SINET: Ethiop. J. Sci., 36(2):93–108, 2013
 ISSN: 0379–2897

WILD EDIBLE PLANTS: SUSTAINABLE USE AND MANAGEMENT BY INDIGENOUS COMMUNITIES IN AND THE BUFFER AREA OF AWASH NATIONAL PARK, ETHIOPIA

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ABSTRACT: Wild edible plants are valuable resources in rural livelihoods for supplementing the staple food, ensuring food security, dietary diversification and sustained income. This study aimed to identify and document indigenous uses and management of wild edible plants being used by the Afar and Oromo communities in and the buffer area of Awash National Park. A total of 96 informants between the ages of 20 and 80 were identified using prior information. Data were collected using semi-structured interviews, guided field walk, discussions, market surveys and field observation. A total of 55 wild edible species were identified by members of the local communities. About 93% of the species were reported with their vernacular (local) names, where 69% were reported by the Afar and 87% by the Oromo communities. Eighty-nine percent of the species were classified as indigenous to the area, while 11% were classified as exotics. Preference ranking indicated that the fruits of *Balanites aegyptiaca* (L.) Del. are the most preferred edible fruit by the local communities. The local people access the National Park for some of the wild edible plants as they are largely depleted from the surrounding areas. The yet untapped potentials of the wild edible plants as food sources in the area need better attention in future research plans. The issue of conservation of wild edible plants is unquestionable to ensure household food security, dietary diversification and local communities' income, which also contributes to the biodiversity.

Keywords/phases: Awash National Park, domestication, Ethiopia, wild edible plants

INTRODUCTION

Wild edible plants have been used as source of food since ancient times (Özbucak *et al*., 2007). In Ethiopia, the rural populations have a wider knowledge, tradition and opportunity of using wild edible plants despite the variation in age, sex, time and season (Amare Getahun, 1974; Getachew Addis *et al*., 2005; 2009). Due to this reason, they are an integral part of the diet of many rural communities and hence have diverse contributions in various ways.

Firstly, wild edible plants are relevant to household food security and dietary diversification in some rural areas, particularly in the dry lands, to supplement the staple food, to fill the gap of seasonal food shortages and as emergency food during famine, prolonged drought or social unrest (Amare Getahun, 1974; FAO, 1988; Minnis, 1991; Turner and Davis, 1993; Ezeagu *et al*., 1996; Guinand and Dechassa Lemessa, 2001; Zemede Asfaw and Mesfin Tadesse, 2001; Teshome Soromessa and Sebsebe Demissew, 2002; Getachew Addis *et al*., 2005; Kebu Balemie and Fassil Kebebew, 2006; Getachew Addis *et al*., 2009; Bharucha and Pretty, 2010; Demel Teketay *et al*., 2010; Tilahun Teklehaymanot and Mirutse Giday, 2010; Debela Hunde *et al*., 2011b&c; Neudeck *et al*., 2012). A relatively high risk of crop failure and devastating famine causes increasing interest towards wild food plants by local communities (FAO, 1988; Minnis, 1991; Cotton, 1996). For instance, according to Dandena Gelmesa (2010) the use of wild foods increased from 10% in normal year to up to 40% in famine period. Based on this, Zemede Asfaw and Mesfin Tadesse (2001) reported that about 15% of the wild edible plants are considered as famine foods. Due to this reason, wild edible plants are widely consumed in food insecure areas as compared to relatively food sufficient areas, including most dry land areas (Amare

Getahun, 1974; Guinand and Dechassa Lemessa, 2001; Demel Teketay *et al*., 2010). As a result, wild edible plants have diverse contributions especially for women, children and the poor households. This is because they can contribute substantial amounts of dietary carbohydrates, lipids, fibre, proteins, minerals and vitamins, where some or most of the nutrients are reported by FAO (1986), FAO (1988), Turner and Davis (1993), Ezeagu *et al.* (1996), Vainio-Mattila (2000), Özbucak *et al*. (2007), Demel Teketay *et al*. (2010) and Debela Hunde *et al*. (2011c).

Secondly, many wild edible plants serve to generate household income to the poor households (FAO, 1988; Kebu Balemie and Fassil Kebebew, 2006; Getachew Addis *et al*., 2009; Bharucha and Pretty, 2010; Dandena Gelmesa, 2010; Demel Teketay *et al*., 2010; Assegid Assefa and Tesfaye Abebe, 2011; Debela Hunde *et al*., 2011b; Neudeck *et al*., 2012).

Thirdly, wild edible plants have also several indirect benefits such as sources of genetic diversity; encourages agroforestry practice in dry land areas; habitat for different organisms; rehabilitation of degraded lands; soil and water conservation as well as mitigation and adaptation to climate change (Demel Teketay *et al*., 2010; Debela Hunde *et al*., 2011b). Overall, the promotion of wild edible plants maintains the existence of biocultural heritage including valuable natural resources and the associated indigenous knowledge as well as their property rights (Debela Hunde *et al*., 2011b).

Despite this fact the role of wild edible plants in developing countries has been ignored and under-estimated for many years (Guinand and Dechassa Lemessa, 2001; Demel Teketay *et al*., 2010). For example, a study conducted in southern Ethiopia by Guinand and Dechassa Lemessa (2001) and in Afar Region by Dandena Gelmesa (2010) indicated that strong traditions, beliefs and religious taboos still limit people's psychological and mental willingness to domesticate and cultivate wild food plants. As a result, the indigenous knowledge, practice and skill associated with wild edible plants is highly developed, but it is poorly investigated and documented (Amare Getahun, 1974; Minnis, 1991). The information, in turn, is incomplete and scattered in various written documents, informal notes and oral traditions and transferred for generations in their daily activities (Zemede Asfaw and Mesfin Tadesse, 2001). This indigenous knowledge, practice and skill is gradually being eroded and lost due to urbanization, industrialization as well as mobility of youth from rural settings (Amare Getahun, 1974). Others include a rapid cultural, social and economic transformation of the people (Teshome Soromessa and Sebsebe Demissew, 2002; Tigist Wondimu *et al*., 2006; Bharucha and Pretty, 2010). In addition, a number of natural and anthropogenic factors contribute owards the loss of wild edible plants. Among these, agricultural expansion and human settlement, overgrazing, forest fire, deforestation for construction and energy supply, environmental degradation and global climatic change have a direct impact (Kebu Balemie and Fassil Kebebew, 2006; Tigist Wondimu *et al*., 2006; Tinsae Bahru, 2009; Bharucha and Pretty, 2010; Demel Teketay *et al*., 2010; Assegid Assefa and Tesfaye Abebe, 2011; Debela Hunde *et al*., 2011a; Debela Hunde *et al*., 2012; Neudeck *et al*., 2012). Thus, the development, promotion and wider utilization of wild edible plants particularly in the dry land areas undoubtedly resolve the food insecurity problems. To achieve this objective, wild edible plants could be integrated to the dry land agroforestry system and home gardens to improve people's livelihoods and maximize their income sources as well. Therefore, the present study aimed at investigating and documenting the sustainable use and management of wild edible plants by indigenous communities in and the buffer area of Awash National Park, Ethiopia.

MATERIALS AND METHODS

Study area

The study was conducted in and the buffer area of ANP, Ethiopia. The Park is located 225 km east of Addis Ababa on the Addis Ababa-Djibouti highway and situated between latitudes 8°50' and 9°10' north and longitudes 39°45' and 40°10' east (EMA, 1992) (Fig. 1). It is approximately 756 km^2 wide and is bordered by the Sabober plain to the west, the Addis Ababa- Djibouti highway and Awash River to the south and southeast as well as Kesem River and Filwuha Hot Springs to the north (Jacobs and Schloeder, 1993). Awash National Park is characterized by semi-arid agroclimatic conditions with a bimodal rainfall pattern, with the annual rainfall ranging between 400 and 700 mm per year (Jacobs and Schloeder, 1993). The climate data obtained from Awash Sebat Kilo station indicated that the highest mean

annual rainfall of the study area over 10 years was 120.8 mm recorded in July, whereas the lowest mean annual rainfall was 5.9 mm in February. Likewise, the highest average temperature over 10 years was 30.6°C recorded in June, while the lowest average temperature was 24.2°C recorded in December. The vegetation type of the ANP is classified under *Acacia-Commiphora* woodland (Sebsebe Demissew and Friis, 2009) in the Somali-Masai Regional Centre of plant endemism (White, 1983).

