehaymanot and Mirutse Giday, 2010). The people in the study site especially elders are rich in the indigenous knowledge concerned to wild edible plants which is not documented yet. However it is contrasted with the ideas of Fentahun Mengistu and Hager, H (2008), where children and youth are more knowledgeable than older people in case of wild food plant knowledge. This indigenous knowledge unless documented, is threatened by various factors like less contact with natural environment, influence of modern education, influence of western culture, availability of readymade products in shops and super markets and various negative social perceptions.

It is also founded 4 use categorise of these plant species accounting fruit/berries (69.23%), leaf/young shoot (15.88%), squash in pods(7.69%) and root tubers(7.69%).

Fruit was the major part of plant widely employed by local people followed by young shoot and leaf. It was the most commonly used for diet among other parts used in the area because it consumed at fresh and does not need any pre conditions for preparation and used as soon as collected unlike those need cooking which takes time. This result disagrees with result of EtanaTolasa (2007) who investigated the diversity of herbs as a dominant growth form.

The finding of Cunningham, (1997) indicated that the harvest of leaves or young shoot part have a treat to the deterioration of wild edible plants since the removal of leaves or young shoot part

limit the transformation of vegetative to reproduce development such as flower production and fruit/seed set, which in its turn limit the natural/wild regeneration of plants.

The dependency of local people on fresh materials in the study area put the plants under serious threat than the dried form as fresh materials are harvested directly and used soon with its extra deterioration with no chance of preservation. The livelihood of most indigenous people relied on fresh materials that had aggravated the decline of rare wild edible plants from the study area.

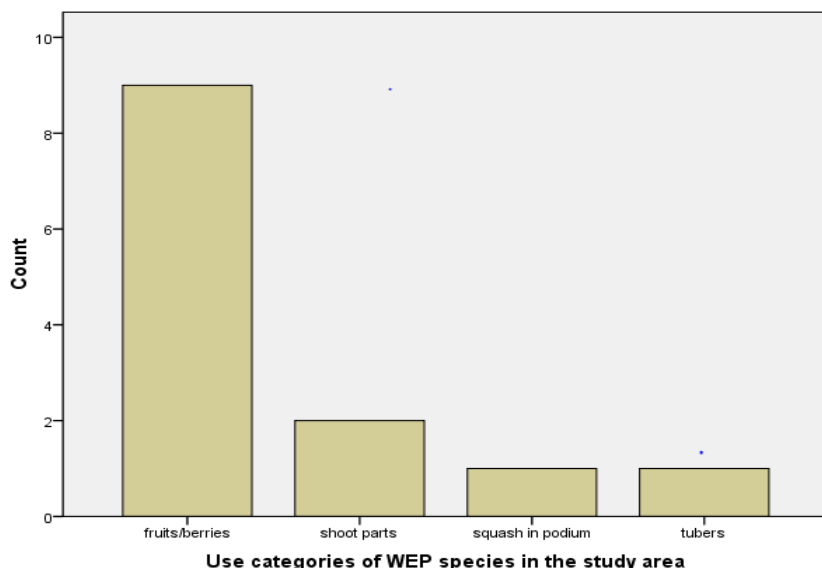


Figure 16 Bar chart showing use categories of wild edible

Identified wild edible plant species on how to use

The study also founded species with their how to use of which 69.23% used without cooking at fresh, 23.08% used cooked, and 7.69% used either fresh or fermented. Some of species eaten without cooking at fresh were fruit from *Carissa edulis*, *Syzygium guineense*, *Syzygium species*, *Vanquerieline ariseppala*, *Rubus apetalus*, *Ximenia americana*, *Cordia africana*, *Vitex doniana*, and (Qillimmee-Oro.). This agrees with Beyafers Tamene, (2000) and Tigist Wondimu *et al.* (2006), where fruits were reported as the most utilized plant parts out of the total parts used. This might be due to the taste they have, delicious and easily accessible and edible from the wild without any processing. As a result, fruits are important sources of essential vitamins and minerals for the communities in the study area. This is also disagree with works of Ali-Shtayeh *et al.* (2008) and Hinnawi (2010) who indicated most of edible

