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Getu Alemayehu
Jigjiga University, College of Natural Sciences, Department of Plant Biology, P.O. Box 1020, Jigjiga, Ethiopia.

Zemede Asfaw
Addis Ababa University, Department of Plant Biology and Biodiversity Management and the National Herbarium, P.O. Box, 3434, Addis Ababa, Ethiopia.

Ensermu Kelbessa
Addis Ababa University, Department of Plant Biology and Biodiversity Management and the National Herbarium, P.O. Box, 3434, Addis Ababa, Ethiopia.

Correspondence
Getu Alemayehu
Jigjiga University, College of Natural Sciences, Department of Plant Biology, P.O. Box 1020, Jigjiga, Ethiopia

Plant diversity and ethnobotany in Berehet District, North Shewa Zone of Amhara Region (Ethiopia) with emphasis on wild edible plants

Getu Alemayehu, Zemede Asfaw, Ensermu Kelbessa

Abstract
Background: This study was conducted in Berehet District, North Shewa Zone of Amhara Region (Ethiopia) to estimate the total species richness and diversity along with the ethnobotanical knowledge associated with the wild edible plants used by the local people.
Methods: Based on vegetation cover and availability of wild edible plants a total, of five rural kebeles in three agroecological areas were selected for the study following a stratified sampling method from August 21-28, 2013. In each kebele, two parallel transect lines were laid out 700 m apart, with quadrats at an interval of 600 m. Each transect had eight 20×20 m (400 m2) quadrats. Therefore, sixteen quadrats were laid out in each kebele, in total 80 quadrats for the whole study. A hierarchical cluster analysis, with PC-ORD for Windows version 5.0 software, was used to identify plant communities and synoptic values for identification of the dominant species for naming plant communities. Shannon Wiener index of species diversity was applied to quantify species diversity and richness. Ethnobotanical data were collected by interviewing 65 informants selected from five study sites (40 males and 25 females). Information on local marketability, cultivation practices, habitat, abundance and threats of wild edible plants was gathered through semi-structured interviews, field observations, group discussion, preference ranking, paired comparisons and direct matrix ranking with informants.
Results: A total of 143 plant species belonging to 113 genera and 60 families were collected. Fabaceae (18), Solanaceae (8), Asteraceae (7), Lamiaceae (5) were the families with the highest number of species. Of the total, 143 species, about 54(38%) plant species were shrubs, 43(30%) were herbs, 37(26%) were trees and 9(6%) were climbers. Field studies on wild plants of Berehet District furnished 53 plant species consumed as wild foods by the community, and the plant species belonged to 38 genera and 30 families. Based on richness of the edible species and usefulness, the most important families are the Fabaceae, Tiliaceae and Solanaceae. The edible plant species in the area comprised of 27(51%) shrubs, 14(26%) trees and 12(23%) herbs. Fruit is found to be the most edible plant part and mostly taken as raw. About 11% are considered famine foods. Of the reported edibles, all of the documented species have at least two uses or more, Medicinal uses contributed approximately 36% out of the total uses, Firewood and Charcoal 15%, Construction 18%, Fodder 13%, Bee forage 13% and Beekeeping 5%. The study showed that the majority of the species were collected from fallow land and forest patches. Elderly people of the area possess vast knowledge on wild food plants along with the ethnoecological distribution of plants in comparison with the young generation. Pair wise ranking results indicated that agricultural expansion as principal threats to wild edible plants in the study area.
Conclusion: The study indicated that wild edible plants are valuable resources for improving food and nutritional security of households living in the area but many wild species are under growing pressures from various anthropogenic factors. Thus, public awareness and community based management need to be encouraged at all levels alongside of urgent collection of germplasm. Conservation of these biological resources is very important these plants may have the potential to be valuable food sources (if cultivated) and could be part of a strategy in tackling food insecurity.

Keywords: Berehet District, Ethnobotany, Wild edible plants

Introduction
Ethiopia is an important regional center for biological diversity due to its wide ranges of altitude, its great geographical diversity with high and rugged mountains, flat-topped plateaus and deep gorges, incised river valleys and rolling plains [33, 44]. These helped the emergence of wide ranges of habitats that are suitable for the evolution and survival of various plant and animal species. As a result, the country is regarded as one of the most important countries in Africa with respect to endemism of plant and animal species in tropical Africa [23]. The Ethiopian flora contains approximately 6000 species of higher plants of which about 10% are endemic [25, 30]. It is known as a 'biodiversity hot-spot' and a centre of origin and

diversification for a significant number of food plants and their wild relatives [29, 22]. The rural populations in Ethiopia have a rich knowledge of wild edible plants and consumption of wild edible plants is still an integral part of the different cultures in the country. Rural people of Ethiopia are endowed with a deep knowledge concerning the use of wild plants. This is particularly true for the use of medicinal plants [2] but also for wild plants some of which are consumed at times of drought, war and other hardship. Elders and other knowledgeable community members are the key sources or 'reservoirs' of plant lore. Ethnobotanical studies conducted in Ethiopia have indicated that over 300 species of wild plants are gathered and consumed by the people [11, 22, 21]. In addition, [13] identified 66 wild edible plant species classified among 54 genera and 34 families. Recently, [34] compiled; 413 wild edible plants belonging to 224 genera and 77 families including herbs, trees, shrubs, and climbers. Still many more wild species are believed to be edible and undocumented yet.

Although the rich indigenous knowledge on the medicinal use of plants has been relatively well documented [11]. Studies on the knowledge of wild edible plants in Ethiopia are limited [28]. Similar to elsewhere in Ethiopia, people living in Berehet District in North Shoa Zone of Amhara Region of Ethiopia have a rich knowledge of wild edible plants. Berehet District is among the pocket areas in the Amhara Regional State where researchers have not been attracted yet to carry out various studies.

Though we have these facts, literature survey carried out on the ethnobotanical investigation reveals that there is no previously written document or ethnobotanical investigation conducted in any place in the Wereda. Most of the natural vegetation is heavily affected due to human impact. Therefore, collecting and documenting ethnobotanical knowledge before it is lost forever is a fundamental urgent task. For this reason, this study is initiated to gather, record and document indigenous knowledge of Berehet District and the dependence of the surrounding people on plant resources, to compile a checklist of ethnobotanically most important plants for nutritional purpose and find how the local people try to conserve these habitats and the plant species of the area. This study was also initiated to estimate the total species richness, diversity, plant community types in Berehet District.

Materials and Methods

Description of the Study Area

According to [15] report, the district had a total land area (size) of 88,430 and is divided in to thirteen rural kebele peasant associations and one town administration. The district bordered on the South by the Germame River which separates it from Minjar Shenkora, on the west by Hagere Mariamna Kesem District, on the north by Asagirt, and on the east by the Afar Region. The elevation of Berehet District ranges from 900 m.a.s.l to 3100 m.a.s.l. The main administrative centre of the district is located at Metiteh Bila town (Figure 1).

Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia [17], this district has a total population of 34, 810 an increase of 13.07% over the 1994 census, of whom 17, 669 are men and 17, 141 women; 3, 978 or 11.43% are urban inhabitants. Berehet has a population density of 43.98, which is less than the Zone average of 115.3 persons per square kilometer. A total of 7, 658 households were counted in this district resulting in an average of 4.55 persons to a household. The two largest ethnic groups reported in Berehet were the Amhara (80.26%), and the Argobba (19.47%); all other ethnic groups made up 0.27% of the population. Amharic was spoken as a first language by 99.75% and the remaining (1.25%) ones speak other languages [15]. The majority of the inhabitants practiced Ethiopian Orthodox Christianity, with 79.21% reporting that as their religion, while 20.75% were Muslim.