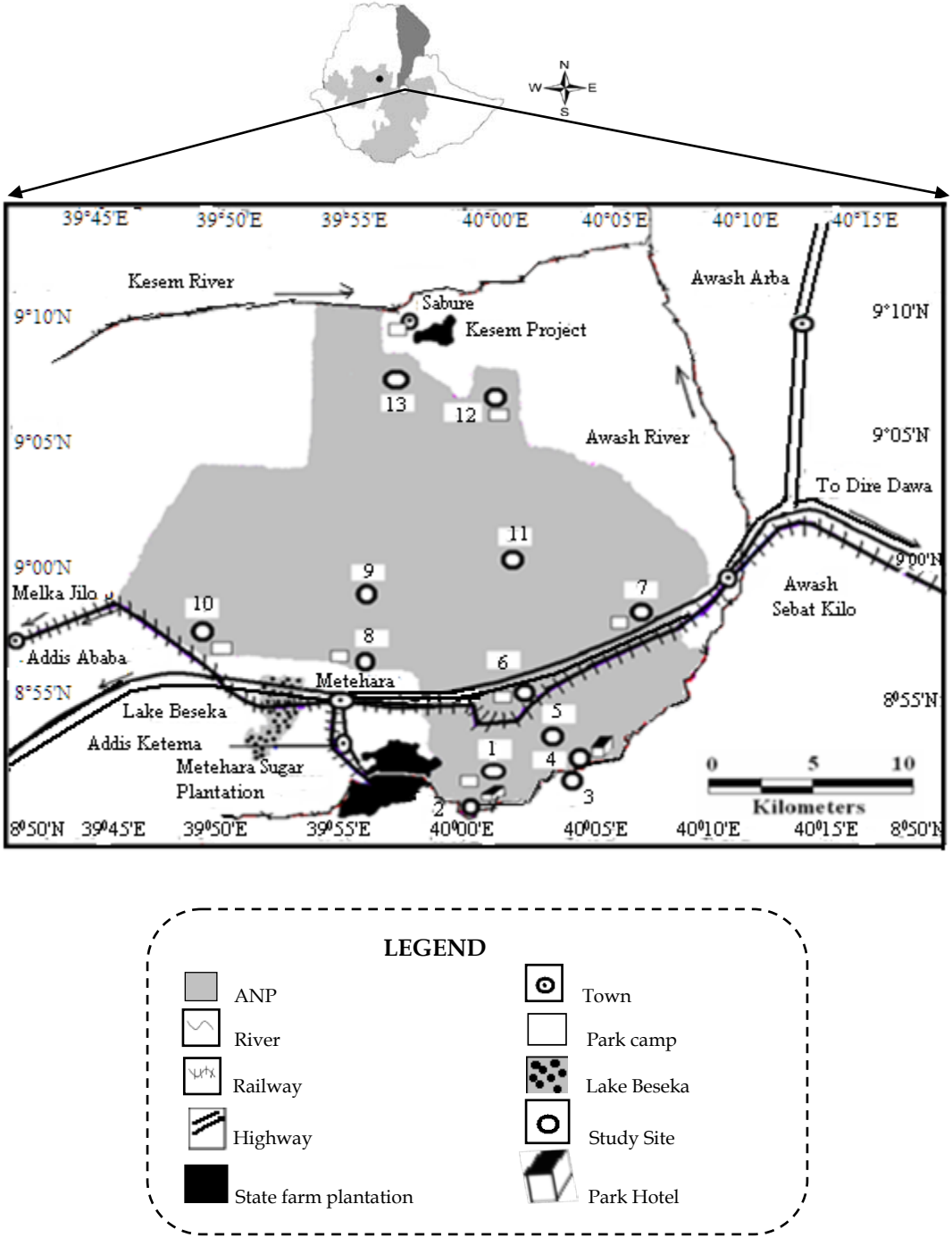

Figure 1. Location of the study area (adopted from Tinsae Bahru *et al.* (2011 and 2012a&b)).

Sampling and data collection

A reconnaissance survey was made from August 15 to 30, 2008 and 13 study sites (see Fig. 1) were selected. These sites were: 1. Gotu, 2. Awash River, 3. Awash Gorge, 4. Karreyu Lodge, 5. Ilala Sala plain, 6. Hamareti, 7. Geda, 8. Sogido, 9. Mt. Fentale, 10. Sabober, 11. Dunkuku (Kudu Valley), 12. Filwuha and 13. Sabure. Since there is no permanent human settlement found within the ANP, informants and key informants were sampled from selected *kebeles* and brought to the study area in order to carry out the investigation. *Kebele*, which is an Amharic term, is part of a *woreda* (district) and the smallest administrative division or structure in Ethiopia. In this case, key informants refer to informants having better indigenous knowledge regarding wild edible plants than informants. Accordingly, ethnobotanical data were gathered and the selection of informants and key informants was carried out based on prior information obtained from clan and religious leaders, knowledgeable elders, Park scouts (*i.e.,* who have served in the ANP for more than 12 years and members of either the Afar or Oromo communities), pastoralists and agro-pastoralists. Other informants included individuals from different age groups, gender and ethnicity as well as field observation. Despite the effort made to involve as many women informants, only few could take part in the study, as women are not encouraged culturally within the society. Other reasons are lack of permission from their husbands and socio-cultural grounds, which they refrain from describing. Consequently, the informants were sampled almost in equal proportions from the Afar and Oromo communities based on the vicinity of their *kebeles* and associated impact to the Park.

Interviewees were selected from four *kebeles* in the Afar Region (Awash, Doho, Dudub and Sabure *kebeles*), whereas five *kebeles* from the Oromia Region (Benti, Fate Leidy, Gelcha, Ilala and Kobo *kebeles*). A total of 96 informants (7 or 8 from each study site) constituting 76 men and 20 women, between the ages of 20 and 80 were, identified by systematic/stratified random sampling. Out of these, 36 key informants (32 men and 4 women) were selected. Following this, ethnobotanical data were collected, following Martin (1995), Cotton (1996) and Cunningham (2001). Semi-structured interviews, guided field walk, discussions, market surveys and field observation, with informants and key informants were applied based on a checklist of questions prepared ahead of time (Appendix 2). The interviews were administered in the local languages, the Afar (Af) and Oromo (Or) languages, with the help of native speakers as translators. The relevant data about the indigenous use and management of wild edible plants included. Items such as local names, plant use(s), part(s) used, mode of consumption, their management and other related aspects were collected. Voucher specimens of the wild edible plant species identified by informants were collected, identified and deposited at National Herbarium of Ethiopia, Addis Ababa University.

Data analysis

Ethnobotanical data were summarized and analyzed using simple frequency tables and figures as well as preference ranking method, following Martin (1995) and Cotton (1996). In preference ranking method, 15 out of the total key informants (*i.e*., 36) were randomly selected and participated in the ranking exercise. Accordingly, each of them ranked the selected seven most popular wild edible plants based on their taste qualities. The Jaccard's Coefficient of Similarity (JCS) was calculated to compare the similarity in wild edible plants composition between the Afar and the Oromo communities. The computation of JCS was made following Kent and Coker (1992). Accordingly, JCS was calculated between paired habitat types (A and B) as follows:

$$JCS = \frac{c}{c+b+a}$$

where,

a is the number of species found only in habitat A,
b is the number of species found only in habitat B,
c is the number of common species found in habitat A and B

