

Participatory Assessment of Threatened Forest Species in Hararge Area, Eastern Ethiopia: Community Based Participatory

Research article

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Abstract

Ethiopia was endowed with abundant and diversified flora and fauna. Spatially, forest ecosystem is one the more diversity and provide as home of variety of life. Thus, wood vegetation that covered almost of the area is reduced since on miss management, limited awareness of forest value and high population pressure. Particularly, Harari region and eastern and west Hararge zone the forest resource dramatically degraded due to limited agricultural land, over grazing, limited awareness of forest value, due to high population pressure to extending agricultural land, mismanagement and recurrent drought these natural resource have dwindled dramatically. The study was conducted in eastern part of Ethiopia both Hararge zone. The aim of the study was to collect and document threatened Forest Biodiversity species found in Hararge, eastern Ethiopia; to identify threatened species for priority conservation. Data were collected community based participatory using single visit transect walk, informal interviews of elder community and review other literature. The collected data was summarized by table, percent and figure. A total of 116 forest species were recorded. Out of them 43.1% plant species were highly threatened, 23.3% species near threatened, 33.3% plant species are least. So that, 43.1% and 23.3% plant species were highly threatened, and near threatened respectively. Hence, the following recommendations were suggested for urgently conservation: Carry out further study on the population and population distribution of the priority species selected for genetic conservation in the area; Raise public awareness on the value of forest genetic resources and the problems related to loss of genetic information and devise a mechanism by which human impacts can be minimized through discussion and consultation with the local people; Establish legal basis for the in situ and ex situ conservation sites for the conservation of the priority species.

Keywords: Ethiopia; Forest resource; Hararge; Rare; Threatened

Introduction

Ethiopia is one of the top 25 biodiversity-rich countries in the world [1], and hosts two of the world's 34 biodiversity hotspots, namely the Eastern Afromontane and the Horn of Africa hotspots. It is also among the countries in the Horn of Africa regarded as major centre of diversity and endemism for several plant species. The Ethiopian flora is estimated to about 6000 species of higher plants of which 10% are considered to be endemic [2]. Woody plants constitute about 1000 species out of which 300 are trees.

Forests form the major constituents of vegetation resources and thus conservation of Forest Genetic Resources (FGRs) is among the

priority areas of biodiversity conservation in Ethiopia. Efforts have been made to conserve and sustainably utilize FGRs in the country. Notable examples of such efforts are floristic, structure and socio-economic studies of woody plant species in Afromontane forests of the country; FGR conservation strategies and establishment of in situ and ex situ conservation sites.

Studies have shown that tropical forests are being destroyed at an alarming rate [3-6]. Deforestation has been contributing to a decline in forest cover, loss of biodiversity both at global and national levels [7,8]. Poverty and lack of alternative livelihoods have been driving forces of forest destruction. The forest genetic resources conservation

stratagem of Ethiopia (2002) and proclamation on forest development, conservation and utilization (2007) had identified deforestation as major threat to Ethiopians forest biodiversity [9,10]. Deforestation of agricultural land as a result of over-increasing population growth, increase demand for fuel wood and construction material, illegal settlements within forests, logging, and the expansion of illegal trade were considered major contributing factors to the loss of forest resources. The reduction in forest cover and loss of forest genetic resources pose serious threat to conservation of biodiversity.

The annual rate of deforestation in Ethiopia was found to be extremely high [11,12]. The major causes of deforestation were reported elsewhere [13-17]. This unprecedented deforestation rate is considered a major threat to the Ethiopian biodiversity [15,16,18-21] and the habitats of the 120 threatened endemic plant species of Ethiopia [22].

A century ago Ethiopia was endowed with abundant and diversified flora and fauna. Spatially, forest ecosystem is one the more diversity and provide as home of variety of life. It also an integral part of natural resource base of the country that have been devastated. Thus, wood vegetation that covered almost of the area is reduced since on miss management, limited awareness of forest value and high population pressure. This reduce of natural resource has lead negative impact on socio-economy of the country and diminish genetic resource of indigenous plant.

