



DIVERSITY OF WILD EDIBLE WOODY PLANT SPECIES IN JORE WOREDA, GAMBELLA REGIONAL STATE, SOUTH WEST, ETHIOPIA

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ABSTRACT

An ethno botanical study was conducted in Jore woreda of Gambella Regional State of Ethiopia with the objective of identifying the Diversity of Wild Edible woody Plant Species in Jore Woreda of Gambella region, southwestern part of Ethiopia. The study was given special emphasis on assessing the diversity of wild edible plant species and their benefit as supporting local community food gap (especially during shortage of main food crop) in the area. In vegetation data sampling transect method having 84 square shapes with size of 20 x 20 meter (400 m²) sample plots were established along transect line. In addition 120 households from two representative administrative kebeles were selected and interviewed using semi-structured questionnaire. In addition to household interviewed, other methods such as focus group discussions and key informants interview were also employed. Twenty one, wild edible plant species belonging to 13 families were identified. Arecaceae family, which is represented by three species accounted for the largest population of the entire plants followed by Ulmaceae represented by two species. The population status of the plant in the study area was decreasing and showed abnormal population structure (more or less J-shape and bell shape population structure). Deforestation due to agricultural expansion, forest fire and increased demand of forest resource for different purpose (fuel wood, construction materials) are the major threats encountered in sustainable of these valuable wild plant species. Therefore, there is a need to design and implement sustainable natural resource management and enhance the productivity and environmental services capacity of identified plant species as well as the entire vegetation in the study area.

KEYWORDS: Wild edible plant; Ethno botanical; wild food.

INTRODUCTION

1.1 Back ground and justification

Wild edible plants (WEPs) refer to species that are neither cultivated nor domesticated, but are available from their wild natural habitat and used as sources of food (Beluhan and Ranogajec, 2010). It contribute to food security directly in the form of fruits, seeds and other edible parts or indirectly by maintaining and restoring soil fertility and water resource which subsequently increase agricultural production (Guyassa *et al.*, 2014). In addition to their role in closing food gaps during periods of drought or scarcity, wild edible plants play an important role in maintaining livelihood security for many people in developing countries (Afolayan and Jimoh, 2009).

Estimates done by the World Health Organization, (2013) reveal that 80% of the people living in developing countries use wild plants to meet some of their health and nutritional needs. Thus, billions of people, especially those living in rural areas in developing countries, make use of non timber forest products (NTFPs) on a daily

basis. This involves thousands of plant and tree species, most of which are consumed within the household of the gatherers and are not traded in markets. This home-consumption is also called 'subsistence use'. Life would be virtually impossible for most people living in rural areas in developing countries without the availability of palm leaves for roof thatch, medicinal plants and natural fibers to construct baskets and fish traps (Tinde van Andel, 2006).

Many people in the rural regions have no money to buy zinc sheets for roofing, prescription medicine, construction material or domestic utensils. Moreover, the further away from cities and towns, the higher the transport costs are. Commodity items inevitably become too costly or even unavailable in remote rural areas, so that people are heavily dependent on the forest and savannah products around their homes (Tinde van Andel, 2006).

Gambella National Regional State of Ethiopia, specifically Jore Woreda (the study district) has got

abundant diversity of natural vegetation in which local community dependent on as food source. However, no adequate scientific studies have been conducted in the area for generating accurate required information to conduct detail further study as well as to design and implement sustainable natural resource management. Therefore, the study was undertaken with the objective of assessing the Diversity of Wild Edible woody Plant Species in Jore Woreda, Gambella Regional state, South West, Ethiopia.

2. MATERIALS AND METHODS

2.1 Description of study area

Gambella National Regional State (GNRS) is one of the National Regional states of the Federal Democratic Republic of Ethiopia (FDRE) located in the southwestern part of the country (Fig. 1). It is located between the geographical coordinates of 6°28'38" to 8°34" North Latitude and 33° to 35°11'11" East Longitude, which covers an area of about 34,063 km². The Region is bounded to the North, Northeast and East by Oromia National Regional State, to the South and Southeast by the Southern Nations, Nationalities and People's

Regional State and to the Southwest, West and Northwest by the Republic of Sudan (BoLR., 2011).