RESULTS AND DISCUSSION

Taxonomic diversity, distribution and status of wild edible plants

The study area is generally endowed with diverse and rich sources of wild edible plants and these serve to the local communities as food sources and other multipurpose values. Fifty five species distributed in 39 genera and 26 families were identified by local communities within the study area as wild edible plants (Fig. 2 and Appendix 1). Eighty-nine percent of the species were reported with their vernacular names,

where 69% were reported by the Afar community and 87% by the Oromo community. Of these, 11 species were reported only by the Afar community, seven by the Oromo community, while the remaining 37 were reported by both of them (Table 1 and Appendix 1). The Afar community reported more number of wild edible plants than the Oromo community for this particular study. Some wild edible plants are confined in their distribution and/or in uses probably due to geographic location and climatic conditions. One best example is *Hyphaene thebaica* (L.) Mart., which is geographically restricted to Filwuha study site within the Afar community, but far from the Oromo community. Hence, only the Afar community has the opportunity and access to use this species for food and other various uses and unique to that social group. As a result, the knowledge associated with this wild edible plant is also confined only to this particular social group. A similar finding was also reported by Teshome Soromessa and Sebsebe Demissew (2002), where a particular species is used only by Zeyise people around the shore of Lake Chamo. In the same way, *Balanites aegyptiaca*, *Acacia tortilis* (Forssk.) Hayne and *Ficus sycomorus* L. are culturally the most important plant species in the Oromo culture. Thus, the above plant species are unique to this social group from the cultural point of view, and hence more respected and better conservation is given. Such knowledge and experience variation might be due to cultural, custom and language differences within commu

Table 1. The species similarity between the Afar and Oromo communities for wild edible plants and the JCS in the study area.

Community	Number of species reported
The Afar community	11
The Oromo community	7
Both communities	37
Total	55
JCS	0.67
% similarity	67.00

nities (Tinsae Bahru *et al*., 2011). On the contrary, the percentage similarity (about 67%) for the species, in turn, indicated that since the two groups situated almost in close geographical settings, there is a cultural diffusion and sharing of experiences and knowledge between them. Thus, they commonly utilize the same species in the study area (Tinsae Bahru *et al*., 2011).

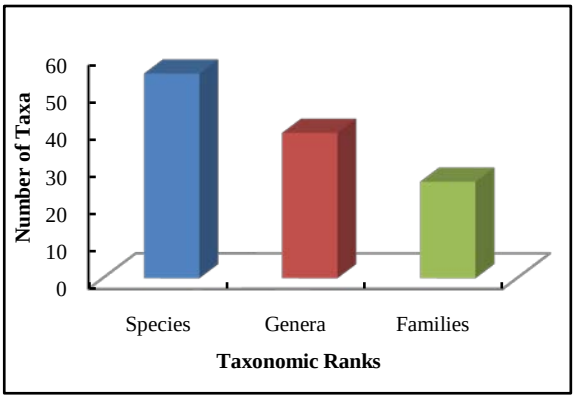

Figure 2. Summary of the taxonomic ranks of wild edible plants in the study area.

Some of the wild edible plants found in the study area were also reported elsewhere in other parts of Ethiopia and other parts of Africa. These include Amare Getahun (1974) 17 species, FAO (1988) 9 species, Peters *et al.* (1992) 38 species, Bein *et al.* (1996) 16 species, Zemede Asfaw (1997) 26 species, Bayafers Tamene (2000) 16 species, Zemede Asfaw and Mesfin Tadesse (2001) 25 species, Arbonnier (2004) 23 species, Gemedo-Dalle *et al*. (2005) 10 species, Getachew Addis *et al*. (2005) 16 species, Kebu Balemie (2006) 6 species, Kebu Balemie and Fassil Kebebew (2006) 7 species, Tigist Wondimu *et al*. (2006) 15 species, Azene Bekele (2007) 21 species, Getachew Addis *et al*. (2009) 17 species, Demel Teketay *et al*. (2010) 32 species, Tilahun Teklehaimanot and Mirutse Giday (2010) 11 species, Assegid Assefa and Tesfaye Abebe (2011) 10 species, Debela Hunde *et al*. (2011b) 21 species, Maroyi (2011) 7 species as well as Neudeck *et al*. (2012) 4 species. A report from West African dry zones by Arbonnier (2004) revealed that two species, *i.e*., *Capparis tomentosa* Lam. (root and fruit) and *Cissus quadrangularis* L. were toxic to humans and even other animals. Whereas the leaves and seeds of *Maerua angolensis* DC. are edible, its fruit is toxic. On the contrary, Peters *et al.* (1992) indicated that the above species are edible despite the variation in method of preparation and mode of consumption of plant parts. Therefore, further detailed study on mode of consumption and preparation, digestibility and nutritional composition as well as its toxic and anti-nutrient factors is very important before they can be used as human food (Sethi and Kulkarni, 1995; Ezeagu *et al*., 1996; Getachew Addis *et al*., 2009).

With respect to the diversity of the species gathered, the highest number of wild edible

plants were recorded in the family Fabaceae (24%), followed by Tiliaceae (11%), Capparidaceae (9%) and Rhamnaceae (6%) (Fig. 3 and Appendix 1). These botanical families are among the largest and the most economically important sources of food. This is because people tend to use wild edible plants that are easily available to them. The above figures are in agreement with the earlier study by Demel Teketay *et al*. (2010), where Fabaceae, followed by Tiliaceae comprised 32% and 18% wild edible plants, respectively. However, a study conducted around Dheeraa town (located between Adama and Asela), by Tigist Wondimu *et al*. (2006) indicated that Tiliaceae and Fabaceae families had the highest proportion of edible species, respectively. Similarly, Tilahun Teklehaimanot and Mirutse Giday (2010) and Assegid Assefa and Tesfaye Abebe (2011) reported that Capparidaceae and Tiliaceae had the highest number of edible species. In the study area, the remaining 6 and 16 families had 2 and 1 species each, respectively. Most of the species were classified as indigenous to the area, while only 11% of them were classified as exotic species (Appendix 1).

These plant families had different life/growth forms and different plant parts are consumed. Nineteen different plant parts (52.8%) in the family Fabaceae, followed by Tiliaceae and Capparidaceae (19.4%) each were used as edible plants. Fruits (52.8%) were the most commonly preferred plant parts in all the largest plant families, followed by edible gum (19.4%) and seeds (11.1%) (Table 2 and Appendix 1). As a result, fruits have a rich source of nutrients and social unrest (Debela Hunde *et al*., 2011c). Fruits easily available especially during emergency and as the most edible parts also reported in previous studies by Amare Getahun (1974), Turner and Davis (1993), Zemede Asfaw and Mesfin Tadesse (2001), Gemedo Dalle *et al*. (2005), Getachew Addis *et al*. (2005), Kebu Balemie and Fassil Kebebew (2006), Demel Teketay *et al*. (2010), Tilahun Teklehaimanot and Mirutse Giday (2010), Assegid Assefa and Tesfaye Abebe (2011), Maroyi (2011) and Neudeck *et al*. (2012). The results from this study disagrees with earlier studies by Lentini and Venza (2007) and Łuczaj and Szymański (2007), who reported that fruits are the second most important plant parts used in Sicily and Poland, respectively. Other plant parts such as bark, leaf, root, young shoot, leaf/fruit and young shoot/stem were also reported for edibility in different families.