Particularly, Harari region, eastern and west Hararge zone the forest resource dramatically degraded due to limited agricultural land, over grazing, limited awareness of forest value, due to high population pressure to extending agricultural land, mismanagement and recurrent drought these natural resource have dwindled dramatically. Moreover, unestablishment forest protected area and law are the main cause in region. As well as, limited floristic document on forest diversity and conservation status are tackle for future conservation and research. These situations are urgently called for forest data collection and writing forest biodiversity resource document in this region. Therefore, the objectives of this study was to collect and document tree and shrub species found in Harari, eastern and west Hararge; to identify threatened species for priority conservation; to provide data for forest conservation and research.

Methodology

Description of the study area

The study was conducted in the eastern part of Ethiopia. Both zones of Hararge, West and East, located in Oromyia Region and Harari. It is situated approximately 200 km from the capital, Addis Ababa .it is bordered by east Showa zone in the west, Arsi zone is in south west, Bale zone in the south, Somali National Regional State in the east and south-east, and Dire Dawa Administrative Council in the north. Harari Regional State is encircled by the East Haraghe zone (Figure 1). The study area has 541 kebeles from east Hararge, 449 from west Hararge and 36 from Harari which have totally 1026 kebele. The study area has the total area of 2,262,266 km² from east Hararge and 1,723,000 km² from west Hararge .The physiographic condition of the Hararge zone is characterized by plateaus, rugged dissected mountains, deep valleys, gorges and plains. There are

various prominent mountains and peaks in the zone and Kundudo and Gara Mullata mountain chain are the major ones.

Methods of data collection

The data were collected from both primary and secondary data collection.

Primary data collection: The primary data were collected through community based participatory approach us Ing reconnaissance survey of single field visit, transect walk and informal interviewing with farmers and elder of local community who know perfectly the past endangered tree species and confidentially who know perfect local name. As well as, during field observation we have been collected data with picture of tree and shrub. Scope of our observation Harari region, Babile, Jarso, Gara Mullata, Meta, Qarsa & Fadis and Kurfa Chaleworedas in East Haragehe zone of Oromia regional state. And Also Habro, Hirna, Malka Ballo Woreda and Ades Forest Protected Area From West Hararge. During informal interview respondent was requested to categorize level threatened forest species into three categories: High, Medium and low. Where ‘High’ represent highly threatened plant species. When the population of the plant is rare and low distributed in the study area (first priority). Where’ medium ‘represent near threatened plant species (second priority). When the population of plant species some was present but, not much abundant generation. Where ‘low’ represent least threatened plant species. When the population of plant species was good regeneration. To identify three criteria through, asking the distribution of plant species: Asking trends of plant species; Endemic/indigenous of species: Asking the origin of plant species; How much importance of species: Asking importance of individual species.

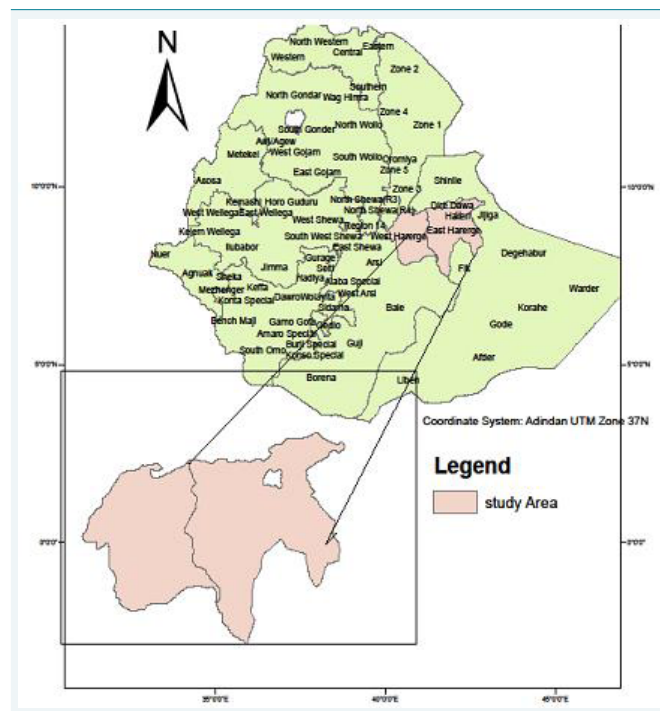


Figure 1: Map of the study area.

Secondary data collection: Secondary data were collected widely data from referring many documents from Azenabekele. Use full tree and shrubs of Ethiopia, referring the published Hedberg I, Friis I and Person E. General Part and Index to Volume 1-7. Flora of Ethiopia and Eritrea Volume 8: The National Herbarium, Addis Ababa, Ethiopia and Uppsala, Sweden for species identification and provided further guidance, as did the authors' experience.