The annual rainfall of the Region in the lower altitudes varies from 900-1,500mm. At higher altitudes it ranges from 1,900-2,100mm. The region is endowed with a vast marginal land which is suitable for agriculture and other economic activities. The existing land use/land cover types of the region are identified as cultivated land, forest land, wood land, bush land, shrub land, grass land, bamboo, wet (marsh) land, and others (Tadese *et al.*, 2016).

The study was specifically conducted in Jore Woreda, which is one of the 13 Woredas of Gambella Region. The district is bordered with Jikawo Nuer Zone on the north, on the east by Goge, on the south by South Sudan, on the west by Akobo. The district is located 145 km away from the regional town of Gambella. The terrain of Jore district is predominantly flat, with the elevation ranging between 400 to 600 meters above sea level. A major water body of the district is Gilo River and 30% of the district is forest (CSA, 2007). It extends between 7°N to 8.20°N latitude and 33°E - 36.02°E longitude (Paul *et al.*, 2012).

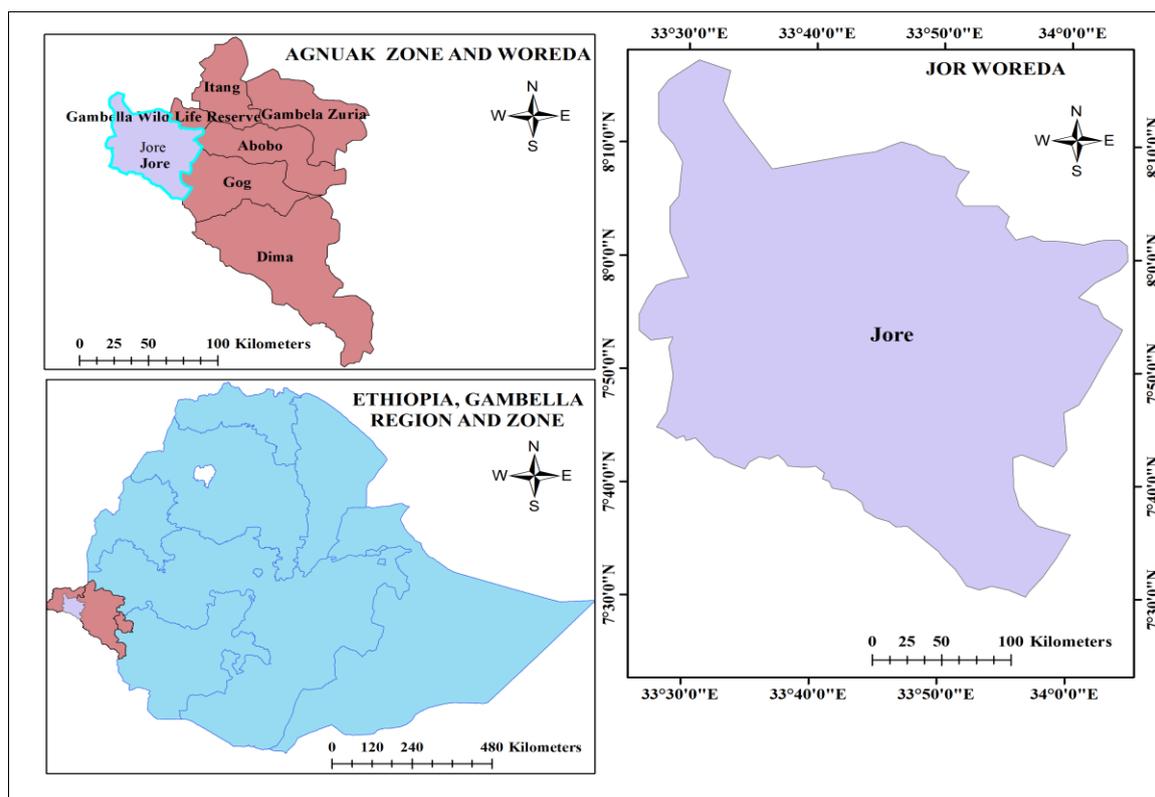


Figure 1: Map of the Study District.