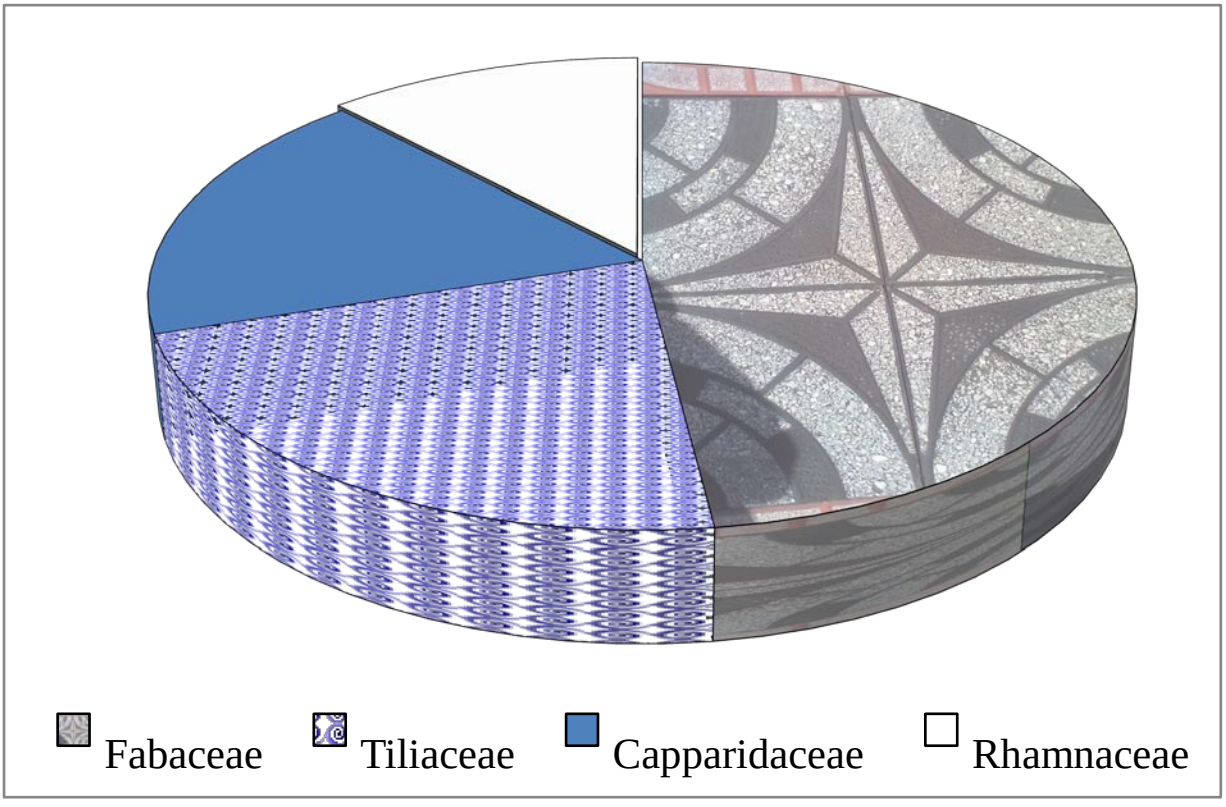

Figure 3. Graph showing t**he dominant families of wild edible plants recorded in the study area.**

Table 2. The dominant families of wild edible plants recorded and their respective plant parts used in the study area.

Parts used	Families and number of species of wild edible plants					
	Fabaceae	Tiliaceae	Capparidaceae	Rhamnaceae	Total	%
Bark	1	-	-	-	1	2.8
Fruit	7	6	3	3	19	52.8
Gum	5	-	2	-	7	19.4
Leaf	1	-	2	-	3	8.3
Root	1	-	-	-	1	2.8
Seed	4	-	-	-	4	11.1
Young shoot	-	-	-	-	-	-
Leaf & young shoot	-	-	-	-	-	-
Fruit & young stem	-	-	-	-	-	-
Leaf & young stem	-	1	-	-	1	2.8
Total	19	7	7	3	36	
%	52.8	19.4	19.4	8.3		100

Of the recorded wild edible plants in the study area, shrubs were the highest life forms with 34 species, followed by trees with 26 species from the total wild edible plants. On the other hand, climbers were the least life forms with 4% (Table 3 and Appendix 1). In addition, within the two major plant habits (*i.e*., shrubs and trees), fruits were the most commonly preferred plant parts, which accounted for 52%. Similar result was obtained by Kebu Balemie and Fassil Kebebew (2006), who revealed that shrubs and trees accounted for the highest proportion of life forms. Demel Teketay *et al*. (2010) also reported that shrubs accounted for the highest part.

The analysis indicated that wild edible plants are widely distributed in diverse habitats and wide altitudinal ranges as well. Shrub lands, bush lands and some grasslands having scattered shrubs and bushes yielded more species, which accounted for 46 wild edible plants. These habitats are located within the altitudinal ranges of 750–2,007 masl in Hamareti, Geda, Kereyu Lodge, Dunkuku, Gotu, Awash Gorge, Sabure and Mt. Fentale study sites. The more commonly found wild edible plants in these habitats included *Acacia, Grewia* and *Ziziphus* species, *Balanites aegyptiaca*, *Dobera glabra* (Forssk.) Poir., *Ximenia americana* L. and *Ehretia cymosa* Thonn. These were followed by the Awash riverine vegetation (at an altitude of 895 masl) that comprised with 31 plant species. These included *Ficus sycomorus* L., *Tamarindus indica* L., *Berchemia discolor* (Klotzsch) Hemsl., *Celtis toka* (Forssk.) Hepper & Wood, *Manilkara butugi* Chiov. and *Euclea racemosa* Murr. subsp. *schimperi* (A. DC.) White. On the other hand, the Ilala Sala grassland/open grassland (1,035 masl) as well as the *Hyphaene thebaica* dominating woodland (755 masl) around the Filwuha area had 16 species each. Such differences in altitudinal distribution in species diversity and richness of wild edible plants are mainly due to differences in agro-ecological zones. This further depends on the soil, temperature and rainfall of the area that has a direct impact on plant species (Azene Bekele, 2007).

During discussions, informants reported that some wild edible plants in the study area were consumed to supplement their staple food. In normal times, collection of such wild edible plants is mainly done by children and livestock herders, youngsters and the poorest families as also reported by Dandena Gelmesa (2010) for the collection and consumption of indigenous vegetables in Afar Region. It is common for the community to use wild edible plants as snack with milk. However, most of the consumption of wild edible plants is limited to times of food shortages due to crop failure, prolonged drought, famine or social unrest/war, when preferred alternatives are not available. During this time, people consume the plants so as to prevent starvation and sustain life. This may indicate that wild edible plants provide reserve food and may fill the gap in the nutrition of the local people during shortage of cultivated crops. This result is partly in agreement with Amare Getahun (1974), FAO (1988), Getachew Addis *et al*. (2005) and Dandena Gelmesa (2010). For instance, the Afar community consumes cooked or fresh fruits of *Dobera glabra* to fill the gap of seasonal food shortage as also reported by Guinand and Dechassa Lemessa (2001). Similarly, the gum of *Acacia senegal* (L.) Willd and *Acacia seyal* Del. are also used during social unrest and war by both

Table 3. Commonly reported habits of wild edible plants and their respective used parts used in the study area.

Parts used	Habits and number of species of wild edible plants					
	Climber	Herb	Shrub	Tree	Total	%
Bark	-	-	-	2	2	2.9
Fruit	1	3	22	14	40	58
Gum	-	-	5	6	11	16
Leaf	-	-	4	-	4	5.8
Root	1	1	-	-	2	2.9
Seed	-	1	2	3	6	8.7
Young shoot	1	-	-	-	1	1.5
Leaf & young shoot	-	-	-	1	1	1.5
Fruit & young stem	1	-	-	-	1	1.5
Leaf & young stem	-	-	1	-	1	1.5
Total	4	5	34	26	69	
%	5.8	7.3	49.3	37.7		100

the Afar and Oromo communities. According to Demel Teketay *et al*. (2010), *Acacia senegal* is the source of about 90% of the Gum Arabic of international trade since the quality of the gum is superior to that of any other acacias. Gum Arabic is traded commercially for use in dying, ink making and medicine (Azene Bekele, 2007; Demel Teketay *et al*., 2010). It is also used in feeding (cooking, pastries, syrups) as a gelling agent and emulsifier (Arbonnier, 2004). Likewise, FAO (1988) and Demel Teketay *et al*. (2010) indicated that the trees of *Acacia seyal* produce medium to good quality edible gum, which accounts for 10% of the annually exported Gum Arabic from Sudan. Therefore, their future potential as food crops should be considered and valued. Related observations and similar explanations were provided by Cotton (1996), Zemede Asfaw (1997), Cunningham (2001), Guinand and Dechassa Lemessa (2001), Zemede Asfaw and Mesfin Tadesse (2001), Kebu Balemie and Fassil Kebebew (2006), Tigist Wondimu *et al*. (2006) as well as Assegid Assefa and Tesfaye Abebe (2011).

