

Ethnobotanical Study on the Diversity and Utilization of Wild Edible Plants in Majang Zone of Gambella Region, Southwest Ethiopia

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Abstract:- Wild edible plants are important source of nutrient and vitamin supplements for indigenous people. This research was conducted in Majang Zone of Gambella Region, Southwest Ethiopia to focus on Ethnobotanical study of the diversity and utility of wild edible plants. The study was carried out between June 2018 and May 2019. Ethnobotanical data were collected by interviewing 84 informants (70 males and 14 females) aged 16-70 years where key informants. Quantitative analytical tools for ethnobotanical methods including simple preference ranking, pair-wise ranking, direct matrix ranking, informant consensus factor and dependability level were employed. Majang zone furnished 77 plant species consumed by the community and among these plants sixty two (62) genera and 37 families. The Moraceae and Cucurbitaceae with six species (7.8%), Dioscoreaceae with five species (6.49%) and Brassicaceae, Amaranthaceae each with four species (5.19%) species were the most useful edible plants. Most of the wild edible plants were herbs represented with 28 (36.4%) species. Among the other edible parts fruit was found to be the most edible plant part, accounting for 40 (36.4%) species, and mostly eaten as raw. Of the reported wild edible species, most of the species were reported for more than two uses.

Keywords: Ethnobotany, Fidelity Level, Majang, Informant Consensus, Wild Edible Plant.

I. INTRODUCTION

Ethnobotany is the study of plants and human relationship with the surrounded ecosystem of natural and social constituents [1]. Biodiversity is very important in securing different ultimate human needs. Long years before, people have collected different types of plants to fulfill various basic necessities [2]. Multi million people across developing countries, obtain a substantial part of their subsistence and income from wild plants or plant products. These consumed wild plant species contain important nutrient or use as supplements food for indigenous people [3]. Therefore, wild edible plants can play enormous role to

reduce the vulnerability of local communities to food insecurity and provide a safeguard in times of food scarcity. Ethiopia is a country with varied topography and a wide variety of habitats which constitutes a large number of endemic plants and animals. According to the flora of Ethiopia and Eritrea approximately six thousand (6000) species of higher plants, of which about 10% are endemic [4]. Many scholars recognize that, as Ethiopia is the biodiversity hotspot and center of origin and diversification for a much amount of food plants [5]. The variety of climatic and different soil conditions allow to the growing of diversified of wild food plants [6]. Some studies on the utilization of wild edible plants in Ethiopia indicated that many rural peoples are capable with the indigenous knowledge of how to utilize the non-domestic plants. This is particularly true for the use wild edible plants that are consumed at times of famine, war and use as a supplement food. So that, particularly the elders are considered as source/reservoir of indigenous knowledge regarding to utilization of wild plants. [7]. So far as Ethiopia is one of the third world country there is remarkable system of indigenous knowledge that supports people to survive under hostile environmental conditions, famine and poverty [8]. The hypothesis of these research is stated as, Majang zone is rich with vegetation diversity and abundance this implies that there is also abundant and diversified wild edible plants.

II. MATERIALS AND METHODS

Majang zone is one of the zone which is found in Gambella Region. It is bounded with Sheka and Bench Maji zones of South Nation and Nationality of People region (SNNPR) in its Southeastern part, Ilubabor zone in its Northern and Agnwa zone of Gambella in its Western part. Majang zone is gifted by rich bio-cultural variety. More than 70% of the Majang zone is covered by forest. The topography is predominantly hilly, and elevations range 800 to 2100 meters above sea level. The climate of the area is a hot and humid type. The vegetation type is characterized as moist evergreen afro-montane forest. The mean annual rainfall is estimated to be around 2100 mm. The mean annual temperature is ranged between 20 and 33°C.

