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The significance of dry forest income for livelihood resilience: The case of the pastoralists and agro-pastoralists in the drylands of southeastern Ethiopia



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ABSTRACT

There is a growing interest to take into account dry forests in planning sustainable development in arid and semi-arid sub-Saharan Africa. A mixed quantitative and qualitative research design involving various data collection tools was employed to examine the significance of dry forest income and associated conditioning factors in the context of pastoral and agro-pastoral production systems of southeastern Ethiopia. Income from livestock and dry forests were the first and second most important components of the total household income. Dry forest income accounts 34.8% and 35.2% of the total household income and 38% and 46% of the total household cash income in the Liben and Afdher Administrative Zones of Somali National Regional State, respectively. It was the largest income compared to all other incomes added together for 45% of the respondents. Most notably, for very poor households, dry forest income contributes up to 63% of their total income. Dry forest income levels varied significantly with occupation ($P < 0.05$), pastoralists generating more income than agro-pastoralists. Dry forest income enables 24% of households to remain above the poverty line, and it reduces income disparity by 13.7%. Moreover, dry forest income has become increasingly important for households' ex-ante risk and ex-post drought coping strategies. The number of youths per household ($P < 0.001$), access to extension services ($P < 0.001$), and being member of a cooperative ($P < 0.05$) significantly affected dry forest income levels in both Zones. Findings of this study could apply to similar dryland eco-regions in the Horn of Africa and contribute to enhance promotion of sustainable management of dry forests for integrated livelihood adaptation, biodiversity conservation and combating desertification. Further research is needed to quantify the contribution dry forests make to livelihoods through livestock production and to develop options that will guide policy making process to generate additional economic incentives for communities and countries to be engaged in sustainable management and use of dry forests.

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1. Introduction

Ethiopia is an agrarian country where traditional crop and livestock production employs over 85% of the population (Ethiopian NAPA, 2007; MoFED, 2012). Crop production is the major livelihood strategy in the highlands, where rainfall is relatively high. The vast majority (over 70%) of the landmass of Ethiopia is dryland, characterized by low and unpredictable rainfall patterns (EAC, 2007). These regions are poorly developed and suffer historical political and economic marginalization (Fekadu, 2009). Traditional pastoralism and agro-pastoralism are the major livelihood strategies in the drylands, where households depend on livestock production for a significant proportion of their food, income and traction power (Dalle et al., 2005; FAO, 2009). Livestock production is not only the mainstay, but also their social pride and security. For

centuries, pastoral and agro-pastoral livelihood strategies are able to maintain diverse cultures and flexibility, where a complex indigenous knowledge system governs the management of common resource base and continually adapt to highly uncertain environments, especially climate (Brooks, 2006; Homann, 2008). Pastoralism and agro-pastoralism employ an estimated 14% of the human and over 40% of the livestock population in Ethiopia. Pastoral areas cover some 60% of the total land area in Ethiopia and the country stands fifth in the world in its pastoral and agro-pastoral population size (Bekele and Amsalu, 2012).

Despite the long-standing adaptation practices, recent trends indicate an increase in drought incidence in the dryland eco-regions in the Horn of Africa in general and in Ethiopia in particular (IPCC, 2007; Ethiopian NAPA, 2007). Increasing in frequency and intensity of drought leads to rise in the vulnerability of pastoral and agro-pastoral communities (Homann, 2008) as pastoral and agro-pastoral communities are continuously losing a significant proportion of their livestock assets (Kassahun et al., 2008). A continued severe environmental degradation, shrinking resource bases and transhumance mobility routes are

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becoming major problems facing these production systems (Fekadu, 2010, 2013). A post drought livestock re-stocking, a common phenomenon in the drylands, has become a difficult process due to protracted drought, alarming rangeland degradation and diseases (Homann, 2008). The gradual depletion of livestock assets, exacerbated by existing limited alternative coping strategies is therefore putting additional pressure on livelihood systems. According to Fekadu (2013), increase in the frequency of violence, political insecurity and a decline in the capacity of customary authority in conflict management, on the one hand and the lack of enforcement of formal institutional framework, on the other hand, gradually exacerbated the vulnerability of these communities. According to Davies et al. (2012), such complex socio-ecological problems facing the pastoral and agro-pastoral livelihoods call for informed policy interventions to achieve solutions to environmental and livelihood related challenges.

The increasingly uncertain climatic conditions and related impacts across the drylands demand for new and integrated resource management approaches that facilitate more resilient land use planning (IPCC, 2007). Promotion of sustainable forest management is a key strategy put forth in recent international and national negotiations to reduce the negative impacts of climate (CIFOR, 2005). According to FAO (2010), the role of forests in climate change adaptation and mitigation is important; the sustained provision of ecosystem goods and services can help people adapt to the local consequences of a changing climate, while the carbon stored in these ecosystems, if well managed, can contribute to climate change mitigation (Robledo et al., 2012). Forests play a vital role in the generation of income for households in developing countries (Vedeld et al., 2004). According to Babulo et al. (2008) and Mamo et al. (2007) forests hold key position in the provision of households with income that was more important than the combined income from other activities for low income groups in northern and western Ethiopia. In Nigeria, Chukwuone and Okeke (2012) emphasized the importance of forests in relation to food quality among the poorer rural population. Forests also play key roles in reducing poverty and income inequalities (Shackleton et al., 2007; Fonta et al., 2011). In addition to income, forests provide opportunities to develop new commercial products that facilitate urban–rural linkage (Alemu et al., 2012). According to FAO (2010), the role of forests and woodlands is even more important, both biologically and socio-economically, in arid lands than it is elsewhere, where rangelands, agroforestry parklands and trees outside forests play vital roles in the livelihood of communities in Africa's drylands.

