

# Forest incomes and poverty alleviation under participatory forest management in the Bale Highlands, Southern Ethiopia

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## SUMMARY

There is an increasing interest in understanding the role forest products and forest resource management in rural livelihoods and poverty reduction strategies. This study investigates the contribution of forest resources to the livelihoods of rural households under a participatory management arrangement in southern Ethiopia. Data were collected through key informant interviews, group discussion, and household surveys from a total of 350 households. Income data were collected in four separate seasons at intervals of three months. The result indicates that forest products are the most important sources of income contributing to 34% and 53% of household per capita income and per capita cash income, respectively. Forest income also helps 20% of the population to remain above the poverty line. Forest income reduces inequality (Gini coefficient) by 15.5%. In general, the result confirms the importance of forest income in poverty alleviation and as safety nets in times of income crisis.

Keywords: rural livelihoods, Forest user groups, Household income, forest dependency, co-management

## Revenus forestiers et soulagement de la pauvreté dans un arrangement de gestion forestière participative dans les hautes terres de Bale en Ethiopie du sud

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La compréhension du rôle des produits forestiers et de la gestion des ressources forestières dans les revenus des ruraux et les stratégies de réduction de la pauvreté connaît un intérêt croissant. Cette étude examine la contribution des ressources forestières aux revenus des foyers ruraux dans un arrangement de gestion de participation en Ethiopie du sud. Les données ont été recueillies au cours d'interviews d'informateurs clés, de discussions de groupe, et d'étude de foyers, comprenant un total de 350 foyers. Les données sur les revenus ont été recueillies dans quatre saisons distinctes, à des intervalles de trois mois. Le résultat indique que les produits forestiers sont les sources de revenus les plus importantes, contribuant à 35% des revenus par foyer, et à 53% des revenus en liquide par foyer. Les revenus de la forêt ont également aidé 20% de la population à demeurer au dessus du seuil de pauvreté. Les revenus forestiers diminuent l'inégalité (coefficient de Gini) de 15.5%. Le résultat confirme généralement l'importance du revenu forestier dans le soulagement de la pauvreté, et en tant que soupape de sécurité en temps de pénurie.

## Los ingresos de origen forestal y la paliación de la pobreza: un proyecto de gestión forestal participativa en la altiplanicie de Bale, en el sur de Etiopía

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Existe cada vez más interés en comprender el papel que pueden desempeñar los productos forestales y la gestión de recursos forestales en el nivel de vida de las comunidades rurales y la reducción de la pobreza. Este estudio investiga el aporte de los recursos forestales al nivel de vida de los hogares rurales del sur de Etiopía, dentro de un proyecto de gestión forestal participativa. Los datos fueron recogidos a través de entrevistas con informantes claves, discusiones en grupo y encuestas realizadas en 350 hogares en total, y la información sobre los ingresos fue captada en cuatro estaciones distintas en intervalos de tres meses. Los resultados indican que los productos forestales son la fuente de ingresos más importante, llegando a componer un 34% y un 53% de los ingresos per cápita del hogar y de los ingresos per cápita en efectivo, respectivamente. Los ingresos forestales ayudan también a un 20% de la población a mantenerse encima del umbral de la pobreza, y reducen el índice de desigualdad (coeficiente de Gini) en un 15.5%. En términos generales, los resultados confirman la importancia de los ingresos forestales para la paliación de la pobreza, ya que sirven como protección en épocas de crisis para los ingresos.

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## INTRODUCTION

The importance of forest resources to the livelihoods of people living in and around forests has increasingly been recognised during the last three decades. Concepts such as social forestry, community forestry, joint forest management, and conservation and development projects were meant to reflect such recognitions (Carter and Gronow 2005, Shepherd 2004). Lately, many studies are providing more evidences on the role of forests in rural people's livelihoods. It is indicated that about one billion of the worlds poor depend on forest resources to sustain their livelihoods (Scherr *et al.* 2003). Studies in sub-Saharan Africa (Babulo *et al.* 2008, Campbell *et al.* 2002, Cavendish 2000, Fisher 2004, Kaimowitz 2003, Mamo *et al.* 2007, Paumgarten 2005, Shackleton *et al.* 2007), in Asia (Adhikari *et al.* 2004, Illukpitiya and Yanagida 2008, McElwee 2008, Reddy and Chakravarty 1999), and in Latin America (Gavin and Anderson 2007, McSweeney 2002, Pattanayak and Sills 2001, Takasaki *et al.* 2001) have shown that rural households regularly supplement their income from forest resources.

Following the Millennium Development Goals of UNDP<sup>1</sup>, attention has been more focused on the possible link between poverty alleviation and incomes from forest products (Anderson *et al.* 2006, Geller and McConnell 2006, Shackleton *et al.* 2007, Sunderlin *et al.* 2005). The underlying arguments linking forest management and poverty alleviation include the correlation between chronic poverty and natural forests (Sunderlin *et al.* 2005), the role of forest products in filling seasonal shortfalls and as safety nets in times of emergency (Byron and Arnold 1999, Fisher and Shively 2005, McSweeney 2004, Pattanayak and Sills 2001, Shackleton *et al.* 2007, Sunderlin *et al.* 2005). However, the main dilemma is whether forest production can successfully be made more pro-poor to provide pathways out of poverty (Sunderlin *et al.*, 2005) or whether going out of the forest is a better and more desirable option to the forest-dependent poor (Levang *et al.* 2005). Shackleton *et al.* (2008) argues in their South African study that income from natural products still lift households to income levels approximating those of the wider community hence their importance can not be questioned. The income-equalizing effect of forest income among rural households has also been evidenced by other studies (Cavendish and Campbell, in press, Fisher 2004, LóPez-Feldman *et al.* 2007, Mamo *et al.* 2007, Reddy and Chakravarty 1999). In spite of these arguments, forest resources are not adequately considered in the poverty reduction strategies of most developing countries (Oksanen and mersmann 2003) including Sub Saharan African countries (McConnell 2008). This is mainly because poverty analysis based on income or material consumption discounts the role of forests, and hence disregards the impact of the degradation and disappearance of forests and natural resources on the livelihoods of the poor (Oksanen and Mersmann 2003).