The majority of wild edible plants (*i.e*., 82%) have reproductive parts (fruits and/or seeds) as edible parts, while only 20% of them are vegetative parts (leaves, stems, barks, roots, *etc*.) reported as edible parts. This report is in agreement with earlier study by Zemede Asfaw and Mesfin Tadesse (2001), who reported that 72% of species have reproductive parts as edible parts. Harvesting of these reproductive structures, *i.e*., fruits and/or seeds generally have a low impact on individual plants as compared to vegetative parts, *i.e*., leaves, stems, roots, etc. (Cunningham, 2001). Wild edible plants are important sources of essential vitamins and minerals, carbohydrates, proteins, lipids and fibber for the rural communities, where some or most of the nutrients are reported by FAO (1986), FAO (1988), Turner and Davis (1993), Ezeagu *et al*. (1996), Vainio-Mattila (2000), Özbucak *et al*. (2007), Demel Teketay *et al*. (2010) and Debela Hunde *et al*. (2011c). Therefore, this study provides remarkable evidence to the significant nutritional benefits of these plants to the communities in the study area. Most of the edible plant parts, *i.e*. 66.2%, were eaten raw without any further processing (cooking and spicing) by the local communities (Table 4 and Appendix 1). Similar trends were observed in other areas of the country by Getachew Addis *et al*. (2005) in Alamata, Cheha, Goma and Yilmana Denssa Districts, by Kebu Balemie and Fassil Kebebew (2006) in Derashe and Kucha Districts and by Tigist Wondimu *et al*. (2006) around Dheeraa town. This was followed by chewing the gum of plants and consuming the plant part after cooking, which accounted for 14.9% each.

The preference ranking of seven most important wild edible plants indicated that *Balanites aegyptiaca* attained the highest total score and ranked 1st, followed by *Grewia villosa* Willd. and others (Table 5). These species were frequently selected by all age groups of the local people and have good market value due to their good taste quality and source of income.

Table 4. Plant parts used and their respective mode of consumption of wild edible plants.

Parts used	Mode of consumption and number of species of wild edible plants						
	Boiled like coffee and tea	Chewing	Cooked	Raw	Roasted	Total	%
Bark	-	-	-	2	-	2	2.7
Fruit	-	-	1	39	2	42	56.8
Gum	-	11	-	-	-	11	14.9
Leaf	1	-	2	2	-	5	6.8
Root	-	-	2	-	-	2	2.7
Seed	-	-	3	4	-	7	9.5
Young shoot	-	-	1	1	-	2	2.7
Leaf & young shoot	-	-	1	-	-	1	1.4
Fruit & young stem	-	-	-	1	-	1	1.4
Leaf & young stem	-	-	1	-	-	1	1.4
Total	1	11	11	49	2	74	
%	1.4	14.9	14.9	66.2	2.7		100

Table 5. Preference ranking of seven most popular wild edible plants based on their taste qualities as perceived by key informants in the study area.

Wild edible plants	Key informants															Total score	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}		
Acacia senegal	5	5	5	3	6	7	5	5	6	5	5	5	4	4	6	70	3rd
Balanites aegyptiaca	6	6	7	7	7	3	6	6	7	2	2	7	3	5	7	81	1st
Ficus sycomorus	1	1	3	2	2	1	1	1	2	1	3	3	2	3	5	31	7th
Grewia villosa	4	4	6	6	5	5	4	4	5	7	6	6	6	7	3	78	2nd
Salvadora persica L.	3	3	4	5	4	6	3	3	4	6	4	4	5	6	4	64	4th
Tamarindus indica	2	2	2	1	3	4	2	2	3	4	7	2	1	2	1	38	6th
Ziziphus mucronata Willd.	7	7	1	4	1	2	7	7	1	3	1	1	7	1	2	52	5th

Note: "R" refers to key respondents or informants who participated in the ranking exercise

It was observed in the field that children and women collect some of the more popular fruits including *Balanites aegyptiaca*, *Grewia villosa* and *Tamarindus indica* as well as the gum of *Acacia senegal*, thereby selling the excess at the villages, road sides and in the nearest local markets (Table 6). *Tamarindus indica* was reported as one of the wild edible plants to have good local market demand (Zemede Asfaw, 1997; Bayafers Tamene, 2000; Zemede Asfaw and Mesfin Tadesse, 2001). *Ziziphus spina-christi* (L.) Desf. and *Ziziphus mucronata* are also known around *Dheeraa* town being sold in the local markets (Tigist Wondimu *et al*., 2006). The gum of *Acacia senegal* is also chewed by both children and elderly people and sold in local markets as also described by Gemedo Dalle *et al*. (2005) in Borana pastoral community. In addition to household consumption, various wild edible plants are sold at local markets, roadsides and villages to supplement household income. Income derived from the sale of wild edible plant species is of particular importance to people having low incomes in order to meet their basic needs. This result is in agreement with earlier studies by Kebu Balemie and Fassil Kebebew (2006) in Derashe and Kucha Districts, by Assegid Assefa and Tesfaye Abebe (2011) in Benna-Tsemay District and by Debela Hunde *et al*. (2011b) in semiarid east Shewa Zone. The marketability of wild edible plants in the study area was very low due to small production and supply (Debela Hunde *et al*., 2011b).

On the other hand, exotic but naturalized plant species such as *Lantana camara*, *Prosopis juliflora* (Sw.) DC. and *Solanum nigrum* L. also serve as sources of food. For instance, the local people frequently eat the bread made from the pods flour of *Prosopis juliflora* and they gave the plant a local name YEFERENJI BISKUT (Amharic), which shows that they relish the product calling it the white man biscuits. Similar reports around Dheeraa town by Tigist Wondimu *et al*. (2006) indicated that *Prosopis juliflora* is locally called YEZINJERO QITTA, which means bread of baboons. Likewise, women and children of the area also enjoy eating the fruits of *Lantana camara.* As a result they called it MIDAN DUBRA (Oromo language), which means women crop. This is in

Table 6. List of marketable wild edible plants at villages, roadsides and the nearest local markets in the study area.

Wild edible plants	Parts marketed	Wild edible plants	Parts marketed
Balanites aegyptiaca	Fruit	*Ziziphus spina-christi*	Fruit
Grewia villosa	Fruit	*Dobera glabra*	Fruit
Tamarindus indica	Fruit	*Manilkara butugi*	Fruit
Ziziphus mucronata	Fruit	*Lantana camara* L.	Fruit
Ficus sycomorus	Fruit	*Cordia monoica* Roxb.	Fruit
Ximenia americana	Fruit	*Acacia senegal*	Gum
Berchemia discolor	Fruit	*Acacia seyal*	Gum

line with earlier study done by Debela Hunde *et al*. (2011b). This naming might be due to the fact that women and children have more experience, knowledge and responsibility than men in the management, harvesting, processing and sale of edible wild plants (Gemedo Dalle *et al*., 2005; Demel Teketay *et al*., 2010; Tinsae Bahru *et al*., 2011). This may be due to a number of factors including occupation, culture, place of work, interaction existing between individuals, *etc*., which influence plant experience and knowledge both in age and gender among individuals (Cotton, 1996).

Multi-purpose values of wild edible plants

Some of the surveyed wild edible plants in the study area were found to have multi-purpose values in various ways such as forage/fodder, medicine, fuel wood (charcoal and firewood), material culture and miscellaneous uses. Out of the total recorded wild edible plants, about 40% of the species were found to have four distinct uses, 20% with five uses and 24% with six uses to the local people. Likewise, 2% of the species were found to have one and two distinct uses each and 15% with three uses. Food plants have multiple values to human beings, of which the value of food plants in the health care is quite prominent. A nutraceutical plant is defined as 'a food or food product that provides a health and medical benefit' (Kalral, 2003). It is a plant that provides health care while eaten. Out of the total wild edible plants, 25 species serve the local community both as sources of food and as traditional medicine. These nutraceutical plants are used to treat 25 human and five livestock aliments or health problems (Table 7 and Appendix 1). For instance, *Acacia tortilis*, *Balanites aegyptiaca, Grewia villosa, Salvadora persica* and *Ziziphus* spp. are the most commonly used nutraceutical plants as analyzed from the report of the local people in the area. On top of being eaten, the leaves of *Grewia villosa* are further used to treat Pasteurellosis, which is a common livestock disease in the area. Of these, three nutraceutical plants were reported by Tilahun Teklehaimanot and Mirutse Giday (2010) in the Lower Omo River Valley, four species by Debela Hunde *et al*. (2011a) in east Shewa Zone and two species by Tigist Wondimu *et al*. (2006) around Dheeraa town. Out of the total nutraceutical plants, leaves (40%) were the most widely used plant parts in the preparation of traditional remedies to treat human and livestock health problems. Collecting leaves may have a serious impact on the survival and continuity of wild edible plants as compared to fruits and/or seeds (Cunningham, 2001).

