MEFCC

THE CONTRIBUTION OF FORESTS TO NATIONAL INCOME IN ETHIOPIA AND LINKAGES WITH REDD+

EXECUTIVE SUMMARY

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MAIN FINDINGS

- **Contribution of forests to national income in Ethiopia:** This report concludes that Ethiopian forests generated economic benefits in the form of cash and in-kind income equivalent to 111.2 billion Ethiopian Birr (ETB) (USD16.7 billion) or 12.86% of Gross Domestic Product (GDP) in 2012-13[1], considerably larger than previously thought. Of this, 6.09% of GDP is attributed to forest industries. The contribution of forest ecosystems to other sectors, particularly agriculture, is valued at 6.77% of GDP. In addition, 2.4 billion ETB was attributed to non-market benefits based on Ethiopians' willingness to pay to maintain forests.[2]

- **Important forest goods and services:** The largest market income benefits were associated with flows of wood fuel (firewood and charcoal) and livestock fodder from forests. Together, these accounted for 62% of forest use benefits (69.0 billion ETB, USD10.3 billion). Wood fuel and fodder are so valuable because their use is widespread in Ethiopia and, in the case of fodder, because agriculture is economically very important in the country. In addition, roundwood supply (11.4% of use benefits); forest coffee production (10.8%); control of cropland erosion (6%); pollination of crops by forest insects (4.5%); forest honey/beeswax production (1.5%); and collection of wild medicinal plants (1.1%) were all important sources of forest-derived income.

- **Undervaluation of the economic contribution of forests in national accounts:** All valuation methods used in this report are compatible with the System of National Accounts, which means that the valuation results can in principle be reflected in GDP. The findings suggest that current GDP estimates undervalue the contribution of the forestry sector to national income by about 38%, as official statistics show the sector's contribution to be 3.8% (Ministry of Finance and Economic Cooperation (MOFEC), 2015) whereas the assessment here estimates the contribution to be 6.09%. In addition, as mentioned, forest-derived income in terms of cash and in-kind from other sectors, particularly agriculture, are estimated to be 6.77% of GDP.

- **Options for policy making:** These findings can help strengthen the national REDD+ process in Ethiopia by, among others, permitting the Ministry of Finance and Economic Cooperation (MOFEC, the Central Statistical Agency and the Ministry of Agriculture to better understand the extent to which Ethiopia's forests underpin the economy. This could provide the basis for updating Ethiopia's System of National Accounts (ESNA) with a more accurate account of forest-derived benefits in GDP and by developing a satellite forest account. In addition, the results and recommendations could be incorporated in the REDD+ National Strategy and potentially also in Ethiopia's Growth and Transformation Plan 2 (GTP2).

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1. All major findings of this assessment are reported for the Ethiopian fiscal year 2012-13, as this is the year for which reliable estimates of all important forest ecosystem goods and services could be made.
2. Non-market benefits are not conceptually consistent with GDP estimates. For this reason, they are reported separately here.

PROJECT OBJECTIVES

In 2014, the Government of Ethiopia requested the UN-REDD Programme to support the country in assessing the contribution of forest ecosystems to national income in the context of the national REDD+ process. The primary objective of the project was to establish the contribution of Ethiopian forests to national income[3] (GDP) by assessing the following.

- **Value added of the forestry sector:** The annual contribution of the production of forest ecosystem goods and services to GDP attributed to the forestry industry in the Ethiopian System of National Accounts (ESNA).

- **Contribution of forest ecosystems to other sectors:** The annual contribution of the production of forest ecosystem goods and services to GDP attributed to other industries in the ESNA (for example, the contribution of forest-based insect pollinators to the value added of the agriculture industry or the contribution of protected areas to the tourism industry).

- **Non-market benefits:** the annual contribution of forest ecosystems to non-market income in Ethiopia (which is conceptually beyond the scope of national accounting and therefore not included in GDP).

The contribution of forest ecosystems to national income is seen as a vital element of the case for forest conservation in Ethiopia. Prior to this study, no full assessment of the income derived from forest-derived goods and services had been undertaken in the forestry sector or other sectors. The only figure available had been the official ESNA estimate (MOFEC, 2015) of the contribution of the forestry industry to GDP (3.8% in 2012-13). By assessing the full contribution of forests to market and non-market income, a more complete picture of their economic importance emerges.

CONTEXT

With more than 90 million inhabitants, Ethiopia is the most populous nation in Eastern Africa and the second most populous in all Africa after Nigeria. Annual population growth is above 2%, meaning that Ethiopia's population could grow to 120 million people by 2030. Most people live in rural areas. Only about 17% of Ethiopians live in urban centres and nearly half of these live in the capital, Addis Ababa.