plant part used were leaves which consumed cooked. The Species which used cooked were *Biden sprestinaria*, *Rumex nervosus* and *Discorea species*. Species *Bidens prestinaria* and *Rumex nervosus* were collected, chopped into pieces, boiled or cooked with salts and oil or butter to be eaten with bread directly. According to information gathered from respondents on how to use *Discorea species*, it can be either cooked and eaten directly or dried and grinded forming dough mixing with water to make bread while squash in podium of species *Senna perestinia* can be mixed with water to ferment and made juice for drinking during the dry season. The rich sources of the area with edible plant parts from trees, Climbers, Shrubs, and herbs led the community members have accumulate indigenous knowledge over years on general edible plant use. Indigenous knowledge refers to the accumulation of knowledge, rule, standards, skills, and mental sets, which are possessed by local people in a particular area (Quanash, 1998). It is the result of many generations' long years' experiences, careful observations and trial and error experiments (Martin, 1995).

Seasonal availability of wild edible plants in the study area

Harvesting seasons of wild edible plants in the study area were broadly divided into rainy (May-September) and dry (October-April) seasons but some are harvested all seasons. There were about 46.15% species used in dry season including *Rubus apetalus*, *Vitex doniana*, *Cordia africana*, *Senna perestinia*, *Syzygium sp.*, *Vanquerialine ariseppala* while about 38.46% species were used in rainy season including *Carissa edulis*, *Ximenia americana*, *Bidens prestinaria*, Qillimmee (-Oro), and *Rumex nurvosus* (Table 2). The species *Syzygium guineense* (7.69%) can be used both in dry and rainy season based on its habitat distribution whether near river bank or in an open field or forest (Table 2). *Discorea species* (7.69%) can be available every season remaining under soil (Table 2). The 3 main rudimentary methods people of the area were using to harvest wild edible plants were plucking from plants (seeds with podium, fruit, shoots, etc.), digging (tubes and roots), and ground collecting of fallen seeds and fruits.

Wild edible plants in the study area are declining due to agricultural expansion, overgrazing, urbanization, less conservation of forests, charcoal production, deforestation for timber production and fire wood (Table 6). The low living standard of people and the lack of alternatives were the major factors responsible for the decline in useful forest resources as was stated by Taye Bekele *et al.* (2001).

Thus, identification of such multi-purpose plant species in the study area is very crucial from the conservation and management point of view. This is because the most valued plants species particularly should be given priority in order to conserve and manage them before extinction takes them away (Cunningham, 2001).

Bayafers Tamene *et al.* (2000), stated that as local people and communities encounter cultural changes, unless documented and conserved, the knowledge of the people on plant resource use could vanish forever.

4.2 Conclusion

The study conducted in the study area was founded and recorded about 13 edible wild plants through observation, questionnaires, interview and focal group discussion. Even though the area is rich with edible wild plant species, no information or little information is known to agricultural research community or other stake holders about the study area (Sasiga district). Fruits/Berries are the most frequently used due to its abundance and diversity followed by shoot or leaf, roots and squash in podium at their availability periods. Trees were the most distributed life forms of edible plants species from all followed by climbers, herbs and shrub respectively. Most of identified species were used fresh and some used cooked while few of them can be used fresh or fermented. Majority of identified and assessed species were collected in dry season, some in rainy season while few of them can be collected both in limited periods of season or all months of season. However, these plants are threatened now days. The main threats to these wild edible plants in the study area arose from farm land expansion, overgrazing, fire wood, charcoal production, deforestation, timber production and construction purposes. So, there is a need to asses, identify, document, and publish such information to enable specialized research institutions to carry out specific studies on a variety of issues concerning the prevalence and use of wild edible plants in the study area.