Forestry managers and professionals recommend integration and responsible management of the currently marginalized dry forests in Africa (FAO, 2010; Lemenih and Kassa, 2011). There are various socio-economic, ecological and political reasons for Ethiopia to sustainably manage its dry forests. For instance, value added commercialization of gums and resins produced from dry forests would offer access to additional income for the drought prone pastoral and agro-pastoral households and the national and regional economy at large (Lemenih and Kassa, 2011; Worku et al., 2011). Demonstrating the ways through which dry forests contribute to increasing income and reducing poverty, would lend additional weight and relevance to forest management initiatives that also contribute in combating desertification (FAO, 2010; Lemenih et al., 2011). However, despite their values, dry forests are caught in a spiral of deforestation, fragmentation, and degradation (FAO, 2010). Until recently, dry forests in Ethiopia and elsewhere in the Horn have had less attention in the national as well as regional planning, their potential to enhance the local and national economy has been overlooked, and their contribution to sustainable environmental management has not been recognized (FAO, 2010; Lemenih and Kassa, 2011; Worku et al., 2011).

Much of the debate on the importance of forests is based on the lessons from the humid tropics, with little information on dry forests and woodlands that cover large areas and host hundreds of millions of Africans (Shackleton et al., 2007; FAO, 2010; Asfaw et al., 2013).

Recent professional discussions reveal that progress towards integration of dry forests has been hindered, partly by a shortage of empirically based knowledge on their socio-economic significance (FAO, 2010; Lemenih and Kassa, 2011). Studies on dry forests so far have focused on bio-physical and ecological aspects (Eshete et al., 2011), while the few existing socio-economic studies have targeted farming households in which private and regulated forest management regimes are predominant and where the relative market integration of forest produce is high (Tesfaye et al., 2011; Dejene et al., 2012). The contribution of dryland forest resources in terms of income provision, poverty mitigation and drought coping in the context of the pastoral and agro-pastoral production systems, where dry forests are a common resource and market performance is poor has not been surveyed systematically, and hence it is usually undermined in the process of drylands development planning (Lemenih et al., 2011; Asfaw et al., 2013). Despite the accumulated knowledge on determinants of forest dependence (e.g. Coulibaly-Lingarni et al., 2009; Timok et al., 2010; Kar and Jacobson, 2011; Abebaw et al., 2012), little empirical evidence exists on the pastoral and agro-pastoral areas of Ethiopia. Such knowledge gaps restrict the advice available to policy-makers that would enable them to effectively incorporate dry forests into development planning and minimize their marginalization and conversion to other lands (Teketay, 2004–5). The objectives of this study were to examine the significance of dry forest income and identify factors conditioning dry forest income dependence in the pastoral and agro-pastoral production system of Somali Regional State in Ethiopia.

2. Materials and method

2.1. The study area

The pastoral and agro-pastoral areas of Ethiopia are estimated to cover some 60% of total land area and are inhabited by 14% of the population. This study was conducted in Somali Regional State (SRS), in the south-eastern drylands of Ethiopia (Fig. 1). Organized into nine political administrative zones, SRS accounts for 53% of the country's pastoral and agro-pastoral areas and has a population of over four million. Arid landscapes are the pre-dominants in the region (60%), followed by semi-arid (20%), dry sub-humid (10%) and barren land (10%) (WBISPP, 2004). Mean annual rainfall, temperature and evapotranspiration values range between 150 and 600 mm, 27 and 42 °C and 1750 and 2000, respectively (Zerfu et al., 2010). SRS has become one of the most heavily drought stricken regions of Ethiopia and desertification is of great concern. Traditional pastoralism and agro-pastoralism are the two major livelihood strategies in the region. The region supports the country's largest dry forests, predominated by diverse high value tree and shrub species, including those that produce frankincense, myrrh, opopanax and gum arabic (Lemenih et al., 2003). According to the woody biomass assessment report (WBISPP, 2004), the region own a total of 13,199,662 ha woodland (45%) and 5,384,022 ha (20%) shrub land of the total woodland and shrub land of the country.

2.2. Sampling procedure and data collection

Nested sampling was employed to select study villages and respondents. Two administrative zones (Liben and Afdher) out of nine zones were selected based on their accessibility, dry forest endowment, history of forest products trade and relative availability of prior studies on dry forests. Liben zone is mainly characterized by pastoral livelihoods, whereas Afdher is predominantly agro-pastoral. Two districts from each zone (Filtu and Dolo Ado from Liben and Chereti and Dolo Bay from Afdher) and three villages from each district were randomly selected (Fig. 1). A total of 137 households (i.e. 70 households from villages in the Liben zone and 67 households from villages in the Afdher zone, covering 5 to 25% of village residents), were randomly selected for a household survey. In addition, 12 households and 28 key informants

