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Floristic Composition and Community analysis of Gendo Moist Montane Forest of East Wellega, Western Ethiopia

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Abstract
Gendo Forest is one of the moist montane forests found in eastern highlands, East Wellega Zone, Ethiopia, containing diverse animals and plant species. The objectives of the present study were to investigate floristic composition and community structure to produce floristic document and appropriate recommendation based on the outcome of the study. Seventy two plots each 20 m X 20 m, 400 m^2 were laid along eight transect lines along elevation gradient in systematic sampling. About 168 species, belonging to 140 genera and 65 families were recorded from the field data of Gendo Forest. The two most diverse families were Asteraceae, with 18 (12.9%) genera and 24 (14.3%) species and Fabaceae 17 (12.1%) genera and 21 (12.5%) species. The next large families were Poaceae with 7 (5%) genera, 8 (4.76%) species, Acanthaceae, Euphorbiaceae and Lamiaceae each having 6 (4.3%) genera and 8, 6, and 7 species respectively while the rest 59 families were containing 1-3 species. There were about 33 (19.6) trees, 56(33.3%) shrubs and 79 (47%) herbs were recorded. There were also 15 (9.9%) climbers. There were about 18 endemic species, 2 (1.2%) trees, 2 (1.2%) shrubby tree, 4 (2.5%) shrubs and 8 (4.8%) herb. About 12 (6.9%) and 152 (90.5%) of the total species documented were monocots and dicots respectively while 2 (1.2%) and another 2 (1.2%) were ferns and gymnosperms respectively. Only 3 (1.8%) species were recorded as hemi-parasitic plants. Gendo Forest also contained 9 (5.3%) of those 24 economically recognized national timber tree species (EFAP, 1994). Moreover, since the forest is yet not recognized in forest priority areas, it is recommended that it should be included in forest priority areas for further conservation and management.
Keywords: Gendo Forest, Floristic composition, Moist Montane Forest, Plant Community

INTRODUCTION

Forest ecosystems are open systems in that they exchange energy and matter with other systems including adjacent forests, downstream ecosystems and atmospheric environment (Waring and Schlesinger, 1985). Forests have unique ability in resource capture and transformation which is vital for survival of life on the planet earth; hence all other organisms including humans depend on this unique ability of plants (Legesse, 2002; Raven and Johnson, 2002). Forests contain a multitude of both living and non-living things (plants, wild animals, micro-organisms, rivers, soils, rocks and minerals (EWNHS, 1996). It is also important habitats for great diversity of wildlife; agents of pollination and dispersal of seeds are some to be mentioned (Money, 1980; Begon *et al.*, 1996; Pandey, 1996). Moreover, Forests have many ecological, economic, social, cultural, biological, and ethical values and services (Farb, 1963: EPA, 1998; Frankel *et al.,* 1998; Azene, 2001; Tefera, 2006).

In Ethiopia, population is growing at 2.9% (CSA, 1996; 2008) while agriculture, which accounts for 80% of employment, 52% of the country's GDP, 90% of the total export, 85% of populations involvement grows at 2.4% (Badege, 2001). In addition to this, Ethiopia held the first position in Africa by quantity of livestock populations i.e., about 99.8 million (EPA, 2003). Grazing removes about 95% of the total above ground plant biomass (Purves *et al.,* 2004). Based on the information gained from the remnant indigenous forests, ecological settings, pollen analysis, vegetation map and rainfall patterns, many scholars reconstructed the past forest cover of Ethiopia and estimated it to be about 36 - 40% in 1900s (Friis, 1992; EFAP, 1994). As a result of accelerated degradation, only little forest patches at a secondary stage of development or representing various stages in the development were present, leading to ecological (environmental) crisis (catastrophe) facing Ethiopia (Longman and Jenik, 1990; Tamrat, 1994; Struhsaker, 1997; Teshome and Ensermu, 2013a & 2013b; Teshome and Ensermu, 2014; Teshome, 2015). Types and distribution of vegetations in Ethiopia are determined by geology, topography (altitude, slope and aspect), edaphic (soil) and climatic factors, specifically the seasonal distribution of rainfall than the amount of rainfall (Vernede, 1955). Altitude is an important environmental factor which by affecting temperature, radiation, moisture and atmospheric pressure influences the growth, distribution and development of vegetation (Toumey, 1944; cited in Lisanework, 1987). Slope angle influences soil depth; acidity and drainage. Steeper slopes usually have thinner soil, less water logged and less acidic than gentle slopes. Aspect, the orientation of slope also alters sun light and temperature, where south facing slopes in northern hemisphere being more favorable to plant growth than those facing north (Moriel *et al.,* 2006).

Ethiopia is one of the countries with great varieties (diversity) of: geography, flora and fauna, so is recognized to host the fifth largest flora diversity in tropical Africa (Brenan, 1978; cited in Muluneh, 2001).

Ethiopian flora is very heterogeneous, estimated to be about 6,000 species of higher plants with 10% endemism in the previous findings (PGRC, 1996), which was estimated to be about 5,600 species of higher plants from 200 families (flowering plants, conifers, and ferns) of which 10% are endemic to the country (Vivero *et al.,* 2005). Endemic species are usually common in lowlands, afroalpine and subafroalpine vegetation types. How ever afromontane forests and Ogaden areas also contributed a lot (Ensermu *et al.*, 1992; EPA, 2003). Ethiopia therefore has remained as one of the 12th Vavilovian center of many crops genetic diversity in the world (Vavilov, 1997).

The eight categories of Ethiopian Vegetations are 1) Afro-alpine and sub Afro-alpine, 2) Dry evergreen Afromontane 3) Moist evergreen Afromontane, 4) Broad leaved deciduous woodland (*Combretum-Terminialia*), 5) Low land semi- evergreen forests (dry peripheral semi-deciduous Gunio Congolian), 6) Riverine, riparine and swamp, 7) Acacia commiphora woodland and 8) Desert and semi-desert Scrub land forests. Moist evergreen forests are traditionally referred to as Afromontane rainforests, humid broad leaved, wet and mixed type of vegetations in which *Pouteria adolfi-friederici* and *Podocarpus falcatus* (about 30-46 m tall) are forming closed upper canopy. Brown (1962; cited in Tamrat, 1993) characterized wet montane forests as vegetation types with a high proportion of large and soft leaved species while dry montane forests as being dominated by hard-leaved evergreen species. Dry afromontane forest is either a mixture of *Juniperus procera* or predominantely *Podocarpus falcatus*, both with some elements of broad leaved species (IBD and GTZ, 2004). Gerhardt and Hytteborn (1992; cited in Tamrat, 1993) set the climatic limits for the dry forest to be a drought period of about half the year in one or two periods with an amount of precipitation between 400- 1700 mm. On the other hand, moist forests can be climatically delimited as having a period of at least six months of rainfall in one period with at least 1700 mm precipitation. Based on evidence from the altitudinal range, which was between 1500-2600 m a.s.l., annual temperature which was 18^0C- 25^0C, annual rainfall, which was 1,500-2,000 mm and the vegetation compositions described (MoA, 1986; Friis, 1992; Sebsebe *et al.,* 2004), Gendo Forest belongs to the moist montane forest type. Moist montane forests get rain all round the year and consist of tree species like *Pouteria adolfi-friederici, Podocarpus falcatus*, *Albizia schimperiana, Cordia africana* and *Ficus sur*. Afromontane forests are one of the seven endemic sites of Tropical Africa including Ethiopia (Huntley, 1988; cited in Mulugeta and Demel, 2004). Because of the ever increasing natural and anthropogenic factors affecting the vegetation covers in Ethiopia, deforestation and land degradations are major issues threatening the survival of Ethiopian flora and the people. The futures of many of the remaining forests of Ethiopia and protected areas were uncertain since the efforts to address the issues and proper guidance and managements even for the selected high forest priority areas (FPAs) are lacking (Sayer and Wegge, 1992; Tamrat, 1993; EFAP, 1994; Feyera and Demel, 2003).

Gendo (Gura Tirigni) Forest, located in East Wellega Zone in Oromia National Regional State, Ethiopia is one of the moist Afromontane forests which is or would be affected by most of the anthropogenic problems addressed above. Since no previous study was made about this forest, the objectives of the present study is to investigate: population structures of the dominant plant communities, provision of primary information on the status, conditions and threats to biodiversity posed by human pressure and practiced thereby and then to predict and recommend appropriate conservation and management strategies of the forest. Moreover, the information obtained from this study would serve as a useful starting point for further research and decision-making in natural resource conservation.