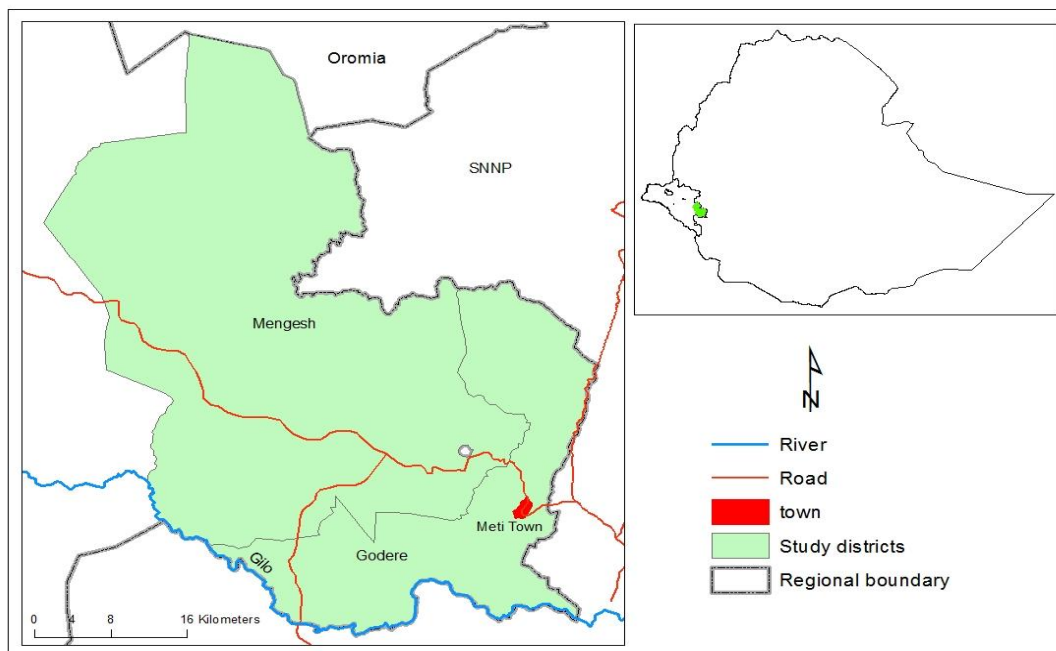


Fig 1:- Map of the study area

➤ *Reconnaissance survey*

Reconnaissance survey has been conducted to have a mental picture of the study area. It was conducted from October 20/2018- April 30/2019 for the purpose of obtaining an inspiration about wild edible plants and a general image of the study areas and to observe the possible ways to deploy the study.

➤ *Specimen collection and identification*

Ethnobotanical data was gathered from districts and selected localities in the Majang Zone. Semi-structured questionnaires'. Additionally, field observation, preference and direct-matrix ranking was used to get further information. Key informants of the study were identified by using systematic method of informant selection however other informants were selected randomly.

Survey of markets was accompanied to determine the presence and abundance of wild edible plants. Detail studies were conduct from May 2018 to April 2019 on major markets of Majang Zone. Formal, informal and extensive interactions was applied with the wild edible plant sellers and with those involved in the collection and marketing in order to gather detailed information [9]. The local names, sources, life forms, growth habit, availability period, and edible part, mode of consumption, availability status, distribution pattern, and mode of propagation of the plants were comprised in the investigation.

Voucher specimens were collection using the information gathered from the informants and local field assistants. Further identification of the voucher specimen

were made in National Herbarium of Ethiopia (ETH), Addis Ababa University.

➤ *Ethnobotanical data collection*

We were select a total of 11 localities from Majang zone based on vegetation cover and the availability of locally recognized traditional healers with the assistance of District and locality's authorities.

➤ *Sample size determination*

The number of localities which to collect information were 11 and informants from aged 16 and above were participate to collect information on crop wild relatives and wild edible plants knowledge of the community. The households were selected randomly from each localities for the survey, by assign random numbers to the households (as lottery methods). Sample size of each localities were calculated using proportion of the number of households of the localities in the Districts. The sample size for quantitative data were determined using Cochran's (1977) formula as indicated by Bartlett and Higgins (2001) as follows:

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

= sample size for the research, N= total number of households in all 11 kebeles

e= maximum variability or margin of error 5% (0.05)

1= the probability of event occurring.