Most, however, agree that higher value forest products

that have the potential to lift people out of poverty are generally beyond the reach of the poorest groups (Belcher 2005, Sunderlin *et al.* 2005). Therefore, it is argued that changes in underlying socioeconomic and political constraints including securing and redistributing access are important to secure benefits to the poorest households (Sunderlin *et al.* 2005, Kaimowitz 2003). The World Bank forest strategy also prioritised institutional arrangements such as collaborative forest management to enable indigenous groups manage their natural resources (World Bank 2004). However, such expectations need to be confirmed through research that assesses actual outcomes. In a review of collaborative forest managements, Carter and Gronow (2005) indicate that inadequate devolution of power to local community and disproportionate control by local elites are the main threats against social justice and sustainable livelihoods through collaborative managements. Many community-based arrangements take the assumptions of a community as spatially limited and attached group of people with shared norms and interests with homogeneous social structure and thus, fail to understand the multiple interest groups, the processes through which they interrelate, and the institutional arrangement that structure their interactions (Agrawal and Gibson, 1999). Even if the participatory forest management process provides for inclusiveness and empowerment, it might still be insufficient to prevent elite capture of valuable resources unless special arrangement such as for marketing of products is made by the facilitating agency (Hobley and Shields, 2000).

This study aims at evaluating and explaining the contribution of forest resources to the livelihoods of local households in the context of participatory forest management arrangement in Ethiopia. It employs the sustainable livelihoods framework. The following are the main questions addressed in the study:

- What is the contribution of forests to the rural livelihood in the study area and what are the most important forest products?
- Are there patterns and seasonal variation in forest use, forest dependence, and forest product preference among income groups?
- Are socio-economic characteristics of households important in explaining such patterns?

### Contribution of forest products to rural households

Most quantitative studies on the contribution of forest income to rural livelihoods indicate the importance of various socio-economic and contextual factors (Table 1). Some relationships are more nuanced. For instance, in Malawi (Fisher 2004), young and old age (<35 years and >45 years) get more income from low-value forest products and less from high-value forest products whereas the reverse is true for middle age groups (35 - 44 years old). Education level and family labour can be positively or negatively related to forest dependence depending on village types (Illukpitiya and Yanagida 2008). In eastern Honduras, McSweeney (2002) found that households that

<sup>1</sup> <http://www.undp.org/mdg/basics.shtml>

TABLE 1 *Studies on the contribution of forest resources to the livelihoods of rural households*

Author	Study area/ context	% total income	Factors related to forest use and forest income
Illukpitiya and Yanagida, 2008	Sri Lanka	9% – 19%	The more forest dependent households: get lower off-farm income, have lower male to female ratios, have lower wealth, live close to the forest, have low technical efficiency in agriculture
McElwee (2008)	Ke Go Nature reserve under ICDP project, Vietnam	20%	Households more forest dependent are younger, low in livestock income, have low share of wage income, have lower value of rice produced, live closer to the forest, are migrant and non-poor
Babulo, et al, 2008	Northern Ethiopia, state owned forest	27%	Households getting higher forest income are female-headed, possess smaller cropland, are less educated, have low access to roads and credit, have better access to grazing land, have larger household size
(Vedeld et al. 2007)	Meta analysis (51 case studies)	22%	Higher education level is related to lower forest income; households farthest from town get higher forest income
Mamo, Sjaastad, and Vedeld (2007)	Central Ethiopia, state owned forest	39%	Forest dependence is negatively related to, distance to forest, household size, area of land, wage and self-employment, age of head, number of adult labour, per capita income, crop income, and education level of head
Fisher (2004)	Southern Malawi, three villages under government, customary, and weak customary management	30%	Forest income decreases with farm size per capita, number of goats owned, secondary school attendance, whereas it increases with, natural log of ratio of forest to maize return and number of men in the household,
Adhikari, Falco, and Lovett (2004)	Community managed forest in Nepal	Not available	Collection of fuelwood is higher for households that are, less educated (average), belongs to higher caste, more wealthy, live more distant from forest, have more labour, better in leadership quality
(Ambrose-Oji 2003)	NTFP's in South West Cameroon	6-15%	The poorest (bottom quintile) get lower share of their income (6%) compared to the richest (15%) from NTFPs,
McSweeney (2002)	Natural forest under customary ownership, Honduras,	18%	NA
Khanal, K.P. (2001)	Community managed forests of Middle Hills, Nepal	13%	Poor people are getting more benefits from community forests. Out of the four wealth classes of (i) poorest of the poor, (ii) poor, (iii) medium and (iv) rich, the families of wealth class "poor" are getting highest benefits and the rich are getting lowest benefits.
Taksaki, Barham, and Coomes (2001)	A national reserve rain forest in Peru, protected by the state	26%	NA

are most reliant on earnings from forest products also get the highest earnings from forest products. In addition, households earning from forest products appeared to have more diversified strategies (ibid). In Sri Lanka, diversification increases the income of households and thus, decreases dependence on forest resources (Illukpitiya and Yanagida 2008). This indicates the context specificity of these relationships that defines the interplay of many contextual factors such as institutions controlling access, access to markets, availability of family labour, resource endowment, employment opportunities, etc.