Species identification

Species identification of most plant species were identified in the field and most taxonomically known. The species were also identified in the field with the help of district experts, individual informants and with the help of literatures following similar method, as well as using guide books such as 'Useful trees and shrubs of Ethiopia' by Azene et al. and referring the published Hedberg I, Friis I and Person E. General Part and Index to Volume 1-7. Flora of Ethiopia and Eritrea Volume 8: The National Herbarium, Addis Ababa, Ethiopia and Uppsala, Sweden.

Data analysis

The collected data were mostly analyzed and summarized by Table 1. The data on level of plant threat, local name, family and scientific name was analyzed by descriptive statics such as, Table, graph and percentage by using Excel Microsoft.

Result and Discussion

Forest composition of study area

The study of the vegetation data revealed that a total of 119 plant species were registered from study area. This all were belong to 42 families and 86 genera. Of these, Fabaceae is most dominant family comprises species 23(54.8%). This is in harmony with the findings of Mohammed Omer (2011) who find a total family of Fabaceae 22. Euphorbiaceae is the second dominant family comprised 7(16.7%) species each. Rosaceae and are the third family holds 6(14.3%) species. Moraceae and Asteraceae are the fourth family compromise 5(11.9%) species. Rhamnaceae, Tiliaceae, Lamiaceae, and Anacardiaceae) are the fifth family holds 4(9.5%) species each. Sapindaceae, Boraginaceae, Combretaceae, Sapotaceae, Flacourtiaceae, and Rubiaceae are sixth family comprise 3(7.1%) species. Simaroubaceae, Burseraceae, Apocyno, Myrtaeae, Oleaceae, Acanthaceae and Capparidaceae are the seventh family holds 2(4.8%) species. 22 families were represented by more than one species while 20 families were represented by a single (2.4%) species each. The genus *Acacia* was represented by 10 species, *Ficus* by 5 species, *Grewia*, *vernonia*, *rhus* and *Euphorbia* were represented by 3 species each, *Cordia*, *Combretum*, *Grewia*, *Prunus*, *Ziziphus*, *Kirkia*, *Ocimum*, *Indigofera*, *Cordia*, *Comiphora*, and *Albizia* by 2 species each and the rest contained a single species each (Table 2 and Figure 2). On the other hand, the remaining family of the survey area comprises one species each (i.e. 0.86 % of total number of species).

As above table show total of 116 forests plant species were identified. According to this all identified plant species level of threatened plant species were determined by knowledge of local community. Among all determined plant species 53(45.7%) species were categorized under highly threatened, 26(22.4%) species were

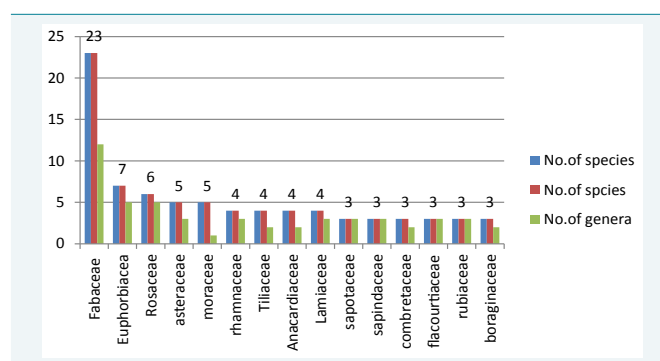


Figure 2: Top dominant family and genera found study area.