4.3 Recommendation

1. Identifying endangered or rare species in the study area and encouraging the local people to grow and domesticate in home gardens, mixing with domesticated crop plants to minimize food gap and ensure food security.
2. Since some wild edible plants are on the way to extinction all responsible bodies including governmental and nongovernmental organizations must be arrive and save

- the life of this plants by restoring and initiating the people through valuable training and establishment of forest priority area (parks), particularly for wild edible plants.
3. Local people should minimizes the factors affecting plant growth negatively and concerned body must involve in raising the awareness in the local people
 4. Governmental and nongovernmental organization should participate in awareness rising for indigenous knowledge by encouraging the people to exercise their skills and protect it by minimizing its loss.
 5. Further study or analysis must be carried out on nutritional contents of the plants.
 6. Special attention or focus must be given for threatened species in the study area.
 7. It should be worked on the indigenous knowledge of the people which is transferring only by oral and visual along with its documentations and keeping it from loss.
 8. Cultural bias which limit females from collecting and using wild edible plants must be focused and allow all sexes to feed and enjoy equally with their natural resources and environments avoiding discrimination.
 9. It will be very important to recognize the nutritional values of wild edible plants and set plans for conservation, management and sustainable utilization.

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Annex (Appendices)

Appendix 1 Questionnaire used for data collection

Questionnaire

Dear esteemed respondent, my name is GemechuWaktole. I am a graduate student at Addis Ababa University and here I interview you for the partial fulfilment of my course as thesis in which I am interested to explore the availability and the status of wild edible plants in your area. The information you provide will be used only for an academic purpose and has no harm or reward to you particularly. However, the accuracy of the information will help me to understand the real picture of wild edible plants in this area and will help in finding some solutions to the challenges, kindly request you to provide your genuine response. When you answer the following questions, think about plants used by your parents, Grandparents or your neighbours while growing up(home remedies, etc), as well as any plants you may still use today. Put (x) in the box provided for the close ended questions and write responses on the space provided for open ended.

Part I: Personal information of the respondent

1. Address: State/region-----,Zone-----,district-----,PAs-----
2. Age: 15-30 ☐ 31-45 ☐ 46-60 ☐ above 60 ☐
3. Sex: Male ☐ Female ☐
4. Education
 - A. Did not attend school/illiterate ☐
 - B. Can only read and write ☐
 - C. 1-4 grades ☐
 - D. 5-8 grades ☐
 - E. 9-12 grades ☐
 - F. TVET/College ☐
 - G. University ☐

Part II: Questionnaire used to collect data on wild edible plants

1. Is there a non- cultivated plants or crops which people consume from forest in your area?
 - A. yes ☐
 - B. No ☐
2. If your response to above question is yes, which part of the Wild Edible Plant is mostly consumed by the people?
 - A. roots ☐
 - B. stems ☐
 - C. leaves ☐
 - D. Fruits/berries ☐
 - E. young shoots ☐
 - F. Squash in pods ☐
 - G. Whole plants ☐
3. Why people consume or eat these plants?
 - A. medicinal purpose ☐
 - B. Food source ☐
 - C. for refreshment ☐
 - D. because it is free of cost ☐
 - E. Available and easy to collect ☐

4. What is abundance (distribution) of these plants now days comparing to the past?

- A. decreasing ☐ C. increasing ☐
 B. appears as previous/no change ☐ D. enormously nearer to extinction ☐

5. If you agreed with option “A” and “D” above, what is the cause of their thinning?

- A. deforestation ☐ C. urbanization E. overgrazing ☐
 B. plant disease D. charcoal production F. agriculture ☐

6. What measurement you have taken to restore them?

- A. replanting the deforested areas of WEP by traditional way ☐
 B. keeping the survived plants from danger only ☐
 C. restoring it collaborating with stakeholder/Governmental body ☐
 D. No measurement taken. ☐ E. others-----

7. Have you tried to domesticate the WEP? A. Yes ☐ B. No ☐

8. If your response to above question is “No”, why didn’t you try?

- A. has slow growth rate than domestic plants ☐
 B. has very long productivity period ☐
 C. because of lack enough farmland for all varieties of species along with domestic plants ☐
 D. because it does not give as much yields as of domestic plants ☐
 E. because it is not marketable as of domestic plants ☐
 F. because it is easily decomposed and cannot preserved ☐

Part III: Question for group discussion

1. Write the vernacular names of plant, their habitat, mode of consumption, availability period in the table accordingly and then put “x” under appropriate options of parts used and their habit.

