Assessing Households' Fuel Wood Tree Species Preference, The Case of Desa'a Afro Alpine Forest, Tigray

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Abstract

Desa'a forest is a remnant forest of northern Ethiopia, Tigray, which is currently heavily exploited for fuel wood and charcoal processing. Although the forest is gazeted to be protected area, it is not immune from illegal cutting and grazing, resulting reduction of forest cover and biodiversity loss. Hence, the study was intended to assess the species type and parts of the species mostly preferred by fuel wood collectors from the forest area. Purposive stratified random sampling technique was employed to select respondents for interviewing and questionnaire distribution. Field observations and discussion with key informants were also employed to validate the data generated. As the result revealed, woody vegetation species like *O. europaea, J. procera* and *A. etibyca* were the most extracted species from the forest with 62.34 % (22.85 tone/day), 13.95 % (5.11 tone/day) and 10.12 % (3.71 tone/day) coverage, respectively. More than 93% of fuel wood extraction from the forest area was only stem/ split wood part leading to whole cutting of the tree species. Hence, the species degradation on the forest area was expected to be more intensive on *O. europaea, J. procera* and *A. etibyca* than other species which invite purposive intervention by concerned body.

Keywords: Desa'a , remnant forest , fuel wood

1. Introduction

Forests are the principal sources of woody biomasses. Almost 2 billion people from low – income countries are dependent on biomass fuel (Anderson, 1996). However, regardless of the efforts made worldwide, the globe's woody biomass is declining in unimaginative rates and the trend seems irreversible. The consumption of biomass fuels such as fuel wood, charcoal, agricultural residue and animal dung has negative environmental, economic and health impacts (Mekonnen 2000, Anderson 1996). Increased use of firewood and charcoal leads to deforestation resulting ecological imbalance (Lopez 1997). The extent of forest degradation depends on the source of supply and demand, the nature of fuel wood and charcoal markets and household behavior (Arnold *et al*. 2003). Being one of the poorest countries in the world, Ethiopia, specifically Tigray's experience is not an exception (Mekonnen 2002, Badege 2005 and Gessesse 2007). The country including Tigray heavily depends on traditional energy consumption and is characterized by high dependence on biomass fuels. Thus, the extent of dependence on traditional fuels has had serious repercussion for the ecological balance and agricultural activities in general. The excessive deforestation, which led to the depletion of tree stock, caused a household energy crisis in Ethiopia and consequently the cost of fuel wood has continued to increase, thereby challenging the already staggering living condition.

Desa'a forest is a remnant forest of northern Ethiopia, Tigray, which is currently heavily exploited for fuel wood and charcoal processing. Although Desa'a forest is gazeted to be protected area, it is not immune from illegal cutting and grazing, resulting in reduction of forest cover, biodiversity loss and land degradation. Increasing demand for woody biomass by the rural household living near the forest area and the ever increasing of urban areas, the presence of road, the placement of the forest in between two regions and among different wereda's are believed to put more pressure on Desa'a forest and will lead to intensification of forest product collection. This will have, in all likelihood negative implication for the forest biodiversity and steadily losing biodiversity in the study area. The fuel wood from Desa'a forest is not only for domestic purposes, but its collection and sale is a major livelihood activity. Hence, the study intended to assess the species type and parts mostly preferred by the households.

2. Materials and methods
2.1 Area description
2.1.1 Location
Desa'a forest is located between 130 20' and 140 10' North latitudes and between 390 32' and 390 55' East longitude (figure 1). It falls within two regions of Ethiopia, namely Tigray and Afar regions. In Tigray region, it covers three Woredas; Saesie Tsaeda Emba, Atsbi Wonberta and Enderta and the remaining part is falling in Afar region's districts Shikhet, Berahle, and Dallol.
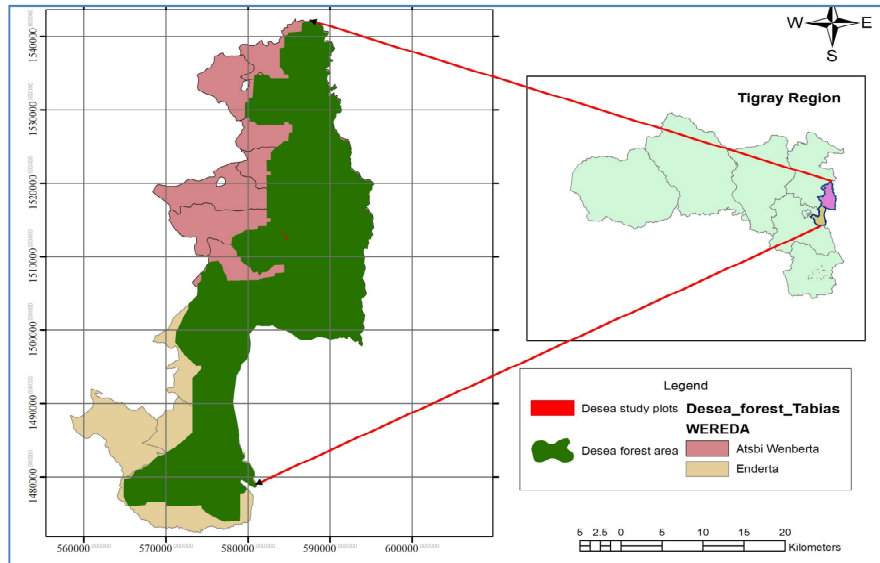
Fig 1 location of study area