MATERIALS AND METHODS

Study area

The study was conducted in Oromia National Regional State, East Wellega Zone, Gida Ayana District in Gendo (Gura Tirigni) moist montane forest located at 422 km west of Addis Ababa. It is situated at $9^0$49.5' - $9^0$59.6' N and $36^0$40.' - $36^0$43' E, having a total area of 16 hectares (including 4-6 ha community plantation on east and south edges). The forest is located along Nekemte – Bure road between altitudinal ranges of 2183 and 2300 m a.s.l (Ethiopian Mapping Agency, 1986; Encarta Premium, 2006; GPS reading during field survey, 2009).

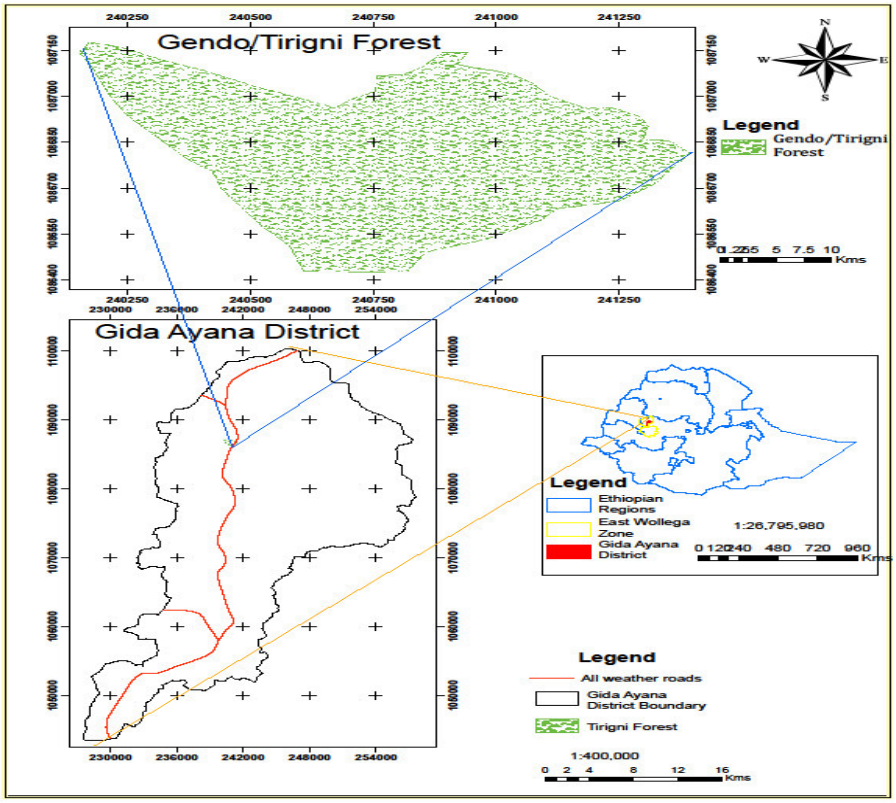

Figure 1: Local map of the study area

Soils of the study area

Even though no specific study on the geology and soil character of the study area was conducted, the topography, geology and soil of the study area fits with that of *weyina dega* agroclmatic zones described by MoA (1986) and Mesfin Abebe (1998). According to basic data of Gida Ayana Agriculture and Rural Development Office, about 12,265.27 ha of land is plain (flat), 101,325.77 ha is hill slope, 6,319.5 ha is gentle gorge, 7,322.55 ha is swamps and 1,830.64 ha is other land forms (GAARDO, 2009). The study forest is characterized by gentle slope from south to north sides of hill foot with flat upper surface (Personal observation). The rock of the present study fits to the tertiary volcanic rocks of the Precambrian (ryolites, tuffs igmimbrites agglomerates and basalt) rock types stated for all parts of Ethiopia (Mohr, 1971, Friis, 1992). The soil of the study area is pale brown to dark reddish and red in color, clay and clay-loam in texture (Murphy, 1959). Moreover, about 20%, 60% and 20% of the soils in Gida Ayana Wereda was sandy, clay-loam and clay respectively (GAARDO, 2009).

Climate of the study area

There are two types of agroclimatic zones in the Wereda: *Kola* about 51% and *Weyina Dega* 49% of the total land area (GAARDO, 2009). Annual rainfall of the study site is between 1487 – 2119 mm while the average annual rainfall is 152.6 mm. Monthly maximum and minimum temperature recorded was 27.5^{0}C (in February) and 12.8^{0}C (in December), while the average annual temperature is about 18.9^{0}C respectively. (Ethiopia National Meteorological Service Agency, 2006). The climate diagram of the study area is provided in Figure 2.

GidaAyana (2180) 18.7 ^{0}C 152.6
[10]

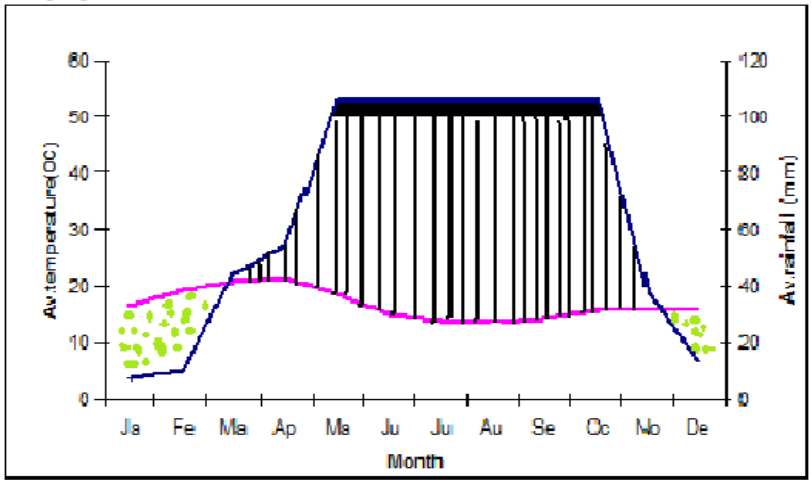

Figure 2: Climatic Diagram of Gidda Ayana, the nearest meteorological station to Gendo Forest

Regarding to the people and the economy of the study site, the total human population size of Gida Ayana District (1996) was 101, 766, of this, 50,805 were males and 50,961 were females (CSA, 1996). About 88% of these people were residing in rural area, only 12% were urban dwellers. The population increased to 171,985, (85,041 males and 86,944 females currently (GAARDO, 2009). The total area of land in the Wereda is about 183,063.73 ha which was used for: various activities by local community.

Data Collection

Reconnaissance survey and data collection of the study forest was conducted between November 18 – 20 /2008 and November 21 – December 14 / 2008 respectively. Seventy two quadrats, each 20 m x 20 m, 400 m^2 were used for trees, shrubs and seedlings, saplings while small subplots of 2 m x 2 m, 4 m^2 at representative sites were used for herbaceous plants (Mueller-Dombois and Ellenberg, 1974). On hillsides with large sample sizes, continuous belt transect can be used preferentially than others (Kellman, 1980). Eight transect lines; about 100 m far apart from each other were used systematically following uphill to ensure a uniform assessment through out all the plots. Depending on the length of transect line belts (350 m, the shortest to 2,160 m the longest), the number of quadrats laid on each transect belt may vary from 3-18. Vernacular names, number of individuals of tree and shrubby species, height, and diameter of trees at breast height and cover estimates of each species in the study forest were recorded. Trees, shrubs, herbs seedlings and saplings are defined conventionally in this study in the manner described by different authors differently on different vegetation types and location including Mueller-Dombois and Ellenberg (1974); Westhoff and van der Maarel (1978) as follows: Tree - single stemmed woody plant taller than 5m, Shrub - multiple stemmed woody plant with height between 30 – (50) cm - 5 m, herb non woody plant less than 30 cm to 1 m, seedling a young woody species less than 1.3 m while sapling extends from 1.3 m on wards but whose DBH is less than 2.5 cm. Vegetation data, such as stratifications, diameter of trees at breast height (DBH), species list, frequency class distributions, leaf size, bark thickness, twig diameter, height classes, population density, species richness and evenness indices, cover-abundance, basal area, cylindrical volume, important value indices, biomass, etc. are all used to describe vegetation structure (Mueller-Dombois and Ellenberg, 1974; van der Maarel, 1979; Crawley, 1997).