2.2 Method of Data Collection

2.2.1 Vegetation data sampling

For gathering data on their diversity and population status of edible wild plant species, field reconnaissance survey was conducted then; two representative Kebele Administrations (**Olawo and Shantawa**) were selected

purposely on the bases of their better wild edible vegetation cover and information gathered from development agents, woreda agricultural office. After specific research area was defined transect method of sampling will be adopted, since vegetation is distributed across a large area. Accordingly 6 transect lines were

laid across west- east landscape direction at each kebeles. In each transect line there were 7 sample plots having 20x20 meter (400 m²) square shape established at 200m interval along transect line. Totally 84 sample plots were established at both kebeles.

Data were collected from the first sample plots on line transect and then progressing to the next quadrat in an east-west compass direction. All encountered edible plant species were recorded and categorized into 1) seedling (if height <1.5m), 2) sapling (if height 1.5m - 3m), and 3) tree (if height >3m) (Worku *et al.*, 2012a; Adem *et al.*, 2014). Diversity and regeneration profile of all encountered woody species were investigated. DBH was measured for individuals >1.5 m in height using diameter tape (Adem *et al.*, 2014). Seedlings (<1.5m height) were counted and recorded. Plants were identified at the field using different trees and shrubs identification manuals of Eritrea and Ethiopia. Useful Trees and Shrubs of Ethiopia (Azene *et al.*, 2007), but those species that were not known at field, local name was registered and voucher specimens were used and identified at herbarium of Biology Department, Addis Ababa University. Specimens were dried and identified with reference to authenticated specimens (Edwards *et al.*, 1995, Hedberg and Edwards 1989; Hedberg *et al.*, 2006).

2.2.2 Socio economic data sampling

Two representative Kebele Administrations from the study Woreda or district (**Olawo and Shantawa**) were selected purposively on the bases of their better vegetation cover and higher consumption status of wild edible plant in the area. Following a procedure by (Krejcie and Morgan, 1970), a total of 120 respondents (79 males and 21 females) from the two Kebeles were selected to take part in the study.

Various socio-economic survey methods were employed for gathering data on the contributions of wild edible plant species to rural households filling food gap during the seasons of food shortage and until new growing crops are harvested. These methods and techniques include semi-structured questionnaire for conducting household interview, Focus Group Discussion (FGD), transect walk and key informants interview.

2.3 Method of Data Analysis

Following Magurran (1988) to investigate species diversity of wild edible plant species in the study area the collected data on vegetation was analyzed by using (Shannon and Wiener, 1949).

In order to determine their population structure, the generated data from wild edible plant species was analyzed by grouping into different arbitrary of nine diameter classes of 5cm interval and six height classes of 2m interval. Frequency histogram of both diameter and height class distributions were used to construct

population structure by using diameter and height class versus number of individuals categorized in each class.

The collected data was putted into computer excel worksheets and analyzed by using descriptive statistics, such as means, standard deviation, frequency in order to identify the role of wild edible plants to the community living in each study areas.

3. RESULTS AND DISCUSSION

3.1 Household Demographic

Among the sampled households, 79(65.83%) were male and 21(34.17%) were female household heads. The average family size of informants in the area was 6, and the average age of the sampled household head was 43.5 with minimum of 22 and maximum of 60 ages.

About 42% of respondents did not attend formal education, with the remaining proportions of 28%, 18% & 12% having some educational background from grade one up to grade ten.

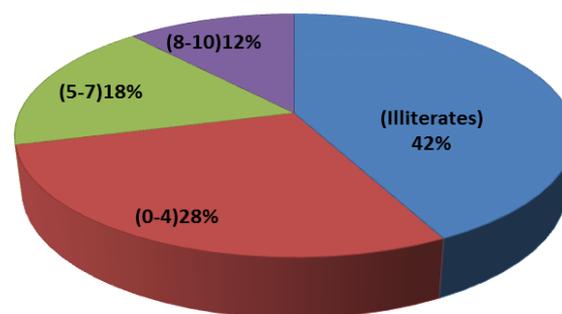


Figure 2: Educational status of respondents

3.2 Socioeconomic Characteristics

The livelihood of the community in the study areas were more of less subsistent in nature. Almost 85.83% of household's respondents were dependent on crop production, while, 14.17% of the household respondents were dependent on crop production and livestock, no engagement on livestock production as major livelihoods activities in the study area (Table 2).

