Ethiop. J. Biol. Sci., 7(1): 1-15, 2008

ISSN: 1819-8678

VEGETATION COMPOSITION AND STRUCTURE OF THE BELETE FOREST, JIMMA ZONE, SOUTH WESTERN ETHIOPIA

Kitessa Hundera[1,*] and Tsegaye Gadissa[1]

ABSTRACT: Woody species composition and structure of the Belete forest was studied from December 2005 to September 2006. Thirty two sampling plots, each having a size of 20 m X 20 m, were laid at every 50m altitudinal gradient. 74 woody species belonging to 68 genera and 38 families were recorded in the forest. Thirty two (40.5%) of the species were trees, 39 (49.4%) shrubs and the remaining 8 (10.1%) species were climbers. *Podocarpus falcatus* was the only Gymnosperm identified from the forest and all the rest were Angiosperms. Diameter and height was measured for all trees and shrubs with DBH greater than 2 cm. Tree density was 1482 individuals per hectare and the basal area was 90.6m^2/ha. Most of the individuals were distributed in the lower DBH and height classes. Four general patterns of population structure were recognized.

Key words/phrases: Basal Area, Belete Forest, Diameter at Breast Height, Species Composition

INTRODUCTION

In Ethiopia, environmental degradation and deforestation have been taking place for hundreds of years. Especially during the last century, Ethiopia's forests and woodlands have declined both in size and quality. By the early 1950's, high forests areas were reduced to 16% of the total land area. It has been estimated that by the early 1980's, the land area covered by forests declined to 3.6%, and by 1989 to about 2.7 % (Milion Bekele and Leykun Berhanu, 2001). Annual deforestation rate was estimated to be 150,000 to 200,000 ha (EFAP, 1994). Because of this, a considerable area of what was once a closed forest had been converted to a heavily disturbed forest.

The major reasons given for reduction of the forest area are uncontrolled exploitation, shifting cultivation, forest fires and the expansion of permanently cultivated areas (Friis, 1992). Clearance to meet the demands of agriculture is exacerbated by the rise in population; forests are also cleared for construction purposes, and they provide material for farm implements. Environmental problems such as soil degradation, erosion and decrease in biodiversity as well as the loss of potential natural resources are

[1]Department of Biology, Jimma University, P.O. Box 52, Jimma, Ethiopia.. E-mail: kitessah2@yahoo.com
[*]Author to whom all correspondence should be addressed.

negative effects resulting from the destruction of these habitats. Indigenous knowledge on medicinal and other useful plants is eroded with destruction of these forests.

Despite rapid forest destruction in South-western Ethiopia, primarily moist forests are still the main natural production assets, since a great proportion of the population living close to forest patches depends on forest products. Particularly, non-timber forest products (NTFPs) such as honey, 'wild' coffee, spices, fruits, and medicinal plants, are of high importance in this regard, for both home consumption and as cash crop (Stellmacher, 2005).

The low living standard of the people coupled with lack of alternatives is the underlying factor responsible for the decline in forest areas of Ethiopia. This is expressed by increasing demands for crop and grazing land and wood for fuel and construction (Taye Bekele *et al*., 1999). New settlements in forests are increasing and have resulted in the conversion of forest land into agricultural and other land use systems. The pressure from investors who are converting the moist montane forests of the southwestern part of Ethiopia into other land use systems such as coffee and tea plantations at present, threatens the few remaining high forests (Taye Bekele *et al*., 2001).

The speed of deforestation in Belete forest was rapid; local sources in Jimma area informed Lagon (1946, cited in Friis, 1992) that the forest which by 1946 was little nearer to Sadaro and Beletta some 25-35 km away, had in 1900 reached almost Jimma town.

A study conducted during 1996–1998 in the Belete forest and the Gera forest of Jimma zone showed that the annual rates of deforestation were 9.5% and 4.7%, respectively (Bezuayehu Tefera *et al.*, 2000). Encroachment rate of farmland and pasture into natural forest was 1.45% per year. Encroachment occurred mostly on areas with gentle slopes adjacent to populated villages and along roads and footpaths. The extent and impact of coffee production activities were high. Up to 49% of the accessible natural forest was under the influence of coffee production activities, among which collecting of naturally grown coffee beans has the least and the coffee plantations has the most impact on the natural forest. Coffee plantations in natural forest have reduced the forest density and species diversity (Sheauchi *et al*., 1998).

Presently participatory forest management (PFM) is being implemented in Belete forest through the agreement between Japan International Cooperation Agency (JICA) and Oromiya Regional State. The primary aim of the PFM was to realize sustainable forest management in and around Belete-Gera National Forest Priority Area. In this respect, the principle that the project is following is official recognition of the existing livelihood practices.