The cover values of the study forest for all species was first estimated visually, then recorded and later converted to the Braun-Blanquet 1-9 modified scale (van der Maarel, 1979) as follows: 1 = one or few individuals, 2 = occasional and less than 5% cover, 3 =abundant and with very low cover or less abundant but with higher cover, in any case less than 5% cover, 4 = very abundant and less than 5% cover, 5 = cover values between 5 - 12.5% irrespective of number of individuals, 6 = cover values between 12.5 - 25%, 7 =cover values between 25 - 50%, 8 = cover values between 50 - 75%, and 9 = cover values between 75 - 100% of the total plot area. Trees with many branches below 1.3 m were measured separately. Hemi-parasites (partial plant parasites) and ferns on branch and trunk were also recorded whenever encountered. Any anthropogenic and natural disturbances like logging timber, natural tree fall were recorded when ever encountered. Physiographic variables such as altitude and location were recorded using Garmin navigation UTM – GPS system (Geographical Position System). Silva Clinometer was used to measure slope and tree height, while aspect is simply judged from reference of, the direction of sunset and sun rise in association with north-south orientation of the forest topography. Plant specimens were collected, pressed, dried and brought to the National Herbarium

(ETH) of AAU for identification. In fact plant identification begun at the field, proceeded in villages (by asking local people for vernacular names) while the final identification of species, habits, endemicity and nomenclature were made following all volumes of the published Flora of Ethiopia and Eritrea in ETH of AAU as well as by referring of Honey bee Flora (Fichtl and Adimasu, 1994) and Use fuel trees and Shrubs of Ethiopia for some vernacular names (Azene, 2007) were used. Finally some of voucher specimens were mounted labeled and deposited (preserved) in ETH of AAU for further identification and storage.

Data analysis

The first and most applicable analysis of field data is the searching of specimen's scientfic names in the National Herbarium where different flora books, Use full trees and plants (Azene Bekele, 2001; 2007) and in comparison with ppreserved vouchers specimens. Height, DBH, BA, Density, species richness, IVI, Dominancy and community types were analyzed following some methods and conversion formulas described by previous ecologists. The population density for mature trees, shrubs, sapling and seedling of the study forest were manipulated from field data, and then organized for further analysis and interpretation. Frequency is the number of times species occurred in a given number of repeatedly placed quadrats. It gives a certain indication of uniformity in distribution rather than density. A species with very small individual's spread out over sample area will give high frequency values even if its cover is insignificant (Mueller-Dombois and Ellenberg, 1974).

% F was given by: $\frac{\text{numbers of occupied quadrats by species}}{\text{Total numbers of quadrats examined}} \times 100$

Relative frequency = $\frac{\text{frequency of species}}{\text{Total frequency of all spp}} \times 100$

Species diversity, (H') = $-\sum_{i=1}^{s}(pi \ln pi)$ where, H' Shannon diversity index, pi, the proportion of individuals or abundance of i^{th} species expressed as the proportion of the total species, S = number of species (Shannon, 1949). Evenness (J) = H'/lnS, where J= evenness index, ln=log base n. Further more similarity between plant community types and between different forest types of Ethiopia with that of Gendo forest was evaluated by use of Sorensens' (1948) similarity indices as follows.

Sorensen's similarity coefficient (S_s) was given by the formula:

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

where a, species in plot X and b= species in plot Y, c= common species to both plots

By comparing their similarity indices, it is possible to group plant communities together if they were similar or to separate groups if they were dissimilar (Mueller-Dombois and Ellenberg, 1974). Important value is defined as the sum of relative density, relative dominancy and relative frequency. Any of these three values are interpreted as important value (Whittaker, 1970; Curtis, 1959; cited in Mueller-Dombois and Ellenberg, 1974). Dominance, the stem cover, usually synonymous with basal area, which was the most abundant species in the area (Botkin *et al.,* 1987). Dominant communities are those communities defined by dominant species, which occurred uniformly through out the sample stand (Mueller-Dombois and Ellenberg, 1974). Dominance is the product of mean basal areas of trees with the total numbers of trees per species while relative dominancy (RDO) was given by the formula:

RDO= $\frac{\text{Dominance of tree species}}{\text{Dominance of the whole species}} \times 100$

Finally, the floristic data recorded in two-ways (Quadrat by species), called multi-variate was analyzed and the method used to analyze such data is called multivariate analysis (Kent and Coker, 1992).

RESULTS AND DISCUSSION

Floristic Composition

A total of 168 species, belonging to 140 genera and 65 families were recorded from Gendo Forest (Appendices 1 and 2). The first two most diverse families were Asteraceae, which has 18 (12.9%) genera and 24 (14.3%) species followed by Fabaceae having 17 (12%) genera and 21 (12.5%) species. Both families were contributing about 25% of the total genera and 26.8% of the total species. The next large families were Poaceae having 7 (5%) genera, 8 (4.8%) species, Acanthaceae, Euphorbiaceae and Lamiaceae each having 6 (4%) genera and 8, 6, and 7 species respectively while the rest 59 families contained 1-3 species. There were about 89 (53%) woody species including, 33 (19.6) trees, 56 (33.3%) shrubs and 79 (47%) herbs were recorded in the forest. There were also 15 (8.9%) climbers. Of 18 (11%) endemic species, 2 (1.2%) were trees, 2 (1.2%) shrubby- tree, 4

(2.5%) shrubs and 8 (4.8%) herb (Appendix 3). Eight of the 18 endemic species were included within IUCN red data list category of Ethiopia's endemic and threatened species (IUCN, 2000; Viviro *et al.,* 2005) (Appendix 3). About 12 (6.9%) and 152 (90.5%) of the total species encountered were monocots and dicots respectively while 2 (1.2%) and another 2 (1.2%) were ferns and gymnosperms. Only about 3 (1.78%) species were recoded from hemi-parasitic plants. Gendo Forest also contained 9 (37.5%) of the 24 national priority tree species, which are commercially important (EFAP, 1994). These include *Cordia africana, Albizia gummifera, Albizia schimperiana, Pouteria adolfi-friederici, Podocarpus falcatus; Celtis africana, Ekebergia capensis, Croton macrostachyus* and *Syzygium guineense* which are considered extremely important tree species in Ethiopia both economically and ecologically (Vivero *et al.,* 2005).

Community Types

Log transformation Euclidean distance Ward's method PC-ORD 4.20 version resulted in 6 community types at similarity cut level greater than 25% (McCune and Grace 2002) soft ware programme out put. This software verifies the variation of floristic composition between areas using species cover value. It groups areas according to species composition and the species according to area (Marina *et al.,* 2008). Similar species from different plots were clustered or agglomerated together as a result of cluster analysis techniques (Figure 3). Each community was named after the names of two dominant species within each group. Synoptic values were obtained from the product of mean average cover values and mean frequency values of each species belonging to the particular community type. This value is used to assign names to the communities, as it is described for the first six top community types (Figure 3).

Type 1 *Acacia etbaica-Girardinia bullosa* - This community consist only two quadrats and 79 species. This community was the most disturbed, found at the least altitudinal gradient (between 2183-2187m a.s.l.) on the south end of the Forest. Dominant species in this community includes *Acacia etbaica, Girardinia bullosa, Acanthus polystachius, Acacia abyssinica, Bidens carinata, Cordia africana, Nuxia congesta, Clematis longicauda, Pittosporum viridiflorum* and *Hypoestes forskaolii* This community was generally characterized by open canopy with few patches of trees where *Croton macostachyus*, dwarfed *Albizia gummifera, Cordia africana* and *Maytenus addat* forming the upper canopy, *Acanthus polystachyius* and *Acacia etbaica* form the middle canopy followed by numerously abundant lower herb layers at ground floor.

Type 2 *Solanecio gigas –Bersama abyssinica* - This community consists of 113 (67.3%) total species, the most diversified found between 2209-2288 m a.s.l. and 14 quadrats. Dominant species include *Solanecio gigas*, *Ficus sur, Bersama abyssinica, Pouteria adolfi-friederici, Syzygium guineense, Dracena steudneri*, *Combretum paniculatum* and *Podocarpua falcatus.* Of these species*, Pouteria adoulfi-friederici* and *Podocarpus falcatus* were found sparsely and form the top upper storey followed by *Syzygium guineense, Ficus sur* and *Dracanea steudneri* constituting the middle canopy layer. *Bersama abyssinica* and *solanecio gigas* occupy the lower canopy layer in this community. In fact, numerous climbers, shrubs and herbs were also encountered. It is the most diverse community among all the six (Table 2).