However, most of the informants stated that the local people do not take wild edible plants as credible sources of food, as compared to other major use categories, a general attitude which needs combating with awareness raising programmes. The residual effect of the reduced attention given to wild edible plants means that they are over-harvested for fuel wood, construction material, medicine and other minor uses and this could lead to species rarity and habitat modification. This might be a reason for the scarcity and rarity of some of the wild edible plants especially outside of the ANP. Such a problem was similarly described in other parts of Ethiopia by Bayafers Tamene (2000) in the Cheffa area and by Tigist Wondimu *et al*. (2006) around Dheeraa town. Consequently, some wild edible plants were scarce and not easily accessible outside the ANP and even inside and at the buffer areas of the park (*e.g.,* Geda, Sogido, Sabober and Sabure study sites), where more human impact is imposed. These include *Tamarindus indica*, *Balanites aegyptiaca*, *Ziziphus spina-christi*, *Salvadora persica*, *Berchemia discolor*,

Table 7. List of wild edible plants with Nutraceutical values.

Scientific name	Part used	Disease treated	Scientific name	Part used	Disease treated
Acacia mellifera (Vahl) Benth.	Root	Stomachache	*Ficus vasta* Forssk.	Sap	Haemorrhoids
Acacia nilotica (L.) Willd. ex Del.	Leaf	Toothache	*Grewia villosa*	Leaf	Pasteurellosis **
Acacia oerfota (Forssk.) Schweinf.	Bark	Evil eye	*Indigofera arrecta* Hochst. ex A. Rich.	Root	Snake bite
Acacia senegal	Gum	Constipation	*Indigofera coerulea* Roxb.	Leaf	Snake bite
Acacia tortilis	Bark	Wound	*Ocimum spicatum* Deflers	Leaf	Eye disease
Asparagus africanus Lam.	Root	Babesiosis **	*Prosopis juliflora*	Leaf	Diarrhea
Balanites aegyptiaca	Fruit	Snake bite	*Rhus vulgaris* Meikle	Leaf	Anthrax **
Cadaba farinosa Forssk.	Root	Gonorrhea	*Salvadora persica*	Root	Expel placenta
Capparis cartilaginea Decne.	Leaf	Intestinal parasites **	*Senna occidentalis* (L.) Link	Root	Snake bite
Capparis tomentosa	Fruit	Cancer	*Tamarindus indica*	Fruit	Diarrhea
Cissus quadrangularis	Seed	Black leg **	*Ziziphus mucronata*	Leaf	Dandruff
Ehretia cymosa	Leaf	Toothache	*Ziziphus spina-christi*	Leaf	Dandruff
Ficus sycomorus	Sap	Hepatitis			

Note: ** Nutraceutical plants used against livestock ailments. All the rest nutraceutical plants used against human ailments.

Ximenia americana, *Grewia villosa*, *Ficus sycomorus* and *Ziziphus mucronata*. On the contrary, the ANP is home to threatened and near-threatened endemic species (*e.g.,* Dunkuku, Awash River, Ilala Sala plain, Hamareti and Gotu study sites), where we cannot find such species outside the Park. This showed that the Park is not only a tourist attraction centre, but also a major plant biodiversity hot spot area. Thus, the presence of the ANP in the area has created a special opportunity to maintain and conserve wild edible plants in particular and wildlife in general.

Threats to wild edible plants

Since the local people have an intimate relationship towards their natural environment, they are familiar with the threats on wild edible plants. Therefore, during both group and individual discussions, key informants identified seven major threats to wild edible plants by priority ranking in the ANP. Accordingly, overgrazing/over browsing (21.7%), followed by removal of woody plants (19.9%) for different purposes (e.g. firewood and charcoal production, building and construction, fencing materials, *etc.*) were the major threats. These were followed by human settlement and agricultural expansion as well as burning forests, in their respective orders (Tinsae Bahru, 2009; Tinsae Bahru *et al*., 2011 and 2012a&b). Some or most of the above results are also reported in different areas by Kebu Balemie and Fassil Kebebew (2006), Demel Teketay *et al*. (2010), Assegid Assefa and Tesfaye Abebe (2011), Debela Hunde *et al*. (2011a; 2012) and Neudeck *et al*. (2012). Due to these reasons, plant species such as *Acacia prasinata* Hunde and *Acacia negrii* Pic.-Serm. are identified as threatened and near-threatened endemic species, respectively in and the buffer area of the ANP as also reported by Tinsae Bahru (2009) and Tinsae Bahru *et al*. (2011).

Conservation and management of wild edible plants

Local communities in the study area have various indigenous management strategies of conservation. Due to their diverse uses, wild edible plants are left to widely grow in farmlands (*e.g., Acacia tortilis, Ziziphus mucronata* and *Ziziphus spina-christi*), farm boundaries and watershed areas. Others frequently appear around homesteads as live fence (*e.g., Lantana camara*, *Prosopis juliflora* and *Balanites aegyptiaca*), shade (*Ficus sycomorus, Ficus vasta, Acacia tortilis* and *Dobera glabra)* and along roadsides and degraded areas (*e.g., Senna occidentalis*). Besides, personal observation and communication revealed that children and livestock herders bring the seeds after consuming the fruits back to homes and cultivate them around homesteads and fence the seedlings saved from livestock foraging. This gives some hint for the possibility of conservation and domestication of wild edible plants. Community norms are such that cutting of valuable shrubs and trees, particularly for charcoal making as well as killing of wildlife, is strictly prohibited unless a special permission is given by the clan chiefs of the Afar and Oromo communities. Similarly, shrub and tree fodders

for livestock feed during dry seasons and drought are lopped or leaves, seeds and pods are shaken down using a sort of sticks instead of cutting down the plants. These are sustainable modes of resource use that need to be encouraged and applied by blending them with standard modern management practices. Despite this fact, informants reported that charcoal production was one of the major threats to wild edible plants in the study area. This might be due to the fact that indigenous conservation and management practices have been weakened, gradually eroded and even lost forever by cultural changes, increased human interest and shifting towards cash economics (Cotton, 1996, Cunningham, 2001). Other factors include urbanization, industrialization as well as mobility of youth from rural settings (Amare Getahun, 1974) as well as rapid socio-economic changes of the community (Teshome Soromessa and Sebsebe Demissew, 2002; Tigist Wondimu *et al.*, 2006).

CONCLUSION AND RECOMMENDATIONS

Considerable numbers of wild edible plant species that are suitable for human consumption are available in the study area. They are valuable resources in rural livelihoods for supplementing the staple food, ensuring food security, dietary diversification and sustained income in the dry land areas. Thus, more research is needed to assess their nutritional value and economic as well as ecological contributions. These species could in the future be domesticated and integrated into the dry land agroforstery and home garden in order to better ensure food security, dietary diversification and maximise household income. Thus, promoting their potential uses and initiating their domestication and cultivation, studying the nutritional values, propagation techniques, marketing and value addition within the communities through cultural transformation is very crucial. This can be realized through the implementation of appropriate conservation strategies designed to rescue/salvage the endangered and threatened species before situations drive them to eminent local extinction. Concrete evidence on nutritional values and the possible toxic effects of some wild edible plants were not confirmed despite their positive/negative perception for their edibility (*e.g., Capparis tomentosa*, *Cissus quadrangularis* and *Maerua angolensis*). Therefore, further detailed study on mode of consumption and preparation, digestibility and nutritional composition as well as the possible toxic constituents and anti-nutrient factors of the wild edible plants is very important before they can be used as human food.