Thus, in order to maintain the ecological equilibrium and to meet the forest products requirement of the population, scientific information is required. Without a full assessment of the properties of the various sites in a forest and their relation to vegetation growth, the management of the forest will be severely handicapped. Therefore, assessment of these forests is the basis for meaningful planning to rationally utilize the remaining forest resources. Therefore the objective of this study was to document the woody species composition and structure of the Belete forest and to provide baseline information that would help in developing the management plan of the forest.

MATERIALS AND METHODS

Description of the study area

Belete forest is situated in Seka Chekorsa *Wereda*, Jimma zone, Oromiya National Regional State, 375 km south west of Addis Ababa. It is part of the Belete Gera National Forest Priority Area (Fig. 1). The Forest is located at longitudes between $36^0$15’ E and $36^0$45’E and latitudes 7.30^0 N $7^0$45’N (Belete Gera PFMP report, 2006).

Soils are largely volcanic in origin and relatively fertile. The dominant soil types are nitosols. Tertiary volcanic and related volcano-clastic sediments underlie the area (Omo-Gibe River Basin Master Plan, 1996). The mean annual rainfall of the area is between 1800 mm and 2300 mm with maximum rainfall between the months of June and September. The mean annual temperature of the area is between 15^{o}C and 22^{o}C (Ethiopian Mapping Authority, 1988).

A survey of the land in this Woreda (district) showed that 45.3% was arable or cultivable (44.9% was under annual crops), 6.1% pasture, 25.8% forest, and the remaining 22.8% was considered swampy, degraded or otherwise unusable. Khat, peppers, fruits and teff are important cash crops. Coffee is another important cash crop for this *Woreda* (district); over 50 km^2 are planted with this crop. Based on figures published by the Central Statistical Agency in 2005, this *Woreda* has an estimated total population of 336,277, of whom 168,863 were males and 167,414 were females; 14,574 or 4.33% of the population are urban dwellers, which is less than the Zone average of

12.3%. With an estimated area of 1,607.66 square kilometers, Seka Chekorsa has an estimated population density of 209.2 people per square kilometer, which is greater than the Zone average of 150.6 (CSA, 2005).

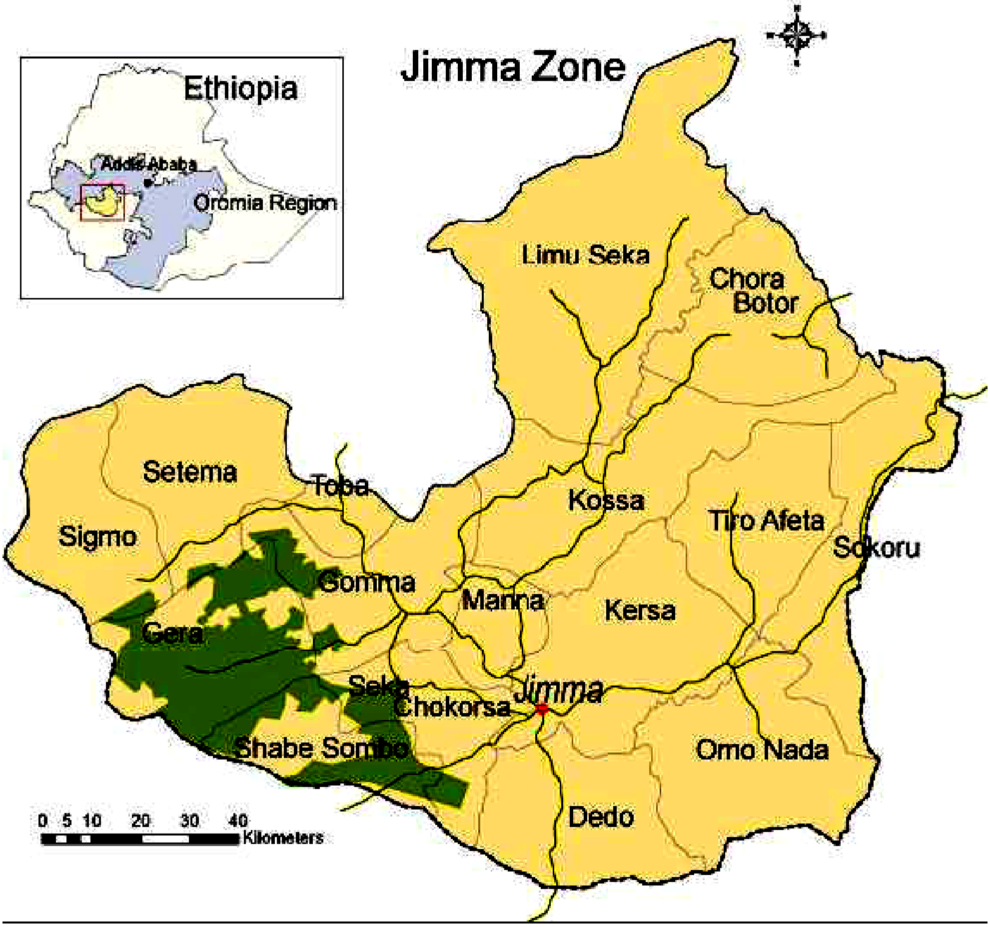


Fig. 1. Map of the study area

According to Belete Gera Participatory Forest Management Project report (2006) there has been a practice of settlement in the forest, coffee farming in the forest, honey production, livestock rearing, crop farming, cutting trees for different purposes and collecting non-timber forest products. As a result of these activities, there is decline of the forest, both in quantity and quality, which is exacerbated by population explosion.