List of figures and tables

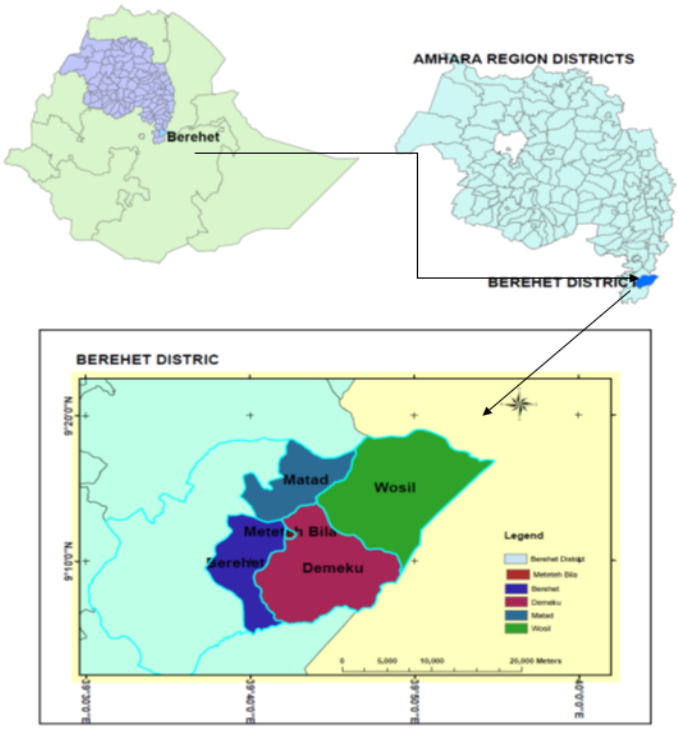
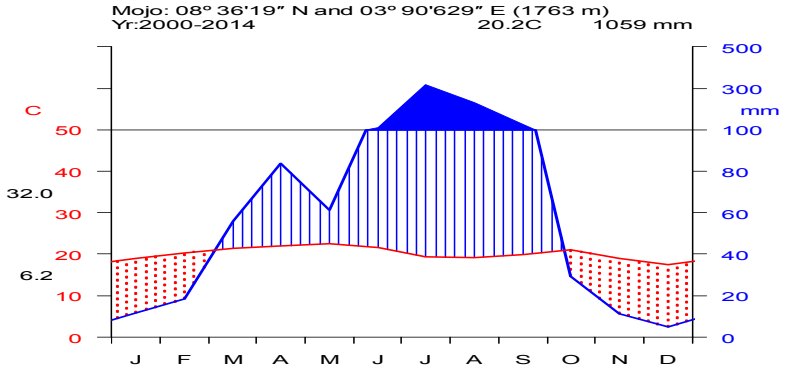


Fig 1: Location of Berehet District

The topography of the District lands are characterized by diverse geomorphologic features distributed over the three major agroclimatic zones, Dega (high lands), Weinadega (mid lands) and kola (low lands). Unpublished data from the wereda administration office indicates that 84% of the land area to be hilly plain followed by 2% plain, 1% cleft topographic features.

The rainfall and temperature data for this study were collected from the nearest Meteorological station of Modjo Town about 72 km from the Metiteh Bila town. Metrological data taken from Addis Ababa National Meteorology Service Agency indicates that Berehet area obtains high rain fall between June to August and low rain fall in March to May, and dry season extends from September to February. The highest mean annual rain fall of the study area within fifteen years was 1059 mm, whereas the lowest mean total was 162.8 mm (NMSA, 2006). The lowest mean annual temperature over fifteen years was 6.2 ^{0}C, whereas the highest was 20.2 ^{0}C (Figure 2).

The Ethiopian region is characterized by a wide range of ecological, edaphic and climatic conditions that accounts for the wide diversity of its biological resources, both in terms of floral and faunal wealth. The work of [24] showed the vegetation type of Ethiopia is recognized and categorized in to 12. these are Desert and semi-desert scrubland; *Acacia commiphora* wood land and bush land; wooded grass land to the western Gambella region, *combretum-Terminalia* wood land wooded grass land complex; moist evergreen afromontane forest; Transitional rain forest; Ericaceous belt; Afro alpine belt; Reverie vegetation; freshwater lakes, lakeshores, marshes swamps and flood plains vegetations and salt water lakes, lakeshores, salt marshes. The main vegetation type of the study area is dry ever green montane forest and grass land complex with a shrub and to small to large sized trees while the low land of Berehet District is categorized under semi desert scrub land. Data obtained from agricultural and rural development office of the study district and filed observation confirmed that the area is with scattered vegetation dominated by *Acacia etbaica, Euphorbia Abyssinica, Opuntia ficus indica, Euclea racemosa, Dodonaea angustifolia*



Source: National Meteorological Service Agency (NMSA)

Fig 2: Climadiagram of the study area from 2000 to 2014.

Methods of Data Collection and Analysis

Vegetation data collection

Vegetation surveys were conducted in the district to**:** Estimate total species richness and diversity, Classify and describe plant community types and measure wild edible plant richness and mean cover abundance in each community type. Then, a stratified sampling method was used to identify specific places of each selected kebele. To conduct this, the selected study villages were stratified into four land uses (forms), that is, Wood and Grazing land, Cultivated fields, Home-gardens, Fallow land and Forests patches. Then, representative populations in each land use/form were selected. The inventory was conducted by systematic transect sampling. In each kebele, two parallel transect lines were laid out 700 m apart, with quadrats at an interval of 600 m. Each transect had eight 20×20 m (400 m2) quadrats for trees and shrubs. Accordingly, a total of 80, 20 x 20-m2 quadrats were established for tree and shrubs inventory in the manner described by Kent and Coker (1992) at every 50 m altitudinal drop. For herbaceous species, 1 m x 1 m representative sub-quadrats were laid down within each quadrat. Therefore, sixteen quadrates were laid out in each kebele.

Vegetation data analysis

In order to assess the distribution of plants in the area, vegetation surveys were carried out. The plant community types were determined and named as 'type' by dominant characteristic species; mainly trees and shrubs with high cover abundance values were used. It also provides one way of summarizing our knowledge of vegetation pattern. As the study encompasses large-scale area, lining transects or quadrats were used and identification of the community types were established based on the cover abundance values of species.

Synoptic cover-abundance value was calculated as mean cover-abundance values for each species. This was calculated by adding all the cover values of the species occurring in revels belonging to that community and dividing the figure with the number of revels the species found in. Then the average cover/abundance value of each species in each cluster identified was computed and then characteristic species and local plant community types of the cluster were recognized. The naming of the communities was given after one or two dominant characteristic species with higher synoptic values. Finally, results were presented using tables and charts.

Shannon and Wiener (1949) index of species diversity were applied to quantify species diversity and richness. It is useful in the identification or selection of areas with relatively higher diversity of plants for defining conservation priority and strategy. The two main techniques of measuring diversity are richness and evenness. Richness is a measure of the number of different species in a given site and can be expressed in a mathematical index to compare diversity between sites, communities and Quadrates and can be expressed in a mathematical index to compare diversity between sites. The method most widely used approaches in measuring the diversity of species. $H = -\Sigma$ (Pi in Pi), Where "H" is the Shannon and Wiener diversity index, "Pi" is the ratio of a

species average to the total species average, "in" the natural logarism to base (log). J = H/Hmax, where "J" is the species evenness "H" Shannon and Wiener diversity index and "Hmax" is lnS, where S is the number of species.