Type 3 *Albizia schimperiana- Urera hypselodendron-* This community has 79 species clustered from 15 different quadrats extend between 2189-2298 m.a.s.l. Dominant species of this community include *Albizia schimperiana, Urera hypselodendron, Celtis africana, Brucea antidysenterica, Cyperus fischerianus, Dalbergia lactea, Tiliacora troupinii* and *Buddleja poylstachya*. More over, *Celtis africana* and *Albizia schimperiana* form the upper storey, while *Brucea antidysenterica, Tiliacora troupini* and *Buddleja polystachya* form the middle storey. Herbs like *Bidens carinata* and *Hypoestes forskaolii* were encountered in the lower layer of this community.

Type 4 *Clausena anisata- Albizia gummifera* - This community consists of 95 species (the second rank in species richness) attributed from 18 quadrats (between 2216-2298 m a.s.l.). Dominant species in this community includes *Clausena anisata, Albizia gummifera, Phytolacca dodecandra, Rubus apetalus, Rubus steudneri Maesa lanceolata* and *Rytignia neglecta. Albizia gummifera* forms sparsed upper storey while *Maesa lanceolata* and *Rytignia neglecta* form the middle canopy followed by *Phytolacca dodecandria, Rubus apetalus* and *Rubus steudneri* constituting the ground flora (lower storey).

Type 5 *Justicia schimeriana- Saba comorensis* -.This community consists of 70 species in 13 quadrats extend between 2199 - 2260 m a.s.l. In this community the ground floor was completely covered by *Justicia schimperiana*. Dominant species includes *Justicia schimeriana*, *Saba comorensis, Desmodium repandum, Inula paniculata, Vernonia amygdalina, Cyathula uncinulata, Carissa spinarum* and *Vepris dainellii.* There were sparsed *Coroton macrostachyus, Pouteria adolfi-friederici,* and *Albizia schimperiana* forming upper canopy even though not included with dominant species here. *Vepris dainellii, Carissa spinarum, Justicia schimperiana* and *Vernonia amygdalina* formed the middle canopy layer followed by *Desmodium repandum* and *Inula paniculata* at the lower storey.

Type 6 *Croton macrostacchyus – Teclea nobilis-* this community consists of 91 species and 10 quadrats. Dominant species in this community include *Croton macrostacchyus, Teclea nobilis, Ricinus*

communis, Grewia ferruginea, Lepidotrichilia volkensii and *Achyranthes aspera*. Even though not mentioned with dominant ranks, *Podocarpus falcatus, Syzygium guineense, Celtis africana* were encountered and sparsely distributed within this community type forming the upper storey, followed by *Teclea nobilis, Ricinus communis, Grewia ferruginea* and *Lepidotrichilia volkensii* in the middle storey while herbs like *Achyranthes aspera, Hyposetes forskaolii* form the ground floor.

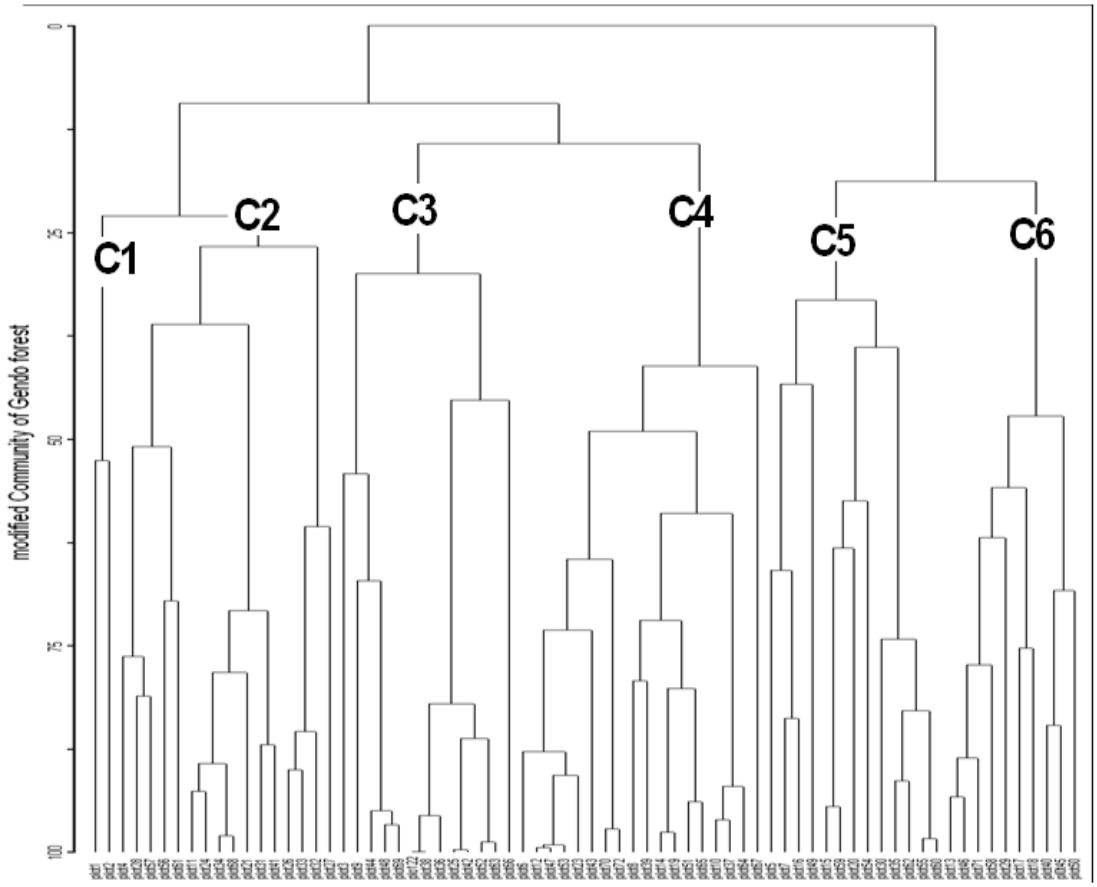

Figure 3: Gendo Forest plant community types

Table 1: Indicator (Synoptic) Values (% of each species in each community types) of Gendo Forest

No	Species list	C1	C2	C3	C4	C5	C6
1	*Acacia etbaica*	**5.5**	0.01	0	0.00	0	0.07
2	*Acanthus polystachius*	**4**	0.00	0.01	0.06	0.00	0.06
3	*Girardinia bullosa*	**4**	0.01	0.16	0.38	0.03	0.05
4	*Acacia abyssinica*	**3.5**	0.01	0	0.06	0	0.02
5	*Hypoestes forskaolii*	**3**	0.02	0.13	0.28	0.02	0.01
6	*Cordia africana*	**2.5**	0.00	0.01	0.00	0.06	0.03
7	*Pittosporus viridiflorum*	**1.5**	0.00	0	0.11	0.01	0.00
8	*Bidens carinata*	**1.5**	0.06	0.01	0.06	0	0.02
9	*Nuxia congesta*	**1**	0.00	0	0.06	0	0.07
10	*Clematis longicauda*	**1**	0.00	0.11	0.00	0	0.07
11	*Solanecio gigas*	0.02	**3.28**	0.56	1.39	1.15	0.09
12	*Bersama abyssinica*	0.03	**3.08**	1.36	1.44	0.61	0.04
13	*Pouteria adolfi-friederici*	0	**3.06**	1.8	1.20	1.02	0.01
14	*Syzygium guineense*	0.01	**2.8**	0.78	1.89	0.21	0.01
15	*Dracaena steudneri*	0	**2.30**	1.48	1.33	0.36	0.01
16	*Ficus sur*	0	**1.08**	0.5	1.50	0.28	0.00
17	*Combretum paniculatum*	0	**0.50**	0.48	0.23	0.02	0.04
18	*Podocarpus falcatus*	0	**0.46**	0.1	0.56	0.16	0.00
19	*Albizia schimperiana*	0.36	0.80	**7.3**	0.22	1.31	0.39
20	*Urera hypselodendron*	0.98	0.80	**4.59**	1.01	0.02	0.34
21	*Celtis Africana*	0	0.00	**2.33**	0.02	0.04	0.00