Selection of site and establishment of quadrats

A reconnaissance survey and data collection trips were made to the study area between December 2005 and September 2006. Based on the reconnaissance survey, three sites with fewer disturbances were selected in Belete forest with altitudinal ranges from 1850-2250 m above sea level. In each site, two transects at a distance of 500 m apart from each other, were established from bottom of the valley to the ridge top of the area. Then, following these transects, thirty two 20 m x 20 m quadrats were established at every 50 m altitudinal interval.

Vegetation data collection and plant identification

Woody plant species in each quadrat were recorded. Trees and shrubs with DBH >2 cm were counted. Diameter at breast height (DBH) of all trees with DBH greater than 2 cm was measured using a diameter tape. Height was also measured by using Sylva Hypsometer. The altitude of each quadrat was recorded by using altimeter. Voucher specimens were collected, numbered, pressed and taken to Jimma University Herbarium, for drying storage and identification. Keys and descriptions of taxa in the Flora of Ethiopia were used to verify the identification. Nomenclature follows Edwards *et al* (1995, 1997, and 2000), Hedberg and Edwards (1989) and Hedberg *et al* (2003).

Method of data analysis

From the woody species (trees and shrubs) identified, only species with DBH greater than 2 cm or density greater than 3 individuals/ha were used in the analysis of structural features (height, density, diameter and basal area).

Tree density was computed by converting the count from the total quadrats into a hectare basis. DBH was classified into 8 classes (1= 2-10cm; 2= 11-20 cm; 3=21-30cm; 4= 31-40 cm; 5= 41-50 cm; 6= 51-60 cm; 7=61=70 cm; 8= >70cm) and the percentage distribution of each tree was computed for each species. Basal area was computed according to Müeller-Dombois and Ellenberg (1974).

Basal area = $(DBH/2)^2 * 3.14$

The importance value index was computed by first computing:

Relative Density = (Density sp. A/Total Density) X 100

Relative frequency = (Frequency of sp. A/ Total Frequency) X 100

Relative dominance = (Basal area of sp. A/ Total Basal area) X 100 and then, Importance value index = Relative density + Relative frequency + Relative dominance (Kumar, 1981).

The frequency distribution of tree species was calculated as:

% frequency of sp. A = (Number of quadrats in which sp. A occurs/ Total number of quadrats examined) x 100.

RESULTS AND DISCUSSION

Floristic composition

79 woody plant species belonging to 38 families and 63 genera were identified in the Belete forest. Fabaceae was found to be the most diverse family with 7 genera and eight species comprising 10.13 % of the total woody plant species identified, followed by Rubiaceae with 7 genera and seven species and comprising 8.9 % of the total woody plant species identified. From the total woody species identified in the forest, only *Podocarpus falcatus* was a Gymnosperm and the rest were Angiosperms. 32 (40.5%) of the species were trees, 39 (49.4%) shrubs and the remaining 8(10.1%) species were climbers (lianas). *Coffea arabica* was the most important understory shrub and wild coffee is still harvested extensively. The tall, open canopy consists of *Pouteria adolfi-friedrichii*, *Olea welwitschia*, *Croton macrostachyus*, *Syzygium guineense*, and *Podocarpus falcatus*. Trees here were typical of eastern Africa, with *Aningeria* and *Olea* being dominant (Kingdon, 1989).

Structure of the forest

Tree and shrub density

Tree and shrub density, expressed as the number of individuals with DBH greater than 2 cm was 1482/ha, and those with DBH greater than 10 cm was 613/ha. Comparison of the density of individuals with DBH > than 10 cm in the Belete forest with that of Masha Andracha forest (384.7/ha, Kumilachew Yeshitila and Taye Bekele, 2003) shows that the density of Belete forest is much greater than that of Masha Andracha forest but more or less equal with that of the Chilimo forest (638/ha, Tamrat Bekele, 1993).