Hence, the importance of socio-economic factors and the nature of their relationship with forest incomes can vary between villages, product types, or can be localised and specific to a country or region or particular forest. Still, table 1 shows that forest income in many areas account for a

large part of the household total income, not the least among poorer families.

## METHODS

### Conceptual framework

The expanded view of poverty has made it important to understand households' access to various assets, their livelihood strategies, and their vulnerability to shocks (Arnold 2002, Shepherd 2004). As a result, the sustainable livelihood framework serves as an important framework in explaining forest-poverty link (Shackleton 2007, Shepherd 2004, Kaimowitz 2003, Warner 2000). In the sustainable livelihoods framework, livelihood refers to the assets, the

activities, and the access to these that together determine the living gained by a household (Ellis 2000). Five types of livelihood assets are identified in the Framework used by DFID (2001) – human, natural, physical, social, and financial capital. According to (Scoones 1998), the framework helps in outlining the key question on what combination of livelihood assets will result in the ability to follow different livelihood strategies and with what outcome. The livelihood approach attempts to capture some of the concepts of Sen's capability approach to define poverty. Sen presents five instrumental freedoms that "... contribute, directly or indirectly, to the overall freedom people have to live the way they would like to live." Sen's capability approach focuses on the freedoms and the abilities among people to use them to achieve a decent life. Poverty and inequality, according to Sen, have to be analysed according to these extensive definitions of capabilities and how they are distributed in a society (Sen 1999).

From a sustainable livelihood perspective forests are natural assets that contribute to household cash income, food security, reduced vulnerability, and improved well being through non-material benefits (Warner 2000). Because achieving a positive livelihood outcome requires the availability of a range of assets, those households with more assets have a greater range of options and an ability to shift emphasis in their livelihood strategies. Thus, understanding household access to assets and how these assets combine to sustain livelihoods, especially among the poor is important to understand the role of forests (ibid). For instance, there is evidence that poorer groups are more reliant on low-value forest products such as NTFPs, firewood, and charcoal (Neumann and Hirsch 2000; Pattanayak *et al.* 2004). The pro-poor economic characteristics of these products in terms of low requirement for skill and capital and open access to the resources explain this link (Sunderlin *et al.* 2005, Belcher 2005, Kaimowitz 2003). The safety net function of forests is particularly important for the poor and landless families (McSweeney 2004, Takasaki *et al.* 2004, Byron and Arnold 1999).

The livelihoods approach also gives sufficient emphasis to the vulnerability context where forest products play a crucial role particularly to poorer households. In summary, the following important issues on forest and poverty alleviation can be outlined to analyse the contribution of forest resources to the livelihoods of rural households:

- Forests constitute the natural assets of rural households and provide benefits that serve a multiple of functions including as a major source of income, means of coping with predictable and unpredictable gaps in income, or as a means of wealth accumulation to escape from poverty.
- The degree of benefits depend on an interplay of factors like the nature and security of access to the resource and the capabilities of households in terms of skill, labour, and other capital resources.
- The correlation between forest dependency and poverty is explained by the characteristics of forest activities and forest outputs.

- The better off households are favourably positioned to control and exploit high-income earning forest activities and new opportunities for increased income from forest products.

### The research context

Ethiopia is a landlocked country. About 84% of the 74 million population live in the rural areas (CSA 2008). The human development index of UNDP for 2007/08 ranked Ethiopia at 169<sup>th</sup> out of 177 countries (UNDP 2008). Per capita GDP is 900(PPP US\$, 2008 estimate). Agriculture is the major economic activity accounting for 45% of GDP (CSA, 2008). Poverty eradication is the major development objective of Ethiopia (PASDEP 2006).

The study was conducted in Dodola woreda (district) which is located in the Bale zone of the Oromia regional state. The local people are mainly from Oromo ethnic groups. The whole study area can be divided into three parts – the farming zone, the forest edge, and the upland forest (Synopsis 1997). The forest edge includes the areas close to the foot of the mountains where farmlands gradually shift to fields with scattered remnants of natural forest. The upland forest is on the most inaccessible and climatically harsh areas. The main species in the forest are *Hagenia abyssinica*, *Juniperus procera*, *Podocarpus falcatus*, *Hypericum lanceolatum*, *Erica arborea*, *Allophylus abyssinicus*, and *Maytenus addat* (Tadesse 1999) Almost all of the existing forest is found along the slopes and ridges of the mountains.

The farming system in the region consists of cereal farming based on barley and wheat (WBISPP 1995). The mean annual rainfall is 815mm. About 60% of the rainfall comes in the main rainy season from June to August while a small amount of rainfall occurs between January and March followed by dry spell in May. The main dry season is between November and December (IFMP 2002).

The participatory forest management (PFM) project in the Dodola forest was started as a pilot project with the major goal of organizing the local community in to a Forest Dwellers Association (WAJIB). WAJIB members are required to protect the forest, to carry out management activities, and to pay annual forest rent. Members also have the right to live in the forest, to get forest-based benefits, and to grazing in the forest. Farm plots remain fixed at the size existing during the contract. The number of member households per WAJIB is limited to 30.