➤ *Data analysis*

Informants' Consensus Factor (ICF) were used to calculate the level of homogeneity between information provided:

Where, Nur is the number of use reports from informants for a particular plant-usage category and Nt is the number of species that are used for that plant usage category for all informants. Values range between 0 and 1, where "1" indicates the highest level of informant consent

$$ICF = \frac{Nur - Nt}{(Nur - 1)}$$

➤ *Use value of useful plants analysis*

The use value scores assigned to these classes were, 0, 0.5, and 1 respectively (Phillips O 1996). The plant use value has been analyzing to evaluate the importance of each plant species to the ethnic people and calculated as the average use value of the species using the following formula:

$$Uvis = \frac{\sum Uis}{nis}$$

Where, Uvis = the use value (Uv) attributed to a particular species (s) by one informant m (i); $\sum Uis$ = summation of all the uses mentioned in each event by the informant; nis = total number of events in which that informants give information on the species.

III. RESULT

A total of 77 wild edible plants species belonging to 62 genera and 37 families were collected and identified from the study area. The family Moraceae and cucurbitaceae represented the highest number of species 6 species each (7.8%), followed by Dioscoreaceae 5 species (6.49%) and Brassicaceae, Amaranthaceae each with 4 species (5.19%), Cucurbitaceae, Commeliaceae, Asteraceae, Capparidaceae, Vitaceae, and Solanaceae each with 3 species (3.9%), Apocinaceae, Fabaceae, Balanitaceae, Rosaceae, Tiliaceae, Sapotaceae, and Oleaceae each with two species.