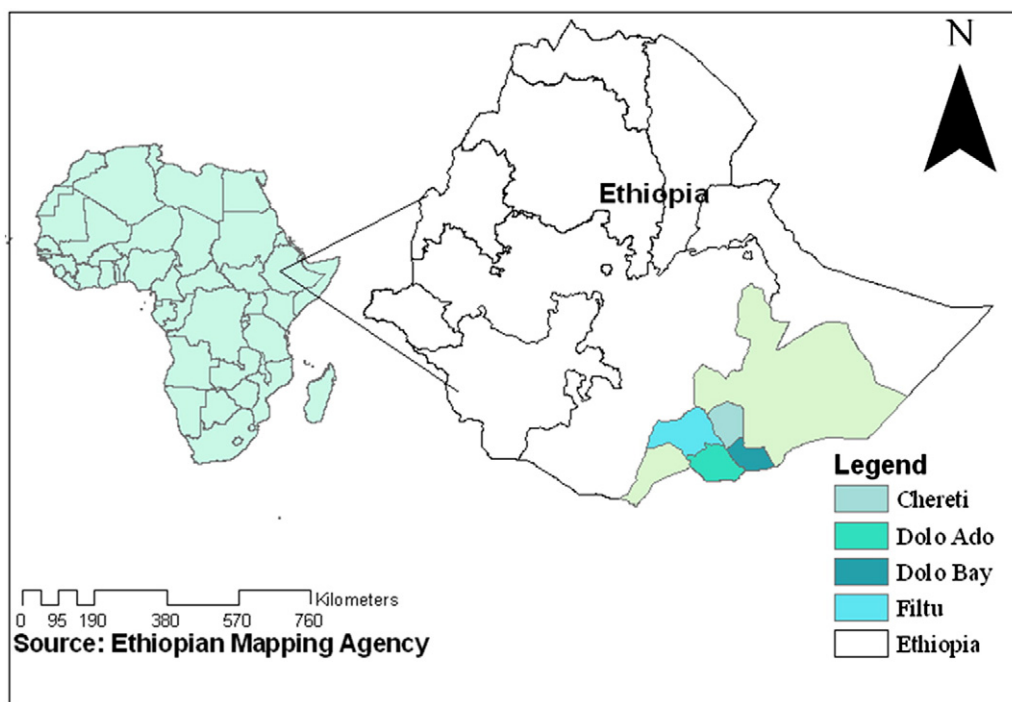


Fig. 1. Map of Ethiopia indicating the study sites.

(6 and 14 from villages in each zone), were purposely selected for an in-depth case study and interviews. Sampling followed procedures described in Campbell et al. (2002) and Zenteno et al. (2012).

Guided by principles of social–ecological co-evolution theory (Colding et al., 2003), a mixed quantitative and qualitative research design (Creswell, 2009) was employed to collect data. Primary data were collected by questionnaire survey, case study analysis, focus group discussions (FGDs), key informant interviews (KIIs), market assessments and a guided transect walk (Campbell et al., 2002; Cavendish, 2003). Data collection was mainly based on a detailed questionnaire formulated based on the prototype developed by the Poverty Environment Network of CIFOR (CIFOR, 2010). A total of eight local enumerators and one Field Assistant from Forestry Research Center (Addis Ababa) participated in the data collection process under the leadership of the lead author.

Data were collected on a number of variables including: household characteristics, livelihood strategies, household asset and income composition, expenditure, preference of dry forest management system, dry forest products collected, push and pull factors conditioning dry forest income dependence, drought trend and the consequent vulnerability, and ex-ante risk and ex-post coping strategies of dry forests. Key informant interviews were held to understand the local context and identify relevant criteria to categorize households into different wealth groups. Key informant interviews (KIIs) were conducted with elderly people, clan leaders, local administrators, district experts, staff of NGOs, and women and youth representatives in each of the study districts to better understand livelihood systems, variations among households in terms of wealth, and to identify locally relevant wealth indicators. These include livestock number (mainly camel), savings, housing type, number of children sent to school, number of months a household is food self-sufficient and number of wives and social status of the head of the family. Various questions that investigate these criteria were included in the questionnaire, case study analysis and in the check lists guiding key informant interviews and focus group discussions. Based on these wealth indicators respondent households were categorized into four wealth groups: very poor, poor, medium and rich during the quantitative data analysis. The key informants also grouped the respondents into two livelihood occupations: pastoralists

and agro-pastoralists, the latter engaged also in crop production. Income data was recorded using Birr (the local currency in Ethiopia), and the average exchange rate of one USD was Birr 17.52 during the field data collection time, i.e. between February and April 2013.

2.3. Data analyses

An income accounting technique was used to empirically value the significance of dry forest income to total household income compared to other income sources. The definition and method of income valuation was based on Cavendish (2002). Total household income was calculated as the sum of total household subsistence income and total household cash income from all income sources, including income from dry forests. Cash income included income from the sale of goods including forest products as well as petty trade and transfer, while subsistence income was calculated as the value of products being directly consumed by the household or given away to friends and relatives as gifts, multiplied by their local price per unit volume. Costs such as hired wage, purchased goods and transportation were subtracted from the total. Family labor was not considered as a cost. Various descriptive and statistical tests, including ANOVA and t-tests, were employed to examine variation in dry forest income levels of households with different socio-economic characteristics. Both Lorenz curve and Gini coefficient were computed to assess the income equalizing effect of dry forests income (Deaton, 1997). The headcount poverty index was used to estimate the role of forest income in poverty mitigation (Tesfaye et al., 2011). Different explanatory variables hypothesized to affect dry forest income dependence were tested using multiple-linear regression model (Kar and Jacobson, 2011). Qualitative data were summarized by way of text analyses (Cavendish, 2002).

3. Results

3.1. Socio-economic characteristics of sample households

Pastoralism is the dominant livelihood system in Liben zone, engaging 71% of the respondents. In the Afdher zone, 66% of respondents were agro-pastoralists. The prevalence of agro-pastoralism in Afdher is

attributed to the proximity of settlements to the Web and Genale river basins, which cross most of the districts within the zone. In the Liben zone in contrast, two rivers (Genale and Dawa) flow around the peripheries of the zone and, except for a few districts, settlements are far from river basins. The majority of respondents belonged to poor and medium wealth categories and the average family size was 7 and 6.8 in Liben and Afdher, respectively. Sixteen percent of the respondent families in Liben and 18% in Afdher were headed by women. Illiteracy was very high, represented by 61% in Liben and 67% in Afdher. About 22% of respondents in Liben and 25% in Afdher were members of cooperatives. Most villages were characterized by poor access to roads and market information. Less than 23% of the respondents were able to satisfy consumption using own production and the rest reported seasonal food shortages.