Table 1: Major livelihoods and source of income.

Source of income	N=	Percentage
1 Crop production	103	85.83
2 Livestock	0	0
3 Both crop and Livestock	17	14.17
Total	120	100

3.3 Ethno botanical information of identified plant species

A total of 21 wild edible plant species belonging to 13 families were identified during the study. The family Arecaceae was the most diverse family represented by 3 species (*Borassus aethiopicum*, *Amorphophallus*

gallaensis and *Borassus aethiopum*). Family Meliaceae, Rhamnaceae, Sapotaceae, Cappariaceae, Fabaceae and Ulmaceae were represented by 2 species of wild edible plants. The rest Family *Balanitaceae*, Euphorbiaceae, Anacardiaceae, Moraceae, Annonaceae, and Poaceae represented by one species each. The list of these plant

species together with their families are indicated in (Table 3). From the tree species dominating the density of the study area *Balanites aegyptiaca*, *Lepidotrichillia volkensii*, *Borassus aethiopum*, and *Tamarindus indica*, were the fourth top wild edible plant species constituting 66.42% of the entire density of study area.

Table 1: List of identified wild edible plant species in the study area

Species scientific name	Family	Plant form						
			DE/ha	N	N%	RDO	RFR	IVI%
<i>Balanites aegyptiaca</i>	Balanitaceae	Tree	271	10	18.4	29.743	8.038	18.945
<i>Lepidotrichillia volkensii</i>	Meliaceae	Tree	264	7	12.9	14.388	4.787	11.758
<i>Borassus aethiopum</i>	Arecaceae	Tree	199	5	9.7	12.621	8.747	10.036
<i>Tamarindus indica</i>	Rhamnaceae	Tree	120	3	5.8	9.663	7.801	7.256
<i>Butyrospermum paradoxum</i>	Sapotaceae	Tree	118	3	5.7	8.014	2.837	6.195
<i>Amorphophallus gallaensis</i>	Araceae	Tree	113	3	5.5	5.18	4.492	5.307
<i>Cadaba farinosa</i>	Capparidaceae	Tree	111	2	3.8	3.802	7.092	5.147
<i>Ximelia americana</i>	Meliaceae	Shrub/tree	78	2	3.6	2.532	2.128	5.046
<i>Acacia Senegal</i>	Fabaceae	Tree	73	2	3.5	1.85	2.6	3.518
<i>Celtis zenkeri</i>	Ulmaceae	Shrub	71	2	3.4	1.491	5.201	3.097
<i>Vitellaria paradoxa</i>	Sapotaceae	Tree	70	2	3.2	1.402	2.364	3.06
<i>Crateva adansonii DC.</i>	Capparidaceae	Tree	66	1	2.6	1.112	6.383	2.187
<i>Flueggea virosa</i>	Euphorbiaceae	Tree	53	1	2.5	0.839	1.655	1.85
<i>Lannea welwitschii</i>	Anacardiaceae	Tree	51	1	2.5	0.709	4.728	1.746
<i>Ficus capreaefolia Del.</i>	Moraceae	Tree	51	1	2	0.618	2.6	1.724
<i>Annona senegalensis.</i>	Annonaceae	Shrub/tree	41	1	2	0.618	1.891	1.641
<i>Oryza barthii</i>	Poaceae	Shrub/tree	40	1	1.9	0.481	2.364	1.578
<i>Celtis toka</i>	Ulmaceae	Tree	38	1	1.8	0.419	3.783	1.562
<i>Ziziphus spina-christ</i>	Rhamnaceae	Shrub/tree	37	1	1.6	0.373	5.674	1.387
<i>Borassus aethiopum</i>	Arecaceae	Shrub/tree	20	1	1	0.214	2.6	1.268
<i>Piliostigma thonningii</i>	Fabaceae	Tree	20	0	0.6	0.214	1.891	1.08
Total			1905		100	100	100	100

Total density per ha (DE) = 1905, (N) = Abundance/plot, N (%) = relative Abundance, RFR (%) = relative frequency, RDO (%) = relative dominance, IVI = Importance Value Index (%). wild edible species

3.4 Proportion of population structure

In general, in this study the proportion of seedling, sapling and trees were occurs in the proportion of (23.88%), (32.95%) and (43.18%) respectively which were exhibit abnormal population structure (Figure 3). This may probably occurs, due to high consumption rate, shrinking of forest resource and fire regime as major factors limiting regeneration of most species in the study area.

