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Contribution of Dry Forest Products to Household Income and Determinants of Forest Income Levels in the Northwestern and Southern Lowlands of Ethiopia

Busha Teshome[1], Habtemariam Kassa[2], Zerihun Mohammed[3], Christine Padoch[4]

[1]Forestry Research Center, Addis Ababa, Ethiopia
[2]Center for International Forestry Research (CIFOR), Ethiopia Office, Addis Ababa, Ethiopia
[3]Forum for Social Studies, Addis Ababa, Ethiopia
[4]Center for International Forestry Research (CIFOR), Bogor, Indonesia
Email: bayush051@yahoo.com

Abstract

Dry forests are dominant vegetation types in East Africa. The contribution of these resources to local livelihoods is poorly understood. This study was conducted to quantify the contribution of dry forest products to household income and to identify factors that influence forest income level in the northwestern and southern lowlands of Ethiopia. Data was collected using key informant interviews, focus group discussions and formal survey administered to 428 randomly selected households from representative districts in three regional states. Regression analysis, one way ANOVA, chi-square and t-tests were used to analyze the quantitative data. The major sources of household income are crop production, livestock farming, forest products, off- and non-farm activities, and remittances and aid, contributing respectively to 46.3%, 27.6%, 17.0%, 6.3% and 2.8% of the household income. The relative importance of forest income to total household income varied significantly across wellbeing categories (P < 0.001), representing 31.8%, 15.5% and 9.9% respectively for poor, medium and rich households and also between male headed (16.1%) and female headed (23.5%) households(P < 0.001). In terms of magnitude, however, forest income differed significantly (P < 0.05) with wealth category of households but not with the gender of the household head. Forest income level was significantly and positively influenced by family size (P < 0.01) and being a member of gums and resins producers cooperative (P < 0.01), while distance to the forest resource (P < 0.01) and being in Tigray or Amhara Regional States (Oromia being reference state) negatively and significantly affected forest income levels of households. Attempts to promote sustainable management of dry forests should recognize these factors that influence access to forests and forest income level of different members of the community to ensure equita-

ble responsibility and benefit sharing arrangements and inclusive participation for better livelihoods and conservation outcomes.

Keywords

Gender, Gums and Resins, Fire Wood, Forest Management, Livelihoods, Wealth Category

1. Introduction

The livelihoods of most rural households throughout the developing world depend on agriculture and forestry. As these livelihoods are inherently fragile and exposed to a range of shocks, and seasonal fluctuations, rural households maintain diversified livelihood strategies [1]. One such strategy is collection and marketing of forest products [2]. The availability and accessibility of forest products determine the prospects for forest-based livelihoods options. Dependence of people on forests and trees continues to be important both in the worldwide [3] and in Ethiopia [4] [5]. The importance of forest income to total household income has been debated. Some stress its significance in terms of reducing depth of poverty in the poorest member of the community [6] while others argue the opposite [7]. Studies in Sub-Saharan Africa [8]-[14] have shown that rural households regularly supplement their income from forest resources. In the case of Ethiopia data regarding the contribution of dry forests to rural households are still limited [5] and information to influence policy making remains scarce. These are the largest forest type in many African countries [15]. In Ethiopia, dry forests are the most important forest types both in terms of area coverage and their contribution to export earnings through gums and resins [16]. They are home to economically important species of *Acacia*, *Boswellia* and *Commiphora* that are sources of gums and resins [17] [18]. Dry forests contain a wealth of unique biodiversity [19] and directly support the livelihoods of approximately one billion people worldwide [20]. About a quarter of a billion people live in or around the dry forests of Sub-Saharan Africa [21]. These forests provide diverse goods and services such as fodder, fuel and commercial non-timber forest products [22]. Knowledge on the dependence of communities on these forests and factors affecting this dependence is limited. Therefore, this study is conducted to quantify the contribution of dry forest to total income of households and to identify major factors that determine forest income levels in northwestern and southern lowlands of Ethiopia where dry forests are important but are facing land use changes.

2. Methodology

2.1. The Study Area

The study was conducted in three regional states of Ethiopia, namely Tigray, Amhara and Oromiya. One representative district was selected in each region. The selected districts are Asgede-Tsimbla district in Tigray Region, Quara district in Amhara Region and Yabelo district in Oromia Region. **Figure 1** below shows these study sites.