3.2. Contribution of income from dry forests to household income

Five major income sources: livestock, crops, forests, off-farm employment (wage and petty trade) and transfer (remittance and aid) were identified. Significant variations existed among households in total annual household income and in the relative importance of a particular income source to total household income. The average total household income was Birr 10,034 ± 7231 in Liben and Birr 9444 ± 5873 in Afdher Zones. In relative terms, income from transfer was the least important, followed by income from crop production. Livestock production was the major income source in both zones, followed by forest income. Forest income constituted 34.8% and 35.2% of the total household income in Liben and Afdher Zones, respectively (Fig. 2). In addition to using the forest as rangeland for livestock (the contribution of which was not estimated in monetary terms in this study), communities collect five major products (gum and resins; firewood and charcoal; wood for construction and farm tools, and medicinal plants and forest food) both for subsistence and for sale to generate cash income.

Subsistence income was dominated by livestock and crop income. The relative contribution of dry forests to total subsistence income of households was 26% in the Liben and 18% in Afdher Zones. Firewood, construction wood, medicinal flora and fauna from forests and forest food contributed more to subsistence than to cash income. Despite the low cash value assigned to it, majority of respondents reported the use of medicinal plants to treat human and livestock diseases as important contribution of forests. Gums and resins collection and charcoal making were used primarily for cash income. In addition, firewood, construction wood and wild honey were sources of cash income mainly for medium and poor households. Cash income from forests is the second largest (38%) contributor of total household cash income in Liben and the largest (46%) in Afdher Zones (Fig. 3). The importance of forest cash income was recognized both in normal and difficult years in terms of rainfall distribution. According to the case study households, income from livestock and crop production are not readily available

for sale due to frequent droughts. Hence, the collection of forest produce has become a regular source of cash income. The key informants emphasized that cash income from forests is also becoming more important even for the well-off households, perhaps due to climate change and changing market opportunities.

3.3. The role of dry forests in coping with drought, in poverty mitigation and income equality

Frequent and persistent drought has a negative effect on the availability of food and on the nutritional status of people dependent on livestock and forests, and increased the disparity between assets and income levels among households. Drought has not only augmented the number of poor households in time and space, but it has also increased the level of poverty. In such cases, households employ various adaptation and risk management strategies. Dercon (2000) identified three common ex-ante risk management strategies such as risk reduction, risk transfer and risk avoidance, and two ex-post coping strategies, namely consumption and asset smoothing. In the study area dry forest income was mainly used for risk reduction, such as income gap, by way of diversification of income sources and assisting saving before the onset of drought. Majority of respondents spend dry forest cash income to purchase food, medicine and cloths. Some used it to purchase agricultural inputs, for debt repayment, and in investing in children's schooling, social and religious activities, livestock restocking and small business initiation and/or expansion. The role of dry forest income to transfer ex-ante income risks to a third party was also mentioned. This was done based on a traditional agreement in which villagers receive advance payments (credit) from urban businessmen, which gave the producers the opportunity to access cash income during critical times. The debt was then repaid at a later date in the form of gum and resins. Few respondents reported the risk avoidance effect of dry forest income, and mainly comprised villagers who engaged in gum and resins trade for premium revenue from cross-border trade. Similarly, many respondents reported ex-post effects of dry forest income via enhanced food consumption. Dry forest income also helped asset smoothing by way of protecting the remaining livestock from being sold and giving household additional capacity to increase their stock by purchasing small animals. In general, a growing trend of dry forest income dependence for adaptation was reported.

Dry forest income plays a vital role in poverty mitigation. The number of households below the poverty line rose from 43.3% to 66.7% in Liben and from 38.8% to 64.2% in Afdher when dry forest income was excluded from the annual income. The number of households falling below the poverty line significantly differed ($P < 0.05$) when dry forest income was included or excluded. In addition, respondents underlined the importance of dry forest income in reducing the poverty gap. Exclusion of dry forest income from total household income resulted in deep

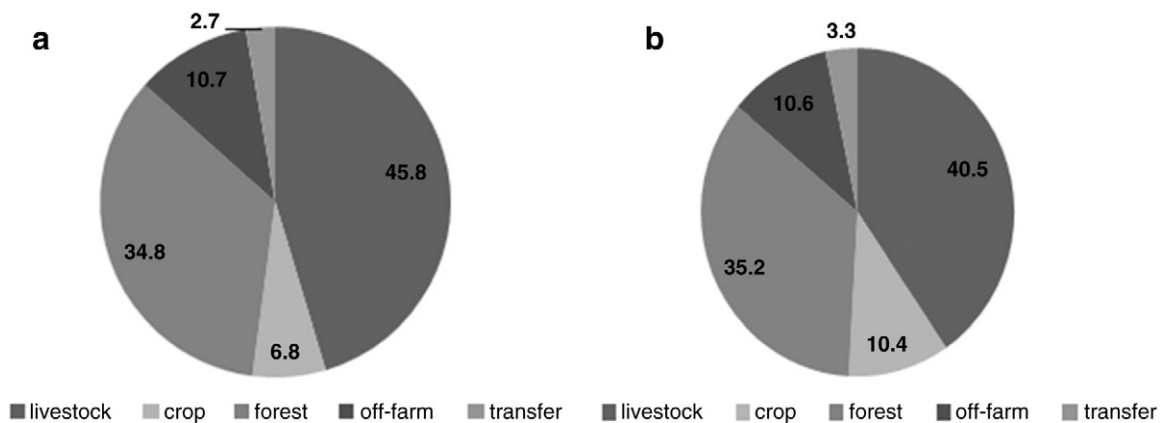


Fig. 2. The relative importance of dry forest income in total household income in Liben (a) and Afdher (b) administrative Zones.