Price inflation and drought during 2007/08 were important events during the study period. The National Bank of Ethiopia estimates the inflation at 29.3% p.a. as of July, 2008. According to reports of local people, the unusually heavy rainfall during the main rainy season has caused physical damage to crops and water-logging in some areas. The dry season was unusually long resulting in shortage of grazing.

### Data collection and analysis

The study included the relatively older WAJIBs (>4 years

old). Out of 32 older WAJIBs, 22 WAJIBs were randomly selected. From each WAJIB, 60% of the households were randomly selected for the survey. While 50% was the planned sampling intensity, 10% was included to compensate for possible attrition during the study period. This has given to a total of 352 households, the number of households per WAJIB ranging from 10 – 18.

Data were collected through group discussions, household surveys, and key informant interviews between April 2007 and June 2008. Group discussions were carried out at the beginning and end of the survey period in each WAJIBs involving 5 to 10 people. In group discussion, village level information such as major agricultural and forest products, institutions, infrastructure, and trends in forest resource availability were discussed. There were two types of household surveys. The first type includes two annual surveys conducted at the beginning and end of the data collection period. They focused on general household socio-economic characteristics and annual information on risks, prices, and vulnerability. The second type consists of four quarterly surveys to collect information on household incomes and engagement in forest management activities. Key informants were interviewed for history of the area, the process of WAJIB establishment, and other qualitative information.

The income and activity reports for forest, environmental, wage, and business income were based on a recall period of one month whereas the recall period for crop income, livestock income, and transfer payments was three months. The first quarterly survey covered the period between April – June when the main rainy season starts and land preparation activity is resumed. The second survey covered the period July – September when sowing and weeding is undertaken for main agricultural crops. The third covered the period of October – December when harvesting of the major crops is made in lower altitude areas and most of the upper altitude areas. The fourth survey covered the period January – March.

Definition of forest, forest products, and income follows the poverty and environment network (PEN) definitions (PEN-CIFOR<sup>2</sup>). Accordingly, household income is defined as the return to the labour and capital owned. Four types of forest income were distinguished: 1) income from self employment in the harvesting of forest products that are used or sold in an unprocessed way; 2) income from self employment of processed (value added) forest products; 3) wage income from employment in forest based activities; 4) direct payment (transfers) to the household for forest-based environmental services. All products obtained from the forest whose supply is not necessarily dependent on the existence of the forest, such as grazing and wild vegetables, are categorized as environmental products. All price values were obtained from respondent own reports. Prices of subsistence uses were obtained from respondent own estimation.

Income is calculated as gross value minus the total costs of all purchased inputs. While the cost of hired labour is considered, family labour is not included in the cost

calculation. All income values were converted to per capita income using adult equivalent unit (aeu) of the World Health Organisation (as quoted in Cavendish 2002). Households were divided into five quintile groups based on per capita income. Patterns of forest income and other socio-economic factors were analysed with one way ANOVA and weighted least square (WLS) regression methods.

Income inequality was measured with the use of the Gini Coefficient. To estimate the effect of income from different sources on income inequality, the Gini coefficient was first calculated for total income. Then this Gini coefficient was recalculated by removing each income source and compared with the total income Gini coefficient. To assess coping strategies, households were asked about the occurrence of crisis during the year, how severe was its impact on income, and the top three coping strategies they adopted to cope with the income crisis.

## RESULTS

### Characteristics of survey households

The major assets of households are livestock and cropland. In general ownership of physical assets and financial assets (saving) are low among the sample households (Table 2). With the poverty line of \$1 per day (PPP) the poverty incidence is 31.7% which is lower than the national level of 39.3% estimated in 2004/05 (PASDEP 2006). The literacy rate is 38.6% which is higher than the 31% of the national level estimated in 2004/05 (ibid). However, literacy rate among household heads is only 27%. The average per capita income of female headed households is about 60% of the per capita income of male-headed households.

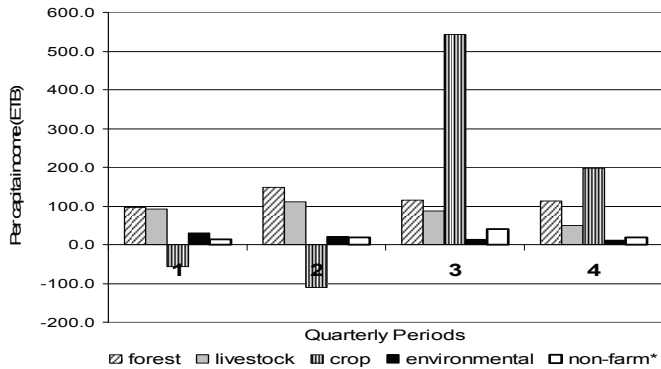
### Household Income sources and seasonality

The main sources of income are crop production, livestock production, and extraction of forest and environmental products. The result shows that forest products constitute an important part of the household income portfolio contributing 34% of total per capita income followed by livestock (30%), crop (26%), and environmental products (6%). Private business, remittance, transfers, and wage together constitute only 4% of total per capita income. If forest income which usually is not fully accounted for in the national account estimate is excluded the poverty incidence will rise from 31.7% to 51%.