The ratio of density of individuals with DBH >10 cm to density >20 cm showed the distribution of size classes (Grubb *et al*, 1963). The density of individuals with DBH >10 cm and >20 cm was 613 and 323, respectively and the ratio of the former to the latter was 1.9, indicating that the proportion of small-sized individuals are relatively larger than the large-sized individuals. This indicated that Belete forest was at stage of secondary regeneration. This ratio was 2.4 for Masha Andracha forest (Kumilachew Yehitiala and Taye Bekele, 2003) showing that in Masha Andracha forest small-sized individuals are much larger than the large-sized individuals mainly due to the high density of *Cyathea manniana* that was absent from Belete forest. This ratio was 2.6 for Chilimo forest, 2.3 for Menagesha forest (Tamrat Bekele, 1994) and 3.28 in Hugumburda Gratkasu forest, Tigray (Leul Kidane, 2003), all having higher proportions of small-sized individuals than Belete forest.

Size class distributions

The diameter at breast height (DBH) class distribution of the woody species is given in Fig. 2. From this figure, it is evident that about 55% of the individuals have DBH between 2 cm and 10 cm indicating the dominance of small-sized individuals in the forest. More than 74% of the individuals in the forest have DBH less than 20 cm. Only 7.6% of the individuals have DBH greater than 50 cm, indicating that the forest is in the stage of secondary regeneration. The density distribution of the different size classes in the Belete forest was not uniform. The number was lower at DBH between 40 cm and 60 cm indicating the presence of selective cutting at these diameters.

The height class distribution of trees and shrubs in the Belete forest (Fig. 3) indicated that more than 42% of the individuals had height less than 10m but in the Masha Andracha forest (Kumilachew Yeshitila and Taye Bekele, 2003), more than 83% of the individuals had height less than 10 m. There is high reduction in the fourth height class (16-20m) maybe because of selective cutting at this height class. Generally the height class distribution shows an irregular pattern decreasing in the second (5-10m) and then increasing in third (11-15 m) and then decreasing in fourth (16-20m), etc. This could be attributed to high rate of regeneration but irregular recruitment may be due to selective cuttings at different size classes.

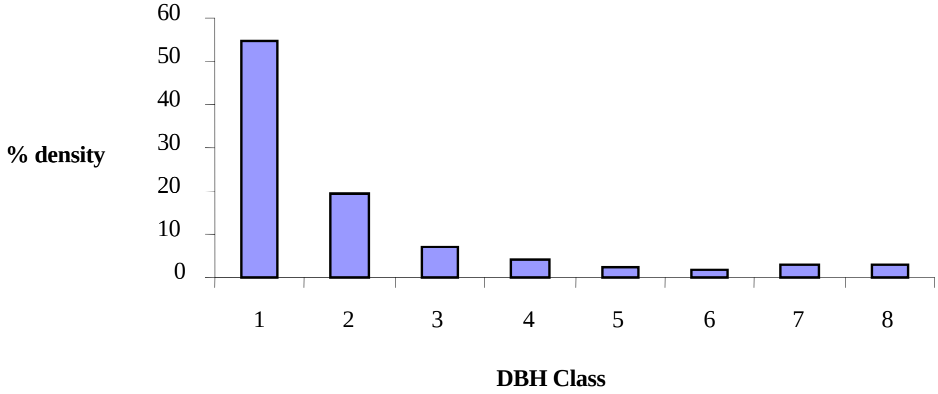
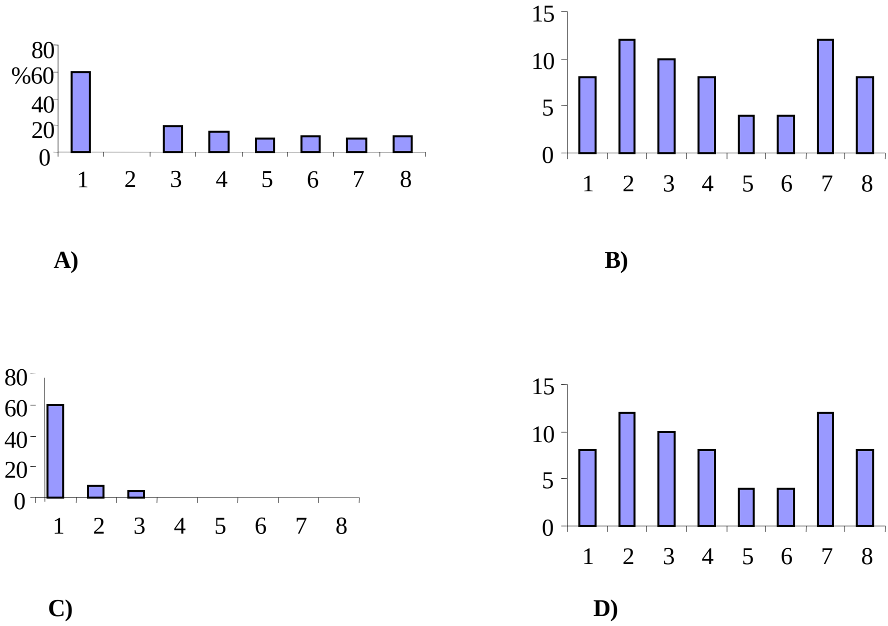