ACKNOWLEDGEMENTS

The first author would like to acknowledge the Horn of Africa Regional Environment Centre and Network (HoA-REC/N) Demand Driven Action Research (DDAR) for its financial support. He is also particularly deeply indebted to members of the Afar and the Oromo communities of the study area, who actively participated in the study, for their hospitality, patience and unreserved kindness and willingness to share their indigenous knowledge during data collection. Awash-Fentale Wereda and Fentale Wereda Offices, all the staff members of the National Herbarium, Addis Ababa University and ANP, the former Department of Biology and all others who directly or indirectly offered their help are thanked for various supports. Last but not least, we are indebted to the anonymous reviewers of *SINET* for their critical evaluation and valuable comments on an earlier version of the manuscript.

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Appendix 1. List of wild edible plants in the study area (ANP).

Key: Major use category (MUC) [F = Forage/fodder; Fu = Fuel wood; M = Medicine; Fo = Food; Mc = Material culture; Mi = Miscellaneous uses]; **Habit** (Ha) [C-Climber; H-Herb; S-Shrub; T-Tree]; [* Species reported by the Afar community; ** Species reported by the Oromo community; Species without **asterisks** are reported by both communities; [E]Exotic species; [N]Nutraceutical plants]; **Part (s) used** (PU) [B = Bark; F = Fruit; FN = Fruit (nut); G = Gum; L = Leaf ; R = Root; S = Seed; YS = Young shoot; YoS = Young stem]; **Mode of consumption** (MC) [B = Boiled like coffee & tea; C = Chewing; Co = Cooked; R = Raw; Ro = Roasted]; **Collection No. (CN).**

Scientific name	Family name	Ha	Vernacular name	PU	MC	MUC	CN
Acacia brevispica Harms	Fabaceae	S	HAMARESA (Or)	L	B	F, Fu, Fo, Mc	TB204
Acacia mellifera (Vahl) Benth. [N]	Fabaceae	S	MAKA'ARTO/MA'EGHERTO (Af); SEPENE GURO (Or)	F; G	R; C	F, Fu, M, Fo, Mc, Mi	TB011
Acacia nilotica (L.) Willd. ex Del. [N]	Fabaceae	T	KESEL-E (-TO) (Af); BURKUKE (Or)	G	C	F, Fu, M, Fo, Mc, Mi	TB003
Acacia oerfota (Forssk.) Schweinf. [N]	Fabaceae	S	GOMERTO (Af); AJO (Or)	F	R	F, Fu, M, Fo, Mc, Mi	TB045
Acacia senegal (L.) Willd. [N]	Fabaceae	S	ADADO (Af); SEPENSA DIMA/SEPESA (Or)	S; G	R; C	F, Fu, M, Fo, Mc, Mi	TB001
Acacia seyal Del.	Fabaceae	T	ADIGENTO/MAKANI (Af); WACHU (Or)	B; G	R; C	F, Fu, Fo, Mc	TB190
Acacia tortilis (Forssk.) Hayne [N]	Fabaceae	T	E'IBITO/BEHBEY (Af); DEDECHA (Or)	F/S; G	R; C	F, Fu, M, Fo, Mc, Mi	TB026
Asparagus africanus Lam. [N]	Asparagaceae	C	HIDE SERE/SERITI (Or)	YS	R/Co	M, Fo, Mc, Mi	TB130
Balanites aegyptiaca (L.) Del. [N]	Balanitaceae	T	UDAYITO/ALA'ITO (Af); BEDENO (Or)	F; G	R; C	F, Fu, M, Fo, Mc, Mi	TB004
Berchemia discolor (Klotzsch) Hemsl.	Rhamnaceae	T	YEYEBITO (Af); JEJEBA (Or)	F	R	F, Fu, Fo, Mc	TB191
Boscia salicifolia Oliv. *	Capparidaceae	S	-	L	R	F, Fu, Fo, Mc	TB107
Boswellia papyrifera (Del.) Hochst.	Burseraceae	T	LUBATEN (Af); MUKE ITANA (Or)	G	C	F, Fu, Fo, Mc	TB099
Cadaba farinosa Forssk. *, [N]	Capparidaceae	S	FURA (-YITO)/NUMHELE (Af); KELIKNATIONHA (Or)	L & YoS	Co	F, Fu, M, Fo, Mc, Mi	TB031
Capparis cartilaginea Decne. [N]	Capparidaceae	S	DELENSISA (Or)	F; G	R; C	Fu, M, Fo	TB117
Capparis tomentosa Lam. **, [N]	Capparidaceae	S	HARENIGEMA (Or)	F; G	R; C	F, Fu, M, Fo, Mc, Mi	TB084
Ceiba pentandra (L.) Gaertn. *	Bombacaceae	T	FERENJI TUTI (Af)	F	R	F, Fu, Fo, Mc, Mi	TB083
Celtis toka (Forssk.) Hepper & Wood	Ulmaceae	T	GUDIBI'ATO (Af); METEKOMA (Or)	F	R	F, Fu, Fo, Mc	TB192
Cissus quadrangularis L. [N]	Vitaceae	C	ALI'E (Af); CHOPHI (Or)	F & YoS	R	M, Fo, Mc	TB053
Cissus rotundifolia (Forssk.) Vahl **	Vitaceae	C	BURI (Or)	R	Co	F, Fo, Mc	TB111
Commiphora habessinica (Berg) Engl.	Burseraceae	S	HEDAYITO (Af); HAMESA (Or)	F	R	F, Fu, Fo, Mc, Mi	TB086
Cordia monoica Roxb.	Boraginaceae	S	MINE GURE/SUBULA (Af); MEDERO (Or)	F	R	F, Fu, Fo, Mc	TB025
Dobera glabra (Forssk.) Poir.	Salvadoraceae	T	GHERSA (Af); ADE (Or)	F/S	R/Co	F, Fu, Fo, Mc, Mi	TB195
Ehretia cymosa Thonn. [N]	Boraginaceae	S	MINE GURE (Af); ULAGA (Or)	G; F	C; R	F, Fu, M, Fo, Mc	TB097
Euclea racemosa Murr. subsp. *schimperi* (A. DC.) White **	Ebenaceae	S	MIESSA (Or)	F	R	F, Fu, Fo, Mc	TB200
Ficus sycomorus L. [N]	Moraceae	T	SUBULA (Af); ODA (Or)	F	R	Fu, M, Fo, Mc, Mi	TB043
Ficus vasta Forssk. [N]	Moraceae	T	MARA'ITO (Af); KILTU (Or)	F;G	R; C	Fu, M, Fo, Mc, Mi	TB047
Flacourtia indica (Burm.f.) Merr. **	Flacourtiaceae	S	-	F	R	F, Fu, Fo, Mc	TB014
Grewia bicolor Juss.	Tiliaceae	S	ADIBI'ATO (Af); HARORESA (Or)	F	R	F, Fu, Fo, Mc	TB185
Grewia ferruginea Hochst. ex A. Rich.	Tiliaceae	S	ADIBI'ATO/FO (Af); HARORESA (Or)	F	R	F, Fu, Fo, Mc	TB186
Grewia schweinfurthii Burret	Tiliaceae	S	ADIBI'ATO (Af); MUDHE GURE (Or)	F	R	F, Fu, Fo, Mc	TB181
Grewia tenax (Forssk.) Fiori	Tiliaceae	S	HEDAYITO/HUDA/MINE GURE (Af); DEKA TUNTUNA (Or)	F	R	F, Fu, Fo, Mc	TB038
Grewia velutina (Forssk.) Vahl	Tiliaceae	S	ADIBI'ATO (Af); HARORESA (Or)	F	R	F, Fu, Fo, Mc	TB054
Grewia villosa Willd. [N]	Tiliaceae	S	GARIWA (Af); OGOMDI (Or)	F	R	F, Fu, M, Fo, Mc, Mi	TB024
Hibiscus micranthus L. f. *	Malvaceae	H	AKILEHENA (Af)	F	R	F, Fu, Fo, Mc	TB145
Hyphaene thebaica (L.) Mart. *	Arecaceae	T	UNGA/GARA'ITO (Af); METI (Or)	FN	R	F, Fu, Fo, Mc	TB128
Indigofera arrecta Hochst. ex A. Rich. [N]	Fabaceae	H	HERCHUMEN (Or)	R	Co	Fu, M, Fo, Mc	TB008
Indigofera coerulea Roxb. **, [N]	Fabaceae	H	ADULALA (Or)	F	R	Fu, M, Fo	TB120
Lantana camara L. [E]	Verbenaceae	S	BADUWA HARA (Af); MIDAN DUBRA (Or)	F	R/Ro	F, Fu, Fo, Mc, Mi	TB050
Maerua angolensis DC. *	Capparidaceae	S	DUNIBIAYITO/SEKILELI'A (Af)	F; L	R; Co	F, Fu, Fo, Mc	TB136
Manilkara butugi Chiov.	Sapotaceae	T	BUTUYE (Af); BUTUJI (Or)	F	R	F, Fu, Fo, Mc, Mi	TB194
Momordica trifoliolata Hook.f. **	Cucurbitaceae	C	KORICHA AJA (Or)	F	R	Fo	TB138
Moringa stenopetala (Bak.f.) Cuf.	Moringaceae	T	-	L & YS	Co	Fu, Fo, Mc	TB096
Ocimum spicatum Deflers *, [N]	Lamiaceae	S	MISE (Af); KORCHA MICHI (Or)	S	R	Fu, M, Fo	TB139
Parkinsonia aculeata L. *, [E]	Fabaceae	S	-	F	R	F, Fu, Fo, Mc	TB057
Premna resinosa (Hochst.) Schauer *	Lamiaceae	S	BOBA'O (Af); URGESA (Or)	F	R	F, Fu, Fo, Mi	TB035
Prosopis juliflora (Sw.) DC. *, [E, N]	Fabaceae	S	WEYANE (Af & Or)	F/S	R	F, Fu, M, Fo, Mc, Mi	TB020
Rhus vulgaris Meikle [N]	Anacardiaceae	S	DEBOBESA (Or)	F	R/Ro	F, Fu, M, Fo, Mc	TB103
Salvadora persica L. [N]	Salvadoraceae	S	HADAYITO/DADAHO (Af); ADE (Or)	F; L	R; Co	F, Fu, M, Fo, Mc	TB039
Senna occidentalis (L.) Link *, [E, N]	Fabaceae	H	FERAHIYITI (Af); SHESHEKISA (Or)	S	Co	M, Fo, Mi	TB183
Solanum nigrum L. **, [E]	Solanaceae	H	SARA KORPO (Or)	F	R	F, Fo	TB034
Sterculia africana (Lour.) Fiori	Sterculiaceae	T	KERERI (Or)	S; B	Co; R	F, Fu, Fo, Mc, Mi	TB022
Tamarindus indica L. [E, N]	Fabaceae	T	SEGENTU (Af); ROKA (Or)	F	R	F, Fu, M, Fo, Mc, Mi	TB126
Ximenia americana L.	Olacaceae	T	HUDHA (Or)	F	R	F, Fu, Fo, Mc	TB199
Ziziphus mucronata Willd. [N]	Rhamnaceae	T	KUSIR-A (-TO) (Af); KURKURA HADO (Or)	F	R	F, Fu, M, Fo, Mc, Mi	TB056
Ziziphus spina-christi (L.) Desf. [N]	Rhamnaceae	T	KUSIR-A (-TO) (Af); KURKURA (Or)	F	R	F, Fu, M, Fo, Mc, Mi	TB041