As indicated on figure 1 and figure 2, total income and cash income during the first two quarters are mainly obtained from forest and livestock products. Total income from crops becomes important during the third and fourth quarters. On the other hand, the frequency of users of wild vegetables during periods of relatively lower food supply (first and second quarter periods) indicates its importance in supplementing household food consumption. Relatively higher number of households reported use of wild vegetables in these two food-deficit periods (88% and 85%, respectively) as compared to 68% and 50% for

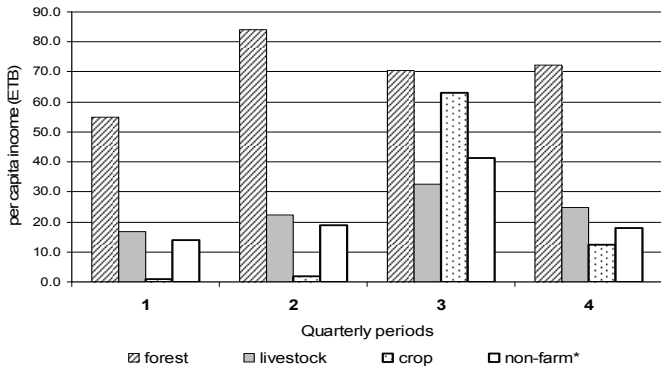
<sup>2</sup> [http://www.cifor.cgiar.org/pen/\\_ref/tools/index.htm](http://www.cifor.cgiar.org/pen/_ref/tools/index.htm)

FIGURE 1 Quarterly distribution of total per capita income from main sources



\*non-farm=business, wage, remittance, transfers

FIGURE 2 Quarterly distribution of net cash per capita income from main sources



\*non-farm=business, wage, remittance, transfers

the other quarters when harvested crops are available.

The importance of forest products becomes even higher when cash income is considered (Figure 2). Forest products are the main source of cash income (53% of cash income) almost throughout the year followed by sale of livestock. Forest cash income helped about 31% of households earn positive net cash income during the first and second quarters when most of the agricultural expenses are made. Crops are important as cash income mainly during the third quarter.

**Income quintile groups and socio-economic characteristics**

Livelihoods outcomes are related to the livelihood assets at a households’ disposal and the choice of livelihood strategies. According to wealth ranking exercise, the most important indicators of wealth are size and productivity of cropland, number of livestock, amount of adult labour, ownership of a house in the nearby town, number of children sent to town for education, savings in the bank, and ability to lend money to other households. Regression of per capita income on socio-economic variables indicates that per capita income is positively related to education level, number of large livestock, and value of physical assets owned (Table 3). On the other hand, household size, age and sex of household head, and distance from town are negatively related to income.

In general female headed households have lower livelihood assets including adult labour (p<0.005), education level (p<0.0001), number of large livestock (p<0.0000), and area of cropland (p<0.0001). About 63% of female headed households belong to the lowest two quintile classes.

Education level of head, number of large livestock and age constitute the major differences between quintile classes (Table 4). Ownership of donkeys and horses implies a capacity to transport bulky materials such as timber, wood splits, and poles in the difficult terrain. However, firewood and charcoal can be carried by women and children from areas close to the town though they bring lower returns.

The big difference in crop income and the relatively lower difference in cropland area between the bottom and top quintile classes reflect differences in productivity (Table 5). Output per unit of cost for the top quintile class is 5 times as much as the lowest quintile class. The upper two quintile classes made 79.5% of the land rentals, 53% of machinery rentals, 66% of hired agricultural labour, and 48% of fertiliser application whereas the corresponding values for the lower two quintile classes is 5%, 25%, and 22%, and 30% respectively. Hence, the upper quintile classes employ more capital intensive production and earn higher return.

The lowest quintile class represent the poorest of the

TABLE 2 Socioeconomic characteristics of sample households

Socio-economic characteristics	Mean	SD	Min.	Max.
Percent of Female headed	21%			
Number of school years of head	1.31	2.55	0	13
Age of head	46.6	15.8	17	103
Area of cropland owned (ha)	1.39	1.05	0	5
Per capita income (ETB <sup>1</sup> )	1 672	1 263	49	8 688
Net Saving (ETB)	103	1 462	-14 164	20 000
Value of physical asset (ETB)	558	541	15	4 460
No. of large livestock	11.6	5.97	1	46.2
No. of goat and sheep	8.5	5.92	0	36.5
No. of chicken	0.94	2.19	0	17.3

<sup>1</sup> Weighted Inter-Bank Foreign Exchange Market Rate for the year 2007/08 is 9.2441 ETB/USD

TABLE 3 WLS\* Regression results of total income over socio-economic factors

Total Income (ETB)	Coef.	Std. Err.	t	P>t	No. of obs = 350
Household size	-216.144	20.686	-10.45	0.000	F( 7, 342) = 31.40
Age of head	-8.486	3.145	-2.7	0.007	Prob > F = 0.0000 R2 = 0.3912
Education Level of head	53.331	25.055	2.13	0.034	Adj R2 = 0.3788
Total physical asset	0.307	0.191	1.61	0.109	Root MSE = 842.26
Distance from town	-53.088	10.983	-4.83	0.000	
Sex of head (dummy, 1=female)	-359.26	107.462	-3.34	0.001	
No. of large livestock owned	94.425	11.092	8.51	0.000	
Constant	2 965.276	273.749	10.83	0.000	