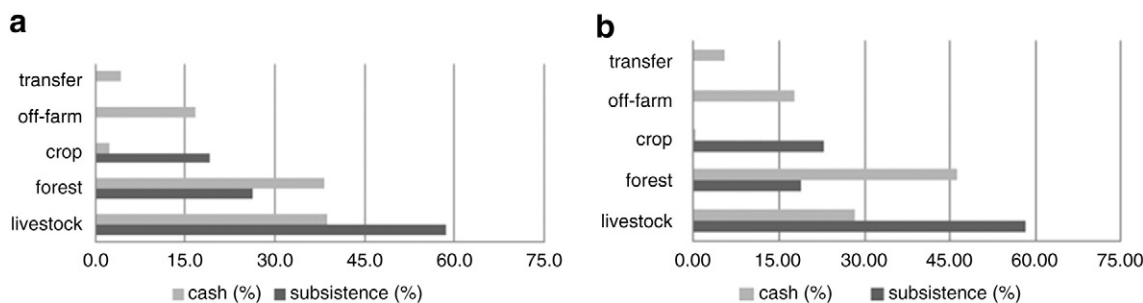


Fig. 3. Relative contribution of dry forests to total household subsistence income and to total household cash income in Birr in Liben (a) and Afdher (b) administrative Zones.

sleeping into poverty of some of the poor households. Large income inequality was observed among respondents. About 68% of the respondents recognized the importance of dry forest income in narrowing the income gap between poor and well-off households. Some 18% attributed the effect to gender rather than to wealth groups. For this group, most dry forest income was earned by the well-off households, thereby increasing inequality. The remaining 14% considered dry forest income to have no equalizing effect. Quantitative analysis however showed a positive effect. The addition of forest income reduced the area between the line of equality and the Lorenz curve (Fig. 4), and the Gini-Coefficient by 15% in Liben and 12.4% in Afdher.

3.4. The relative importance of dry forest income to different wealth groups

Medium wealth group earned more total dry forest income than richer households (Table 1). There was a significant difference ($P < 0.05$) in dry forest income among wealth groups in the Liben zone, the medium wealth group earning significantly more than the others. But the difference in dry forest income between wealth groups in the Afdher zone was not statistically significant ($P < 0.05$).

There was variation in the relative dependence on dry forests among wealth groups. In spite of the higher absolute income earned by the well-off households, the very poor and poor households relied more on dry forest income. More than half of the annual income of the very poor and poor households came from dry forests (Fig. 5). The medium wealth group was second most dependent on dry forest income. No clear demarcation between wealth groups and collected dry forest product type was observed, indicating preference of pastoralists and agro-pastoralists for diversification of income sources including engagement in dry forest income activities to specialization. Nonetheless, the medium wealth group earned more cash income from firewood and charcoal than other wealth groups. Very poor and poor households participated less in the collection of firewood and charcoal making. The key informants associated this to a lack of means of transport mainly donkeys to transport products to markets. The rich households generate

less cash income from firewood, charcoal, construction wood or forest food. Instead they earn more forest cash income from gums and resins. During the survey, rich households indicated their preference to be involved in trading of gums and resins than to be engaged in collecting these dry forest products by themselves.

3.5. Sources and levels of dry forests income of pastoral and agropastoral households

Variations were observed between pastoral and agro-pastoral households in terms of dry forest income level, level of engagement in forest income generating activities and type of products extracted. In general, pastoral households earned more dry forest income than agro-pastoralists. In Liben, pastoral households earned Birr 4089 from dry forests, whereas agro-pastoralist earned Birr 1716. Similarly, in Afdher, pastoralists earned on average Birr 5223 compared to Birr 2308 earned by agro-pastoralists. An independent *t*-test depicted significant differences in dry forest income levels ($P < 0.05$) between pastoral and agro-pastoral households in both zones.

Labor scarcity due to competing agriculture and distance to the forest were mentioned as factors hindering agro-pastoralists' dry forest income. In most cases, agro-pastoralists settled relatively far away from gum and resin rich dry forests compared to the pastoral households. The mobility of pastoralists also allows them to cover wider areas of forests with gums and resins bearing species. According to the key informants, pastoralism is more compatible to dry forest income activities in terms of labor allocation. Nonetheless, agro-pastoralists earn more income from charcoal making compared to pastoralists. This in fact was due to the ongoing government development program aimed at resettling pastoral households around river banks. According to the discussions with zonal and district administrators, there is an ambitious plan supported by the federal government to assist pastoralist households to be engaged in crop farming and become agro-pastoralists. Those pastoral households involved in the new plan were allowed to clear 1 ha of land each for crop production and are supplied with agricultural inputs. Most of the re-distributed land was forest land and the

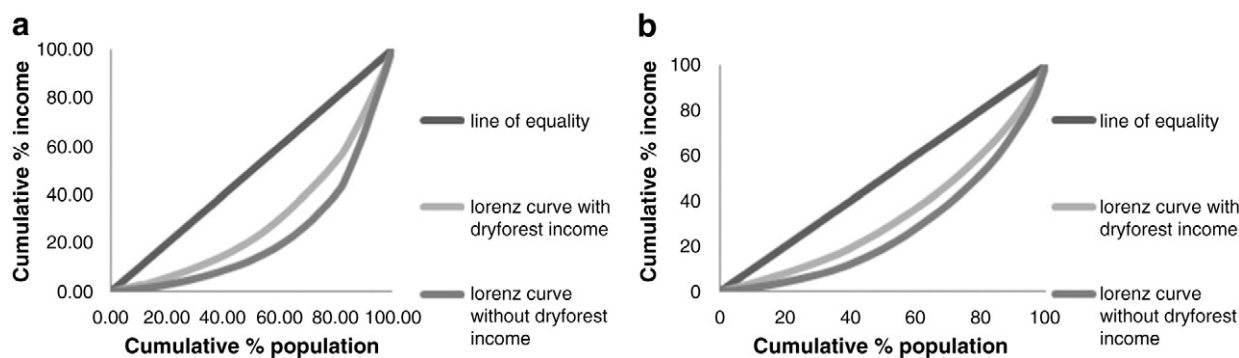


Fig. 4. Schematic presentation of the Lorenz curve showing income equalizing effect of dry forests in Liben (a) and Afdher (b) administrative Zones.