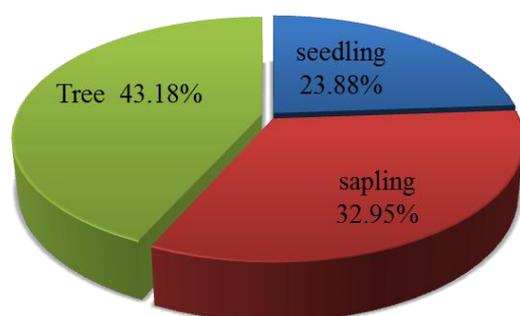


Figure 3: Proportion of population structure of entire vegetation.

3.5. Population structure based on stem diameter and height class distributions

The population structure (stem diameter and stem height class distributions) the species in the study sites is presented in (Figure 4). Analysis of the diameter and height size class distribution shows that more or less as diameter and height class increases stem density increase. The population structure of the species depicts the existence of more number of individuals at higher diameter classes which were happened less regeneration capacity of the species or high degradation to an area. The patterns of diameter class distribution showed more or less J –shape while height class distribution indicate bell shape population structure which both showed not an health population pattern in the area(Figure 4&5).

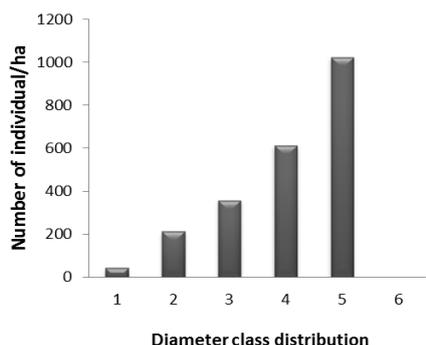


Figure 1: Diameter class distribution of the species.

Diameter size class in (cm) 1: 0<5cm, 2: 6<10cm, 3: 11<15cm, 4:16<20cm, 5: 21<25cm, 6: 26<30cm,

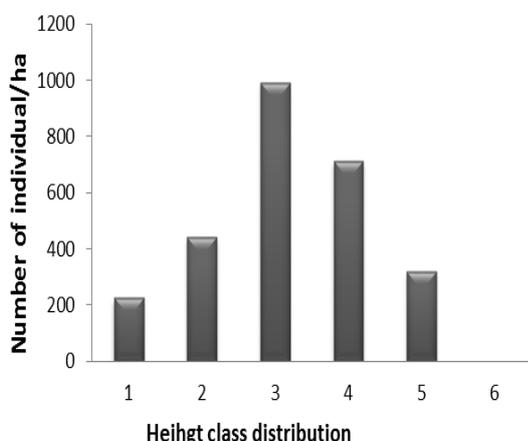


Figure 2: Height class distribution of the species.

Table 2: Major Threats on vegetation regeneration status.

Types of threats	Level of threats	Frequency	Percentage
Deforestation (Agricultural expansion)	Very serious threat	29	24.17
	Serious threat	85	70.83
	Medium	6	5
	Total	120	100
Forest fire	Very serious threat	32	26.67
	Serious threat	74	61.66
	Medium	14	11.67
	Total	120	100
Increased demand	Very serious threat	41	34.17
	Serious threat	68	56.67
	Medium	11	9.16
	Total	120	100

3.6 Role of wild edible plant

It was mentioned during the study that most sources of food and income have been practicing crops production in the study area. However, respondents emphasized that the crop production in the area is not adequate and sustainable throughout the year. The fact that the respondents stated that, wild edible plants only, purchased food sources and both wild edible plant and purchased crop with the voice of 51(42.5%), 14(11.6%)

Height size classes in (m), 1 :< 2m, 2: 2<4m, 3: 4<6m, 4: 6<8m, 5: 8<10m, and 6: 10<12m

In both diameter and height population pattern the lower classes were dominated by shrubs and herbs like *Ficus capreaefolia*, *Cadaba farinose*, *Crateva adansonii*, *Flueggea virosa* and seedlings and sapling of different tree species. The higher diameter classes were dominated by Balanitaceae, Arecaceae, Fabaceae and Arecaceae families of tree species. The last height class was represented by few stems of tree species this was also shows inverse relation between height distribution and density of stem.