2.2. Methods of Data Collection and Analysis

Prior to the formal survey, field visits were conducted in the three regions and discussions were held with some community members, local authorities and experts working within the concerned government offices as well as staff of NGOs. Secondary data were collected from published and unpublished reports of relevant organizations at national and regional levels. This was followed by a formal survey administered to 456 sample households that were selected from three regions and belonged to three wealth categories. The analyses were conducted on 428 households that completed all surveys (152 respondents from each region). The questionnaire included questions on household demographic and socioeconomic characteristics, farm level information (including agricultural land holding, crop and livestock farming, forest product collection and marketing, etc.), livelihood options, including off-farm income and their respective contribution to household income for the production year 2009/2010. The structured questionnaires were administered by enumerators under the supervision of researchers after being pretested and translated into the native languages. The survey was carried out between January and March 2011.
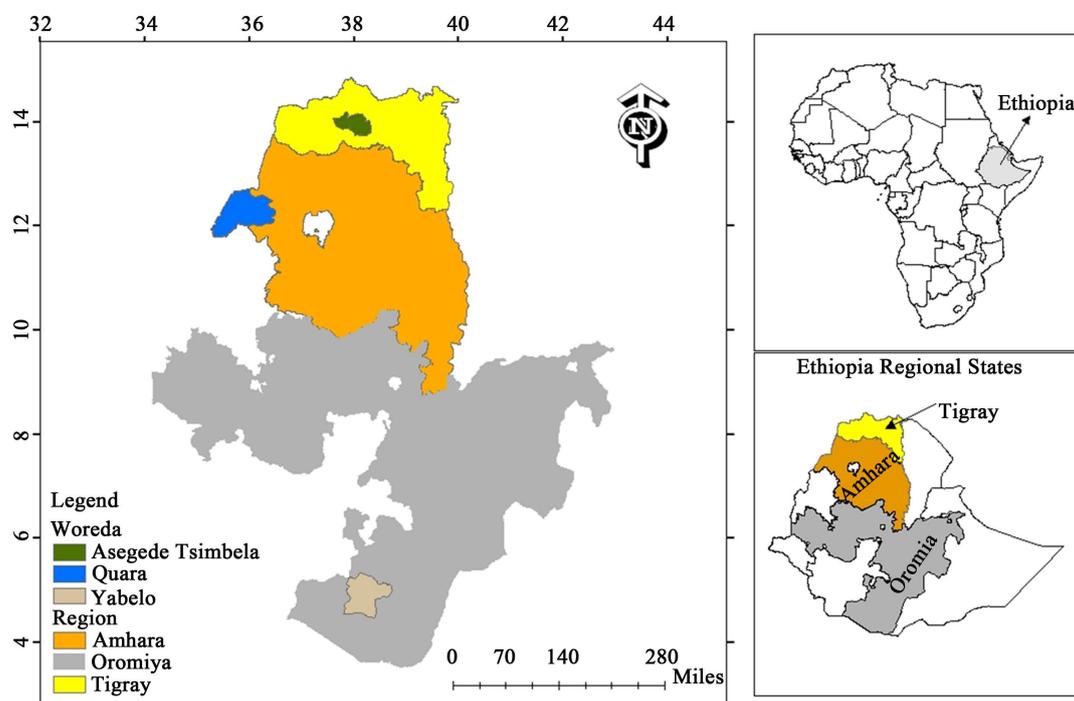
Figure 1. Location of the study areas in Ethiopia.

Wealth status definition of each district was used to designate the socio-economic category of a given household. Accordingly, based on the indicators, three wealth categories (rich, medium and poor) were identified. In Yabello livestock holdings (>50, 20 - 50, and <20) in Asgede Tsimbela were mainly from land size (>1 ha, 0.5 - 1 ha, <0.5 ha) and in Quara district land size (>2.5 ha, 1 - 2.5 ha, <1 ha) were used to classify each of the households to the wealth categories. Both descriptive and inferential statistics were used to analyze the quantitative data. Apart from chi-square that was used to compare proportions, t-test and ANOVA were used to compare mean income levels from the forest. Multiple regression models were employed to identify the determinants of forest income levels.