categorized under medium threatened and 37(31.9%) species were categorized under low/least threatened. According to this finding the 18(15.5%) recorded woody plant species were already nationally red listed (following the IUCN threat categories) as being threatened species. These include *Acacia negrii*, *Acanthus sennii*, *Cadaba divaricata*, *Erythrina brucei*, *Euphorbia burgeri*, *Euphorbia dalettiensis*, *Hillebrandia sandwicensis*, *Indigofera rothii*, *Kirkia burgeri*, *Kotschyana curvifolia*, *Milletia ferruginea*, *Rhus glutinosa*, *Rhynchosia erlangeri*, *Senecio lyriocephalus*, *Sparmannia macrocarpa*, *Syzygium guineense*, *Vernonia phillipsiae* and *Vernonia rueppellii*. According IUCN red data from the total of 17 endemic plant species in study area, six plant species or 35.3% are categorized under VL (vulnerable), 4/23.5% plant species are categorized under EN (Endangered), 3/17.6% plant species are categorized under LC (least concern) and 2/11.8% plant species are categorized under NT (near threatened) see (Appendix 1). And also, 10(8.6%) plant species of this finding are similar with (List of trees and other woody forest species considered to be threatened in Ethiopia [21,22]. This includes *Cordia africana*, *Hagenia abyssinica*, *Juniperus procera*, *Prunus africana*, *Gardenia ternifolia*, *Ficus vasta* and *Podocarpus*. Out of total recorded 22(19.6%) of shrub and tree plant species categorized under highly threatened by community and 23(17.0%) of forest species are endemic and already listed under red data. Therefore, there are need urgent and priority conservation.

Indigenous knowledge on threatened forest plant resource in study area

The majority of the respondents and Expert in study area had good knowledge about the use and regeneration status of species in their vicinity (Table 3). They were able to identify the species and type of Plant species they produce. Moreover, most of the respondents, mainly the elders have good knowledge on the different uses of the study species (Table 3). Regarding the current status of the study species, respondents recognized the declining state of the natural regeneration of some of the useful study species in the area. Nearly 100% of the respondents pointed out that recurrent drought, increased human population and expansion of agricultural land, over use species for medicinal, charcoal, timber, improper use of gum and resin and over domination of few species as a result of prohibition of human induced bush fire are the main factors affecting the natural regeneration of these useful species. About 51% of the respondents indicated that overgrazing impacted natural regeneration in two ways in the form of trampling and browsing of seedlings. During the field

Table 1: List of identified Forest species in study area based indigenous knowledge.