Fig. 2. DBH distribution of trees and shrubs in Belete forest, 2006

1= 2-10cm; 2= 11-20 cm; 3=21-30cm; 4= 31-40 cm; 5= 41-50 cm; 6= 51-60 cm 7=61=70 cm; 8= >70cm



1= 2-10cm; 2= 11-20 cm; 3=21-30cm; 4= 31-40 cm; 5= 41-50 cm; 6= 51-60 cm 7=61=70 cm; 8= >70cm

Fig. 3. Population structure of A) *Syzigium guinensee*, B) *Olea welwitschii C) Teclea noblis* D) *Prunus africana*, Belete forest, 2006

Basal area

Total basal area of the forest was 90.6m^2/ha, of which more than 42% (38 m^2) was contributed by *Syzigium guinensee*. The predominance of *Syzigium guinensee* in the forest was because of very low demand for its timber. Past exploitation (selective felling) in Belete forest has removed the best trees from the stand, leaving the defective and misshaped trees behind (Kidane Mengistu, 2002).

Comparison of the contribution of the different DBH to the total basal area shows that more than 63% of the basal area was contributed by the upper DBH (above 50cm) whose density was only 7.6% of the total individuals in the forest, and this was due to the presence of few, but large-sized individuals of the canopy tree. The contribution of the first DBH class (2-10 cm) to the density was about 55% but their contribution to the basal area was only 1.7%. This situation was also observed in the analysis of the contribution of the different DBH sizes to the basal area in different forests in Ethiopia, as for example, in Masha Andracha forest (Kumilachew Yeshitila and Taye Bekele, 2003), and in the Dodola forest (Kitessa Hundera, 2003).

Table 1. Contribution of the different DBH classes for basal area in Belete forest, 2006.

DBH class cm	individuals/ha	%	Basal area(%)
2-10	829	55	1.7
11-20	296	19.6	8.3
21-30	108	7.3	8.4
31-40	58	4	8
41-50	36	2.4	8.1
51-60	31	2	11.7
61-70	42	2.8	22.2
>70	42	2.8	29.4

Importance value

Analysis of the frequency distribution of trees and shrubs in the forest indicates that *Syzigium guinensee*, *Teclea noblis, Viperis danielli* and *Oxyanthus speciosus* were the most frequent species in the forest occurring in almost all the quadrats sampled. *Podocarpus falcatus* and *Allophylus abyssinicus* were found to be the least frequent species in the forest occurring in only 37% of the quadrats sampled.

The importance value index (IVI) of ten tree species with highest density in the forest was calculated and the result is given in Table 2.

Table 2. Importance value index (IVI) of the dominant trees in Belete forest, 2006

species	Relative density	Relative dominance	Relative frequency	IVI
Syziguim guinensee	16.75	41.99	5.48	64.22
Oxyanthus speciosus	9.72	1.07	5.48	16.27
Viperis danielli	10	0.53	5.48	16.01
Diosporyus abyssinica	7.56	2.05	4.77	14.38
Miletia ferugnea	6.01	2.24	3.45	11.7
Olea welwetschia	5.13	18.65	4.11	27.89
Olea capensis	5.67	0.36	4.77	10.8
Teclea noblis	4.86	0.53	5.48	10.87
Croton macrostachyus	4.32	4.13	4.11	12.56
Prunus africana	2.43	6.95	2.74	12.12

From Table 2, it can be observed that S*yzygium guinensee* and *Olea welwitschii* were found to have the highest IVI, 64.2 and 27.89, respectively, mainly because of their high dominance in the forest. The dominance of S*yzygium guinensee* in the forest may be due to its low demand for construction purposes.

Population structure

Analysis of the population of 15 tree species in the forest showed three general patterns of regeneration. The first pattern was formed by species with positively skewed distribution (inverted J-curve). These species had the highest density in the lower DBH with gradual decrease in density towards the bigger sizes, which suggested good reproduction and recruitment potential in the forest (Fig. 3A). S*yzigium guinensee, Viperis danielii*, and *Oxyanthus specious* had inverted J-curve structure probably because of low demand for these species for construction and other household requirements.

The second pattern was formed by species having irregular distribution over diameter classes. Some diameter classes were poorly represented, indicating selective removal of medium-sized individuals. These species showed good reproduction. *Olea welwitschia* showed this pattern of population distribution mainly because of debarking of the medium-sized individuals for beehive making and use of the bark for smoking houses (Fig. 3B).

The third pattern was exhibited by species with individuals well represented in the lower diameter classes but absent in bigger sizes, representing species with good reproduction but bad recruitment (Fig. 3C).