Ethnobotanical data Collection/ Sampling and data collection

Above age of 18 a total of 65 informants (40 males and 25 females) were selected from 5 kebeles (13 informants per kebele). Fifteen of the total informants (10 per kebele) were randomly selected to get general knowledge during random walk made to houses in the selected areas and working field. This was done by tossing a coin and using him/her as informant whenever head of the coin is up if he/she volunteered to participate (as lottery methods). The other 15 of the total informants (3 per kebele) were key informants purposively selected based on recommendations from the local people, local authorities, and development agents (DAs) to get specific knowledge at each study sites, who were confirmed to be more knowledgeable about wild edible plants and other aspects of rural life

Following reconnaissance study of the study sites, an ethnobotanical data were collected during three different field visits within five kebeles of the wereda between 29 August 2013 and August 19, 2014, to record plant diversity along with the ethnobotanical knowledge associated with the wild edible plants used by the people in the wereda. Ethnobotanical data were collected by closely interacting with informants using semi-structured interview, guided field walk, group discussion, market survey, preference ranking, pair-wise comparisons and use diversity ranking.

Interviews were based on, around a semi-structured checklist of topics consisting 16 main questions (Appendices**)** prepared beforehand in English, and translated to Amharic. Interviews with informants were largely conducted in their local and common languages. The language used with the informants was Amharic. The questions were prepared with the following main components: (a) personal data of the respondents which includes the name, address, age, and gender (b) asked about local names of wild edible plants used, habitat of the species, distance to gathering sites, seasonality of species, marketability of species, degree of management (wild/ cultivated), abundance, parts used, condition of plant part used (fresh/dried).

All semi-structured interviews were followed by independent walk-in-the-woods, which gave an opportunity for more discussion with the informant and the practical identification of traditionally used wild edible plants in the natural environment. Guided field interview were made with informants and all relevant data including the vernacular names of plants, habit, habitat of the plant, the parts used as well as the strategies they use for the conservation of wild edible plants and the preservation of the indigenous knowledge on wild edible plants were recorded. Field observations were performed with the help of local guides, as well as interviewee in the study area.

Group discussions were also carried out to gain further information on wild edible plant knowledge of the community in order to triangulate the information in an effort to ascertain the reliability of the data collected through semi-structured interviews. And discussions took place based on the checklist of questions prepared beforehand in English and translated to Amharic.

Market is a place where plants use culture and agricultural innovations as well as plant germplasm is shared among people from each corner of the area. Hence, they complement to ethnobotanical studies of community and are important components of ethnobotanical data collecting procedures. Three weekly markets (namely Berehet zuria, Wosil, Demeku) from five kebeles were selected for market survey (Including big distance from the town). During the study, market survey were made to record the names of the wild edible plants and other aspect of the plants sold in the local markets of the study area.

Preference ranking was made following [36] and according to this scholar, doing preference ranking involves asking each selected informants to arrange some items, usually five to seven, in accordance to their perceived degree of importance in their community. In this study, five key informants were involved to rank wild edible plants according to their taste they perceived. Thus, six wild edible plant species were short listed (*Balanites aegyptiaca, Ficus sur, Ziziphus spina* christi, *Cordia africana, Carissa spinarium, Rosa abyssinica*) and ranked by five key informants based on their personal preference or perception following the procedure explained by [36, 16] in most of the study sites. Each rank is stated by integer values 1, 2, 3, 4, 5 and 6. The most effective plant is stated by highest value 6 while the least important is stated by a value of one. An overall rank for the species was given by adding up these values for five key informants.

[36] noted the purpose of pair wise comparison, and accordingly it is a tool where informants show the degree of importance of certain items which have been arranged in sets of two. Thus the comparisons done in this case was for most factors affecting plant resources (Firewood, Charcoal, Construction and tools, Grazing and Agricultural expansion) as perceived and reported by most informants. The possible numbers of pairs were calculated using the formula n (n-1)/2, where n is the number of factors affecting plant resources that has been compared. Both the sequence of the pairs and the order within each pair were randomized. The sequences were randomized using drawing of cards having number one to ten on it. To decide whether the original or reversed order is to be taken it was done by flipping a coin such that head (H) indicate the original order and tails (T) indicates the reversed order. The seven key informants that were chosen randomly were asked here to give their responses independently. An overall rank for the species was given by adding up these values for seven key informants. Based on the total score of each species the ranks were determined to infer the most factors affecting plant resources in the study area.

Direct matrix ranking, which is also termed as use diversity ranking or data matrix ranking, is a more complex version of preference ranking. Unlike preference ranking which is based on a single dimension, direct matrix ranking draws explicitly upon multiple dimensions [36]. The purpose of such ranking is to infer most widely used multipurpose plants in the area. Thus direct matrix ranking was done for five multipurpose wild edible plants (*Ziziphus spina christi, Ximenia americana, Cordia africana, Ziziphus mucronata and Balanites aegyptiaca*) that were commonly reported by key informants. Among the key informants used for pair-wise ranking four of them were randomly chosen and were asked to assign numerical scale individually in which the highest value is equal to the 'best' and the lowest number is the 'worst' to each attribute based on the relative benefits obtained from each plant. The list of attributes included medicinal, fire wood, Beekeeping, Bee forage, charcoal, fooder, construction and tools. By adding the scores, it was possible to compare the species based on their use diversity.

Voucher specimen collection was held with the help of informants and local field assistants. The collected voucher

specimens were taken to the National Herbarium of Ethiopia (ETH), Addis Ababa University where they were air-dried, numbered, labeled, pressed, heater-dried, deep-freeze, identified and deposited at the National Herbarium (ETH). Preliminary identification of specimens was performed in the field with the key informants and local expertise in the field. Further identification was made using the modern Flora of Ethiopia and Eritrea at ETH using taxonomic keys and by comparison with authenticated herbarium specimens. The nomenclature of the scientific names of the species follows the volumes of the Flora of Ethiopia and Eritrea and finally seeking confirmation by Advisors.

Ethnobotanical data analysis

Descriptive data analysis method was employed to summarize some of the ethnobotanical data obtained from the interviews on reported wild edible plants and associated knowledge. Microsoft Excel spreadsheet software was employed for organizing and analyzing the data. Data was then entered in an Excel spreadsheet and analyzed using descriptive statistics to identify the number and percentage of wild edible plant species, genera and families of wild edible plants, their growth forms and percentage of commonly utilized plant parts.

Ranking and scoring. Preference ranking was performed to give information on taste quality of wild edible plants as perceived by informants. Pairs wise comparison was computed to assess the major threaten factors of wild edible plants in the study area. Use diversity matrix was done to rank up wild edible plants reported frequently with various ethnobotanical roles.

Ethical consideration

Permission was first obtained from the wereda and kebele administrative offices to conduct the study by showing different official letters wrote from the department and presenting the purpose of the study. During data collection an effort was verbally made to encourage the informants in such a way that their cooperation is of great benefit to the country. All data from this study weren't shared with third party out of researchers. Additionally, informed consent was obtained from the participants to ensure their willingness.

Results

Floristic Composition

One hundred forty three specimens of plants (Herbs, shrubs and trees were collected from Berehet District, North Shewa Zone of Amhara Region, Ethiopia. The specimens identified belong to 113 genera and 60 families. Out of the 143 identified plant (57 species, 40%) were shrubs, (49 species, 33%) were herbs, and (37 species, 26%) were tree. Shrubs occupied the highest floristic composition followed by herbs and trees. Trees and shrubs together contributed to 81% of the floristic composition. Likewise, out of the total families, Fabaceae (18), Solanaceae (8), Astraceae (7), Lamiaceae (5) were the families with the highest number of species. Of the remaining 55 families, two had five species each, three had four species each, eight had two species each, ten had three species each, and thirty-two had one species each.