2.3. Household Income-Definitions and Estimation

The definition of income used in this paper is based on CIFOR's recommendation as outlined in the PEN technical guidelines [23] where income is defined as the return to the labor and capital that a household owns, used in own production and income-generating activities (self-employment or business) or sold in a market. Transfers in the form of remittances, pensions, or other government payments are also included in the income definition. Total household income is taken as the sum of cash income and subsistence income. Subsistence income is defined as the value of products consumed directly by the household or given away to friends and relatives. Production costs were deducted from the income generated in all cases excluding family labor. These costs were calculated and deducted from the total household income to estimate net household income. Accordingly, net income from crop was calculated as the difference between the total income from all crop production activities and the input costs incurred for crop production (the sum of wages paid to hired labor, costs of organic and inorganic fertilizers, improved seeds, and pesticides and rent paid on land leased in by the household). Livestock income included income from the sale or consumption of livestock and livestock products. Changes in stock values overtime were not counted as income. Forest income was calculated by estimating the total volume of all types of forest products collected by a household and multiplied by the local market price of each of the products per unit volume. Forest products considered were fuel wood, wood for construction and farm implements, medicinal plants and gums and resins. Incomes from off- and non-farm activities included income from occasional labor employment, wage employment and petty trade. Income from aid and remittances constitute support from government, non government organizations and gifts and transfers from family members and relatives. All income values presented are net income, calculated as the gross income value minus all purchased inputs including hired labor.

3. Results and Discussion

3.1. Socio-Economic Characteristics of Respondents

This section presents the socio-economic and demographic characteristics of respondent households 40 (9.3%) of respondent households were female headed while the remaining 388 (90.7%) were male headed households. The age category of the households revealed that about 93.2% of households were in their productive working age (15 - 65) and the remaining 12.1% were above 65 years old. The average family size was 5.6, with minimum of 1 and maximum of 15. Age composition of the household members showed that 46.7% were in the 0 to 14 years range and the remaining 50.7% and 2.4% were in the age between 15 and 64 and above 65 years old, respectively. In terms of educational levels 57.9% of the respondent were illiterate while the remaining 42.1% could at least read and write. The farmland size owned by the sample households ranges between 0 and 18 ha with mean of 1.6 ha. Livestock holding varied between 0 and 121 TLU with mean of 14.4 TLU.

3.2. Relative Contribution of Different Livelihood Options

The sources of income for households included crop production, livestock farming, collection and marketing of forest products, engagement in off- and non- farm activities and income from aid and remittance. Dependence on such diversified livelihoods activities is what has been reported by a number of studies. For instance, [24] [25] indicated that forest product extraction did not stand alone to support households but formed an integral component of diversified livelihood strategies of rural household. Communities combine extraction of forest resources with other livelihood activities to improve and sustain rural welfare. **Figure 2** below shows the relative contribution of livelihood option to household. Crop production is still the main source of income (46.3%) for local people in the study area, and this is in line with several similar studies. For instance, at Chilimo forest [10] reported that while agriculture contributed to 40% and livestock to 27.6%, the average contribution of forest products to household income was 17%. The overall average income of respondent households derived from the forests was estimated to be 17% of the total household income. This finding is in line with [26] who reported that NTFPs contributed 18.14% to the household income in Chepang community in Nepal. Likewise, in Chiradzulu District, Malawi, forest income constituted around 15% of the total income (Kamanga *et al.*, 2009). Income from off- and non-farm activities accounted for 6.3% of the total household income and petty trade and working as daily laborer were the most common off-farm activities in the study area. Income from aid and remittance accounted for 2.8% of the total household income and included support from the government and from NGOs to vulnerable households and gifts to family members and relatives.