The fourth pattern was represented by those with reduced regeneration being represented by only higher DBH individuals (Fig. 3D)

CONCLUSION AND RECOMMENDATIONS

Belete forest is one of the few remaining Afromontane moist forests in Ethiopia. Analysis of the woody species composition of the forest indicated that the composition was lower than that of Masha Andracha forest. The presence of relatively higher percentage of lower diameter sizes in the forest indicated that the forest was at stage of secondary regeneration. The population structure of species such as *Prunus africana* showed poor reproduction and recruitment. Conservation of this forest is very important because it holds genetic components and populations of wild Coffee (*Coffea arabica*) and several associated economic plant species. Therefore, the concerned bodies have to take due consideration for conservation and sustainable utilization of this forest resource. For effective management of the forest, the following recommendations are forwarded.

- Developing management plan for the forest conservation and sustainable utilization, as this forest is one of the few remaining moist montane forests of Ethiopia.
- Continuous awareness creation in the local community and developing sense of ownership, responsibility and integrating their traditional forest management practices with modern conservation approaches.
- The participatory forest management being practiced in the forest has to have strong evaluation and monitoring mechanism to ensure that the agreement reached between the government and the forest dwellers is effectively implemented.
- Further research on community types and regeneration of potential in the forest.

REFERENCES

Bezuayehu Tefera, Gezahegn Ayele, Yigezu Atnafe, Paulos Dubale and Jabbar, M.A. (2000). Nature and causes of land degradation in the Oromiya region: A review of literature. In: **Policies for Sustainable Land Management in the Highlands of Ethiopia** (Jabbar, M.A., John Pender, and Simeon Ehui, eds.). Proceedings of a Seminar, 22–23 May 2000, Socio-economics and Policy Research Working Paper 30, International Livestock Research Institute, Addis Ababa, Ethiopia.

Central Statistical Authority (2005). The 2005 National Statistics. http://www.csa.gov.et/text_files/2005_national_statistics.htm (accessed on 11/11/2007)

Edwards S., Sebsebe Demissew and Hedberg I. (eds). (1997). **Flora of Ethiopia. Vol. 6. Hydrocharitaceae to Arecaceae**. The National Herbarium, Addis Ababa and Uppsala University, Uppsala, 586 pp.

Edwards, S., Mesfin Tadesse and Hedberg I. (eds.) (1995). **Flora of Ethiopia and Eritrea**. **Vol 2. Part 2**. **Canellaceae to Euphorbiaceae.** Addis Ababa University and Uppsala University, 456 pp.

Edwards S., Mesfin Tadesse, Sebsebe Demissew and Hedberg I. (eds.) (2000). **Flora of Ethiopia and Eritrea. Vol 2. Part 1. Magnoliaceae to Flacourtiaceae**. Addis Ababa University and Uppsala University, 532 pp.

EFAP, (1994). Ethiopian Forestry Action Program. EFAP, Addis Ababa.

EMA, (1988). National Atlas of Ethiopia. Ethiopian Mapping Authority, Addis Ababa.

Friis, I., (1992). Forest and Forest Trees of Northeast Tropical Africa: Their Natural Habitats and Distribution Pattern in Ethiopia, Djibouti and Somalia. Kew Bull. Add. Ser. 15. 396.

Grubb, P.J., Lloyd, J.R., Penigton, T.D. & Whitmore, T.C. (1963). A comparison of Montane and Lowland Rainforests in Ecuador. *J. Ecol.* **51**: 567-601.

Hedberg, I. and Edwards, S. (Eds.) (1989). **Flora of Ethiopia. Vol. 3. Pittosporaceae to Araliaceae.** The National Herbarium, Addis Ababa and Uppsala University, Uppsala, 659 pp.

Hedberg I., Edwards S. and Sileshi Nemomissa (eds.) (2003). **Flora of Ethiopia and Eritrea**. **Vol 4. Part 1. Apiaceae to Dipsaceae.** Addis Ababa University and Uppsala University, 352 pp.

Kidane Mengistu (2002). Tropical secondary forest management in Africa: Reality and perspectives: Ethiopia Country Paper, for the FAO/EC LNV/GTZ workshop on tropical secondary forest management in Africa, in collaboration with ICRAF and CIFOR, 9-13 December 2002, Nairobi, Kenya**.**

Kingdon, J. (1989). **Island Africa**. **The Evolution of Africa's Rare Animals and Plants**. Princeton University Press, New Jersey.

Kitessa Hundera, Tamrat Bekele and Ensermu Kelbessa (2007). Floristics and phytogeographic Synopsis of a Dry Afromontane coniferous forest in the Bale Mountains (Ethiopia): Implications to Biodiversity Conservation. *SINET: Ethiop. J. Sci.* **30**(1): 1-12.