Plant community type

The Vegetation classification was made using cover abundance values as class labels. Five plant community types (clusters) were identified from the hierarchal cluster analysis using PC-ORD version 5 computer programme (Figure 3). The data matrix contains 80 quadrats and 91 species. A floristic approach of Braun-Blanquet scale was to determine the relative cover proportion of individual species for each of the community types. The percentage cover/abundance of each species was converted into 1-9 Braun- Blanquate scale. All vascular plant species present in sampling unit were recorded and percentage Canopy cover of each species was estimated visually and later converted in to modified 1-9 Braun-Blanquet scale.

Description of the plant community types with their altitudinal distribution is given below. The five community types obtained in this way were named after two or three characteristic and/or dominant tree or shrub species. The highest mean cover estimate that appears in their particular cluster was used as a criterion for giving name to these local vegetation communities. Accordingly, the following is a description of the community types identified. *Euclea racemosa, Dodonea angustifolia*, *Opuntia ficus-indica, Senna bicapsularis Calpurnia aurea* and *Capparis tomentosa* community types.

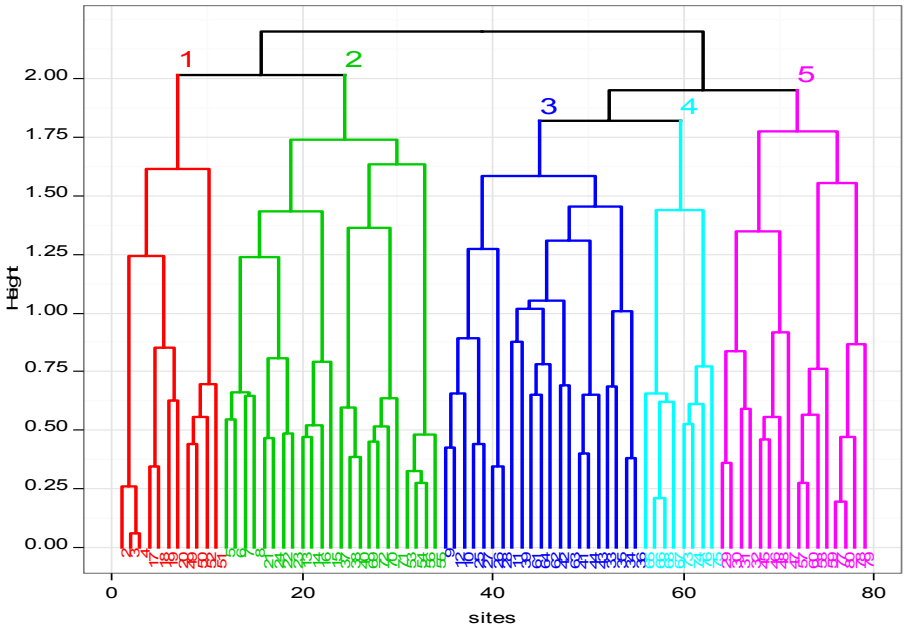


Fig 3: Dendrogram showing plant community types of the study area

Species diversity, richness and equitability

Shannon-Wiener (1949) diversity index was computed for the five communities from the vegetation data of Berehet District. Based on the outcome of the Shannon-Weiner diversity index analysis, community type II had the highest species diversity followed by communities III, IV, I and V respectively. Community II had the highest species richness while community V exhibited the least species richness comparatively because of the local people highly threatened the forest for agricultural expansion, construction materials, fuelwood and rearing domestic animals. The reason why community II has the highest species richness is that it is relatively better protected under the district Agricultural Office. Comparatively community I has the highest species evenness, community IV the second species evenness and community II has the least species evenness while other communities (communities III and V) have intermediate evenness (Table 3).

Regarding to comparing richness of species in quadrats, the Shannon–Wiener diversity index shows that quadrats number 69 and 75 are the richest with regard to the number of species (15) per quadrat, while the lowest number of species (7) was recorded for quadrat 23. The lowest number of species were recorded in this was associated with high disturbances, open canopy and many small roads crossing the quadrat.

Socio-demography of the Informants/ Knowledge Distribution of wild edible plants

Informants in the study area can be represented under two age groups the young (18-30), and elders greater than 30 years old. Sixty-five informants were used for the study purposes taking, thirteen informants from each five sampled kebele (the smallest administrative units). Forty (61%) male and twenty-five (38%) female informants were take part in this study. Out of 65 informants, twenty-four (36%) of the informants are found between the ages 18-30, forty-one (63%) informants were greater than 30 years old. Ethnobotanical knowledge and practice within any culture varies depending on (age, sex, and educational level). Much of knowledge of wild edible plants in the study area obtained from elder informants, when compared with the young people. This was evidence that informants greater than age 30 mentioned 40 (54%) wild edible plants out of the total wild edible plant species. Concerning educational status, majority of informants 35 (53%) were illiterate and 30 (46%) were literate.

Indigenous knowledge on Landscape, Vegetation and Soil Classification (Emic Categorization)

People of the study area classify landscapes based on elevation and suitability of the land for agriculture and grazing. Accordingly, they classify landscapes into four categories. Namely, wotageba", "terrarama", "medama", and "shelequama". The indigenous people of the Wereda classify the vegetation as 'kutquato,' 'meda,' 'chaka' and dene'. People of the study area also classify soils based on texture, color and fertility and valuably for cropping of the soil. and, they also classify soil as follows keyatie, walka, chincha and nechate.

Ethnobotany of wild edible plants in Berehet district

Wild edible plants reported used as food

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-three species distributed in 38 genera and 30 families were identified by local communities within the study area as wild edible plants (Table 1). Ninety percent of the species were reported with their vernacular names. With respect to the diversity of the species gathered, the highest number of wild edible plants were recorded in the family Fabaceae, Solanaceae and Tiliaceae. Thus, 23% of the families were represented by more than one wild edible plant species. 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.

Table 1: Wild edible plants list collected from Berehet district

No	Scientific Name	Family	Local name	Ha	Part used	Other uses	Habitat	Mode of consumption	Reason of use
1	*Acacia etbaica Schweinf.*	Fabaceae	KESSELE	T	Gum/resin	Con	Wl, Gl	Raw, chewing	AF
2	*Acacia senegal (L.) Willd.*	Fabaceae	DERE	T	Gum/resin	BK	Wl, Gl	Raw, chewing	AF
3	*Acacia seyal Del.*	Fabaceae	WACHO	T	Gum/resin	BK	Wl, Gl	Raw, chewing	AF
4	*Acacia seberiana DC.*	Fabaceae	NECHGIRAR/TEDECHA	T	Gum/resin	.....	Wl, Gl	Raw, chewing	AF
5	*Acacia tortilis (Forssk) Hayne*	Fabaceae	TEDECHA/ DERE	T	Gum/resin	Fw, Ch	Wl, Gl	Raw, chewing	AF
6	*Acanthus sennii* Chiov.	Acanthaceae	KUSHESHILA	H	Flower nectar	------	Wl, Gl	Raw, rippen	AF
7	*Gardenia volkensii* K.Schun.	Rubiaceae	.....	T	Fr	Con	Fl, Fp	Raw, rippen	Fam
8	*Acokanthera schimperi* (A.DC.) Schweinf.	Apocynaceae	MERENZ	Sh	Fr	Fw, Ch	Fl, Fp	Raw, rippen	Fam
9	*Amaranthus dubius* Thell.	Amaranthaceae	ALEMA	H	Le, Se	------	Wl, Gl	Cooked	AF
10	*Asparagus africanus* Lam.	Asparagaceae	YESET KISTE	Sh	Fr	Med	Fl, Fp	Raw, rippen	AF
11	*Balanites aegyptiaca* (L.) Del.	Balanitaceae	JEMO	Sh	Fr	Con	Fl, Fp	Raw, rippen	AF
12	*Barleria eranthemoides* R.Br.ex.C.B.Clear.	Acanthaceae	.....	Sh	Flower nectar	Fw, Ch	Wl, Gl	Raw, rippen	AF
13	*Capparis tomentosa Lam.*	Capparidaceae	GUMERO	Sh	Fr	Med	Fl, Fp	Raw, rippen	AF