3.3. Relative Importance of Forest Income by Wealth Category

The annual income of forest income for different wealth groups of the study sites amounted to Birr 1644.7 for the rich, Birr 1962.7 for the medium and Birr 2441.7 for the poor. While relative percentage contribution of forest
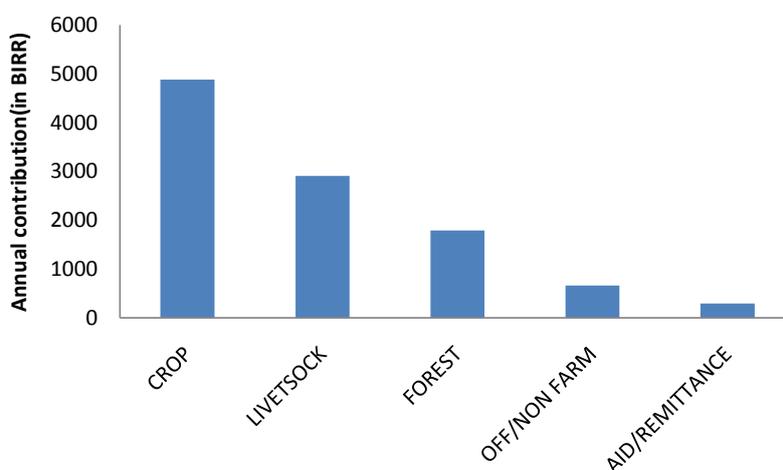

Figure 2. Major source of annual household income and their contribution in Birr.

income of rich HHs was 9.9% while the contribution for medium and poor HHs was 15.5% and 31.8% respectively for the study site. The relative importance of forest income varied significantly (P < 0.00) across wellbeing categories. In terms of magnitude, forest income differed significantly (P < 0.05) with wealth category of households the HH in the poor category benefited more than the rich. Similarly, [27] [28] showed that rich households extracted a smaller amount of forest products. [24] found that poor households extracted greater income from NTFPs than the rich households. The work of [29] showed that in general it was the poorer households that depended on forests for a larger share of their overall livelihood. Similar findings were reported in Chilimo forest in Ethiopia [10] and in a communal area of Zimbabwe [8].

3.4. Income Contribution of Forest by Gender of Household Head

Forest income contributes to 22.4% of the total household income of female headed households and 15.4% for male headed households. The relative importance of forest income to total household income varied significantly (P < 0.000) with the gender of household head. The annual forest income of female headed household was Birr 1728 while male headed households earned Birr 1550 per annual. The difference in magnitude was also statistically significant (P < 0.05). Unlike many of the income-generating activities that households engage in, most studies reveal that both men and women are engaged in forest product collection activities. [30] also observed that forest product collections in many cases was one of the few options available to rural women to generate independent cash income. The authors argue women's involvement in NTFP activities reflects easy access to the resource due to low thresholds of skill and capital needed.

3.5. Contribution of Various Forest Products to Forest Income

Forest products collected and used or marketed are firewood, construction materials, medicinal plants and gums and resins. Annual forest income ranged between Birr 350 and 7780, with mean value was Birr 1740. Of the total income obtained from the forest products, gums and resins collection contributed 39.9% of the forest income. Fuel wood was accounting 57.8% to total forest income while other forest products (construction material and medicinal plant) contribute 2.3% to total forest income. **Figure 3** below shows the contribution of different forest products to total forest income. To further identify which forest products are mostly extracted by the poor households and which ones by the rich, the relative ratios of income of rich households to the income of poor households were calculated for each of the forest products. The results show that the ratios for gums and resins (0.20) and for firewood (0.47) are less than a unit whereas the ratios for other forest products (construction material, farm implement, medicinal plan) are greater (1.58). This illustrates those other forest products (construction material, farm implement and medicinal plants) are collected more by rich households whereas poor households depend more on forest product gums and resins and firewood.
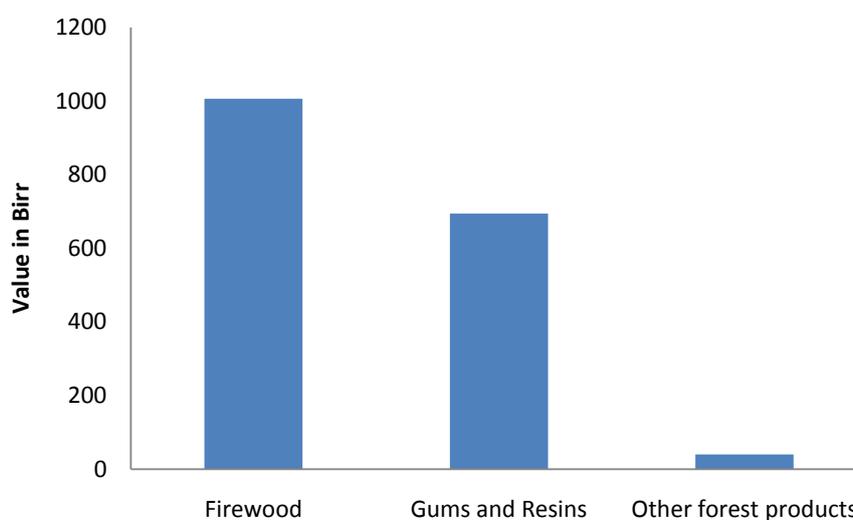