The amount of rainfall during these months ranges from 116.3 up to 230 mm. This amount is very low when compared to that of the other parts of the region. Such an amount of rainfall is also marginal for the growth of trees. The mean minimum and the mean maximum temperature for the area varies in the range of 7.5 0C to 19.3 0C and 22.6 0C to 33.4 0C, respectively (Zenebe 1999). Topographically the area exhibits moderately gentle to steep slopes. The altitude of the area ranges from 1,500 m.a.s.l. at the lower limit to 2,500 m.a.s.l. at the plateau. According to the Aerial photograph interpretation and field observation report of the soil study team (Kebede and Admasu 1997), the entire forest area is composed of sedimentary rocks of Mesozoic age. Fine to medium grained crossed bedded red and white sandstone dominates the northern part, while limestone is the dominant rock type in the southern part of the forest. The soil types of Desa'a forest were classified as Vertic Phaeozem Antalo limestone, Calcaric Combisols Agulae shale, and the soils are clearly Pellic Vertisols (Abraham 2011).

2.2 Methodology used

To understand the tree species and their parts from Desa'a forest mostly extracted for fuel wood consumption, two Kushet (Luguda and Enguleta) were selected based on their nearness. Stratified sampling method was followed to classify the households based on their wealth status. With the help of key informants (Tabia and Kushet leader, DA's and elders) criteria's were set to classify the household as poor, medium and better-off and 20 % of sample size from each wealth group (a total of 182 HH) were selected for final interview by using systematic random sampling technique. Field observations and discussion with key informants including elders, forest guards, DAs and leaders of each *Tabia* and *Kushets* were employed to validate the data from questionnaire and interviews

2.3 Statistical Data Analysis

Both qualitative and quantitative techniques were used for data analysis. Other quantitative analysis was done by using SPSS (version 16) soft-ware. Descriptive statistics were applied to analyze the data. Data collected in local measurement units were converted to the energy equivalent kg to simplify calculations and presented in tabular forms, charts and graphs

3. Result and discussion

3.1 Tree Species preference for Fuel Wood

Various parts of different species of trees and shrubs were identified to be collected from the nearby forest area as a source of energy. Most tree species can be used for fuel, but the quality may vary greatly. Some species burn fast and have a low calorific value. Other species may produce a lot of irritating smoke or be very difficult to dry well sufficiently. Most appreciated for cooking are those species with a heavy wood that burns slowly with a lot of heat and little smoke. A wood that is easy to light is preferred for lighting the fire and charcoal is made from species that yield charcoal which produce a lot of heat (Abraham, 2008). Accordingly, 13 species were identified and collected from the forests area. The preferences of species in the study area were different for different purpose.

No	Spp Name	Spp for baking		Spp for cooking		Spp for heating		Spp for lighting	
		Rk	%	Rk	%	Rk	%	Rk	%
1	OE	2	48.9	1	100	1	99.5	1	100
2	JP	1	96.2	4	11	7	0.5	7	0.5
3	CP	4	15.9	3	15.9	3	15.4	3	13.2
4	TC	3	20.9	2	19.6	2	18.1	2	15.9
5	DA	6	3.8	6	2.2	5	2.2	5	2.2
6	CE	8	1.6	0	0	0	0	0	0
7	AE	5	7.7	5	6.6	4	8.2	4	7.1
8	PS	7	2.2	9	0.5	8	0.5	8	0.5
9	MO	10	1.1	0	0	0	0	0	0
10	CA	11	1.1	8	1.1	9	0.5	9	0.5
11	AS	12	1.1	10	0.5	10	0.5	0	0
12	DM	13	0.5	11	0.5	11	0.5	0	0
13	RV	9	1.6	7	1.6	6	1.6	6	1.6