14	*Carissa spinarium* L.	Apocynaceae	AGAM	Sh	Fr	Med	Fl, Fp	Raw, rippen	Fam
15	*Celtis africana* Burm.f.	Ulmaceae	.....	T	Fr	Fw, Ch	Fl, Fp	Raw, rippen	AF
16	*Commolina latifolia* Hochst. ex. A.Rich.	Commelinaceae	WOFEANKURE	H	Rt	Med	Wl, Gl	Raw, rippen	AF
17	*Cordia africana* Lam.	Boraginaceae	WANZA	T	Fr	Med	Cf	Raw, rippen	AF
18	*Cordia monoica* Roxb.	Boraginaceae	CHEWWANZA	T	Fr	Med	Cf	Raw, rippen	AF
19	*Cyperus bulbosus* Vahl	Cyepraceae	ENGICHA/GIC HIGLA	H	Bulb	------	Wl, Gl	Raw, rippen	AF
20	*Datura stramonium* L	Solanaceae	ASTENAGER	H	Flower nectar	Med	Fl, Fp	Raw, rippen	AF
21	*Dovyalis abyssinica* (A.Rich) Warb	Flacourtiaceae	KOSHIM	Sh	Fr	BF	Fl, Fp	Raw, rippen	AF
22	*Ehretia cymosa* Thonn.	Boraginaceae	GAME	Sh	Fr	Fw, Ch	Fl, Fp	Raw, rippen	AF
23	*Embelia schimperi Vatke.*	Myrsinaceae	ENKOKO	Sh	Fr	Med.	Fl, Fp	Raw, rippen	AF
24	*Euclea racemosa* Murr	Ebenaceae	DEDEHO	Sh	Fr	Fw, Ch	Fl, Fp	Raw, rippen	AF
25	*Ficus sur* Forssk.	Moraceae	SHOLA	T	Fr	BF	Fl, Fp	Raw, rippen	AF
26	*Ficus sycomorus L*	Moraceae	BANBA	T	Fr	BF	Fl, Fp	Raw, rippen	AF
27	*Ficus vasta* Forssk.	Moraceae	WARKA	T	Fr	BF	Fl, Fp	Raw, rippen	AF
28	*Flueggea virosa* (Willd.) Voigt	Euphorbiaceae	LOGE	Sh	Fr	------	Fl, Fp	Raw, rippen	AF
29	*Grewia bicolor* Juss.	Tiliaceae	.....	Sh	Fr	------	Fl, Fp	Raw, rippen	AF
30	*Grewia ferruginea* Hochst ex A.Rich.	Tiliaceae	LENKUATA	Sh	Fr	Med.	Fl, Fp	Raw, rippen	AF
31	*Grewia villosa* Willd	Tiliaceae	AGUBITE	Sh	Fr	------	Fl, Fp	Raw, rippen	AF
32	*Haplocarpha* schimperi (Sch.Bip.) Beauv.	Asteraceae	NECHILO	H	Fr	Con.	Cf	Raw, rippen	AF
33	*Lantana trifolia* L.	Verbenaceae	.....	H	Fr	BF	Cf	Raw, rippen	AF
34	*Myrsine africane* L.	Myrsinaceae	KECHEMO/EU RCHE	Sh	Fr	Med	Fl, Fp	Raw, rippen	AF
35	*Opuntia ficus-indica* (L.) Millr.	Cactaceae	BELES	Sh	Fr	.....	Fl, Fp	Raw, rippen	Fam
36	*Osyris quadripartita* Decn.	Santalaceae	KERET	Sh	Fr	Con	Fl, Fp	Raw, rippen	AF
37	*Phoenix reclinata* Jacq.	Arecaceae	ZEMBABA	T	Fr	Med	Fl, Fp	Raw, rippen	AF
38	*Physalis peruviana* L.	Solanaceae	AWTE	H	Fr	------	Fl, Fp	Raw, rippen	Fam
39	*Pterolobium stellatum* (Forssk.) Brenan	Fabaceae	KONTIR	Sh	Fr	------	Fl, Fp	Raw, rippen	AF
40	*Rhus natalensis* Krauss	Anacardiaceae	CHAKMA	Sh	Fr	Med	Fl, Fp	Raw, rippen	AF
41	*Rhus retinorrhoea* Oliv.	Anacardiaceae	TELEM	Sh	Fr	Con	Fl, Fp	Raw, rippen	AF
42	*Rhus vulgaris* Meikle	Anacardiaceae	KIMMO	Sh	Fr	-----	Fl, Fp	Raw, rippen	AF
43	*Ricinus communis* L.	Euphorbiaceae	GULO	Sh	Root	Fod	Hg	Raw, rippen	AF
44	*Rosa abyssinica* Lindley	Rosaceae	KEGA	Sh	Fr	Con	Fl, Fp	Raw, rippen	AF
45	*Rubus steudneri* Schweinf.	Rosaceae	INJORY	H	Fr	Med	Fl, Fp	Raw, rippen	AF
46	*Rumex abyssinicus* Jacq.	Polygonaceae	MEQMEQO	H	Whole part	Fod	Wl, Gl	Pilled stem	AF
47	*Rumex nervosus* Vahl	Polygonaceae	EMBUACHO	H	Le, stem	Fod	Wl, Gl	Pilled stem	AF
48	*Solanum glabratum* Dunal	Solanaceae	YWESHA BERBERE	Sh	Flower nectar	-----	Fl, Fp	Raw, rippen	AF
49	*Solanum nigrum* L.	Solanaceae	AWTE	Sh	Le	-----	Fl, Fp	Raw, rippen	Fam
50	*Urtica simensis* Steudel	Urticaceae	SAMMA	H	Leaf, Stem	-----	Fl, Fp	Cooked	AF
51	*Ximenia americana* L.	Olacaceae	ENKOY	T	Fr (exocarp)	Med	Wl, Gl	Raw, rippen	AF
52	*Ziziphus mucronata* Willd	Rhamnaceae	YEZENJERO GEBA	Sh	Fr (exocarp)	Fod	Cf	Raw, rippen	AF
53	*Ziziphus spina christi* (L.) Desf.	Rhamnaceae	YESLAME QURQURA	Sh	Fr (exocarp)	Fod	Cf	Raw, rippen	AF

(F = fruit, Rb= root, S= stem, AF=Additional food, Fam= Famine, Hg=Homegarden, Lf=Livefence, Wl=Woodland, Gl=Grezing land, Fl=Fallowland, Fp=Forest patches Cf=Crop filed, BK=Beekeping, Fw=Firewood, Ch=Charcoal, Con=Construction, Med=Medicinal, BF=Beeforage, Fod=Fodder, Fe=Fencing)

Habit of wild edible plants

Of the recorded wild edible plants in the study area, shrubs were the highest life forms with 27 (51%), followed by trees with 14 (26%) whereas herbs 12 (23%) were the lowest life forms (Figure 4). The result of the study revealed that the two major plant habits (*i.e*., shrubs and trees) accounted for the highest proportion of life forms.