\* Weighted by total physical asset

TABLE 4 Socio-economic characteristics of income classes

	Income Quintile class					ANOVA F test
	1	2	3	4	5	
Education level of head	0.63 <sup>a</sup>	0.78 <sup>a</sup>	0.98 <sup>a</sup>	1.60 <sup>b</sup>	2.57 <sup>b</sup>	***
Age of head	50.2 <sup>ab</sup>	50.9 <sup>a</sup>	48.2 <sup>ab</sup>	42.1 <sup>b</sup>	42.2 <sup>b</sup>	**
No of Large livestock	8.3 <sup>a</sup>	10.4 <sup>ab</sup>	11.7 <sup>b</sup>	12.1 <sup>b</sup>	15.2	**
No. of Cattle	6.0	7.6	8.7	8.9	11.4	NS
No of Horse	1.4 <sup>a</sup>	1.9 <sup>ab</sup>	1.7 <sup>ab</sup>	1.7 <sup>ab</sup>	2.2 <sup>b</sup>	**
No of Donkey	0.8 <sup>a</sup>	0.9 <sup>a</sup>	1.2 <sup>ab</sup>	1.3 <sup>b</sup>	1.6 <sup>b</sup>	**
No of Goat & Sheep	7.1	9.2	8.4	7.6	9.9	NS
Cropland cultivated	0.48 <sup>a</sup>	0.70 <sup>ab</sup>	1.03 <sup>bc</sup>	1.36 <sup>c</sup>	2.00	***

Scheffe's test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level, NS = level of significance is &lt; 5%; \*\* = Significant at 0.05, \*\*\* = Significant at 0.01

TABLE 5 Income distribution among sources for quintile classes

	Income Quintile class					ANOVA F test
	1	2	3	4	5	
Per capita income (ETB)	499	935	1 343	1 909	3 676	
Crop	42 <sup>a</sup>	268 <sup>a</sup>	408 <sup>ab</sup>	679 <sup>b</sup>	1 463	***
Livestock	163 <sup>a</sup>	270 <sup>a</sup>	409 <sup>ab</sup>	543 <sup>b</sup>	909	***
Forest	224 <sup>a</sup>	309 <sup>a</sup>	412 <sup>a</sup>	510 <sup>a</sup>	905	***
Environmental	41 <sup>a</sup>	53 <sup>ab</sup>	71 <sup>ab</sup>	85 <sup>b</sup>	136	***
Business	6	12	13	60	163	NS
Transfer	17	14	13	22	41	NS
Wage	5	9	17	9	58	NS

Scheffe's test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level, NS = level of significance is &lt; 5%; \*\* = Significant at 0.05, \*\*\* = Significant at 0.01

poor who have low level of income both in total and cash terms from most income sources. Out of the 39 households that have a negative net income from crop production, 29 (74%) are in the poorest group. A significantly higher portion (47%) of households with negative crop income also reported severe income crisis due to crop failure, illness or death of family member compared to net-positive earners where only 24% experienced such crisis.

### Major agricultural and forest products

Wheat, barley, and *teff* constitute 89% of crop income. However, for some households potatoes and other vegetables from gardens are also important. Draught power, milk, and sale of livestock contribute 86% of livestock income. About 87% of households reported consumption of wild vegetables. Nettle (*Urtica siemensis*) was the wild vegetable used by most households. The leaves specially the young ones are boiled and eaten as vegetable

The major forest products identified are firewood, poles, timber (planks), wood splits, charcoal, logs, tree branches, wooden tools, and medicinal plants. The planks are produced in different dimensions that are priced differently in the market. Firewood is prepared in different ways (splits, round woods, mixed species) and from different sources (dead and fallen dry wood, dead and standing trees). Charcoal, poles, and timber are the main cash generating forest products. Female headed households earn significantly higher income from charcoal ( $p < 0.05$ ) and lower income from timber ( $p < 0.1$ )

Table 6 shows the percent share in total income of the top 5 forest and environmental products. Firewood becomes the top important product for the bottom two quintile classes whereas wheat and draught power are the top ranking products for the upper two quintile classes. Overall, forest and environmental products are more important to lower income quintile classes (54% and 35% of total income) than upper quintile classes (27% and 23%).

### Factors influencing forest income

The pattern of total income and forest income among income classes is indicated in Table 7. Households in the top quintile class earn 4 times as much forest income as the lowest

income class whereas their dependence on forest income is less than half (0.46) of the lowest quintile class.

When share in total cash income (RCFI) is considered, forest products are also important sources of cash income regardless of income classes. Forest cash income constitute more than of half of the total cash income of households except the top quintile class (Table 7). Table 8 shows that per capita forest income and per capita total income are positively related.

The regression of relative forest income over socio-economic characteristics shows that distance from town is positively related to forest dependence (Table 8). Areas farther from town are also at higher altitude. Forest dependence decreases with area of cropland and number of large livestock and increases with distance from town. Age, physical asset, and education level of household head have an insignificant but negative relationship with forest dependence.

### Role of forest income in income inequality

The Gini coefficient for total per capita income is 0.38 which is higher than 0.24 of the national value for rural areas in the year 2004/05 (PASDEP 2006). Among the major income sources, Gini coefficient is highest for crop income (0.63),

TABLE 6 Top 5 forest and environmental products and their share in total income of quintile classes

Products	Quintile classes					One way ANOVA F-test
	1	2	3	4	5	
Firewood	33.7% (1)	15.2% <sup>a</sup> (1)	12.9% <sup>a</sup> (1)	11.0% <sup>a</sup> (1)	6.6% <sup>a</sup> (2)	***
Grazing	7.5% (2)	4.5% <sup>a</sup> (3)	4.4% <sup>a</sup> (4)	3.2% <sup>a</sup> (4)	2.7% <sup>a</sup> (4)	***
Poles	7.3% (3)	8.4% (2)	4.7% (3)	6.3% (2)	5.0% (3)	NS
Timber	3.0% (4)	4.4% (4)	5.6% (2)	5.6% (3)	7.1% (1)	NS
Charcoal	2.8% (5)	2.5% (5)	-	-	-	
Wood splits	-	-	2.6% (5)	1.3% (5)	2.0% (5)	
Total	53.5%	35%	30.2%	27.4%	23.4%	