Kumar, H. D. (1981). **Modern concepts of ecology**, 2nd ed. Vikas publishing house pvt LTD. India. 293pp

Kumilachew Yeshitila and Taye Bekele (2003). The woody species composition and structure of Masha-Andracha forest, Southwestern Ethiopia. *Ethiop. J. Biol. Sci*. **2**(1): 31-48.

Leul Kidane (2003). Floristic composition and forest human interaction in the Hugumburda Gratkassu forest.Unpublished M.Sc. thesis, Addis Ababa University.

Milion Bekele & Leykun Berhanu. (2001). **State of Forest Genetic Resources in Ethiopia**. Sub-Regional Workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of Forest genetic resources in Sahelian and North-Sudanian Africa (Ouagadougou, Burkina Faso, 22-24 September 1998). Forest Genetic Resources Working Papers, Working Paper, Forestry Department, FAO Rome, Italy.

Mueller-Dombois, D. and Ellenberg, H. (1974). **Aims and Methods of Vegetation Ecology**. John Willey and sons, New York.

Omo-Gibe water basin integrated development master plan study final report, Part 1. (1996). Richard Woodroofe and associates, United Kingdom.

Sheauchi Cheng, Yukio Hiwatashi, Hideki Imai, Mitsuru Naito and Tatsuka Numata (1998). Deforestation and degradation of natural resources in Ethiopia: Forest management implications from a case study in the Belete-Gera Forest. *J. Forest Res*. **3**(4): 199-204.

Stellmacher, T. (2005). Institutional factors shaping coffee forest management in Ethiopia. The Case of Bonga Forest/Kaffa Zone. Conference Paper on International Trade and the Protection of Natural Resources in Ethiopia, German Ethiopian Association, 5 – 6 March, 2005, Wannseeforum, Berlin.

Tadesse Woldemariam (2003). Vegetation of the Yayu forest in SW Ethiopia: Impacts of human use and implications for *in situ* of wild *Coffea Arabica* L. Populations. *Ecology and Development Series* No. 10, 2003. Cuvillier Verlag Göttingen.

Tamrat Bekele (1994). Vegetation ecology of remnant Afromontane forests on the central plateau of Shewa, Ethiopia. *Acta Phtogeogr. Suec*. **79**: 1-59.

Taye Bekele, Getachew Berhan, Elias Taye, Matheos Ersado and Kumilachew Yeshitila (2001). Regeneration status of moist montane forests. *Walia* **22**: 45-62.

Taye Bekele, Hasse G. and Teshome Soromessa (1999). Forest Genetic Resources of Ethiopia: Status and proposed actions. In: **Forest genetic resources conservation: principles, strategies and actions.** Proceeding of the national forest genetic resources conservation strategy development workshop, June 21-22, 1999, Addis Ababa.