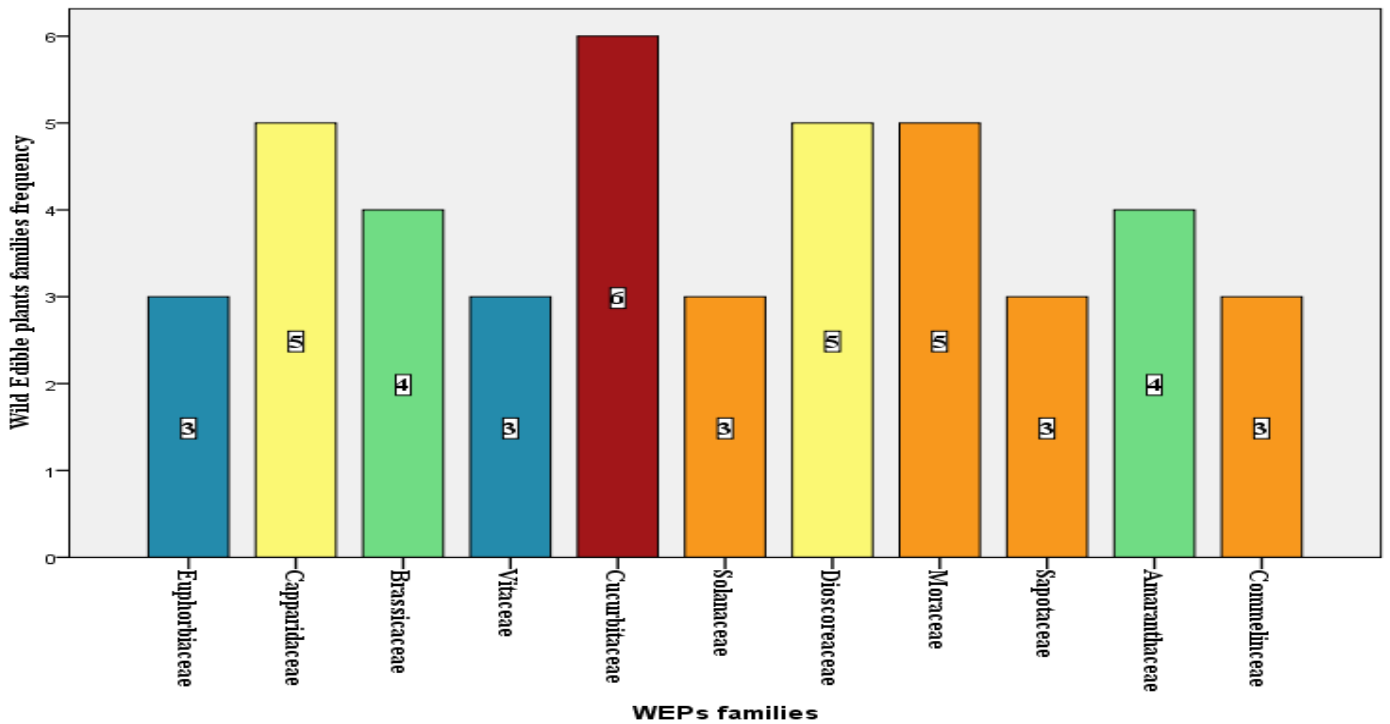


Fig 1:- The frequency of plants family recorded in the study area.

➤ *Habit*

The growth form distribution showed that majority of the species were herbs (36.4%, 28 species) followed by trees

(32.5%, 25 species), shrubs (18.2%, with 14 species). Others were liana and climbers.

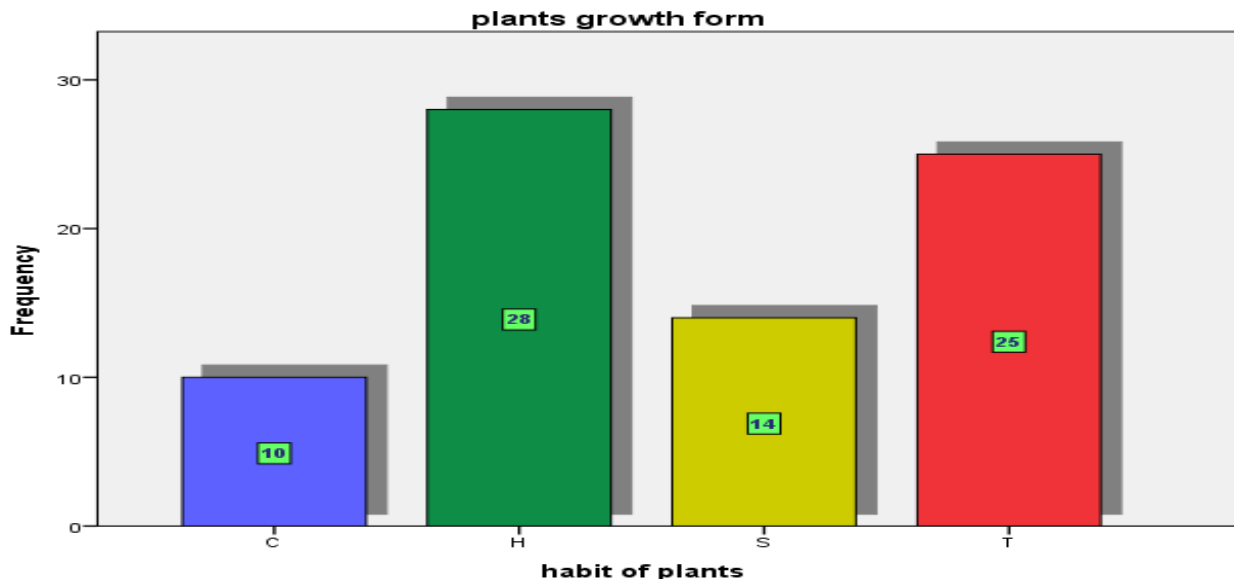


Fig 2:- The frequency of plants growth form in the study area. (C, climbers; H, Herbs; S, shrubs; T, trees)

➤ *Plant parts used as food*

Fruits, leaves, young shoot and stem were found the most widely used wild edible plant parts in the study area. Eleven plant parts were indicated as edible, fruits accounted

for 40 (36.4%), followed by leaves 15 (13.6%), young shoot and root each with 7 (6.4%), flower nectar 2 (1.8%), bark, seed, young leaf, stem, rhizome, tuber each 1 (0.9%) (Figure 4).