Ethiopia is a land of natural contrasts. It stretches over more than 1.1 million km^2 and has a wide variety of climate zones and soil conditions. Forests cover some 162,000 km^2 of the country's landmass, with woodland and shrubland accounting for another 492,000 km^2, according to the 2013 land cover map of Ethiopia (Ethiopian Mapping Agency, 2013) (see Figure 1 below).

The Government of Ethiopia launched a *Climate Resilient and Green Economy Strategy* (CRGE Strategy) in 2011 with the goal of achieving middle-income status for the country by 2025 while following a carbon-neutral growth path. REDD+ implementation[4] is one of the pillars of the CRGE Strategy (Federal Democratic Republic of Ethiopia, 2011).

According to the strategy, Ethiopia's greenhouse gas emissions were about 150 megatonnes CO_2 equivalent in 2010. Under a business-as-usual development strategy, these emissions are projected to more than double to 400 megatonnes CO_2 equivalent by 2030. REDD+ implementation is expected to significantly aid the

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3.   "Income" is defined here in its national accounting sense as value added associated with production activities. "Value added" and "GDP" are also used here to refer to the same income concept.

4.   REDD (Reducing Emissions from Deforestation and Forest Degradation) is a multilateral mechanism that emerged in 2008 to provide financing for developing country activities that lead to verified reductions or removals of greenhouse gas emissions resulting from deforestation and other forms of forest degradation. REDD+ is an enhanced version of the mechanism that includes sustainable management of forests, conservation and enhancement of forest carbon stocks. In 2013, the international community agreed to the details of REDD+. Under what is commonly known as the Warsaw Framework, procedures for implementation of REDD+ activities, including results-based payments are now in place.

country in reaching its development goals while maintaining greenhouse gas emissions at close to current levels.

The impacts of human activities on forests contribute significantly to Ethiopia's emissions. Forest-related emissions amounted to almost 55 megatonnes CO_2 equivalent in 2010, driven by deforestation for agricultural land (50% of all forestry-related emissions) and forest degradation due to firewood consumption (46%) as well as formal and informal logging (4%). These are among the main direct drivers of deforestation and forest degradation.

The CRGE Strategy recognizes that deforestation and forest degradation must be reversed if the country is to meet its development goals. Wood fuel accounts for more than 80% of household energy supply in Ethiopia and is particularly important in rural areas. Beyond wood fuel, forests provide other timber products and a host of valuable non-timber products, including livestock fodder, coffee and honey. Forests are also the source of essential ecosystem services, including carbon sequestration, crop pollination, conservation of agricultural soils and control of water discharge to streams and rivers.

Despite their economic and ecological importance, Ethiopian forests are under threat today and the country's growing population will require more wood fuel and food in the future. These demands, in turn, could significantly accelerate deforestation and forest degradation. Projections in the CRGE Strategy indicate that without action to change the country's development path, 90 thousand square kilometers (56% of total forest area) might be deforested between 2010 and 2030. Over the same period, annual wood fuel consumption could rise by 65%.

Figure 1: Forest cover of Ethiopia
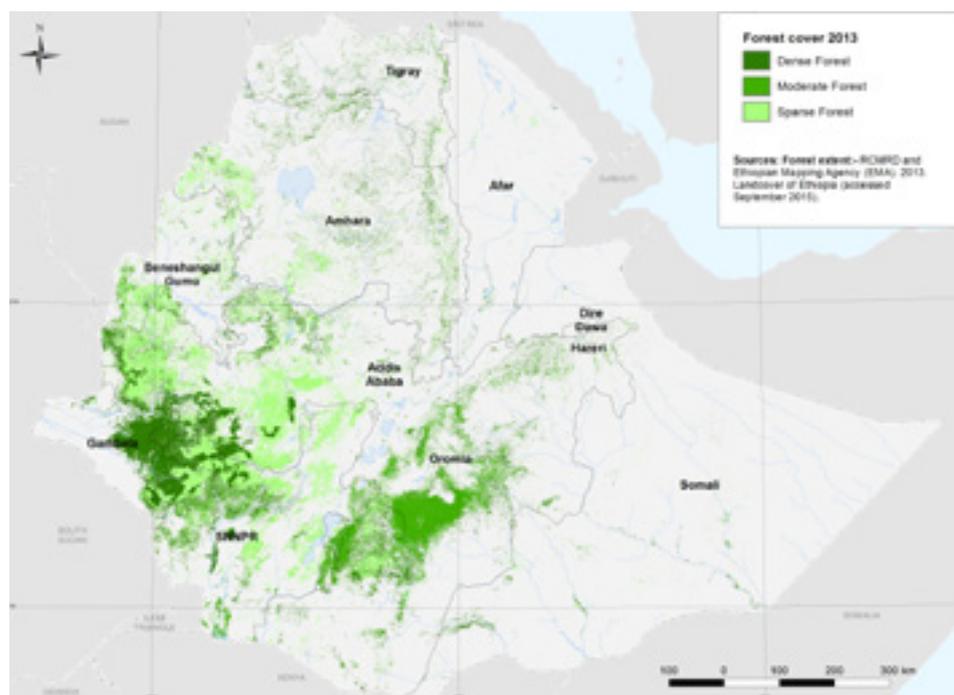
To avoid these negative consequences, the CRGE Strategy prioritizes several initiatives to develop more sustainable forestry and agricultural practices.