No	Species list	C1	C2	C3	C4	C5	C6
22	*Brucea antidysenterica*	0.1	0.20	**2.13**	0.28	0.04	0.13
23	*Cyperus fischur*	0.5	0.03	**2.01**	1.28	0	0.03
24	*Dicliptera laxata*	0	0.05	**1.9**	0.56	0.01	0.00
25	*Tiliacora troupinii*	0	0.01	**1.6**	0.56	0.02	0.00
26	*Buddleja polystachya*	0	0.00	**1.58**	0.24	0	0.00
27	*Clausena anisata*	0.8	0.56	0.46	**5.06**	0.34	1.13
28	*Albizia gummifera*	0.4	0.41	0.89	**4.32**	1.01	0.98
29	*Rubus steudnerii*	0.01	0.00	0.3	**3.04**	0.56	0.05
30	*Rubus apetalaus*	0.1	0.20	1.3	**2.80**	1.03	0.00
31	*Dalbergia lactea*	0.09	0.00	0.78	**2.30**	0.09	0.02
32	*Maesa lanceolata*	0.01	0.06	1.01	**1.80**	0.09	0.01
33	*Rytigynia neglecta*	0.01	0.10	0	**1.48**	0	0.00
34	*Justicia schimperiana*	0.97	0.01	1.38	1.43	**6.71**	1.19
35	*Saba comorensis*	0	0.01	0.02	1.42	**4.08**	0.00
36	*Desmodium repandium*	0.01	0.00	0	0.00	**3.2**	1.11
37	*Inula paniculata*	*0.1*	*0.00*	*0*	*0.00*	***3.01***	*1.19*
38	*Vernonia amygdalina*	0.1	0.00	0	0.00	**2.8**	1.18
39	*Cyathula uncinulata*	0.01	0.00	0.82	0.00	**1.96**	0.01
40	*Carrisa spinarum*	0	0.01	0	0.02	**1.91**	0.00
41	*Vepirs dainellii*	0	0.08	0.41	0.90	**1.38**	1.01
42	*Croton macrostachyus*	1.01	0.58	0.68	0.99	1.28	**5.20**
43	*Teclea nobilis*	0	0.12	1.01	0.93	1.24	**4.80**
44	*Caulpurnia aurea*	0	0.00	0.94	0.81	0	**3.12**
45	*Ricinus communis*	0.48	0.00	0	0.00	0	**2.84**
46	*Grewia ferruginea*	0	0.00	0.06	0.01	0	**1.86**
47	*Lepidotrichilia volkensii*	0	0.00	0.14	0.07	0	**1.73**
48	*Achyrantes aspera*	0.09	0.02	0	0.06	0	**1.20**

Species Richness, Diversity and Similarity Indices

Shannon and Wiener (1949) diversity and evenness indices were computed for Gendo Forest plant communities and the results were shown in Table 2.

Table 2: Shannon and Wiener diversity, evenness and species richness indices

Community type	I	II	III	IV	V	VI
Diversity indices (H')	3.99	4.22	3.57	3.63	3.51	3.71
Evenness (E)	0.99	0.89	0.82.	0.80	0.83	0.82
No of species	79	113	79	95	70	91

As indicated on Table 2, the possible reasons for such high species richness (variability) of each magnitude (values) for different community types is probably due to difference in their species composition, cover abundance value, degree of disturbance involved, % of the slope, intensity of light striking on ground floor and other related factors. Similar findings were given by the work of Lisanework (1987) and Tadesse (2003).

Table 3: Sorensen's similarity coefficient for Gendo Forest plant communities'

Community type	I	II	III	IV	V	VI
I	1.00					
II	0.15	1.00				
III	0.11	0.5	1.00			
IV	0.15	0.55	0.51	1.00		
V	0.14	0.56	0.45	0.45	1.00	
VI	0.12	0.59	0.40	0.51	0.51	1.00

Similarity ratios of communities were calculated following Sorensen's similarity coefficient. According to the results indicted in Table 3 above, similarity between the six communities range from 0.11 (11%) the least value to 0.59 (59%) the highest. The similarity might be due to the fact that they may found in the same and similar environmental factors, endowed with more or less similar species compositions, disturbance and so on than other community types. Community type II was similar to most of the others and community type I is the least to all, because this community was the most disturbed found at the lowest extreme altitudinal range, receiving the highest degree of anthropogenic interactions as it was exposed to all incoming disturbances (Personal observation). However there were more or less slight variations and similarity among each

community, probably because they might have similar: resource base, growth habits, physiological and environmental factors, tolerance to prevailing environmental stresses and similar species compositions. Because of low range in altitudinal gradients (2183-2300 m a.s.l.) much significant and abrupt change in vegetation composition and zonation was not expected in the study Forest, and hence *Croton macrostachyus, Justicia schimperiana, Bersama abyssinica, Dracaena steudneri, Pouteria adolfi-freiderici, Solanecio gigas, Albizia schimperiana* and *Albizia gummifera w*ere distributed almost throughout all the communities with the exception for *Pouteria adolfi-friederici* absent in the first community.

Phytogeographical comparison of Gendo Forest with other similar forests in Ethiopia

Gendo Forest was compared with other ten different similar afromontane forests found in different localities in Ethiopia (Table 4). These are Masha Anderacha Forest (moist montane forest in southwest Ethiopia (Kumelachew and Taye, 2003), Harenna Forest is the second largest moist Afrotropical forest (Lisanework Nigatu, 1987). Jibat Forest is a transitional forest found in western Shewa (Tamrat, 1994), Alata-Bolale Forest in East Welega Zone (Woldeyohannes, 2008), Jima Forest in East Welega Zone (Fufa, 2008), Gura Farda (Bibita) Forest in Southern Ethiopa-Bench Maji Zone, (Dereje, 2007), Sheko Forest in southwest Ethiopia (Feyera *et al.,* 2007), Mana Angatu Forest in Southeasten corner of Bale Zone (Ermias *et al.,* 2008), Bonga Forest, Soutwestern Ethiopia (Ensermu and Teshome, 2008), and Yayu Forest, in Southwest Ethiopia (Illubaor Zone), (Tadesse, 2003) The Comparison of these ten forests with Gendo Forest was computed only for woody species using Sorensen's similarity (S_c= c/ a + b+ c) index. Direct comparison of species diversity with some other forests is not feasible due to differences in size of the forests, survey methods and objectives of the study (Tadesse, 2003). As indicated in Table 4. Gendo Forest have greater than 50% similarity with three forests (Jima, 63%, Alata-Bolale 61% and Jibat 51%), intermediate similarity (40-50%) with four forests (Gura Ferda, 46%, Harenna, 45%, Bonga and Mesha-Andaracha each, 42%) and the least similarity (31-40%) with three forests (Sheko, 31%, Mana Angatu, 35% and Yayu, 37% respectively).

Table 4: Phytogeographical Comparison of Gendo Forest with other 10 forests in Ethiopia (Where a, b, and c are species unique to the forest under comparison (a), Gendo (b) and common to both (c), spp R, species richness, BA, basal area, Sc similarity coefficient),

No	Forest name	Altitude (m asl)	No. spp.	BA	a	b	c	S_c	Ds
1	Alata-Bolale	2061-2360	165	53.33	46	31	59	0.61	0.39
2	Jima	2166-2470	90	33.30	29	35	54	0.63	0.37
3	Masha Andaracha	1250-2700	107	81.90	60	46	39	0.42	0.58
4	Sheko	900-1810	374	54.00	106	46	34	0.31	0.69
5	Jibat	2000-2950	131	47.50	31	37	36	0.51	0.49
6	Gura Ferda	1650-2055	196	69.90	57	47	44	0.46	0.54
7	Yayu		220		80	44	37	0.37	0.64
8	Mana Angatu	1533-2431	211	94	86	45	36	0.35	0.65
9	Bonga	1000-3350	243		37	50	31	0.42	0.58
10	Harenna	1500-3250	203		54	37	38	0.45	0.55
11	Gendo	2183-2300	168	55.25					

Source: 1 Woldeyohannes Enkosa (2008) ;
2 Fufa Kenea (2008);
3 Kumilachew Yeshitela and Taye Bekelke (2003)
4 Feyera Senbata *et al.,* (2007)
5 Tamrat Bekele, 1994
6 Dereje Denu (2007)
7 Tadesse W/mariam (2003)
8 Ermias Lulekal *et al*., (2008
9. Emsermu Kelbessa and Teshome Soromessa (2008)
10 Lisanework Nigatu (1987)

High similarity of Gendo forest with Jima, Alata-Bolale and Jibat was due to geographical proximity, possibly species migration, similarity in altitudinal range, climatic zones and probably soil types. On the other

hand the dissimilarities between Gendo Forests and Sheko, Mana Angatu and Yayu Forests may arise from the differences in sample size, altitudinal range (for example the least similar or the most dissimilar of all is that of Sheko Forest, altitudinally found below 1810 m a.s.l. which was lower than the altitude of Gendo Forest (2183-2300 m a.s.l.), degree of human interaction, over grazing and climatic conditions too.The altitudinal range shared by Gendo Forest and that of Jima and Alata-Bolale, is only from 2061 - 2470 m a.s.l., which might contribute to their similarity.