Where: - Spp=species, *OE= Olea europaea, JP= Juniperus procera, CP= Cadia purpurea, TC= Tarchonanthus camphorates, Carissa edulis DA= Dodonaea anguistifolia, AE= Acacia etibyca, PS= Psydrax schimperiana, MO= Maytenus obscura, CA= Combretum aculeatum, AS= Acokanthera schimperi, DM= Diospyrus mespilferms, RV=Rhus vulgaris*

As sees from the above table, O. europaea were mostly preferred for cooking, heating, lighting and *J. procera were also preferred* for baking purpose. Those preferences were based on their quality of the species that match for each end use. Of all the species used as firewood, *Olea europaea* is preferred for its characteristics: as it burns brightly, slowly and with strong energy, thus providing lighting for the usually dark local houses; it imparts a characteristic good sent to the house; burns with relatively little smoke; burns readily even when fresh as though it contains oil (Abraham, 2008).

According to the household, *Olea* and *Juniperus* were highly preferred for energy consumption. This situation was also proofed by observing from the daily supply of fuel wood from the forest. The dependence of the community on the two species for fire wood was also a daily need of the community, so that it creates high pressure on degrading the status of the species in the forest. Their growth habit is very slow and the extraction of the two species is also high. So, the community near and around the state forest significantly affect the status of the species as the extraction of the species is greater than that of their renewal or growth habit of the species.

3.2 Fuel wood Supply per Species.
Even though a lot of species are extracted from the forest, variation in amount was observed among the species due to the species preference by the rural household as well as the urban households. Woody vegetation species like *O. europaea, J. procera* and *A. etibyca* were the most extracted species from the forest with 62.34 % (22.85 tone/day), 13.95 % (5.11 tone/day) and 10.12 % (3.71 tone/day) coverage, respectively (table 2).

Table 2 Average supply of wood by species in loads and Kg in both seasons

OL	OE	JP	AE	CP	TC	RV	IL	Total
K	130.725	36.525	1.5	11.25	0	0	15	195
Dr	113.64	48.26	0	4.6	0	0	18	184.5
Lk	103.1	0	53.5	11	12.7	12.7	13	189.5
TL	347.465	84.785	55	26.85	12.7	12.7	46	585.5
D	19197.44	4294.36	3115.75	1294.707	647.954	625.094	1619.7	30794.9665
Y	6911078.85	1545969.7	1121670	466094.5	233263.4	225033.8	583077.6	11086187.9
%	62.34	13.95	10.12	4.20	2.10	2.03	5.26	100

Where: - OL=outlet, K=korha, Dr=Dearu, LK=Lewah-kewhi, TL=total load, D=daily extracted in kg, Y=yearly extracted in kg, Spp=species, *OE= Olea europaea, JP= Juniperus procera, AE= Acacia etibyca, CP= Cadia purpurea, TC= Tarchonanthus camphorates, RV=Rhus vulgaris, L-k=Lewah kewhi*

3.3 Tree Part Utilized for Fuel Wood

On top of the species preference variation, this research has revealed special preference of fuel wood collectors to the woody part (stem) part of the preferred species. More than 93% of tree harvesting from the forest area was for stem part collection which is danger for the whole tree.

Table 3 use of tree parts as fuel wood

Tree parts	Better-off		Medium		Poor		Average	
	No	%	No	%	No	%	No	%
Stem/split wood	16	94.1	55	100	99	90	170	93.4
BLT	1	5.9	0	0	11	10	12	6.6

Where, BLT = branches, leaf, twigs

4.Conclusion

Even though most species on the forest has been extracted by households, variation of specie preferences was observed among the species. Woody vegetation species O. *europaea, J. procera* and *A. etibyca* were the most preferred species from the forest. The preferences of those species by households were attributed to the species' burning speed, calorific value, amount of irritating smoke released and charcoal production. As a result the rates of degradation of those species were faster than the species with limited preferences. The degradation of those species could be exacerbated as the households mostly preferred the woody/ stem part of the species which would have been an opportunity for re vegetating if they were preferred branches, leaf and twigs part.

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