- Intensification of agriculture through use of improved inputs and better management of crop and animal residues, resulting in a decreased requirement for additional agricultural land that would be taken primarily from forests.
- Expand agricultural activities on degraded lands through increased irrigation.

- Reduce demand for wood fuel through dissemination of more efficient wood and/or alternative-fuel stoves.
- Promote afforestation, reforestation and improved forest management activities to increase carbon sequestration in forests and woodlands.

SCOPE AND METHODOLOGY OF THE ASSESSMENT

The assessment of forest-derived income was carried out for Ethiopia as a whole. No effort was made to compile sub-national estimates. The focus was on all forests within the country and on all important ecosystem goods and services they provide. The following forest ecosystem goods and services were assessed:

- Provisioning goods and services
  - Timber products
  - Firewood/charcoal
  - Non-timber forest products
    - Livestock fodder
    - Coffee
    - Honey
    - Beeswax
    - Medicinal plants
    - Gums and resins
    - Spices
    - Thatch
    - Wild meat
    - Wild edible plants
    - Civet musk
    - Silkworm cocoons
    - Dyes and tannins
- Regulating services
  - Carbon sequestration
  - Pollination
  - Water flow control
  - Soil erosion control
  - Reservoir sedimentation control
- Cultural and recreational services
  - Protected-area tourism
  - Trophy hunting
  - Non-use benefits

The economic value measured in the assessment was, as noted above, the annual contribution of forest ecosystem goods and services to market and non-market income flows. No effort was made to calculate the stock value of Ethiopia's forests as natural assets. Nor was any effort made to assess the sustainability or distribution of current income flows and it is possible that some forest-derived income today is based on unsustainable or inequitable production of forest ecosystem goods and services.

The assessment was carried out mainly via desk research by an international team of research consultants. Previously existing data were used exclusively. The assessment benefited, however, from the results of a large household survey that assessed the importance of forest ecosystem goods and services to rural Ethiopian households conducted in parallel with this project (Yimer, 2016). The assessment also benefited from modelling of forest pollination and soil erosion control services undertaken by the UNEP World Conservation Monitoring Centre (UNEP-WCMC).

Ethiopian experts also contributed to the analysis through corroboration of assumptions made in the assessment. Access to experts was facilitated by the Ministry of Environment and Forests and by the national consultant responsible for the above-mentioned rural household survey (Dr. Tesfaye Yimer). Advice on the methods, data and assumptions used in the assessment was also gained during a project scoping workshop held in Addis Ababa in April 2015.

The concepts and methods used in the assessment were consistent with the established literature on ecosystem valuation and with the standards for national economic and environmental accounting set out by the United Nations in the *System of National Accounts 2008* (European Commission *et al.*, 2009), the *System of Environmental-Economic Accounting – Central Framework* (United Nations *et al.*, 2014a) and the *System of Environmental-Economic Accounting – Experimental Ecosystem Accounts* (United Nations *et al.*, 2014b).

Overall, the assessment faced no serious limitations and the results are felt to be reliable given the level of accuracy that can reasonably be expected of ecosystem valuation.

DISCUSSION OF RESULTS

Overall, the results of the assessment show that Ethiopian forests generate greater economic benefits than previously thought. Until now, the common understanding, based on measured GDP statistics, had been that about 4% of national income was attributable to forests (the exact share was estimated (MOFED, 2015) to be 3.8% in 2012-13). The more comprehensive assessment undertaken here shows that this figure is about 12.9% (not counting the non-market benefits associated with forest preservation). The gap between these two figures is explained by several factors.