CONCLUSION AND RECOMMENDATION

Conclusion

Gendo Forest is entirely encompassed within moist montane Rain Forests with respect to its: altitudinal range, vegetation compositions and climatic conditions. Gendo Forest have ecological, economic, social and cultural values that local communities obtained from it (including timber trees, hydrological cycle, shadow or shading of villeges in its immediate vicinity during hot weather condition). Even though not too much, when compared with other moist mountain forests, Gendo Forest also hosts 18 endemic species 8 of which are threatened and near threatened according to IUCN red data book. This implies the fact that Gendo Forest contributed in preservation of endemic, threatened and indigenous plant gene pool. The most diverse family in the forest were Asteraceae, Fabaceae and Poaceae followed by Acanthaceae and Euphorbiaceae. *Croton macrostachyus, Justicia schimperiana, Solanecio gigas, Albizia gummifera, Albizia schimperiana. Clausena anisata, Vepris dainellii,* etc are mentioned among dominant species recorded in the forest. Most of the lower height and DBH classes were dominated by species having small statures while at the higer height and DBH classes very few individuals of *Pouteria adolfi-friederici, Podocarpus falcatus, Albizia schimperiana Ficus sure* and *Syzygium guineense* were predominant. Gendo Forest consists of three canopy layers, the top emergent trees (*Pouteria Adolf-friederici and Podocarpus falcatus*), *Albizia schimperiana, Ficus sur, Syzygium guineense and Croton macrostachyus* forming the middle canopy layer while *Teclea nobilis, Vepris dainellii, Bersama abyssinica, Acacia abyssinica, Maytenus addat,* etc form the lower canopy followed by smaller shrubs and groung herbs.

Recommendation

Local people, NGOs and other concerned bodies should promoting plantation on all sides of the forest edge (establishe buffer zones) to the central natural forest as they did during the millenum. As the population increases from 101, 766 (1996) to 171, 985 (2008), there will be high pressure on this forest resource. Therefore awareness creation with respect to forest conservation and management practices to the local community is crucial for consrrvation of this forest in future. Promoting private and community plantations specifically those with fastly growing species (indigenous) to ensure self reliance with respect to demand for wood in the long run and decreasing human pressure on natural forest. Further studies on soil analysis, seed soil seed bank, seed physiology and reproductive biology of those species under risky of extinction and those of highly demanded wood comsumption. Gendo Forest hosts 18 endemic species, 8 of which were threatened, and near threatened within the total 168 species. So this forest served as the natural reservoir of endemic plants gene pool. Thus the forest should be included within the Forest Priority Areas and legal conservation and demarcation is recommended.

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Appendix1: Species List of Gendo Forest (where V name, vernacular name, T, tree, S, Shrub, S/T, Shrub or tree (shrbby tree) and H, herb respectively.

No	Botanical name	V. Name	Family Name	Habit	V.No
1	*Acacia abyssinica* Hochst ex.Benth.	Laaftoo	Fabaceae	T	1
2	*Acacia etbaica* Schweinf.	Doddota	Fabaceae	T	2
3	*Acaia brevispica* Harms.	Amezaze	Fabaceae	S	71
4	*Acanthus eminens* C.B Clarke.	Suguru/ bala-urente	Acanthaceae	S	101
5	*Acanthus polystachius* Delile	Kossorruu	Acanthaceae	S	7
6	*Achyranthes aspera* L	Tuta / Maxxaannee	Amaranthaceae	H	135
7	*Achyrospermum schimper* Hochst. ex.Briq.) Perkins	Kefoo Jaldeessaa	Lamiaceae	H	10
8	*Aeschynomene abyssinica* (A. Rich.) Vatke		Fabaceae	H	32
9	*Ageratum conyzoides* L	Ganuu/ haramaa	Asterace	H	63
10	*Albizia gummifera (*I.F.Gmel.) C A Sm.,	Mukarbaa	Fabaceae	T	49
11	*Albizia schimperiana* Oliv	Mukarbaa	Fabaceae	T	50
12	*Allophylus abyssinicus* (Hochest.) Radlkofer	Sarara/Malqaqqoo	Sapindaceae	T	115
13	*Andropogon pilosellus* Stapf	Ashuffee	Poaceae	H	94
14	*Anthriscus sylvestris* (L) Hoffim		Apiaceae	H	82
15	*Apodytes dimidiata* E.Mey. ex Am	Dongii	Icacinaceae	T	79
16	*Argomuellera macrophylla* Pax	Timboo Jaldeessaa	Euporbiaceae	S / T	138
17	*Argyrolobium schimperianum* Hochst. ex A, Rich..		Fabaceae	S	140
18	*Asparagus africanus* Lam	Sariitii	Asparagaceae	S	44
19	*Aspilia mossambicensis* (Oliv) Wild	Daalattii	Asterace	S	34
20	*Astragalus atropilosulus* (Hochst.) Bunge.		Fabaceae	H	142
21	*Bersama abyssinica* Fresen	Lolchiisaa	Melianthaceae	T	60
22	*Bidens carinata* Cufod ex Mesfin	Hadaa	Assterace	H	39
23	*Bidens pilosa* L	Jugogidii	Asterace	H	23
24	*Bothriocline schimperi* Oliv & Hiern ex Benth		Asterace	H	83
25	*Brucea antidysenterica* J.f.Mill	Qomaanyoo	Simarobaceae	S / T	11
26	*Buddleja polystachya* Fresen.	Hanfaaree	Loganiaceae	T	130
27	*Caesalpinia decapetala* (Roth) Alston		Fabaceae	S	131
28	*Carduus leptacanthus* Fresen	Arraba nadheennii	Asterace	H	136
29	*Carissa spinarum* L.	Agamsaa	Apocynaceae	S	156
30	*Cassipourea malosana* (Baker) Alston	Hudduufardaa	Rhizophoraceae	T	150
31	*Caulpurnia aurea* (Ait.) Benth.	Ceekaa	Fabaceae	S / T	76
32	*Celtis africana* Burm.f.	Qayyii (Cayyii)	Ulmacea	T	59
33	*Cirsium englerianum* O. Hoffm.		Asterace	H	146
34	*Cirsium schimperi* Vatke) C.Jeffrey.ex Cuf.	Mataa bokkee	Asterace	H	157
35	*Clausena anisata* (Willd.) Benth.	Hulumaayii	Rutaceae	S / T	51
36	*Clematis longicauda* Steud. ex A.Rich.	Idda Fitii baala babal'aa	Lauraceae	S	29
37	*Clematis simensis* Fresen	Yidda teeloo (Fitii)	Lauraceae	S	19