Scheffe's test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level, NS = level of significance is < 5%; \*\* = Significant at 0.05, \*\*\* = Significant at 0.01, number in brackets give the rank of the product in the list

TABLE 7 Per capita total and cash forest income values

Incomes (ETB)	Income quintiles					One way ANOVA F-test
	1	2	3	4	5	
Total cash income (TCI)	172 <sup>a</sup>	309 <sup>a</sup>	373 <sup>ab</sup>	607 <sup>b</sup>	1160	***
Total forest cash income (TFCI)	116 <sup>a</sup>	188 <sup>ab</sup>	226 <sup>ab</sup>	344 <sup>bc</sup>	540 <sup>c</sup>	***
Relative forest income (RFI)	0.52 <sup>a</sup>	0.33 <sup>a</sup>	0.30 <sup>a</sup>	0.27 <sup>a</sup>	0.24	***
Relative cash forest income (RCFI)=TFCI/TCI	0.59 <sup>a</sup>	0.55 <sup>ab</sup>	0.60 <sup>a</sup>	0.50 <sup>ab</sup>	0.39 <sup>b</sup>	**

Scheffe's test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level, NS = level of significance is < 5%; \*\* = Significant at 0.05, \*\*\* = Significant at 0.01



TABLE 8 WLS Regression results of per capita forest income and relative forest income

Per capita forest income	Coefficient	Std. Err.	t	P>t	
Total per capita income	0.218	0.0182	11.94	0.000	Number of obs = 350
<b>constant</b>	106.835	22.337	4.78	0.000	F( 1, 348) = 142.58
					Prob > F = 0.0000
					R2 = 0.2906, Adj R2 = 0.2886
Relative for income*	Coefficient	Std. Err.	t	P>t	
Adult labour (>=14 years)	0.00514	0.00649	0.79	0.429	Number of obs = 342
Age of head	-0.00085	0.00081	-1.06	0.292	F( 7, 334) = 17.58
Education Level of head	-0.00371	0.00448	-0.83	0.408	Prob > F = 0.0000
Cropland area	-0.04939	0.01169	-4.23	0.000	R2 = 0.2693
Distance from town (market)	0.014271	0.00382	3.73	0.000	Adj R2 = 0.2540
Number of Large livestock	-0.00903	0.00188	-4.79	0.000	Root MSE = 0.20155
Value of physical asset	-3.2E-05	2.13E-05	-1.52	0.128	
constant	0.384714	0.06508	5.91	0.000	

\* weighted by per capita income, \*\* weighted by number of large livestock

TABLE 9 Main coping strategies of households faced with income crisis

Coping strategy	Percent households in Quintile classes				
	1	2	3	4	5
Sale of forest products	39.3%	42.4%	37.3%	39.3%	21.8%
Livestock sale	17.9%	30.5%	27.1%	39.3%	20.0%
Reduced no of meals	25.0%	22.0%	8.5%	10.7%	5.5%
Support from friends or relatives	23.2%	5.1%	13.6%	23.2%	16.4%
Did nothing in particular	21.4%	25.4%	27.1%	17.9%	38.2%

followed by forest income (0.50), livestock income (0.49), and income from environmental products (0.42). Comparison of Gini coefficients for total income and income excluding every single income source indicates that the increase in Gini coefficient becomes highest when forest income is excluded (0.45) whereas the lowest is for crop income (0.37).

### The impact of income reducing events on forest use

About 285 households reported one or more events that resulted in a reduction of household income during the year. Livestock loss, crop failure, and illness and death of family members were the top three events that have affected households' income during the year each reported by 63%, 32%, and 32% of households, respectively. Livestock loss was a result of the shortage of grazing due to the extended dry period during the year. Crop failures were the result of physical damage on crops from hailstones, floods, and water logging due to heavy rain which was more localised whereas illness and death are more of idiosyncratic events.

Increased sale of forest products was the only, main, or part of the coping strategy for 26%, 11%, and 4% of households with income crisis, respectively. The average forest income of households with forest-based coping strategy is significantly higher than the other groups (Prob>F 0.0008). As indicated on Table 9, higher number of better off households did nothing in particular to cope with negative

events whereas reducing meal is a strategy mainly for lower quintile groups. Livestock sale is also a means of salvaging the possible loss due to death.

### DISCUSSION

Forest income is the most important part of household income portfolio. The 34% share of income from forest products is comparable to the 39% contribution in central Ethiopia as reported by Mamo *et al.* (2007) and the 30% contribution of forest products in Malawi (Fisher 2004). However, over the year of the survey 12% of the households reported a negative income from crop production which lowered the mean contribution of crops to household's income. A disproportionately higher number of these negative earners also reported income crisis due to crop failures, illness or death of adult family labour.

Households get 53% of their cash income from forest products much higher than the 18% in Vietnam (McElwee 2008). The unusual fluctuation of crop prices in the particular survey year combined with unfavourable weather might have contributed to the lower proportion of crop produce converted to cash income. In unprecedented way, the prices of major crops like wheat, barley, *teff*, and maize have more than doubled in not more than four months period. Therefore, it is likely that many of the households were holding back their

produce unable to decide the right time to sell. This may explain the low proportion (8%) of crop income earned in cash. Instead, forest products have played an important role of generating cash income through out the year. Therefore, the result has indicated the role of forest cash income in supplementing financial agricultural expenses.