Appendix 1. List of Woody species identified in Belete Forest, 2006

No.	Botanical name	Family	Vernacular name/ Afaan Oromo
1	*Acacia abyssinica* Hochst ex Benth.	Fabaceae	Laaftoo
2	*Acacia sp.*	Fabaceae	dodota
3	*Acanthus* eminence C.B. Blake	Acanthaceae	Sokoruu
4	*Albiza grandibracta* Taub.	Fabaceae	Ambabeessa
5	*Albiza gummiferae* (J.F.Gmel) C.A. Sm	Fabaceae	Ambabbeessa
6	*Allophylus abysinicus* Hochst) Radlk.	Sapindaceae	Se’oo
7	Aningeria- adolfi-friedrichi Rob. & Gilg	Sapotaceae	Qararoo
8	*Apodytes dimidiata* E. Mey ex Arn	Icacianaceae	Wondabiyyoo
9	*Bersema abyssinica* Fres.	Melianthaceae	Lolchisa
10	*Brucea antidysitrica* J.F. Mill.	Simarobiaceae	Qomonyoo
11	*Calpurina aurera* (Lam.) Benth	Fabaceae	Cheekaa
12	*Celtis africana* Brum. F.	Ulmaceae	
13	*Carissa edulis* (Forsk.) Vahl.	Apocyanaceae	Agamsa
14	Clausenia anisata (Wild.) Hook. F.ex Benth.	Rutaceae	Ulmayii
15	*Clematis longicauda* Steud. Ex A.Rich.	Rananculaceae	
16	*Coffea Arabica* L.	Rubiaceae	buna
17	*Combretum paniculatum* Vent.	Combertaceae	baggee
18	*Cordia africana* Lam	Boraginaceae	Waddeessa
19	*Croton macrostachyus* Hochst. Ex A.Rich	Euphorbiaceae	Bakanisaa
20	*Diosporyus abyssinica* (Hiern.) White	Ebenaceae	Lokoogurracha
21	*Dscopodium penninervum* Hochst.	Solanaceae	
22	Dombeya torrida (JF Gmel.) Bamps	Striculariaceae	
23	*Dracaena afromontana* Mildbr.	Dracenaceae	emo
24	*Entada abyssinica* Steud. Ex A. Rich	Fabaceae	Ambaltaa
25	*Ekebergia capensis* Sparm.	Meliaceae	Somboo
26	*Erythrina brucei* Schweinf.	Fabaceae	Walensuu
27	*Ehertia cymosa* Thonn.	Boraginaceae	ulaga
28	*Euclea racimosa* L.	Ebenaceae	Mieessaa
29	*Embelea schimperi* Vatke	Myrsinaceae	Haanquu
30	*Euphorbia ampliphylla* Pax	Euphorbiaceae	
31	*Ficus sychomorus L.*	Moraceae	Harbuu
32	*Ficus thoningii Bl.*	Moraceae	dambii
33	*Ficus vasta* Forsk.	Moraceae	Qilxuu
34	*Galineria saxifrage(Hochst.)Bridson*	Rubiaceae	simararuu
35	*Grewia ferruginea A. Rich.*	Tiliaceae	dhoqonuu
36	*Jasmium abyssinicum* Hochst. Ex D.C.	Oleaceae	Elchime
37	Justcia schimperiana T.anders	Acanthaceae	Dhummuugaa
38	*Hibiscus sp.*	Malvaceae	incinnii
39	*Hypericum revolutum Vahl.*	Hypericaceae	
40	Ilex mitis (L.) Radlk.	Aquifoliaceae	
41	Laggera alata (D.Don)Sch.-Bip. Ex Oliv.	Asteraceae	
42	Maesa lanceolata Forsk	Myrsinaceae	Abbayyii
43	Maytenus gracilipes (Welw. Ex Oliv.) Excell	Celasteraceae	kombolsha
44	Maytenus arbutifolia (A.Rich.) wilczek	Celasteraceae	kombolsha
45	Maytenus senegalensis (Lam.) Excell	Celasteraceae	kombolsha
46	Maytenus undata (Thunb.) Blakelock	Celasteraceae	kombolsha
47	Miletia ferugnea Hochst.) Bak	Fabaceae	Askraa
48	Olea capensis L.	Oleaceae	Gaja
49	Olea welwetschi (Knobl) Gilg & Schellenb	Oleaceae	Baya
50	*Oxyanthus speciosus* DC.	Rubiaceae	Birango jaldesa
51	*Pavetta abyssinica Fressen.*	Rubiaceae	
52	*Pavonia sp*	Malvaceae	incinnii
53	*Pittosporum viridiflorum* Sims.	Pittosporaceae	Sole
54	*Phytolaca dodecandra* L’ Herit	phytolacaceae	Andoodee
55	*Podocarpus falcatus* (Thunb.) C. N. Page	Podocarpaceae	Bibirsa

Appendix 1 contd.

No.	Botanical name	Family	Vernacular name/ Afaan Oromo
56	*Phoenix reclinata* Jack.	Arecaceae	Meexxii
57	*Polyscias fulva* (Hiern.) Harms	Araliaceae	kariyo
58	*Prunus africana* Hook f.	Rosaceae	Oomoo
59	*Psychotria orophila* Petit	Rubiaceae	Ulaga
60	*Ricinus communis L.*	Euphorbiaceae	Qobo
61	*Rhus glotinosa* Hochst ex Rich.	Anacardiaceae	xaaxessaa
62	*Rhamnus prinoides* L'Herit	Rhamnaceae	geeshoo
63	*Rothmannia urcelliformis* Bullock ex Robyns	Rubiaceae	Dibo
64	*Rubus apetalus* Poir.	Rosaceae	Goraa
65	*Rubus steudneri* Schwinef	Rosaceae	Goraa
66	*Rytigynia neglecta* Robyns	Rubiacea	Mixoo
67	*Sapium ellipticum*(Hochst.) Pax.	Euphorbiaceae	Bosoka
68	*Schefleria abyssinica* Harms	Araliaceae	Gatamaa
69	*Sida schimperiana* Hochst. ex A. Rich.	Malvaceae	muucaraa
70	*Solanum incanum L.*	Solanaceae	Hidii
71	*Solanum marginatum* L. f.	Solanaceae	hidii
72	*Syzigium guinensee*(Wild) D.C.	Myrtaceae	Baddeessaa
73	*Teclea nobilis Del.*	Rutaceae	Hadheessa
74	*Premna schimperi* Engl.	Verbenaceae	Urgessa
75	*Urera hypselodendron (A.Rich.) Wedd.*	Urticaceae	emo
76	*Venonia amygdalina* Del.	Asteraceae	Eebicha
77	*Vernonia auriculifera* Heirn.	Asteraceae	Reejjii
78	*Vernonia dalettiensis* Mesfin	Asteraceae	
79	*Vepris dainellii* (Pichi-Serm.) Kokwaro	Rutaceae	hadheessa