38	*Combretum paniculatum* Vent	Idda Baggii	Combrtiaceae	Cl	88
39	*Commelina diffusa* Burm f.		Commelinacea	H	33
40	*Cordia africana* Lam.	Waddeessa	Boraginaceae	T	26
41	*Crassocephalum macropappum* (Sch.Bip.ex.A.Rich.) S Moore		Asterace	H	95
42	*Crotalaria bogdaniana* Polhill.		Fabaceae	H	154
43	*Crotalaria incana* L.	Atara Qamalee	Fabaceae	H	103
44	*Croton macrostachyus* Del	Makkaanniisa	Euporbiaceae	T	3
45	*Cyathula uncinulata* (Schard) Schinz.	Maxaannee abaaboo jirbii	Amaranthaceae	H	84
46	*Cynoglossum amplifolium* Hochst ex A.DC in DC.		Boraginaceae	H	120
47	*Cynoglossum coeruleum* Hochst. ex A DC.		Boraginaceae	H	18
48	*Cyperus fischerianus A.Rich*	Qunnii (daggoo)	Cyperaceae	H	37
49	*Dalbergia lactea* Vatke	Waraabillee	Fabaceae	S	4
50	*Desmodium repandum* (Vahl) DC.		Fabaceae	H	
51	*Dicliptera laxata* C.B Clarke		Acanthaceae	H	58
52	*Dipsacus pinnatifidus* Steud ex A.Rich.	Qalaamii	Dipsacaceaae	H	124
53	*Dodonea angustifolia* L.F.	Ittacha	Sapindaceae	S	143
54	*Dombeya schimperiana* A.Rich.	Daannisa Diimaa	Sterculaceae	T	57
55	*Dombeya torrida* (J.F. Gmel) P. Bamps	Daannisa Adii	Sterculaceae	T	53
56	*Dracaena afromontana* Mildbr		Dracaenace	S / T	56
57	*Dracaena steudneri* Engl	Warqee Jaldeessaa	Dracaenace	T	54
58	*Echinops macrochaetus* Fresen.	Qarabichoo	Asterace	H	109
59	*Ehretia cymosa Thonn*	Wagi /ulaga/Garmi	Boraginaceae	S	145
60	*Ekebergia capensis* Sparm	Somboo	Meliaceae	T	80
61	*Embelia schimperi* Vartke	Hanquu	Myrsinaceae	S	111
62	*Ensete ventricosum* (Welw.) Cheesman	Warqee bosonaa	Musaceae	H	110
63	*Erthytrococca trichogyne* (Muell.Arg.) Prain	Caakkoo	Euporbiaceae	S	155
64	*Erythrina brucei* Schweinf	Waleensuu	Fabaceae	T	122
65	*Ficus sur* Forrsk.	Harbuu	Moraceae	T	61
66	*Flacourtia indica* (Burem.F) Merril	Akuukkuu	Flacoutiaceae	T	70
67	*Galinsoga quadriradiata* Ruiz and Pavon	Gosa cuqii Xixiqqaa	Asterace	H	25
68	*Geranium arbicum* Forssk.		Geraniaceae	H	104
69	*Girardinia bullosa* (Steudel) Wedd.	Gurgubbee/Dobii	Urticaceae	H	14
70	*Gnidia glauca* (Fresen)Gilg	Diddiksaa/Qaqaroo	Thymelaceae	S	27
71	*Gouania longispicata* Engl.	Idda locaa	Rhamnaceae	Cl	24
72	*Grevillea robusta* A Cunn ex.Br.		Proteaceae	T	47
73	*Grewia ferruginea* Hochst ex A. Rich.	Dhoqonuu	Tiliacea	S / T	112
74	*Guizotia schimperi* Sch BiP ex Walp.	Cuqii	Asterace	H	36
75	*Helichrysum stenopterum* DC.		Asterace	H	153
76	*Helinus mystacinus* (Ait.) E Mey. ex Steud	Idda Xasee/Omichoo	Rhamnaceae	S	72
77	*Hibiscus dongolensis* Del.	Maxajjii	Malvaceae	H	121
78	*Hibiscus ludwigii* Ekel. & Zeyh.		Malvaceae	S	81
79	*Hibiscus surattensis L.*	Incinnii gurrachaa	Malvaceae	H	119
80	*Hyparrhenia hirta L*	Dhodhoota	Poaceae	H	6
81	*Hypericum quartinianum* A..Rich.	Ulee Foonii	Guttiferaceae	S / T	161
82	*Hypoestes forskaolii* (Vahl) R.Br.	Darguu	Acanthaceae	H	16
83	*Inula paniculata* (Klatt) Burtt-Davy		Asterace	H	148

84	*Juniperus procera* Hochst ex Endl.	Gaattiiraa	Cuppressacea	T	87
85	*Justicia schimperiana (*Hochst ex Nees) T.Anders.	Dhummuugaa	Acanthaceae	S	48
96	*kalanchoe densiflra* Rolfe	Ancoruuraa	Crassulaceae	H	166
87	*Kosteletzkya begoniifolia* (Ulbar) Ulbar.	Koskoosii	Malvaceae	H	98
88	*Kotschya africana* Engl.	Xirroo	Fabaceae	H	167
89	*Laggera crispata (*Vahl)Hepper & wood	Geejoo /ajaayee	Asterace	H	30
90	*Lepidotrichilia volkensii* (Gurke) Leroy	Dhama'ee	Meliaceae	S / T	64
91	*Leucas deflexa* Hook. f.		Lamiaceae	H	22
92	*Lindenbergia indica* (L.) Vatke		Scrophularaceae	H	163
93	*Lippia adoensis* Hochst ex Walp	Kussa'ee	Verbenaceae	S	77
94	*Macaranga capensis* (Bail.) Sim.	Ho'aa	Euporbiaceae	T	117
95	*Maesa lanceolata* Forssk.	Abbayyii	Myrsinaceae	T	78
96	*Maytenus gracilipes* (Welw ex Oliv.)	Qacamaa/Kombolcha	Celastraceae	S / T	68
97	*Maytenus addat* (Loes) Sebsebe	Kombolchaa	Celastraceae	T	13
98	*Medicago polymorpha* L		Fabaceae	H	105
99	*Mellera lobulata* S.Moore.	Heraye	Acanthaceae	H	40
100	*Millettia ferruginea* (Hochst.) Baker	Sootalloo	Fabaceae	T	126
101	*Momordica foetida* Schumach.	Ancootee sinbiraa	Cucurbitaceae	H	17
102	*Mukia maderaspatana* (L.) M.J Roem	Sokokkee	Cucurbitaceae	H	123
103	*Nuxia congesta* R.Br.ex Fresen.	Naffuroo	Loganiaceae	T	139
104	*Ochna inermis* (Forssk.) Schweinf. ex Penzig	Muki-jabee	Ochnacease	S	43
105	*Ocimum urticifolium* Roth	Hancabbii/ Enna	Lamiaceae	S	125
106	*Oncoba rontledgei* Sparague	Harsaammeessa	Flacoutiaceae	S	158
107	*Oncoba spinosa* Forssk.	Gosa harsammeesaa	Flacoutiaceae	S / T	165
108	*Oncocalyx schimperi* (A.Rich) M.Gilbert	Qorcha feesaa	Loranthaceae	S	106
109	*Oplismenus burmannii* (Retz.) P. Beauv.	Mariga Gogorrii	Poaceae	H	91
110	*Pennistium macrourum* Trin		Poaceae	H	9
111	*Pennisteum thunbergi* Kunth	Migira saree	Poaceae	H	99
112	*Peponium vogelii* (Hook.f.) Engl.	Buqqee Seexxanaaa	Cucurbitaceae	H	132
113	*Periploca linearifolia* Quart-Dill & A.Rich.	Aanannoo	Asclipediacea	H	108
114	*Phyllanthus boehmii* Pax		Euporbiaceae	H	169
115	*Phytolacca dodecandra* L	Handoodee	Phytolaccacea	S	129
116	*Pittosporum viridiflorum* Sims	Soolee/Qasammee	Pittosporaceae	T	113
117	*Plantago lanceolata*.L.	Qorxobbii	Plantaginacea	H	149
118	*Plectranthus garckelanus (*Vatke) J K Morton	Ajeesa	Lamiaceae	H	35
119	*Podocapus falcatus* (Thumb.) R.Br.ex Mirb	Birbirsa	Podocarpacea	T	55
120	*Polystachya bennettiana* Rchb.f.		Orchidaceae	H	162
121	*Pouteria adolfi-friederici* (Engl.) Baehni	Qararoo	Sapotacea	T	67
122	*Pteris catoptera* Kze.		Pteridaceae	H	107
123	*Pteris quadriaurita* Retz.		Pteridaceae	H	102
124	*Pterolobium stellatum (*Forssk.) Brenan	Manyar	Fabaceae	S	133
125	*Pycnostachys abyssinica* Fresen.	Gosa ajayee	Lamiaceae	H	66
126	*Pycnostachys meyeri* Gurke	Dhumugaa ajja'ee	Lamiaceae	H	127
127	*Rhamnus prinoides L'Herit.*	Geeshoo	Rhamnaceae	S	89