No	Vernacular names	Parts used						Habit				Habitat	Availability period
		Le	Fr	Fl	R	Sh	W	T	Shr	Cl	He		
1													
2													
3													
4													
5													
6													
7													
8													
9													

10													
11													
12													
13													
14													
-													
-													

**Key: Lf=leaf, Fr=Fruit, Fl=Flower, R= Root, Shr=Shrub, Wp= Whole plant,
Tr= Tree, Sh= Shoot, Cl= Climber, He=Herb**

2. Positive satisfactions from feeding WEP.
3. Negative perception on feeding WEP(social attitudes)
4. Positive perception on feeding WEP(social attitudes)

Part IV: Interview questions

1. How young's and new arrival/guests identify WEPs from poisonous plants?
2. What are the general indigenous knowledge of people in collecting, preparing, consuming, preserving, and conserving of wild edible plants?
3. What are the ways information about wild edible plants passes from one generation to the next?

Appendix 2 Gaaffilee daataa funaannachuuf gargaaran

Gaaffilee

Kabajamtoota hirmaattota gaaffii kanaa, maqaan koo Gammachuu Waaqtolee yammuun ta'u, waraqaa qorannookoo degree 2^{ffaaf} ragaalee nafayyadan funaannachuuf waanan dhufeef shakkii tokko malee gaaffilee gaafatamtaniif deebii akka naa laattan kabajaan isiniif ibsuu barbaada. Xiyyeeffannoon gaaffilee koos biqiloota hinmadaqin bakkeedhumatti nyaataman irratti waan xiyyeefatuuf, isinis ragaalee haala itti fayyadamasarratti beektan, dhageessan akkasumas kan duris ta'e amma nyaatamaa jiran xiinxaluun gaaffilee cufamoof bakka saaxiniin jirutti mallattoo(x)guutun akkasuma gaaffilee banamoofimmoo yaada keessan bilisaan akka guuttan kabajaan isin gaafadha.

Ajaja I: Gaaffii waayee ofii keessanii ilaallatu

1. Teessoo: Naannoo....., Godina....., Aanaa....., Ganda.....
2. Umurii: 15-30 ☐ 31-45 ☐ 46-60 ☐ 60 ol ☐
3. Saala: Dhiira ☐ Dubara ☐
4. Sadarkaa barnootaa
 - A. Hin baranne ☐
 - B. Barreessuuf dubbisuu qofaan danda'aa ☐
5. Kutaa 1-4 baradheera ☐ D. Kutaa 5-8 baradheera ☐
 - E. Kutaa 9-12 baradheera ☐
 - F. BLTO/Koleejjii baradheera ☐
 - G. Yuuniversiitii baradheera ☐

Ajaja II: Gaaffilee barreefamaa waayee biqiloota hin madaqin garuu bakkeetti nyaataman irratti xiyyeeffate

1. Naannoo keessan biqiloonni hin madaqin garuu bakkeetti nyaataman jiruu?
 - A. Eeyyee ☐
 - B. Lakkiin ☐
2. Kan gubbaatti "Eeyyee" jettan, qaama biqilaa kamtu nyaatama?
 - A. Hidda ☐
 - B. Jirma ☐
 - C. Baala ☐
 - D. Ija ☐
 - E. Kichuu mataa ☐
 - F. Sanyii ☐
 - G. Qaama hundaa ☐
3. Faayidaan nyaattaniif maaliif?