NO.	Scientific name	Local name	Family	Level of threat based on TK	Habit
1	<i>Acacia albida</i>	Garbi	Fabaceae	Medium	T
2	<i>Acacia brevispice</i>	Hamareessa	Fabaceae	High	T
3	<i>Acacia bussei</i>	Hallo	Fabaceae	High	T
4	<i>Acacia etabaica</i>	Doddoti	Fabaceae	High	T
5	<i>Acacia lahai</i>	Laftoo	Fabaceae	Medium	T
6	<i>Acacia negrii</i>	Dhedacha	Fabaceae	High	T
7	<i>Acacia nilotica</i>	Serkama	Fabaceae	Medium	T
8	<i>Acacia senegal</i>	Sopheensadiima	Fabaceae	Low	T
9	<i>Acacia seyal</i>	Wacuudiima	Fabaceae	Medium	T
10	<i>Acacia tortilis</i>	Dhadacha	Fabaceae	High	T
11	<i>Acanthus sennii</i>	Kosoruu	Acanthaceae	High	S
12	<i>Acokanthera schimperi</i>	Qaraaru	Apocynaceae	Medium	T
13	<i>Albizia lebbek</i>	Lebbek	Fabaceae	Low	T
14	<i>Albizia lophantha</i>	Shifire	Fabaceae	Low	T
15	<i>Allophylus abyssinicus</i>	Duruba	Sapindaceae	Low	T/S
16	<i>Aloe trichosantha Berger</i>	Hargiissa	Aloaceae	High	S
17	<i>Aningeria altissima</i>	Kuraro/quduba	sapotaeae	High	T
18	<i>Arundinaria alpina</i>	karkaa	poaceae	Medium	S
19	<i>Balanites aegyptiaca</i>	Baddanoo	Balanitaceae	High	T
20	<i>Berchemia discolor</i>	Jajeba	Rhamnaceae	Low	T
21	<i>Cadaba divaricata</i>	Qalqalcha	Capparidaceae	High	S
22	<i>Caesalpinia decapetala</i>	Qajiimaaraba	Fabaceae	Low	S
23	<i>Cal purnea aurea Benth</i>	Ceekaa	Fabaceae	Medium	S
24	<i>Capparis tomentosa</i>	gamooraa	Capparidaceae	Low	C
25	<i>Carissa edulis</i>	Agamsa	Apocynaceae	Medium	S
26	<i>Celtis africana</i>	Mataqooma	Ulmaceae	Low	T
27	<i>Combretum aculeatum</i>	Totaf	Combretaceae	Low	T
28	<i>Combretum molle</i>	Bikaa/Rukeesa	Combretaceae	Medium	T
29	<i>Commiphora africana</i>	Anqa	Burseraceae	High	T/S
30	<i>Commiphora erythraea</i>	Hagar	Burseraceae	High	T
31	<i>Cordia africana</i>	Wodeesa	Boraginaceae	High	T
32	<i>Cordia monoica</i>	Medhero	Boraginaceae	Medium	T/S
33	<i>Croton macrostachyus</i>	Mekenisaa	Euphorbiaceae	High	T/S
34	<i>Cussonia holstii</i>	Harfattuu	Araliaceae	Low	T
35	<i>Dichrostachys cherea</i>	Jirime/adesa	Fabaceae	Low	T/S
36	<i>Dodenaea angustifolia</i>	Kitkita/dhadacha	Sapindaceae	Low	S
37	<i>Dovyalis abyssinica</i>	Koshumoo	Flacourtiaceae	Low	S
38	<i>Dracaena afromontana</i>	Algee	Dracaenaceae	Low	S
39	<i>Ehretia cymosa</i>	Huulaga	Boraginaceae	High	T/S
40	<i>Ekebergia capensis</i>	Somboo	Meliaceae	Low	T
41	<i>Entada abyssinica</i>	Kentafa	Fabaceae	Low	T
42	<i>Eriobotrya japonica</i>	Woshmella	Rosaceae	High	T/S
43	<i>Erythrina brucei</i>	Walensuu	Fabaceae	High	T
44	<i>Euclea schimperi</i>	Mi, eesa	Ebenaceae	Low	T/S
45	<i>Euphorbia burgeri</i>	Qancaree	Euphorbiaceae	High	S
46	<i>Euphorbia dalettiensis</i>	Adamii	Euphorbiaceae	High	S
47	<i>Euphorbia tirucalli</i>	Qinciiba	Euphorbiaceae	Low	T
48	<i>Ficus carica</i>	Beles	Moraceae	Low	T
49	<i>Ficus sur (F. capensis)</i>	Qilxuu	Moraceae	Medium	T
50	<i>Ficus sycomorus</i>	Lugoo	Moraceae	Low	T
51	<i>Ficus vasta</i>	Odaa	Moraceae	High	T
52	<i>FicusthonningiiBlume.</i>	Dambii	Moraceae	Medium	T
53	<i>Flacourtia indica</i>	Hudhaa	Flacourtiaceae	High	T
54	<i>Flueggea virosa</i>	Qacacilee	Euphorbiaceae	Medium	T/S
55	<i>Gardenia ternifolia</i>	Gambeloo	Rubiaceae	High	T/S
56	<i>Grewia bicolor</i>	Horeresa	Tiliaceae	Medium	T
57	<i>Grewia tembensis</i>	Dheekkaa	Tiliaceae	Medium	T/S