Major threats on regeneration status

The majority of respondents agreed that there are threats to wild edible plant species in the study area. However, when asked about the threats, the respondents had different opinions. The types of threats that are faced by forest resources in general, and specifically wild edible plant species in the area are; Agricultural expansion, increased demand and Forest fire was Serious threat in the area with voice of 70.83%, 61.66% and 56.67% respectively (Table 5). Deforestation was considered to be a high threat to wild edible plant species by 70.83% of the respondents. This includes cutting of plants for fuel wood as well as deforestation due to land use change, e.g., the expansion of cultivated area and settlements.

Also shifting cultivation and bush encroachment was the common practiced to the area which has been losing very important edible plant species in the area especially mother trees that are edible and which are consumed yearly by the resident of local community.

and 55(45.9) respectively. This indicate that wild edible plant species in the surrounding vegetations has got supplementary food source and high dependency of local community to wild edible plant species in this study area. In comparing these findings similar with the study conducted in Agro -Pastoral Livelihood Zone Lare woreda. In this Livelihood, wild edible plants contribute more to people’s food supply than domesticated crops (Lim et al., 2017).

Table 3: The role of wild edible plant.

	Alternative source of food	Frequency	percentage
1	Wild edible plant only	51	42.5
2	Purchased crop only	14	11.6
3	Both wild and purchased	55	45.9
4	Other	0	0
	Total	120	100

CONCLUSION AND RECOMMENDATION

In this study among the sampled households, 65.83% were male and 34.17% were female household heads. About 42% of respondents did not attend formal education. In the study area more than 80% of households were dependent on crop production. The livelihoods of the community were more or less subsistent in nature.

In this study, a total of a total of 21 wild edible plant species belonging to 13 families were identified. The family Arecaceae was the most diverse family represented by 3 species (*Borassus aethiopum*, *Amorphophallus gallaensis* and *Borassus aethiopum*). Family Meliaceae, Rhamnaceae, Sapotaceae, Capparidaceae, Fabaceae and Ulmaceae were represented by 2 species of wild edible plants. The rest 6 families are represented by one species each. Regarding to the species dominating the density of the study area *Balanites aegyptiaca*, *Lepidotrichillia volkensii*, *Borassus aethiopum*, and *Tamarindus indica*, were the fourth top wild edible plant species constituting 66.42% of the entire density of study area.

In this study the proportion of seedling, sapling and trees were exhibit abnormal population structure. This is due to high consumption rate, shrinking of forest resource and fire regime as major factors limiting regeneration of most species in the study area. The population structure based on stem diameter and height class distributions has showed that more or less as diameter and height class increases stem density increase. The patterns of diameter class distribution showed more or less J –shape while height class distribution indicate bell shape population structure which both showed unhealthy population structure.

In this study area crop production is subsistent and not adequate throughout the year. Wild edible plant provides alternative food source to local community as supplementary food source during season of serious food shortage from stored. In comparing these findings, similar with the study conducted in Agro -Pastoral Livelihood Zone Lare woreda (Lim et al., 2017).

Despite such valuable plant species are threatened by human-induced anthropogenic factors which are affecting the sustainable management of the plants as well as the entire forest ecosystem. Large and small scale agricultural expansion, increased demand and frequent forest fire were identified as major threading factors.

In order to address the major threats identified and enhance the role of wild edible plants some recommendations are required as future line of work. Forestry and environmental protection authority should take a part in impact assessments with any large and small scale investment activities in the area.

All inclusive and participatory natural resource management strategy should be designed and implemented that involve the local community in management and sustainable Utilization of these valuable plant species. Moreover management and utilization strategy of these plant species should be integrated with agricultural development activities.

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