Appendix 2. Format for collecting ethnobotanical data of wild edible plants with a checklist of questions for semi-structured interview, discussions and guided field walk.

PART ONE: PERSONAL INFORMATION

1. Date _____ Month _____Year _____
2. Name of respondent _____
3. Respondent's sex: Male _____ Female _____
4. Age _____ Community/Nation _____ Language_____ Occupation _____
5. Respondent's address: Region ___ Zone ___ Woreda ___ Kebele __ Village ____
6. Respondent's religion: 1. Orthodox, 2. Muslim, 3. Other specify _____
7. Educational status: 1. Uneducated, 2. Educated (Primary, secondary, Other specify)_____
8. Respondent's marital status: 1. Single, 2. Married, 3. Widow, 4. Divorced
9. Family size: Men _____ Female _____
10. The role of respondent in the household: 1. Husband, 2. Wife, 3. Son/Daughter, 4. Other specify _____
11. The role of respondent in the local communities? 1. Clan leader, 2. Religious leader, 3. Kebele Official or representative, 4. Knowledgeable elder, 5. Other specify _____

PART TWO: GENERAL INFORMATION

1. Are you indigenous or native to the area? 1. Yes, 2. No
2. If your answer is "Yes" to Question Number 1, how long you have lived to this area? _____
3. What are the major livelihood options (main job) currently you are engaged in? E.g. Farmer, pastoralist, semi-pastoralist, trader, forest user (Collecting wild edible plants, traditional medicinal plant practitioner, carver, charcoal maker, etc.)
4. How long you involved in this major livelihood options (main job)? _____

PART THREE: ETHNOBOTANICAL INFORMATION

1. Do you know any plant use in your area? 1. Yes, 2. No
2. If your answer is "Yes" to Question Number 1, what plant uses is common to you? E.g. wild edible plants, forage/fodder plants, fuel wood plants (firewood and charcoal making), plants that treat common ailments of humans, animals or both in the area, plants that serve for material culture (construction purposes or traditional art and handicrafts) or other miscellaneous (minor) uses
3. What are the wild edible plants common to you in your area?
4. What is the local name of this particular wild edible plant?
5. Which part of the plant do you use? E.g. Leaves, stem, root, gum, fruit, seed, etc.
6. What is the life/growth form (habit) of the plant? E.g. Tree, shrub, herb, climber, etc.
7. Where does it grow (habitat) in your area? E.g. forest/woodland, shrub land, grassland, riverside, degraded land, etc.
8. How is its mode of consumption? E.g. raw, cooked/roasted, raw/cooked, any ingredients added (e.g. spicing), etc.
9. Of these, what are the most popular wild edible plants commonly used by local communities? List down in their respective orders.
10. What are the major selection criteria to these popular wild edible plants? E.g. based on their abundance, low labour requirement to collect them, simplicity of processing for consumption, tasting qualities, time of availability, etc.
11. At what time of the year wild edible plants are commonly practiced by local communities? E.g. during normal times, food shortage, famine/prolonged drought, social unrest/war, etc.
12. Do you know any wild edible plants that are only consumed during time of food shortage, famine or civil unrest/war in the study area? 1. Yes, 2. No
13. If your answer is "Yes" to Question Number 12, what are this/these wild edible plants common to you?
14. Do you know any wild edible plants that are marketable in the study area? 1. Yes, 2. No
15. If your answer is "Yes" to Question Number 14, what are this/these wild edible plants common to you?
16. Where often this/these wild edible plants are sold? E.g. at villages, road sides, nearest local markets, national markets, etc.
17. Do you have an access or a chance to see people to collect wild edible plants in your area? 1.Yes, 2. No
18. If your answer is "Yes" to Question Number 17, who (in the family) collects wild edible plants in your area? 1. Women, 2. Children, 3. Elder people, 4. Other specify _____
19. Are there any challenges and constraints that limit the local communities to incorporate wild edible plants in their normal diet? 1. Yes, 2. No
20. If your answer is "Yes" to Question Number 19, mention those problems or constraints. _____
21. Are there any indigenous management strategies commonly practiced by the local communities to conserve wild edible plants in the study area? 1. Yes, 2. No
22. If your answer is "Yes" to Question Number 21, describe those strategies commonly practiced by the local communities. _____
23. Is/Are there any other use(s) of wild edible plants other than food at household level in your area? 1. Yes, 2. No
24. If your answer is "Yes" to Question Number 23, what are these multipurpose uses of wild edible plants common to you? E.g. wild edible plants, forage/fodder plants, fuel wood plants (firewood and charcoal making), plants that treat common ailments of humans, animals or both in the area, plants that serve for material culture (construction purposes or traditional art and handicrafts) or other miscellaneous (minor) uses.