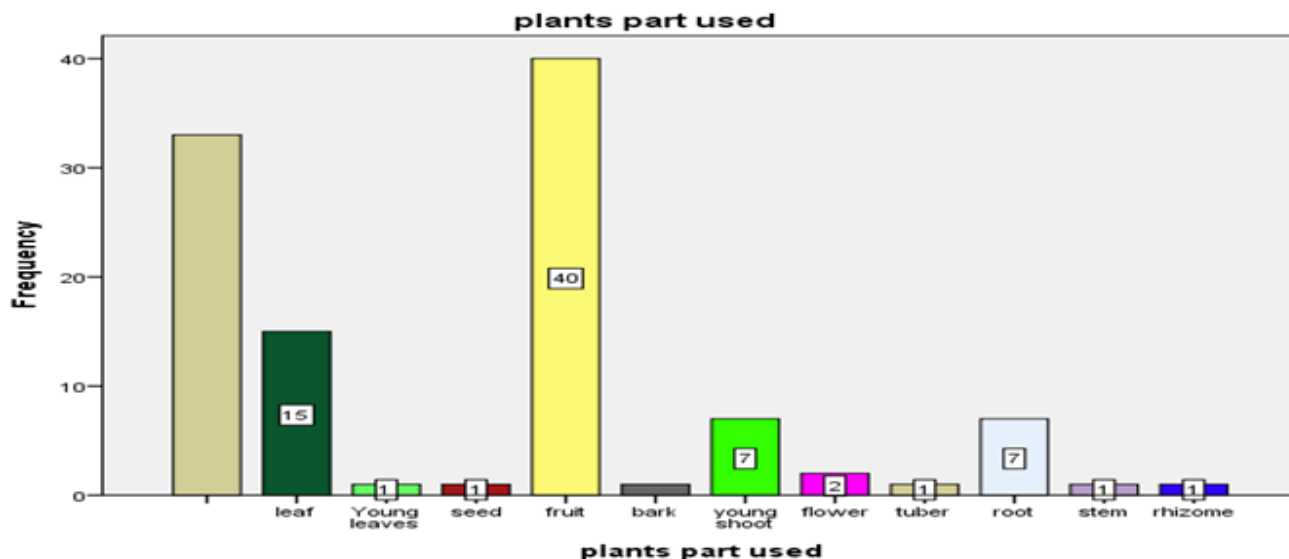


Fig 4:- wild edible plants parts used at the study area

➤ *Mode of consumption*

In this study, 69 (86.25%) lists were counted as unprocessed whereas 11 (13.75% species) were consumed cooked or processed. Processed type, edible plants were consumed after cooking process including preserve, powder and heat pass.

➤ *Preference for WEPs*

Selection and ranking of the most preferred wild edible plants, based on their taste quality was performed in the study area. The results of this study showed that, the most preferred species in decreasing order of their taste quality were *Dioscorea praehensilis*, *Syzygium guineense*, *Cardamine trichocarpa*, *Cleome gynandra*, and *Cordia africana*. (Table 1)

Respondents labelled 1-5	Wild Edible Plants				
	<i>Dioscorea praehensilis</i>	<i>Syzygium guineense</i>	<i>Cordia africana</i>	<i>Cleome gynandra</i>	<i>Cardamine trichocarpa</i>
I ₁	2	3	1	2	2
I ₂	5	4	2	4	3
I ₃	4	2	3	2	4
I ₄	5	3	1	3	3
I ₅	3	5	2	2	2
TOTAL	19	17	9	13	14
RANK	1ST	2ND	5TH	4TH	3RD

Table 1:- Preference for WEPs at the study area

➤ *Factors threatening WEPs*

In Majang zone, comparison of five threatening factors of wild edible plants was conducted using 7 key informants. The results (Table 2) indicated that agricultural expansion stood first, followed by firewood collection, charcoal making, construction, tools, and grazing were management problems of plant resources respectively (Table 2).