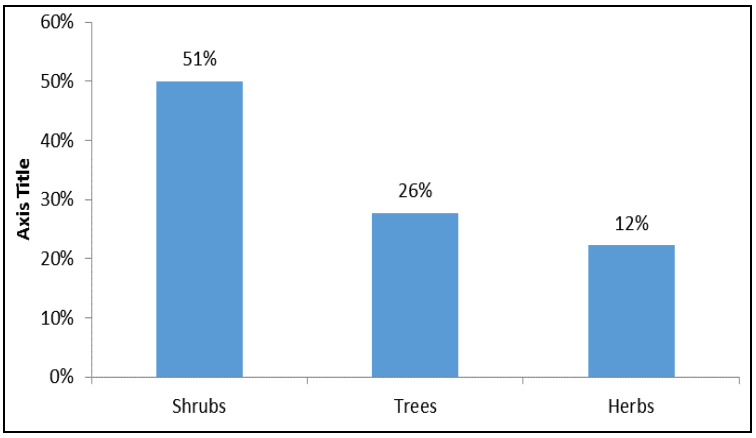


Fig 4: Habit of wild edible plants

Plant parts used and mode of consumption of wild edible plants

Although different plant parts were reported for consumption 36(67%) of the edible plant parts was fruit, 5(9%) gum, 4(8%) were leaves and flower nectar each, 3(6%) roots and 1 (2%) Whole part shared the highest edibility report. About (49 species, 92%) of these fruits were reported to be eaten raw, whereas (4 species, 8%) were consumed cooked or processed. Fruit is found to be the most edible plant part and mostly taken as raw.

Marketability of wild edible plants in the study area

One daily and two weekly markets from five kebeles were selected for market survey. (Including big distance from the town). During the study, three major markets i.e., namely, Berehet zuria, Wosil and Demeku were observed. Many of the wild edible plants consumed raw are eaten outdoors (in agricultural fields, during cattle keeping and travelling), and some other parts that require processing are brought home for preparation prior to consumption. However, there were no wild edible plants sold in the market.

Wild edible plants used as traditional medicine

Food plants have multiple values to human beings, of which the value of food plants in the health care is quite prominent. Out of the total wild edible plants, fourteen (23%) nutraceutical wild plants were used to treat 10(71%) human and 4(29%) for livestock primary health care system.

For instance, *Asparagus africanus, Carissa spinarium, Cordia africana* and *Ximenia americana* are the most commonly used nutraceutical plants as analyzed from the report of the local people in the area. From the wild edible plants used as traditional medicine shrubs 7(50%) followed by herbs 3(21%) and trees 4(29%) were the dominant growth forms of the wild edible plants used as traditional medicine in the area. 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.

Disease treated using nutraceutical wild edible plants

Diseases treated by nutraceuticals includes internal and external parasites, diseases of internal organs such as the Gastrointestinal disorders, Liver disease, Amoeba, Eye infection, Skin rash, Diarrhoea, Maleria and Wound of humans and livestock (Table 2). Only member of family get access by father or mother or elder community leaders.

Table 2: Disease treated using nutraceutical wild edible plants

No	Disease treated	Human medicine species	Livestock medicine species
1	Amoeba	1	0
2	Gastrointestinal disorders	3	0
3	Eye infection	0	1
4	Skin rash	1	0
5	Liver disease	0	1
6	Diarrhoea	1	1
7	Maleria	3	0
8	Intestinal Parasite	1	0
9	Wound	0	1

Habitats for collecting wild edible plants

The analysis indicated that wild edible plants are widely distributed in diverse habitats and wide altitudinal ranges as well. Wild edible plants used by people of Berehet district were collected from various habitats. Only very, few were partly managed around and in household farms. They are distributed in Wood and Grazing lands, Fallow land and Forest patches, Home garden and Live fence and Cropland. Fallow land and Forest patches accounted 33 species (62%), Wood and Grazing land 13 species (25%), Crop field 6 species (11%), Live fence 1 species (2%). Forest patches and Fallow land yielded more species, which accounted for 33 (62%**)** wild edible plants (Figure 5). These habitats are located within the altitudinal ranges of 1400–2600 m.a.s.l in Wosil, Demeku, Meteteh Bila, Mafud, Berehet zuria kebeles. The result indicated that wild food plants are harvested from natural vegetation.

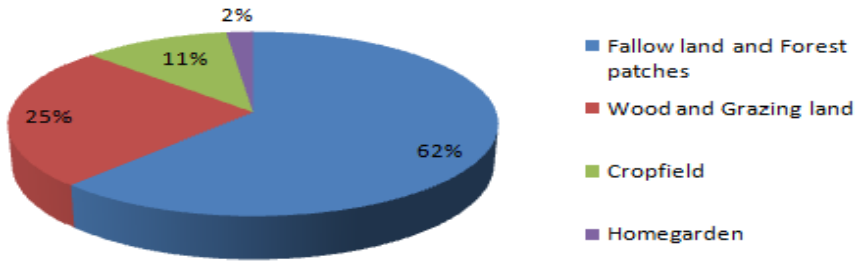


Fig 5: Habitats where people collect nutraceutical wild plants and their number

Indigenous knowledge and use categories 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 construction, firewood, medicine, livestock fodder, beekeeping, food, bee forage and miscellaneous uses. The indigenous people of Berehet district identified more plants indicating variation in indigenous knowledge between communities. The results of the study revealed that the majority 39(74%) of the species have multiple uses and serve for more than one use categories. Taxonomic diversity of the flora of the study area is rich and highly diversified provides diverse useful species. The major use categories of wild edible plants of the area were medicinal uses (14 species, 36%) folllowed by Construction (7 species, 18%), firewood and charcoal (6 species, 15%), fodder and bee forage (5 species, 13%) each, Beekeeping and beehive making (2 species, 5%).

Use categories of wild edible plants

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Ranking and scoring

Preference ranking

The results of this study showed that, the most threatened wild edible plants species based on local importance in decreasing order were *Ziziphus spina* christi, *Balanites aegyptiaca, Cordia africana, Rosa abyssinica, Carissa spinarium and Ficus sur* are ranked as 1st, 2nd, 3rd, 4th, 5th and 6th respectively (Table 3).

Table 3. Preference ranking of wild edible plants species based on their, taste quality as given by respondents

Respondents Labelled 1-5	Wild edible plants					
	Balanites aegyptiaca	*Ficus sur*	*Ziziphus spina* christi	*Cordia africana*	*Carissa spinarium*	*Rosa abyssinica*
I1	2	1	5	4	1	4
I2	3	2	3	4	2	3
I3	4	1	3	2	3	1
I4	3	3	5	1	2	1
I5	3	1	1	1	1	1
Total	15	8	17	12	9	10
Rank	2	6	1	3	5	4

Paired comparison

As indicated by the results of paired comparison of factors affecting plant resources in the study area, seven key informants almost similarly reported that Agricultural expansions stood first, Firewood, Charcoal, Construction and tools and Grazing were 2nd, 3rd, 4th, and 5th management problems of plant resources respectively in the context of local people (Table 4).

Table 4: Results of Paired comparison of factors affecting wild edible plant species in the study area.