Table 1
Mean annual dry forest income (Birr) by wealth group.

Liben zone		Afdher zone	
Wealth group	Mean (SD)	Wealth group	Mean (SD)
Rich (N = 12)	3045 (1619)	Rich (N = 7)	3197 (881)
Medium (N = 29)	4516 (2137)	Medium (N = 36)	3782 (2299)
Poor (N = 19)	2437 (952)	Poor (N = 15)	2741 (869)
Very poor (N = 10)	1814 (444)	Very poor (N = 9)	2447 (779)
Total (N = 70)	3380 (1935)	Total (N = 67)	3308 (1845)

conversion of forest land to crop land encouraged production and marketing of charcoal as a new income activity for these pastoral households. Though currently only few pastoral households are engaged in charcoal making, it is of great concern to some of the key informants as this practice could undermine efforts to promote responsible use and sustainable management of dry forests in the region. According to these informants, their landscapes are diverse and rich, but fragile at the same time. The key concern lies in the long term effects of demographic change (increasing number of agro-pastoral households) and subsequent increase in the privatization of communal grazing lands that are central to ensuring the mobility of pastoral households. Large tract of potentially dry season grazing land could become privatized and under cultivation. This may in turn lead to increased tension and subsequent conflicts between mobile pastoralists and sedentary agro-pastoral communities. Some valuable dryland species could also be threatened following rapid land use changes, and natural resource degradation and desertification may intensify. According to some key informants charcoal making went beyond farming areas and is practiced in forest areas.

3.6. Gender dimension of dry forest income

Despite the difference in the quantity and frequency of dry forest product collection, both female and male headed households reported to earn income from forests. However, female headed households generated less total income from dry forests compared to male headed households. In Liben, the average total dry forest income (cash and subsistence) was Birr 2000 ± 273.81 for female headed households, and 3676 ± 1939.34 for male headed households and the variation was statistically significant (P < 0.05). Similarly, in Afdher Zone, the average total dry forest income for female headed households was less (Birr 2451 ± 1487) than those of male headed households (Birr 3496 ± 1874), although the difference was not statistically significant. This was contrary to the findings of Asfaw et al. (2013) where forest income of female headed households was much higher. But these communities lived close to markets and did not need means of transport to transport forest products. The purpose of dry forest product collection for cash was more among female headed households than male headed households. About 31% and 32% of the total income of female headed households in Liben and Afdher, respectively, came from dry forests,

whereas the share of dry forest income was 34.4% and 35.6% for the two zones, respectively.

Female headed households emphasized that for them dry forest income was the fastest, most accessible and relatively stable income source. For them livestock production was becoming very challenging, as it required frequent and distant migrations in search of fodder and water. They generally see crop production as labor, knowledge and cash-intensive, and often men's job, resulting in farming being less attractive to them. The key informants revealed that, despite their lack of involvement in dry forest management discourses, women's participation in forest product collection and marketing is growing.

3.7. Pattern and trend of engagement in dry forest income generating activities

Three broad categories of household engagement in dry forest income activities were reported including regular, less regular and opportunistic. In Liben, forest product collection appears to be more of less-regular and opportunistic compared to Afdher. Fifty-one percent of the respondents in Liben and 74% in Afdher reported regular participation in dry forest income generating activities, while the remaining respondents reported more of less-regular or opportunistic engagements. The case study households, however, reported that forest related income activities had increasingly become a source of income through regular engagement. According to them, ten years ago, gums and resins collection was the work of children and women and charcoal making was considered taboo. Five years ago, firewood collection for cash income was considered to be the work of poor people and had a lower market value. Now firewood collection has become more profitable, earning up to Birr 400 per donkey cart of firewood when transported and sold in towns and refugee camps.

Dry forest income is now becoming essential before, during and after the occurrence of drought. The number of households engaged in forest product collection in order to accumulate income before the on-set of drought is on the rise. According to key informants, in areas where livestock production suffers from climatic or security related challenges, these cash savings can help reduce further damage to livelihood. Another factor encouraging household's engagement in dry forest income generating activities relates to the discouragement of livestock selling by clan leaders to minimize further depletion of household asset. Recently observed increasing demand for dry forest products such as firewood and charcoal from the nearby towns and refugee camps has also encouraged households' participation in firewood collection and charcoal making.