Preferred item	Respondents							TOTAL	RANK
	R1	R2	R3	R4	R5	R6	R7		
Construction and tools	1	3	2	1	2	3	3	15	4th
Charcoal making	4	2	0	1	1	0	4	12	5th
Coffee plantations	5	2	3	4	2	2	2	20	2nd
Fire wood	3	2	4	3	2	3	2	19	3rd
Investment	2	4	3	4	3	4	4	24	1st

Table 2:- Factors threatening WEB's

➤ *High ranking of WEPs*

In Majang zone, five commonly reported multipurpose species and five use-categories were used for in direct matrix ranking exercise. Among the very common wild edible plants, DMR showed that *Syzygium guineense*, *Cleome gynandra*, *Dioscorea praehensilis*, *Dioscorea bulbifera*, *Plectranthus edulis* were found to be most important in their multiple utility value respectively (Table 3).

Use categories	Wild Edible Plants																			
	<i>Plectranthus edulis</i>				<i>Syzygium guineense</i>				<i>Dioscorea praehensilis</i>				<i>Cleome gynandra</i>				<i>Dioscorea bulbifera</i>			
	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
Med	1	2	2	1	3	4	2	1	2	4	2	3	3	4	4	5	4	3	5	4
Fire W	1	1	1	0	2	3	3	4	0	0	0	0	2	3	2	4	2	0	1	1
Construction	0	0	0	0	2	5	3	4	0	0	2	1	2	1	1	0	0	0	0	1
Food	2	3	4	3	2	5	3	4	2	3	5	3	1	5	4	4	2	5	2	2
L Fence	1	1	2	2	2	1	2	2	1	1	1	1	1	3	1	1	1	1	2	0
Inf. Total	5	7	9	6	11	18	13	15	5	8	10	8	9	16	12	14	9	9	10	8
GC	27				57				31				51				36			
RANK	5th				1st				3rd				2nd				4th			

Table 3:- direct matrix ranking of five WEBs by four informants based on five used criteria (5= best, 4=Very good, 3=good, 2=less used, 1=least used, 1= no value)

➤ *Marketability of WEPs*

Two daily and two weekly markets from four kebeles were selected for market survey. During the study, four major

markets in Mengash and Godere District were observed. Many of the wild edible plants were reported to be consumed raw and outdoors (in agricultural fields, during coffee

collecting and travelling), and some other parts that require processing were brought home for preparation prior to consumption. However, there was two wild edible plant sold in the market of Mengash.

IV. DISCUSSION

Majang zone is generally gifted with diverse and rich sources of wild edible plants and these serve the local communities as food sources and other multiuse values. These plants belong to 77 species, 47 genera and 33 families. In Majang Zone, of the total wild edible plants species 44 (68.75%) were found from natural habitat. The finding is similar to those by Mersha Ashagre *et al.* (2016) and that the local users collected most of these plants from the wild. The role of wild food plants mainly during critical times were well documented by Zemedede Asfaw [10].

➤ *Habit, Plant parts used and mode of consumption*

Of the recorded wild edible plants in Majang zone, 77 wild edible plants species belonging to 62 genera and 37 families were collected and identified from the study area. Demel Teketay also reported that shrubs accounted for the highest part. Similarly, the findings agree with the report from Derashe and Kucha districts by Kebu Balemie and Fassil Kebebew, which showed that wild edible materials were largely collected from shrubs. Fruits, leaves and young leaf were the parts used widely by the two social communities in the study area. Although different plant parts were consumed in Majang zone 46 (71.87%) of the edible plant parts were fruits, followed by 7 (10.93%) leaves. Therefore, fruits were the most important edible plant parts. This is in line with the work of Zemedede Asfaw and Mesfin Tadesse (2001). This finding is similar to that of Hussien Adal (2004), who found that fruit accounted for 80 % of edible wild food. This study revealed that most of the recorded wild edible plant species or their parts were consumed as raw/fresh without further processing. Only 11 (13.75%) species were reported to be cooked before consumption. The high percentage of raw edibles may be due to them prioritized as food items for collecting and use at home compared with cultivated food plant products. This is consistent with other findings including those of Tigist Wonidmu *et al.* (2006); However, this is contrasted with findings of Tilahun Teklehaymanot and Mirutse Giday (2010) whose studies in southern Ethiopia, indicated that sixteen (41%) wild edible plants were used as vegetables being harvested for their leaves, upper parts (leaf and stem) were consumed after cooking.