Preferred item	Respondents							Total	Rank
	R1	R2	R3	R4	R5	R6	R7		
Construction and tools	1	2	3	1	2	3	3	15	4th
Grazing	4	0	1	0	4	1	1	11	5th
Charcoal	2	1	5	3	1	2	5	19	3rd
Agricultural expansions	5	3	4	5	3	5	4	29	1st
Fire wood	3	5	2	4	5	4	2	26	2nd

Use diversity ranking/ direct matrix ranking

Among the very common wild edible plants direct matrix showed that *Ximenia americana* (most threatened) followed by *Cordia africana, Ziziphus spina christi, Ziziphus mucronata* and *Balanites aegyptiaca* were found to be most important in their multiple utility value respectively (Table 5). Thus, the long-term survival of the top- ranked species are under question, as the daily demand of the local society is usual and continuous with lesser rate of re-plantation.

Results of 4 informants (R_1-R_4) against five use values other than their food use. 0=no use, 5=best, UV=use valve, MD=medicines, FW=fire wood, C=charcoal, Fe= Fencing, Ct=construction and tools, Tc=total number of informants, Gc=Grand total, Ra=rank.

Table 5: Direct matrix ranking of six plant species by four informants based on five use criteria (5 = best; 4 = Very good; 3 = good; 2 = less used; 1 = least used and 0 = no value)

Use categories	Wild edible plants																			
	Ziziphus spina Christi L.				*Ximenia americana L.*				*Cordia africana Lam.*				*Ziziphus mucronata Willd*				*Balanites aegyptiaca (L.) Del.*			
	Informants (I1-4)				I				I				I				I			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MD	3	1	1	2	2	4	1	1	5	3	2	2	1	0	1	1	4	3	0	1
FW	5	5	4	5	4	5	4	1	2	4	3	4	4	3	1	1	2	3	4	1
C	1	0	1	0	5	3	4	4	1	0	1	1	3	3	2	2	0	1	0	0
Ct	3	3	1	1	5	5	4	3	4	4	4	1	2	2	0	1	3	3	5	2
Fe	2	1	2	1	3	3	1	1	4	2	2	1	0	1	1	1	1	3	0	1
Inf. total	14	10	9	9	19	20	14	10	16	13	12	9	10	9	5	6	10	13	9	5
Gc	42				63				50				30				36			
Rank	3rd				1st				2nd				6th				4th			

Threats and Management Practices 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 five major threats to wild edible plants by priority ranking in the study area. Accordingly, pair wise ranking of the factors affecting plant resources shows that Agricultural expansion was identified as a major threat followed by Firewood and Charcoal.

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*., *Ziziphus mucronata* and *Ziziphus spina-christi*), farm boundaries and watershed areas. Others frequently used as shade (*Ficus sycomorus, Ficus vasta).* Community norms are such that cutting of valuable shrubs and trees, particularly for charcoal is strictly prohibited.

Discussion, Conclusion and Recommendations

Plant species composition

The Results show that Berehet District is rich in species composition as shown by the presence of 143 species (distributed in 113 genera and 60 families). Shrubs occupied the highest floristic composition in the study area it is similar to the findings of [21]. Based on richness of species and usefulness, the most important families are Fabaceae, Lamiaceae and Asteraceae, the species richness was found to be by far less than that of Borana pastoralists of southern Ethiopia (327 species) [21]. Reports from other studies indicated that species richness and diversity tend to peak at an intermediate altitude and decline at the lower and upper elevations [43, 44]. The result of the present study more or less agrees with this regarding species richness and Diversity.

Plant communities in the study area

Community 5 (the *Calpurnia aurea* and *Capparis tomentosa* community type) was composed of 23 species distributed in higher altitudinal ranges (1500-2600 m.a.s.l.). This is in agreement with the general pattern of presence of *Calpurina aurea* and *Capparis tomentosa* type dominated communities in Farta Wereda, South Gonder Zone of Amhara Region, Ethiopia [7].

Knowledge distribution of wild edible plants

Much of knowledge of wild edible plants in the study area obtained from elder informants, when compared with the young people. This was evidence that informants greater than age 30 mentioned 40 (54%) wild edible plants out of the total wild edible plant species. Young males of Ethiopian rural areas have been reported to consume more wild edible fruits [11]. However, the present result showed youngsters know relatively less wild edible fruits than elders. Less familiarity of the youngsters disagrees with previous assumptions that consider children and youngsters to be more familiar to Wild edible plants than elders because of their frequent appearance in the field and experiences in different landscapes [38]. The contrasting findings may imply that the relationships of age-groups and knowledge on wild edible plants could be reversed depending on the status of the resource base.

Local categories of landscape, vegetation and soil and associated knowledge

People living in Berehet district have well organized indigenous knowledge systems, which they use to classify vegetation based on habit, dominant tree species, and density of plant species as well as the location of plants that cover the land. Similarly, landscapes were classified based on their natural well being and land use systems. Soils were also classified based on color, texture and suitability for crop cultivation. For example, 'Walka' is the black soil which is characterized with medium fertility and suitable for cultivation. Nechate has sandy soil character at most and is poor for cultivation of crops and it is generally designated as grazing place for animals. This is also indicated in similar studies elsewhere in Ethiopia [6, 7, 37]. In addition**,** Emic classifications of the natural habitat are drawn from the way people perceive things through their own eyes and classify objects in their own language [36]. Furthermore, [9] explained that, the people of Ethiopia are knowledgeable about the name and classification of their environment, plants in their surroundings, and their values for the local people, which they have gained orally from generation to generation. This is also indicated by [36] as good way to start an ethnobotanical study is to understand how local people classified hills, valleys, rivers and other geographical features that dominant the landscapes.

Wild edible plants reported used as food

The 53 WEPS consumed in Berehet district are also documented as edible in other parts of Ethiopia [1, 4 11, 13, 27, 28, 34, 40]. Regarding to the family number Fabaceae represented 11% and Tiliaceae 8%. The above figures are in agreement with the earlier study by [41], where Fabaceae was the highest family, followed by Tiliaceae comprised 32% and 18% wild edible plants, respectively.

The present study presents a large proportion of wild edible plants species from a limited area. It can therefore be inferred that further ethnobotanical studies in less studied parts of Ethiopia would add more species to the list. A complete database for Ethiopia could be built through a series of such studies.

Most of the identified trees and shrubs are reported to be edible elsewhere in Ethiopia. In an ethnobotanical study in

Chilga District, northwestern Ethiopia, by [40] recorded 12 of the wild edible plant species reported in the present study, while a study undertaken in Konso Ethnic Community, by [4] 15 wild edible plants and by [11] 24 wild edible plants recorded. The number of species identified in the present study is comparable with the number reported from Borena pastoralists (27) by [21] in southern Ethiopia, it is slightly higher than the number of edible wild fruit tree species (46) reported from northwest part of the country by [38] and higher than the number of edible wild fruit tree species (90) reported from Central Ethiopia of Arsi Zone, by [39]. The present study presents a large proportion of wild edible plants species from a limited area. It can therefore be inferred that further ethnobotanical studies in less studied parts of Ethiopia would add more species to the list. A complete database for Ethiopia could be built through a series of such studies.

The analysis results shown in Table 1 showed that Berehet District was richer by wild food plants. This wild food species recorded in this study were edible in normal times as well as at times of food shortage so as to prevent starvation and sustain life during prolonged drought and social unrest. The role of wild food plants mainly during unsustainable conditions were also explained by [16, 19, 18, 8, 5]. Shrubs, herbs and trees were found to be the sources of wild food plant species in this study. This indicated that the study area was richer with diversity of life forms. This led the community members to have accumulated indigenous knowledge on different life forms. This finding is similar with [31].