128	*Rhus glutinosa* A.Rich.	Xaaxessaa	Anacardaceae	S / T	65
129	*Ricinus communis* L.	Qobyoo	Euporbiaceae	H	12
130	*Rubus apetalus* Poir.	Goraa nyaatamu	Rosaceae	S	62
131	*Rubus steuderi* Schweinf.	Goraa nyaatamu	Rosaceae	S	69
132	*Rumex abyssinicus* Jacq	Bosoqqee Alaangaa	Polgonaceae	H	97
133	*Rumex nepalensis* Spreng	Bosoqqee	Polgonaceae	H	168
134	*Rumex nervosus* Vahl	Dhangaggoo / Seta	Polgonaceae	S	134
135	*Rytigynia neglecta* (Hiern) Robyns	Mixoo seeraa	Rubiaceae	S	96
136	*Saba comorensis* (Boj.) Pichon	Idda gaaguraa	Apocynacea	Cl	42
137	*Satureja simensis* (Benth.)Briq.	Kussa' ee gursummaa	Lamiaceae	H	41
138	*Schefflera volkensii (*Engel) Harms	Gatamaa	Araliaceae	T	31
139	*Setaria megaphylla (*Steud.)Th.Dur.& schinz		Poaceae	H	92
140	*Sida rhombifolia* L.	Qunciitii	Malvaceae	H	21
141	*Sida tenuicarpa* Vollesen	Shetto	Malvaceae	H	141
142	*Snowdenia polystachy (*Fresen) Pilg	Citaa	Poaceae	H	90
143	*Solanecio gigas* (Vatke) C.Jeffrey	Jirma-jaldessaa	Asterace	S / T	164
144	*Solanum anguivi* Lam.	Iddii saree	Solanaceae	H	160
145	*Solanum giganteum* Jacq.	Iddii baala adii	Solanaceae	S	73
146	*Solanum incanum* L.	Iddii	Solanaceae	S	8
147	*Sonchus bipontini* Asch		Asterace	H	128
148	*Sporobolus africanus* (Poir.) Robyns&Tournay	Murii	Poaceae	H	100
149	*Stephania abyssinica* (Dillon et A.Rich.) Walp	Gurraa hantuutaa	Merispermaceae	H	151
150	*Syzygium guineense* (Wild.) DC.	Baddeessaa	Myrtaceae	T	52
151	*Tagetes minuta.*L	Qoricha goondaa	Asterace	H	15
152	*Tapinanthus globiferus* (A..Rich.) Tieghem	Qoriicha fee'isa jabbii	Loranthaceae	S	152
153	*Teclea nobilis* Del	Hadheessaa baala Qal'aa	Rutaceae	T	86
154	*Thalictrum rhynocarpum* Dill. & A.Rich.		Ranunculacea	H	45
155	*Thunbergia alata* Boj .ex Sims..	Marte	Acanthaceae	H	93
156	*Tiliacora troupinii* Cuf.	Idda reeffaa	Menispermacae	Cl	137
157	*Trifolium rueppellianum* Fresen.		Fabaceae	H	85
158	*Triumfetta brachyceras* K..Schum.	Incinnii booyyee	Tiliacea	H	20
159	*Turraea holstii* Gurke		Meliacea	S	114
160	*Urera hypselodendron* (A.Rich.) Wedd	Lanqeessaa	Urticaceae	S	28
161	*Vepirs dainellii* (Pichi-Serm.) Kokwaro	Hadheessaa baala Bal'aa	Rutaceae	T	46
162	*Vernonia adoensis* Sch. Bip.ex Walp.	Ulee harree	Asterace	S	38
163	*Vernonia amygdalina* Del.	Eebicha	Asterace	S / T	75
164	*Vernonia hochstetteri* Sch. Bip. ex Walp.	Ulee harree abaaboo diimaa	Asterace	S	159
165	*Vernonia ischnophylla* Muschl.	Sooyyoma dhalaa	Asterace	S	116
166	*Vernonia rueppellii* Sch. Bip, ex.Walp.	Reejjii	Asterace	S	5
167	*Vigna heterophylla* Muschi		Fabaceae	H	118
168	*Xanthium strumarium* L.	Bandaa / bandoo	Asterace	H	144

Appendix 2: Family, Genera and Species Distrribution of Gendo Forest

No	Family name	No of genera	No of spp	% total
1	Fabaceae	17	21	12.50
2	Euporbiaceae	6	6	3.57
3	Poaceae	7	8	4.76
4	Asteraceae	18	24	14.29
5	Acanthaceae	6	7	4.17
6	Solanaceae	1	3	1.79
7	Simarobaceae	1	1	0.60
8	Rutaceae	3	3	1.79
9	Celastraceae	1	2	1.19
10	Urticaceae	2	2	1.19
11	Cucurbitaceae	3	3	1.79
12	Boraginaceae	3	4	2.38
13	Tiliaceae	2	2	1.19
14	Malvaceae	3	6	3.57
15	Lamiaceae	6	7	4.17
16	Rhamnaceae	3	3	1.79
17	Thymelaceae	1	1	0.60
18	Lauraceae	1	2	1.19
19	Araliaceae	1	1	0.60
20	Commelinacea	1	1	0.60
21	Cyperaceae	1	1	0.60
22	Apocynaceae	2	2	1.19
23	Asparagaceae	1	1	0.60
24	Myrtaceae	1	1	0.60
25	Sterculaceae	1	2	1.19
26	Ulmaceae	1	1	0.60
27	Melianthaceae	1	1	0.60
28	Moraceae	1	1	0.60
29	Rosaceae	1	2	1.19
30	Anacardaceae	1	1	0.60
31	Sapotaceae	1	1	0.60
32	Pteridaceae	1	2	1.19
33	Asclipediaceae	1	1	0.60
34	Musaceae	1	1	0.60
35	Flacourtiaceae	2	3	1.79
36	Pittosporaceae	1	1	0.60
37	Sapindaceae	2	2	1.19
38	Phytolaccaceae	1	1	0.60
39	Loganiaceae	2	2	1.19
40	Amaranthaceae	2	2	1.19
41	Plantaginaceae	1	1	0.60
42	Guttiferaceae	1	1	0.60
43	Orchidaceae	1	1	0.60
44	Apiaceae	1	1	0.60
45	Combretaceae	1	1	0.60
46	Menispermaceae	2	2	1.19
47	Icacinaceae	1	1	0.60
48	Scrophulariaceae	1	1	0.60
49	Rubiaceae	1	1	0.60
50	Geraniaceae	1	1	0.60
51	Crassulaceae	1	1	0.60

No	Family name	No of genera	No of spp	% total
52	Rhizophoraceae	1	1	0.60
53	Dracaenaceae	1	2	1.19
54	Myrsinaceae	2	2	1.19
56	Ranunculaceae	1	1	0.60
57	Verbenaceae	1	1	0.60
58	Dipsacaceaae	1	1	0.60
59	Cuppressaceae	1	1	0.60
60	Proteaceae	1	1	0.60
61	Podocarpaceae	1	1	0.60
66	Ochnaceae	1	1	0.60
63	Loranthiaceae	2	2	1.19
64	Polgonaceae	1	3	1.79
65	Meliaceae	3	3	1.79
	Total	140	168	100.00

Appendix 3: Endemic speices of Gendo Forest (where * representing Threatened and near threatened species)

No	Botanical Name	V name	Family	Habits
*1	*Erythrina brucei* Schweinf.	Waleensuu	Fabaceae	T
*2	*Millettia ferruginea* (Hochst.) Baker	Sootalloo	Fabaceae	T
3	*Argyrolobium schimperianum* Hochst. ex A.Rich.		Fabaceae	S
4	*Astragalus atropilosulus* (Hochst.) Bunge.		Fabaceae	H
*5	*Bothriocline schimperi* Oliv. & Hiern ex Benth.		Asterace	H
*6	*Vernonia rueppellii* Sch. Bip. ex Walp.	Reejjii	Asterace	S
7	*Crassocephalum macropappum* (Sch.Bip.ex A.Rich.) S Moore		Asterace	H
8	*Cirsium englerianum* O. Hoffm.		Asterace	H
9	*Cirsium schimperi* Vatke)C.Jeffrey.ex Cuf.	Mata bokkee	Asterace	H
*10	*Solanecio gigas* (Vatke) C.Jeffrey		Asterace	S / T
*11	*Maytenus addat* (Loes) Sebsebe	Kombolchaa	Celastraceae	T
12	*Cynoglossum coeruleum* Hochst. ex A. DC		Boraginaceae	H
13	*Plectranthus garckelanus* (Vatke) J K Morton	Ajeesa	Lamiaceae	H
*14	*Clematis longicauda* Steud. ex A.Rich.	Idda Fitii baala babal'aa	Lauraceae	S
15	*Vepirs dainellii* (Pichi-Serm.) Kokwaro	Hadheessa dhalaa	Lauraceae	S
*16	*Rhus glutinosa* A.Rich.	Xaaxeessaa	Anacardaceae	S / T
17	*Tiliacora troupinii* Cuf.	Idda reefaa	Menispermacae	T
18	*Pycnostachys abyssinica* Fresen.		Lamiaceae	H

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