3.8. Socio-economic factors affecting dry forest income levels

Bivariate correlation showed that the level of dry forest income was negatively and significantly correlated to crop and transfer incomes (P < 0.05) in Liben. However, no significant relation was observed between dry forest income and incomes from livestock and off-farm activities. In Afdher, dry forest income had a positive and significant

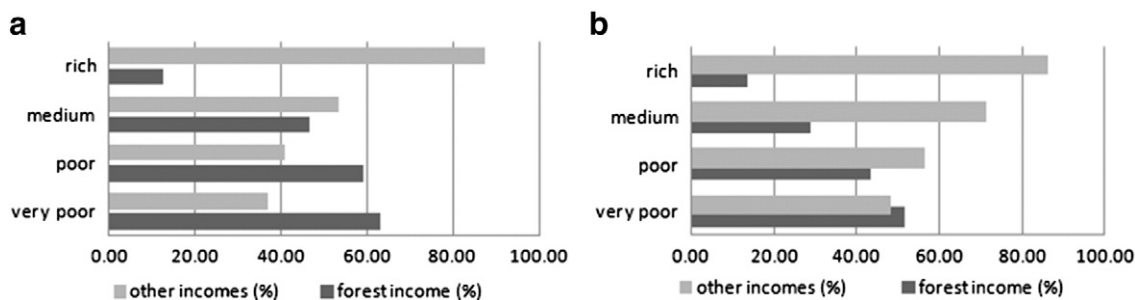


Fig. 5. Relative dependence of different wealth groups on dry forest income in Liben (a) and Afdher (b) administrative Zones.

correlation with off-farm income ($P < 0.05$) but negative and significant correlation with crop income ($P < 0.01$). According to key informants in the Afdher zone, dry forest income creates opportunities to initiate small business via provisioning of a startup capital. The correlation results showed two general trends: first, dry forest income increases with increasing household total income and livestock income, and second, it decreases with increasing crop income for both study areas.

The number of youths in the household, access to extension services, and being member of a cooperative were variables that significantly affected dry forest income levels in both study areas. In addition, perception on the importance of forest income activities, satisfaction on the level of forest product prices, the presence of a village level trader, access to roads in Liben zone, and distance to market and the level of household vulnerability in Afdher zone influenced dry forest income level (Table 2).

The focus group discussions revealed variations in perception on forest based income generating activities. For instance, though gums and resins collection was a tradition among the communities, the collection of firewood and charcoal making for cash were relatively new activities, and there were still certain taboos associated with these activities. The regression results indicated that households that reported satisfaction with the existing forest product prices generated more income compared to those who felt prices were unsatisfactory. Cooperative membership was related to higher dry forest income, as members were encouraged to collect more gums and resins and had better access to price information and markets. Cooperative members also earned income from their own collection and sale, and also from the profits of the cooperative at large based on their shares.

In Afdher negative relationship was reported between dry forest income and level of vulnerability of households to drought. According to the key informants, when vulnerability increases, households temporarily migrate to look for external support. This lowers dry forest income due to a reduction in the frequency of their visits to forests. In Liben zone, the presence of a village level forest product trader was considered as advantage, as it gives collectors the confidence to engage in dry forest product collection.

4. Discussion and recommendations

Due to their extensive distribution and importance to local livelihoods and national economies as well as their vulnerability to climate variability and change, drylands receive particular attention at global scale. According to Sietz et al. (2011), one of the specific aims of the UN Convention on Combating Desertification (UNCCD) is to improve the understanding of dryland development and enhance both ecosystem and community resilience. The focus of this study was on pastoral

and agro-pastoral communities living in the lowlands of southeastern Ethiopia. According to Barrett et al. (2001), the increasing vulnerability of communities in the drylands is forcing them to develop various local practices that improve their adaptation. Basing themselves on the integrated concept of human-in-nature, Berkes and Folke (1998) argue that social systems often tend to adapt to ecological changes through self re-organization to embrace new livelihood activities that enhance resilience. Similarly, the current livelihood portfolio assessment showed a trend of diversification from livestock production to forest management and others. The central question this study sought to answer was how significant the contribution of dry forests was in enhancing livelihoods. Findings show that dry forests provide income that contributes to coping, poverty mitigation and income equalization.

Dry forests are mainly managed as rangelands for livestock production. However, almost all respondents reported that additional income was earned from these forests. The share of dry forest income was significant, and only second to livestock income, in both study areas. In terms of proportion of cash income, forest income was greater than livestock income in Afdher Zone. Dry forest income was greater than income from crop, off-farm and transfer together (Fig. 2). Dry forest income was greater than the sum of income from all other sources for 45% of the respondents. The findings are consistent with other studies, e.g. Mamo et al. (2007) who reported a contribution of 39% forest income to total household income for the Dendi district in western Ethiopia. In northern Ethiopia, forest income contributed up to 69% of the household income of low income groups (Babulo et al., 2008). Similarly, Vedeld et al. (2004) reported an average forest income contribution of up to 22% in Africa, Asia and Latin America. In a border-region of China, forest income constituted 31% of the total household income (Hogarth et al., 2012).

In the present study, respondents emphasized that dry forest income is becoming increasingly more important means of ex-ante risk management and ex-post coping strategies. According to Dercon (2000), ex-ante and ex-post adaptation strategies literally mean interventions before and after shock, respectively. Declining livestock income, increased exposure to various risks, the need for filling seasonal income gaps, cash needs for establishment and/or the expansion of existing small businesses were mentioned as major factors for increased engagement of pastoral and agro pastoral communities in dry forest income generating activities. Fu et al. (2009) reported related push and pull factors affecting participation in income generating activities from NTFPs in China, where the importance of forest income increases with decreasing access to external aid. According to Robledo et al. (2012), saving is a key tool to cope with income risks. Dry forest income was one of the few income activities used to enhance savings before, during and after drought. Pre-drought saving is important because drought increases grain retail prices, in contrast to the drop in the prices of

Table 2
Household level socio-economic variables influencing level of dry forest income.