58	<i>Grewia villosa</i>	Ogomoodi	Tiliaceae	Low	S
59	<i>Hagenia abyssinica</i>	Kosso	Rosaceae	High	S
60	<i>Hillebrandia sandwicensis</i>	*	Convolvulaceae	High	S
61	<i>Indigofera rothii</i>	Khoshi	Fabaceae	High	S
62	<i>Indigofera ellenbeckii</i>	Khoshi	Fabaceae	High	S
63	<i>Jasminum abyssinicum</i>	Biluu	Oleaceae	Low	C
64	<i>Juniperus procera</i>	Gatiraa	Cupressaceae	High	T
65	<i>Justicia schimperiana</i>	Dhumugaa	Acanthaceae	High	S
66	<i>Kalanchoe lanceolata</i>	Kontoma	Crassulaceae	Low	H
67	<i>Kirkia burgeri</i>	HudhaaSawwa	Simaroubaceae	High	T
68	<i>Kirkia tenuifolia</i>	HudhaaSawwa	Simaroubaceae	High	S
69	<i>Kotschyana curvifolia</i>	Henna	Leguminosae	High	S
70	<i>Lanena schimperii</i>	Handarakkuu	Anacardiaceae	Low	T/S
71	<i>Maesa lanceolata</i> Forssk.	Abbayyii	Myrsinaceae	Medium	S
72	<i>Maytenusundata</i>	Kombolcha	Celastraceae	High	T/S
73	<i>Milletia ferruginea</i>	Dedatu, Sotellu	Fabaceae	High	T
74	<i>Mimusops kummel</i>	Buriri	Sapotaeae	Low	T
75	<i>Moringa oleifera</i>	Shefera	Moringaceae	High	T
76	<i>Myrica salicifolia</i>	Abay, kataba	Myricaceae	Low	T
77	<i>Myrtus communis</i>	Ades	Myrtaeae	Low	S
78	<i>Ocimum lamiifolium</i>	Damacasee	Lamiaceae	Medium	S
79	<i>Ocimum jamesii</i> Sebald	Qayyadurbaa	Lamiaceae	Medium	S
80	<i>Olea europaea</i>	Ijersa	Oleaceae	High	T
81	<i>Oncoba spinosa</i>	Jilboo	Flacourtiaceae	High	S
82	<i>Pappea capensis</i>	Biiqqaa	Sapindaceae	Medium	T
83	<i>Phytolacca dodecandra</i>	Handode	Phytolaccaceae	High	S
84	<i>Plectranthus barbatus</i>	Barbarusha	Lamiaceae	Low	H
85	<i>Podocarpus falcatus</i>	Birbirsaa	Podocarpaceae	High	T
86	<i>Polygala obtusissima</i>	Harmal	Polygalaceae	High	S
87	<i>Pouteria adolfi-friederici</i>	Mandhisaa	Sapotaeae	Medium	T
88	<i>Premna schimperii</i>	Urgeessaa	Lamiaceae	Medium	S
89	<i>Prunus africanus</i>	Hadheessaa	Rosaceae	High	T
90	<i>Prunus persica</i>	Kuki	Rosaceae	High	T
91	<i>Psyrax schimperiana</i>	Galo	Rubiaceae	Low	T
92	<i>Pterolobium stellatum</i>	Qajimaa	Fabaceae	Low	S
93	<i>Rhamnus prinoides</i>	Geshoo	Rhamnaceae	High	S
94	<i>Rhoicissusrevouillii</i>	Dagachebsa	Vitaceae	Low	C
95	<i>Rhus glutinosa</i>	*	Anacardiaceae	High	S
96	<i>Rhus retinorrhoea</i>	Tatessa	Anacardiaceae	Low	S
97	<i>Rhus vulgaris</i>	Rigaawaraabo	Anacardiaceae	Medium	T/S
98	<i>Rhynchosia erlangeri</i>	*	Leguminosae	High	S
99	<i>Ricinus communis</i>	Qoboo	Euphorbiaceae	Medium	S
100	<i>Rosa abyssinica</i>	Enqoto, Goro	Rosaceae	High	S
101	<i>Rothmannia urcelliformis</i>	Buruurii	Rubiaceae	Low	S
102	<i>Rubus apetalus</i>	Goraa/Altufa	Rosaceae	High	S
103	<i>Senecio lyriocephalus</i>	*	Asteraceae	High	S
104	<i>Sterculia africana</i>	Geri	Sterculiaceae	Low	T
105	<i>Solanecio angulatus</i>	Jinraas	Asteraceae	High	H
106	<i>Sparmannia macrocarpa</i>	*	Tiliaceae	High	S
107	<i>Suregada procera</i>	Xillo	Euphorbiaceae	Medium	S
108	<i>Syzygium guineense</i>	Baddeessaa	Myrtaeae	High	T
109	<i>Tamarindus indica</i>	Roka	Caesalpinioideae	High	T
110	<i>Terminalia brownii</i>	Birensaa	Combretaceae	Low	T
111	<i>Vernonia amygdalina</i>	Grawa/ebicha	Asteraceae	Medium	S
112	<i>Vernonia leopoldi</i>	Qaxxee korma	Asteraceae	High	S
113	<i>Vernonia rueppellii</i>	reejjii	Asteraceae	High	S
114	<i>Woodfordia uniflora</i>	Marmarte	Lythraceae	Low	S
115	<i>Ziziphus mauritiana</i>	Kurkura	Rhamnaceae	Medium	T/s
116	<i>Ziziphus mucronata</i>	Kurkuragabroo	Rhamnaceae	Low	T/s

Table 2: The top twelve dominant families with holds>3 the highest number of species in the study area .