Figure 3. The contribution of different forest products to total forest income in Birr.

3.6. Determinants of Forest Income Levels

The result of multiple regression models is presented in **Table 1**. Forest income of a household is regressed against some household characteristics that may influence income levels. The results indicate that distance from forest is one such factor, which is negatively related to forest income. This implies that, as distance from the forest increases, the income generated by households from the forest decreases. This is in line with the report of [10] for Chilimo. The results of this study reveal that family size has been positively related to forest income ($P < 0.01$). This indicates that households who have larger family sizes engage more on forest products. The work of [31] also showed that families with more labor tended to extract more forest resources. This was because they were either able to mobilize part of their families to undertake forest dependent activities. Furthermore, larger families had higher subsistence needs, and that may be another reason to depend more on forest resources. Being member of a cooperative of gums and resins producers and traders has been positively related to forest income ($P < 0.01$). This shows that those households who are the members of cooperatives get income from gums and resin as a result they get better income from forest product than non member households. The results also showed that being in Tigray or Amhara Regional States (Oromia being reference state) negatively and significantly affected forest income levels of households indicating restrictions approved by those two regional governments on individual households to collect forest products.

4. Conclusions and Implications

The livelihood of the households in the study area depends on livestock rearing, crop production, forest product collection, off-farm activities and aid. There is reliance of the community on the surrounding woodland for fuel wood, construction materials, medicinal plants, and gums and resins. Our results illustrate that forest products continue to play important role in household livelihoods and in poverty alleviation in the dry land areas where other income opportunities are limited. The determinant of household forest income level is influenced by family size and being member of gums and resins producers cooperative positively while distance to forest resource in Tigray and Amhara Regionla States (Oromia being reference state) negatively and significantly affect forest income levels of households. In terms of improving household livelihoods and alleviating poverty in the study site, enhancing forest product collection and marketing for lower income households should certainly be encouraged

Table 1. Regression result of household total annual forest income on some selected explanatory variables (N = 428).

Factor	Coefficient (B)	Std. Error	T-Value	P-Value
(Constant)	1507.633	263.195	5.728	0.000
POOR HH	29.098	148.552	0.196	0.845
MEDIUM HH	114.788	128.860	0.891	0.374
TIGRAY	−1016.747	103.346	−9.838	0.000[***]
AMARA	−771.470	107.603	−7.170	0.000[***]
Gender of HHH	−26.420	110.922	−0.238	0.812
Age of HHH	0.948	2.523	0.376	0.707
Education Level	58.998	71.075	0.830	0.407
Family Size HH	40.554	15.369	2.639	0.009[**]
TLU	−2.386	2.841	−0.840	0.402
L Holding	−7.851	20.320	−0.386	0.699
Access to Credit	−15.055	69.908	−0.215	0.830
Member of COOP	965.139	70.141	13.760	0.000[***]
DISTRESO(km)	−7.394	2.326	−3.179	0.002[**]
DISMAKT(km)	2.305	1.255	1.837	0.067

as part of an overall strategy. We would also like to suggest improving the income of the traditional income base of agriculture and livestock.

Given the increasing value of forest products especially gums and resins in the dry land areas of Ethiopia and its potential role in poverty alleviation, much more quantitative research is needed throughout Ethiopia dry lands. The current lack of understanding represents a significant barrier to policymaker and donors who attempt to effectively incorporate dry land forest products into Ethiopian targeted poverty alleviation strategy. The research output presented in this study could therefore provide useful information and methods for quantifying the role of forest product income in household livelihoods in the study sites.

Acknowledgements

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