A. Qorichummaaf ☐ B. Tola waan ta'eef ☐ C. Salphaatti waan aragamuuf ☐

D. Waanuma namni nyaatuuf nyaanna ☐ E. Hanqina nyaataaf ☐

F. Yaada biraa.....

4. Hedduminni/faca'iinsi biqiloota kanaa akkami?

A. Gad-bu'aa jira ☐ B. Akkuma duriiti ☐

C. Dabalaa jira ☐ D. Baduutti jira ☐

5. Yoo filannoo "A" fi "D" gubbaa filtan, sababnisaa maali?

A. Bosona ciruu ☐ B. Dhibee biqilootaa ☐ C. Babal'achuu magaalaa ☐

D. Omisha cilee ☐ E. Horii qorqisiisuu ☐ F. Qonna ☐

6. Badii gubbaatti filtan hir'isuuf tarkaanfiin fudhattan maali?

A. Mala aadan biqilaa dhaabuu ☐ B. Warruma hafe kunuunsuu ☐

C. Ogeessa biqilaa fi qaama dhimmi ilaalu waliin ta'uun dhaabu ☐

D. Tarkaanfiin fudhatame hinjiru ☐ E. Yaada biraa.....

7. Madaqsuuf yaaltanii? A. Eeyyee ☐ B. Lakkii ☐

8. Yoo "B" filtan, maaf hin yaalle?

A. Dafee hinguddatu ☐ B. Lafa Ga'aa dhabuu ☐ C. Callaa ga'aa hin argamsiisuu ☐

D. Gabaa gaha waan dhabeef ☐ E. Dafee waan alaa'uuf ☐

Ajaja III. Gaaffii marii-garee(biqiloota hin madaqne garuu nyaataman irratti xiyyeeffatu)

1. Maqaa biqilootaa, bakka itti argamu, fayyadamasaa, fi yeroo itti nyaatamu akkuma gaaffichaatti jalatti barreessaa akkasumas qaama biqilaa nyaataaf fayyadamtanii fi gosa biqiloota fayyadamtan jalattimmoo mallattoo(x) mari'adhaatii filadhaa guutaa.

Lak .	Maqaa biqilootaa afaan keessaniin	Qaama biqilaa nyaataaf fayyadamtan						Garaagarummaa biqilootaa				Bakka itti argamu	Haala itti fayyadamtan	Yeroo itti nyaataaf ga'u
		Bl	I j	Dr	Bs	H d e	Qh	Mu	Mx	Hd	M m			
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
-														
-														

Furtuu: Bl= Baala, Ij= Ija, Dr= Daraaraa, Bs= Baattuu Sanyii, Hde= Hundee, Qh= Qaama hundaa, M= Muka, Mx= Muka xixiqqaa, Hd= Hidda, Mm= Mukeen margaarraa olii

2. Nyaata booda gammachuu irraa argattan ibsaa.
3. Dhiibbaa ilaalchi uummataa namoota fayyadaman irratti qabu mari'adhaa.
4. Gaarummaa biqiloota kana nyaachuu waliigalaan ibsaa.

Ajaja IV: Gaaffii afaaniin deebi'u

1. Ijoolleeniif keessummaan akkamiin biqiloota nyaataman kana warra summaawaarraa addaan baasu?

2. Walumaa gala aadaan uummataa haala funaanuu, qopheessuu, fi tursiisuu waliin wal qabatee jiru maal fakkaata?
3. Waayeen nyaatamuu biqiloota kanaa akkamiin dhalootaa dhalootatti daddarba?

Appendix 3 Some of the samples of collected plant species and respondents



Figure 1 *Rumex narvosus*



Figure 2 *Bidens prestinaria*





Figure 3 *Discorea spp.*





Figure 4 Some of respondents

Declaration

First of all, I declared that this thesis is my genuine work and that all sources of materials used for this thesis have been justly acknowledged.

Declared by

Name of the Candidate: Gemechu Waktole

Signature Date

Name of Advisor Dr. Engineer Sutuma Edessa