No.	Family name	No. of species	Percent	No. of genera	percent
1	Fabaceae	23	54.8%	12	13.9%
2	Euphorbiaceae	7	16.7%	5	5.8%
3	Rosaceae	6	14.3%	5	5.5%
4	Moraceae	5	11.9%	1	1.5%
5	Asteraceae	5	11.9%	3	3.5%
6	Rhamnaceae	4	9.5%	3	3.5%
7	Anacardiaceae	4	9.5%	2	2.3%
8	Lamiaceae	4	9.5%	3	3.5%
9	Tiliaceae	4	9.5%	2	2.3%
10	Combretaceae	3	7.1%	2	2.3%
11	Rubiaceae	3	7.1%	3	3.5%
12	Sapindaceae	3	7.1%	3	3.5%
13	Boraginaceae	3	7.1%	2	2.3%
14	sapotaeae	3	7.1%	3	3.5%
15	Flacourtiaceae	3	7.1%	3	3.5%

Table 3: Top useful and threatened indigenous shrub and tree species identified by respondent.

No.	Top Threatened species	Current status based IK	Use	Habit
1	<i>Acacia brevispice</i>	Highly Decreasing	Fire wood, fodder	T
2	<i>Acacia bussei</i>	Highly Decreasing	Charcoal, local plaguing material ,gum	T
3	<i>Acacia etabaica</i>	Highly Decreasing	Charcoal	T
4	<i>Acacia seyal</i>	Medium	Charcoal, gum	T
5	<i>Acacia tortilis</i>	Highly Decreasing	Charcoal, gum	T
6	<i>Aloe trichosantha</i>	Highly Decreasing	Medicinal	S
7	<i>Balanites aegyptiaca</i>	Highly decreasing	Medicinal	T
8	<i>Cordia africana</i>	Highly Decreasing	Timber, food and fodder	T
9	<i>Commiphora africana</i>	Highly Decreasing	Gum and resin	T
10	<i>Commiphora erythraea</i>	Highly Decreasing	Gum and resin	T
11	<i>Croton macrostachyus</i>	Highly Decreasing	Medicinal	T
12	<i>Ehretia cymosa</i>	Highly Decreasing	Medicinal, fodder and local material	T/s
13	<i>Ficus vasta</i>	Highly Decreasing	Timber, cultural shading	T
14	<i>Flacourtia indica</i>	Highly Decreasing	Food	S
15	<i>Hagenia abyssinica</i>	Highly Decreasing	Medicine	S
16	<i>Juniperus procera</i>	Highly Decreasing	Timber	T
17	<i>Podocarpus falcatus</i>	Highly Decreasing	Timber, construction and shedding	S
18	<i>Prunus africanus</i>	Highly Decreasing	Medicinal, fodder	T/s
19	<i>Rosa abyssinica</i>	Highly Decreasing	Food	S
20	<i>Olea europaea</i>	Highly Decreasing	Medicinal ,charcoal,	T
21	<i>Oncoba spinosa</i>	Highly Decreasing	Food ,medicinal	S
22	<i>Polygala obtusissima</i>	Highly Decreasing	Medicinal	S
23	<i>Rhamnus prinoides</i>	Highly Decreasing	Beverage	S
24	<i>Solanecio angulatus</i>	Highly Decreasing	Medicine	H
25	<i>Tamarindus indica</i>	Highly Decreasing	Food, charcoal	T
26	<i>Ziziphus mauritiana</i>	Highly Decreasing	Food,	T/s

Source: Indigenous knowledge

survey, local people were invited to identify the status of forest species in the area, whether they are increasing or decreasing. They identified about 50 forest tree and shrub species are under highly threatened. Among them, 27 of them are most important and top threatened in study area. Tree, 8 of them is shrub, 3 are shrub/tree and except 1 species is Herbs (Table 3).

Threatened habit types

As the (Figure 3) show that 50 plant species are identified from study are tree, 44 species are shrub, 16 species are tree/shrub and clumber and herbs holds 3 species each. From the total of 50 recorded tree plant species in study area 21(18.1%) species are under highly threatened, 12(10.34) species under medium threatened and from the total of 44 shrub plant species 21(18.1%) species are under highly threatened and 9(7.7%) shrub species are under medium threatened. 16(13.8%) plant species tree or shrub habit in study area. From the total of 16 tree/shrub species 6(5.2%) species under highly and medium threatened respectively. According to this data tree plant species are the most dominant and followed by shrub. However, both are equal high threatened in the study are that means represented by 21 (18.1%) plant species are highly threatened for both tree and shrub. Where clumber and herbs are held 3(2.6%) species each from total of 116 and 1(0.86%) plant species from herbs habit is under highly threatened. As this data described shrub and tree are more used and degraded by local community than herbs (Figure 2 and Table 3).