This study revealed that most of the recorded wild edible plant species or their parts are consumed as raw/fresh without further processing. Only four species is reported to be cooked before consumption. The high percentage of raw edibles may be due to not being given priority to collect and use the plant parts at their home compared with cultivated food plant products. This is consistent with other findings including these of [13, 45]; But, this is contrasted with the findings of [42] studied in southern Ethiopia, who indicated that sixteen (41%) wild edible plants were used as vegetables by harvested their leaves, young twigs, upper parts (leaf and stem) were consumed after cooking.

Habit and parts used of wild edible plants

Of the total wild edible plants 27(51%*)* were shrubs, 14(26%) were tree and 12(23%**)** were herbs. The shrubs and trees were the most harvested life forms than other recorded in the study area. The finding of shrubs as the contributor of higher number of plant species used for food than other life forms is in line with [14, 35]. In contrast, the findings of [26] on medicinal plants revealed that herbs were the most used ones. Regarding to parts used as food in the district 36(67%) of the edible plant parts was fruit, 5(9%) gum, 4(8%) were leaves and flower nectar each, 3(6%) roots and 1(2%) Whole part shared the highest edibility report shared the highest edibility report. Fruits are the most important edible plant parts. This is in line with the work of [3], where fruit uses accounted for 80% of edible wild food.

Use categories of wild edible plants

Food plants have multiple values to human beings, of which the value of food plants in the health care is quite prominent. In Our study the major use categories of wild edible plants of the area were medicinal uses. But in the case of Borana pastoralists, it is the second most important category [21]. Different researchers elsewhere in Ethiopia have also noted multiple uses for wild edible plants such as preparation of remedies, Construction, firewood and charcoal, fodder, bee forage and Beekeeping [13, 42 and 38].

Scoring and Ranking

Information obtained from key informants through scoring and ranking was found to be an important preference means. As indicated by the results of preference ranking good taste quality of wild edible plants species the results indicated that, the most preferred species in decreasing order were *Ziziphus spina* christi, *Balanites aegyptiaca, Cordia africana, Rosa abyssinica, Prunus persica and Ficus sur* are ranked as 1st, 2nd, 3rd, 4th, 5th and 6th respectively. As indicated by the results of paired comparison of factors affecting plant resources in the study area, all informants almost similarly reported that Agricultural expansions stood first. The above results are also reported in different areas by [12, 13, 32, 41].

Among the very common wild edible plants direct matrix showed that *Ximenia americana* (most threatened) followed by *Cordia africana, Ziziphus spina christi, Ziziphus mucronata* and *Balanites aegyptiaca* were found to be most important in their multiple utility value respectively, was found to be most important in its multiple utility value similar to the findings of [32]. From both paired comparison and direct matrix it could be understood that those most favored species are usually most efficacious in the context of the local people, and thus this shall be further investigated in scientific works.

Conservation measures of wild edible plants

To reduce the factors affecting plant resources in the study area, there are conservation measures taken for forest and other natural plant resources in general [11]. in his findings reported that, the home garden is a strategic and ideal farming system for conservation, production and enhancement of wild food plants and for preservation of the valuable indigenous knowledge on them. Likewise, wild edible plants which have additional uses in the area, such as, food, medicine, construction, fuel and forage were planted in home gardens and farmlands.

The second conservation area was observed in the patches of remnant woody plants found in the Orthodox Tewahedo church forests. The sacred church and monastery lands of the Orthodox Tewahedo churches have, survived for many centuries as islands of natural forest biodiversity in the sea, forming different landscapes in much of the study area. For reasons related to the spiritual values attached to the churches, monasteries and their sacred lands, these biodiversity islands have survived until now. They provide the local community with food and minor forest products for construction purposes, medicinal uses, and architectural works as well as other essential human needs as was stated by [20]. Some of the wild food plants obtained from these church forests were *Rosa abyssinica, Carissa spinarium*, *Ximenia americana*, *Cordia africana*, *Ziziphus spina christi*, *Ziziphus mucronata* and *Balanites aegyptiaca.*

Conclusions

Vegetation of Berehet District is grouped into five community types. Community II had the highest species diversity followed by community III, VI, I and V respectively. Community V had the least species diversity than others and Community II had the highest species richness while community V exhibited the least species richness comparatively because of the local people highly threatened the forest for agricultural expansion, construction materials, fuelwood and charcoal production. Quadrats number 69 and 75 are the richest with regard to the number of species (15) per quadrat, while the lowest number of species (7) was recorded for quadrat 23. Least diversity and least even distribution was

recorded, in the place where inhibited by the pastoralists Argoba people, represented by community type V, this may be due to high overgrazing by domestic stocks of the pastoralists of Argoba people. *Calpurnia aurea* and *Capparis tomentosa* community type contributes nine wild edible plants.

The present study indicates that Berehet District has a high diversity of useful plants. The analysis of interviews showed that wild edible materials collected from trees and shrubs make a major contribution to the community, during periods of ample food production to supplement the staple food and during famine. Most of the encountered Wild edible plants provide other services including medicinal value, Construction, Firewood and Charcoal, Fodder, Beekeeping and Bee forage. However, information on the nutritional values and possible toxic effects of most of the wild edible plants reported by Berehet District, and others in different part of Ethiopia is not available. Therefore, the documented information on the wild edible plants may serve as baseline data for future studies on nutritional values and possible side effects, and to identify plants that may improve nutrition and increase dietary diversity.

As the results revealed that many wild species are under growing pressures from various anthropogenic factors. Wild edible plants are suffering from the threats of agricultural expansion, overharvesting (for fuel wood, construction, charcoal and tool) and overgrazing in both agroecologies. However, the management activities are also lower.

Thus, public awareness and community based management need to be encouraged at all levels alongside of urgent collection of germplasm. Conservation of these biological resources is very important these plants may have the potential to be valuable food sources (if cultivated) and could be part of a strategy in tackling food insecurity. This study gives indications that wild-food plants should be considered as a serious issue when it comes to developing strategies to fight rural food insecurity and develop integrated development programmes for chronic food insecure areas in Ethiopia as well as in other parts of the world.

These plants are distributed in Wood and Grazing lands, Fallow land and Forest patches, Home garden and Live fence and Cropland. Forest patches and Fallow land yielded more species. Attention is needed as these species are mostly found in habitats that are already under threat. Many edible species are found in ecosystems converted to agricultural lands and in close association with human dwellings. Options for utilization of wild edible plants should be combined with scientific research covering their botany, nutrient contents, toxicity and ethnobotany to compile the indigenous knowledge that exists with the people that use the plants.

Recommendations

Based on the results of the study, the following recommendations are forwarded**:** Promote wild edible plants as valuable resources to improve household food security and ample food production to supplement the staple food, especially for households living in the study area. The findings suggest further investigation into nutritional profiles and processing methods of all the species reported and study of the pharmacological properties for the nutraceutical species since they are also used for medicinal applications. There is a need for identification of possible side effects of using these wild foods plants. *In-situ* conservation of edible trees and shrubs should be enhanced through the participation of the local community. Some of the highly valued wild food plants are being over exploited due to their use; therefore, conservation strategy should be formulated and implemented for long-term management of plants in the area. It is therefore, necessary to use the documented wild edible plants, and properly use the indigenous knowledge surrounding before irreversibly lost. Policy enhancement is recommended to properly utilize and manage the existing potential of wild edible plants. One of the threats to the vegetation of Berehet district agricultural expansion is being carried out in the area. There is an urgent need for an open discussion between the communities, political and administrative bodies to come up with concrete alternative plan that would help the people without destroying all the vegetations.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

All the Authors made substantive intellectual contribution to this study in data collection, identification of plants, preparation and editing of the manuscript and proof reading.

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