Firewood is the most important forest product for all households (55% of forest income) though it is more important to the lower quintile groups. The result is comparable to the value obtained by Mamo *et al.* (2007) for central Ethiopia where firewood constitute 59% of forest income. Although the poorest households (lowest quintile groups) are more dependent on forest and environmental incomes particularly firewood, the difference for the other quintile groups is not as pronounced. Informants indicated that firewood has become scarcer in the local market following the prevention of the free access situation after the participatory arrangement. This might have contributed to better prices and higher engagement in firewood extraction. Moreover, the capacity to transport firewood and closeness to town can explain the large volume of firewood extraction by the better off households. Poorer households who don't have enough number of pack animals for transport have to rent them from the better off households for an equal share of the revenue from the sale of the products.

The participatory forest management (PFM) arrangement has also influenced the pattern of forest product uses. The PFM legalised the subsistence and commercial use of those forest products that do not involve felling of live trees. Particularly potential crop trees are strictly forbidden from felling without special permission. Charcoal making is forbidden in all WAJIBs though some households particularly female headed, still continue to depend on it for cash income. Therefore, products like firewood and poles which often are obtained from dead and dying trees are the most frequently used products in all income classes. Differences between households for such products are mainly explained in terms of capacity to produce and transport products to market area. On the other hand, timber though a high return product and also more restricted product, is more accessible by fewer better off households.

The seasonal variations reflect patterns in the availability of household resources such as cash, food, and labour and the volume of activity of agricultural activities. According to the seasonal calendar, the second quarter covers the period when the volume of agricultural production is relatively lower whereas the first quarter covers the period when most of the arduous agricultural activity including land preparation takes place. The second quarter is also the period when about 51% of the agricultural expense takes place. Key informants also indicated that the start of the harvesting period (third quarter) is the most cash-deficit period since most expenses on agricultural inputs are made in this period. The result indicated a forest extraction pattern that parallels the relative availability of household labour in the different seasons and also the need for cash income for agricultural expenditures.

All income classes are considerably dependent on

forest income particularly cash forest incomes. This is explained by the dominant forest-livestock based mode of livelihoods of households living in the forest area. It is mainly households at the forest peripheries that are more dependent on crop production. Until the establishment of the PFM scheme, the forest was recognised as state forest and all inhabitants were considered as illegal settlers. In addition to the harsher climate in the higher altitude areas, clearing for crop cultivation had not been an easy task. The main use of the forest was as grazing area and extraction of forest products. Only people with no better option will take the risk and settle in the higher altitude and less fertile forest region. After the establishment of the participatory arrangement the contact agreement requires that agricultural plots should remain fixed at the size during the signing of the agreement. Therefore, increasing crop production by expanding agricultural plots is no longer an option.

The results indicate that asset poor households are generally more dependent on forest incomes. Fisher (2004) has confirmed similar pattern in Malawi. Households with small cropland, fewer livestock, living in higher altitude areas and farther from town are more dependent on forest income. The better off households are more dependent on capital intensive crop production. Similar patterns for cropland, livestock, and distance were also confirmed in other studies in Ethiopia (Babulo 2008, Mamo 2007). Sex is not an important factor explaining forest dependence in contrast to the findings of Babulo (2008) but male headed households obtain higher forest income in absolute terms than female headed households. The negative relationship of forest dependence to age and education level of household head and number of male adult labour is as expected but less significant in comparison to other variables. Most of the households in the study area can be considered as forest dwellers and the prevalence of forest dependence (forest income constituting 34% of income) is confirmed by the results. This partly explains the uniformity of households in terms of forest dependence and the less significant relationship of these factors on forest dependence.

In general, the results indicate the importance of forest products in both subsistence and cash income generation, in poverty alleviation, and also as safety nets in times of income crisis. The prevalence of forest dependence also shows the role of the forest resource in the livelihoods of the local people and hence, justifies the need for their involvement in the management of the forest resource. In view of the demand for higher value products such as poles and timber in both the local and regional market, there is a good potential that incomes from these products can lift poorer households to higher income levels.

## CONCLUSION

The results confirm that forest is the most important contributor to household income followed by income from livestock production. Forest income contributes between 24% to 52% of the household income of the high income

and low income groups, respectively. For about 20% of the population forest income is necessary to maintain per capita income above the poverty line.

Forest resources also constitute the main source of cash income for all income classes through out the year. A total of 191 (54%) households earn more than half of their cash income from forest products. Forest cash income pays for the expense of agricultural inputs helping a third of households avoid financial deficits. Forest cash income has also increased the financial capacity of households after crop harvest enabling them to hold back their agricultural produce, hence preventing them from dumping their produce during seasons of low agricultural prices which they usually do to pay back debts.

Overall, the better off households earn more forest income in absolute terms whereas the low income classes are more dependent on forest resources. Firewood is the most important forest product followed by poles and timber. The poorest groups are particularly highly dependent on forest and environmental products particularly firewood. Forest income is the major source of income when agricultural income is in short supply.

Middle-aged and better educated male headed households who lives closer to town and posses large plots of cropland and own higher number of large livestock are the most important distinguishing characteristics of high income households. On the other hand, forest dependent households have small cropland and fewer livestock. They live in the upper altitude areas and farther from town.

A third of households faced with income crisis have resorted to increased forest extraction activities to cope with income loss. Besides, the exclusion of forest income resulted in the highest increase in income inequality (18,4%) indicating the role of forests in equalising household income. Exclusion of livestock income also results in a 12% increase in income inequality. Hence, forest and livestock production appear to be the main strategies for poorer households.

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