According to above (Figure 4) indicated that a total of 116 plant species were identified. Of these, 50(43.0%) categorized under highly threatened (priority conservation) based, 27(23.3%) near threatened (second conservation), 39(33.6%) under least threatened. So, a plant species recorded under Highly threatened are Rare and few individual distribution in study area it need priority conservation and when plant under near threatened were need second conservation.

Conclusion and Recommendation

The objective of this community based participatory survey was to identify the threatened forest genetic resource in eastern Ethiopia for recommending appropriate genetic conservation approaches in the area. The 116 forest species were collected from Harari region, eastern and west Hararge based on community participatory. From total of this 50(43.1%) highly threatened plant species, 27(23.3%) near threatened plant species, 39(33.6%) least threatened plant species. From the total species recorded, 17 species are already listed in the IUCN red data and recommended as high threatened by community knowledge. This includes *Acacia negrii*, *Millettia ferruginea*, *Cadaba divaricata*, *Erythrina burana*, *Hagenia abyssinica*, *Juniperus procera*, *Prunus africana* and *Podocarpus* [22]. The record of population structure shows that 50(43.1.0%) plant species identified by local community as highly threatened and from 50 plant species 6 species are vulnerable and four are endangered as listed in IUCN red data. Therefore, all 50 plant species identified by community knowledge from study area have abnormal population structures with no or few individual's distribution in study area. These species need urgent conservation measures that will facilitate healthy regeneration and guarantee sustainable use of these species. Hence, the following recommendations were suggested:

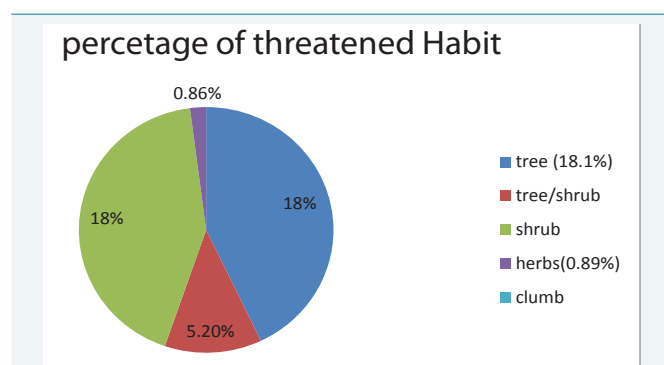


Figure 3: Threatened habitat plant species.

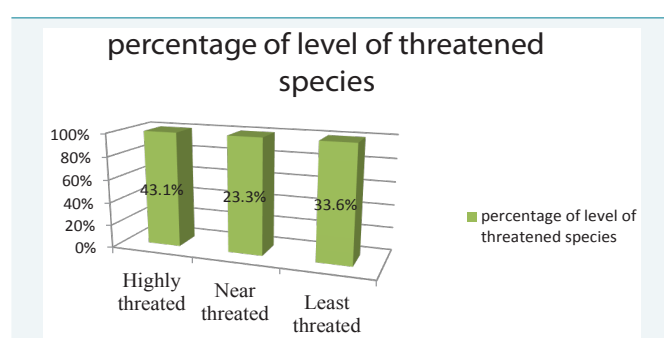


Figure 4: Level of threatened species based traditional knowledge.

- Carry out further study on the population and population distribution of the priority species selected for genetic conservation in the area.
- Raise public awareness on the value of forest genetic resources and the problems related to loss of genetic information and devise a mechanism by which human impacts can be minimized through discussion and consultation with the local people.
- Carry out further studies on the patterns of ecosystem functioning, biology and ecology of the key stone species to be able to restore the composition and structure of the forest.
- Establish legal basis for the in situ and ex situ conservation sites for the conservation of the priority species.
- Conduct research on storage behavior (seed physiology) and reproduction biology of woody species that focus on threatened and economically important species.
- Increase traditional forest management like, home garden and on-farm conservation.

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