Explanatory variables	Liben zone, $R^2 = 0.88$			Afdher zone, $R^2 = 0.79$		
	Coef.	t-value	P-value	Coef.	t-value	P-value
(Constant)	–	8.152	0.000	–	5.646	0.000
Respondent sex (dummy)	–0.020	–0.438	0.663	–0.013	–0.231	0.818
Respondent age	0.011	0.242	0.810	–0.080	–1.536	0.130
Number of youth in the household	0.252	3.786	0.001**	0.390	3.937	0.001**
Distance to market (Hrs)	N/A	N/A	N/A	–0.258	–2.907	0.005*
Respondent occupation	–0.070	–1.204	0.233	–0.008	–0.073	0.942
Respondent wealth class	–0.072	–1.657	0.103	0.041	0.747	0.458
Price satisfaction (1 = unsatisfied, 2 = moderately satisfied, 3 = satisfied)	0.346	4.035	0.000**	N/A	N/A	N/A
Level of vulnerability (1 = not vulnerable, 2 = moderately vulnerable, 3 = highly vulnerable)	N/A	N/A	N/A	0.274	2.566	0.013*
Perception of forest income (dummy)	–0.084	–2.032	0.046*	N/A	N/A	N/A
Presence of village level trader (dummy)	0.141	2.951	0.004*	–0.087	–0.646	0.521
Cooperative membership (dummy)	–0.109	–2.036	0.046*	0.202	2.120	0.038*
Access to credit (dummy)	0.070	1.170	0.247	0.005	0.093	0.926
Access to extension service (dummy)	0.245	3.343	0.001**	0.425	4.319	0.000**
Access to road (dummy)	0.203	3.219	0.002*	0.052	0.591	0.557

Note * = significant at 5%, ** = significant at 1%, and N/A = not applicable.

livestock. Hence, households engage in dry forest income generating activities rather than selling livestock for a lower price. In addition, as most petty trade incomes are mainly based on livestock products such as milk, they are sensitive to drought. During these periods, households engage more in dry forest income activities as they are less likely to be affected by drought. The safety net role of forests was also reported by Angelseon and Wunder (2003). Our study indicates that dry forest income was mentioned as a means to expand small scale businesses aiming to enhance adaptive capacity of households.

Despite a significant reduction in headcount poverty in Ethiopia from 59% in 1992 to 29.5% in 2011 (MoFED, 2012), poverty remains well above the national average in the study areas. The inclusion of dry forest income had a significant contribution in poverty mitigation by enabling 24% of the respondents to remain above the poverty line. According to Tesfaye et al. (2011), the inclusion of forest income in the annual household income reduced the percentage of households below the poverty line from 51% to 32% in Dodola, central Ethiopia. Fonta et al. (2011) and Shackleton et al. (2007) also emphasized the importance of forests in facilitating coping with unpredictable income gaps. The key informants also explained the role forest income plays in preventing poor households from becoming poorer.

According to Barrett et al. (2001), one of the many impacts of drought is to generate wider income gaps between households. Similarly to the respondents revealed that, the severe drought incidence in 2007/8 had claimed much of their livestock asset. The recovery was slow due to another severe drought that occurred in 2011, a year before the field survey of this study was conducted, and covered wide areas of Ethiopia and countries in the Horn of Africa. This fueled the already growing income gap between poor and rich households in the study areas. Dry forest income reduced such inequality between the poor and the well-off households by 13.7%, which is considerably high in the context of rural households in Ethiopia. This figure is relatively small compared to the 30% reduction in inequality reported by Cavendish (2002) based on his study in Zimbabwe. Excluding dry forest income from total household income increased the Gini coefficient from 0.39 to 0.55 in Liben and from 0.32 to 0.45 in Afdher. Mamo et al. (2007) also reported a rise in the Gini coefficient from 0.28 to 0.41 in the Dendi district when forest income was excluded from household annual total income.

In conclusion, the relationship between income from dry forests, poverty mitigation, income equality and coping with the negative effects of drought has attracted little research attention in Ethiopia. The findings of this study point out two key issues. The first is the trend of livelihood vulnerability in the study areas in particular which would also be the case in the drylands of Horn of Africa in general. Drought, desertification and forest degradation are among the major challenges hindering development of drylands. Despite the complex problems facing these ecosystems, a growing human population is creating additional pressure on the dry forests and on the ecosystem at large (Teketay, 2004–5). Reversing environmental degradation through tree planting activities in the dry land areas has proved to be difficult due to various reasons and there are only limited success stories. This shows the need to maintain as much as possible dry forests and woodlands in these fragile ecosystems and exploring options to enhance their economic, ecological, socio-cultural and political significance. The second point is that, the role dry forests play in improving the adaptive capacity of the drought prone communities should not be overlooked.

The overall policy implication of the current findings is that, dry forest income holds crucial position in the livelihood of pastoral and agro pastoral communities. Not considering this contribution in household income accounting, the poverty head count ratio and income inequality increases. Apparently, it is important to improve management of dry forests for livelihood enhancement, while also securing their long-term ecological functions. These could be achieved via promoting their integration into the national, regional and local development planning. Dry forest management should be part of the overall land use planning.

A number of options to increase productivity and sustainability of dry forests need to be researched. For instance, introducing agro-forestry parklands in the newly emerging agro-pastoral production systems, promoting value addition and commercialization of high value forest products such as gums and resins through small and medium scale enterprises; and combining dry forest management with upcoming REDD + (reducing emission from deforestation and forest degradation), CDM (clean development mechanism) and CRGE (climate resilient green economy) initiatives are few potential research areas. The current field level observation also suggests the need to assess current population status of the study forest and propose intervention mechanisms as in some areas degradation was quite severe. The current top-down plan that aims settling pastoralists and engaging them in crop production needs to take into account the possibility of developing additional forest based livelihoods as well as, before too much dry forest is converted to cropland, which may ultimately result in irreversible damages on fragile dryland ecosystem. Finally, attempts should be made to estimate and value the contribution of dry forests to livelihoods through livestock production and to explore additional opportunities to enhance the economic contributions of dry forests to the local livelihoods and to the national economy at large so that communities and governments would see the economic benefits and be engaged in responsible management of the diminishing dry forest and woodland resource bases in the Horn of Africa with also huge contribution in combating desertification.

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