➤ *Preferences and ranks of WEPs*

As indicated by the results of paired comparison of factors affecting plant resources in the study area, all informants almost similarly reported that investment stood first. The above results are also reported in different area by Kebu Balemie and Fassil Kebebew (2006); Assegid Assefa and Tesfaye Abebe (2011) and Debela Hunde *et al.* (2011). In

Majang, among the very common wild edible plants, *Cordia africana* was the most threatened followed by *Acacia mellifera*, *Carissa spinarum* and *Tamarindus indica* respectively. *Cordia africana* was found to be most important in its multiple utility value similar to findings in (Behailu Etana, 2010; Debela Hunde *et al.*, 2011).

➤ *Wild edible plants and crop wild relatives*

As the information's provided about marketability, some wild edible plants, were found common in the market place sold basically for food or spice, medicinal, and other purpose. Kachi (*Dioscorea praehensilis*), Kokomal (*Cleome gynandra*), Inqoko (*Embelia schimperi*), Yuya (*Trichilia dregeana*), Wokoyi (*Dioscorea bulbifera*) were found on markets being sold and purchased entirely for the purposes of their nutritional value.

Regarding wild edible plants, there was one wild edible plant sold in the market of Majang Zone (*Dioscorea praehensilis*). The justification of informants showed that, the limitation of marketable wild food plants was related to reduce accessibility of the sources due to of deforestation taking place from time to time. This was proved from the observation of markets and the discussion with merchants. In addition, the second reason reported by the informant is that wild food selling is culturally prohibited or considered shame by the family members, even children are not allowed to do so. A few numbers of wild foods sold in the market were also reported by other studies made in Ethiopia (Zemedede Asfaw, 1997). Generally, most of the informants stated that the local people give less emphasis to wild edible plants, but highly over-harvested for different purposes. This was also pointed out by Tigist Wondimu [11].

There was loss of plants because of agricultural expansion, firewood collection; charcoals making, timber, construction material was contributing factors for the loss of plant species in general and Wild Edible Plants in particular. In the Majang Zone, investment was the main threat to wild edible plant availability. Similar results were obtained in a different investigation in Ethiopia Endalew Amenu (2007) that showed that need for agricultural land and population pressure severely threatened plant species in general and wild edible plants in particular.

V. CONCLUSIONS

➤ *Wild edible plants in Majang zone*

A total of 77 wild edible plants were recorded in the study area and these plants were distributed in 62 genera and 37 families. From the total wild edible plant species two of them (*Dioscorea praehensilis*) endemic species to Ethiopia were being used as food by the local people of Majang zone. Of the total wild edible plants recorded the majority were obtained from wild vegetation. Of all the families the family Cucurbitaceae and Moraceae are represented each with 6

species, had the highest proportion of edibles followed by Dioscoraceae, Brassicaceae and Solanaceae in Majang zone. The result of growth forms was Majang zone that herbs were the highest proportion of the edible species followed by trees. Fruit is found to be the most edible plant part and mostly taken as raw.

As indicated by the results of paired comparison of factors affecting plant resources in the study area, all informants almost similarly reported that extensive investment stood first. *Dioscorea praehensilis* was found to be most important in its multiple utility value (most threatened) among wild edible plants.

➤ Marketability of wild edible plants

Most of the wild edible plants are not widely traded for food purposes, but mostly for other different uses for medicinal or spice purposes, for farm implement and other purpose. The reason reported by the informants is that wild food selling is culturally prohibited or considered shame by the family members, even children are not allowed to do so.

RECOMMENDATIONS

- The nearby Universities at the study area should have to work on the conservation of WEPs.
- Community-based forest priority areas need to be demarcated and effectively protected in the districts for the conservation of forest in general and WEBS plants in particular.
- Culture and Tourism Offices of the districts should encourage people to protect some cultural believes and traditional practices associated with WEPs.
- The most gathered wild edible plants were from wild habitats and this calls for urgent research on the possibility of adapting, growing and intentionally managing some of the commonly consumed wild edible plants such as Kachi (*Dioscorea praehensilis*), Kokomal (*Cleome gynandra*), Inqoko (*Embelia schimperi*), Yuya (*Trichilia dregeana*), Wokoyi (*Dioscorea bulbifera*) under Ethiopian Biodiversity Institute efforts in its ex-situ conservation sites. Furthermore, further research on the toxicity and nutritional composition of the reported wild edible plants is recommended to ensure safety of consumption.

ACKNOWLEDGEMENTS

We are grateful to the Gambella University, for facilitating this research work and financial support. Staff members of the Gambella University are highly acknowledged for their technical and material support in plant specimen collection, identification and handling. We would like to thank the local residents of the study area who have been helpful during the fieldwork and kind enough to share their knowledge and experiences without any reservations.

REFERENCES

- [1] Abebe, D., Ayehu, A., "Medicinal plants and enigmatic health practice of Northern Ethiopia.," Addis Ababa., 1993.
- [2] Yadav, U., Ram, C.P., Krishna, K.S., Sangeeta, R., Narendra N.T., Uttam, B.S., Hugo, A. , "Diversity of use and local knowledge of wild edible plant resources in Nepal.," *Journal of Ethnobiology and Ethnomedicine*, vol. 8, p. 16, 2012.
- [3] Ali, et al, "some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe)," *Food Chem Toxicology*, vol. 46, no. 2, pp. 409-420, 2008.
- [4] B. Azene, "Useful Trees and Shrubs of Ethiopia: Identification, Propagation and Management for 17 Agroclimatic Zones. RELMA in ICRAF Project.," World Agroforestry Centre, East Africa Region, Nairobi, Kenya, 552., 2007.
- [5] Tesfaye, A., "A Study on the Ecology and Ethnobotany of Non-cultivated Food Plants and Wild Relatives of Cultivated Crops in Gambela Region, South Western Ethiopia.," in *Msc. thesis Addis Ababa University*, , Addis Ababa, Ethiopia., 1997.
- [6] Addis, G., Urga, K., Dikasso, D., "Ethnobotanical study of edible indigenous plants in some selected districts of Ethiopia.," *Human Ecology*, vol. 33, no. 1, p. 83–118., 2005.
- [7] Amare, G., , "The role of wild plants in the native diet in Ethiopia.," *Agro-Ecosystems*, Vols. 1, , p. 45–56., 1974..
- [8] Fenta T, "Harnessing local and outsider's knowledge: Experiences of multi-stakeholder partnership to promote farmer innovation in Ethiopia .," *.Prolinnova working paper*, p. 12, 2006.
- [9] Uprety D.C., V.Jain, "effect of elevated carbondioxide concentration on the stomatal parameters of rice cultivars.," *photosynthetica*, vol. 40, no. 2, pp. 315-319, 2002.
- [10] Zemede Asfaw and MesfinTadesse, " Prospects for Sustainable Use and Development of Wild Food Plants in Ethiopia.," *Economic Botany*, vol. 55, pp. 47-62, 2001.
- [11] Tigist Wondimu, Abel Gizaw, Tusiime, F.M., Masao, C.A., Abdi, A.A., Gussarova, G., Popp, M., Sileshi Nemomissa, and Brochmann C., "Crossing barriers in an extremely fragmented system: two case studies in the afro-alpine sky island flora.," *Plant Syst Evol.* , vol. 300, p. 415–430, 2014.
- [12] Z. a. MesfinTadesse, "Prospects for Sustainable Use and Development of Wild Food Plants in Ethiopia.," *Economic Botany*, vol. 55, pp. 47-62 , 2001.