- **Attribution of forest-derived income to non-forest industries in GDP.** Forests provide benefits to economic activities that appear in the national accounts as income in non-forest industries. In particular, forests are the source of major income flows that are attributed in GDP to the agriculture industry. The fodder that livestock farmers obtain freely by allowing their animals to graze on forest land is particularly important in this regard. Since animal feed is the only major intermediate input into livestock rearing and this input is obtained free of charge by many Ethiopian farmers, the value added of the livestock agriculture industry is considerably larger than it would be in the absence of forest-derived fodder. The value added of forest-derived fodder estimated here for 2012-13 (29.9 billion ETB; USD4.5 billion) equates to 36% of the value added of livestock agriculture as reported by the Ethiopian Ministry of Finance and Economic Development (MOFED, 2015). Other important income flows found in this assessment to be attributed to non-forest industries are:
  - the value added of forest soil erosion control (6.6 billion ETB; USD996 million; attributable to crop agriculture)
  - the value added of forest pollination services (5 billion ETB; USD752 million; attributable to crop agriculture), and
  - protected area tourism (850 million ETB; USD127 million; attributed to hotels and restaurants, travel and communications and public administration).
- **Underestimation of forest-derived benefits in GDP** – A considerable portion of forest income benefits are in-kind benefits associated with the subsistence use of forest goods and services. The value added of wood fuel production, for example, provides very large in-kind income benefits because many households collect wood fuel themselves rather than purchasing it in the market. MOFED's estimate of the value added of wood fuel in 2013-13 is 25.5 billion ETB (USD3.82 billion) compared with an estimate of 39.1 billion ETB (USD5.9 billion) here. The majority of this difference is due to the exclusion of in-kind income from subsistence use of fuel wood in MOFED's estimate.

  In other instances, MOFED's figures understate forest income because they are unable to include estimates for production that takes place outside of the observed economy (for example, illegal harvesting of wood). This is particularly the case with roundwood production, where MOFED estimates value added in 2012-13 to have been 4.1 billion ETB (USD615 million) compared to 12.7 billion ETB (USD1.9 billion) here. A substantial (but unmeasurable) portion of this difference is due to the inclusion of an estimate of illegal production (the remainder is due to underestimation of in-kind household income benefits from roundwood production).
- **Gaps in GDP** – In a few cases, the income flows associated with forests goods and services are not captured at all in GDP as currently measured. However, none of these is economically important.

Figure 2 below summarizes the findings of the assessment in terms of the contribution of forests to various types of income in 2012-13. The blue bar on the left represents the contribution of forests to national income attributed to the forest industry, estimated here to be 6.09% of measured GDP (52.8 billion ETB; USD 7.9 billion). Of this, about 27% is estimated to have been cash income to producers in the forest sector (including households that produce forest products such as fuel wood). The remaining 73% is in-kind income to households that produce and consume their own forest products.

The light blue bar on the left represents the official MOFED (2015) figure for the value added of the forestry sector of 3.8% of GDP (30.4 billion ETB; USD4.6 billion), which is presented here for comparison's sake. As can be seen, the results of the assessment undertaken here suggest that MOFED's estimate is considerably too low. The reasons for this are discussed further below.

The red bar in the middle represents the income associated with production of forest ecosystem goods and services but attributed in the ESNA to non-forest industries, the vast majority of which is income associated with the agriculture industry. This income is estimated here to equal 6.77% of measured GDP. It includes income that is measured directly in GDP (such as the value of forest coffee production, which is part of measured value added of the crop agriculture industry) and that measured implicitly in GDP (such as the value of forest-derived fodder production and crop pollination services). Most of the income represented by the red bar is already included (explicitly or implicitly) in MOFED's official estimate of GDP, though the results of the assessment undertaken here suggest that MOFED's estimates of the value added of medicinal plant and thatch production are too low. In addition, MOFED makes no estimate at all for the value added of wild spice, meat or plant production.

The sum of the blue plus red bars represents the total estimated value added of forest-ecosystem goods and services production. In 2012-13, this production is estimated to have contributed 111.2 billion ETB (USD 16.7 billion), or 12.86% of measured GDP, to the Ethiopian economy.

The green bar on the right represents the non-market income benefits associated with Ethiopian's willingness to pay to preserve the nation's forests. The green bar is not directly comparable with GDP due to conceptual differences and therefore is presented separately.

Figure 2: Summary of forest contributions to the national economy, 2012-13
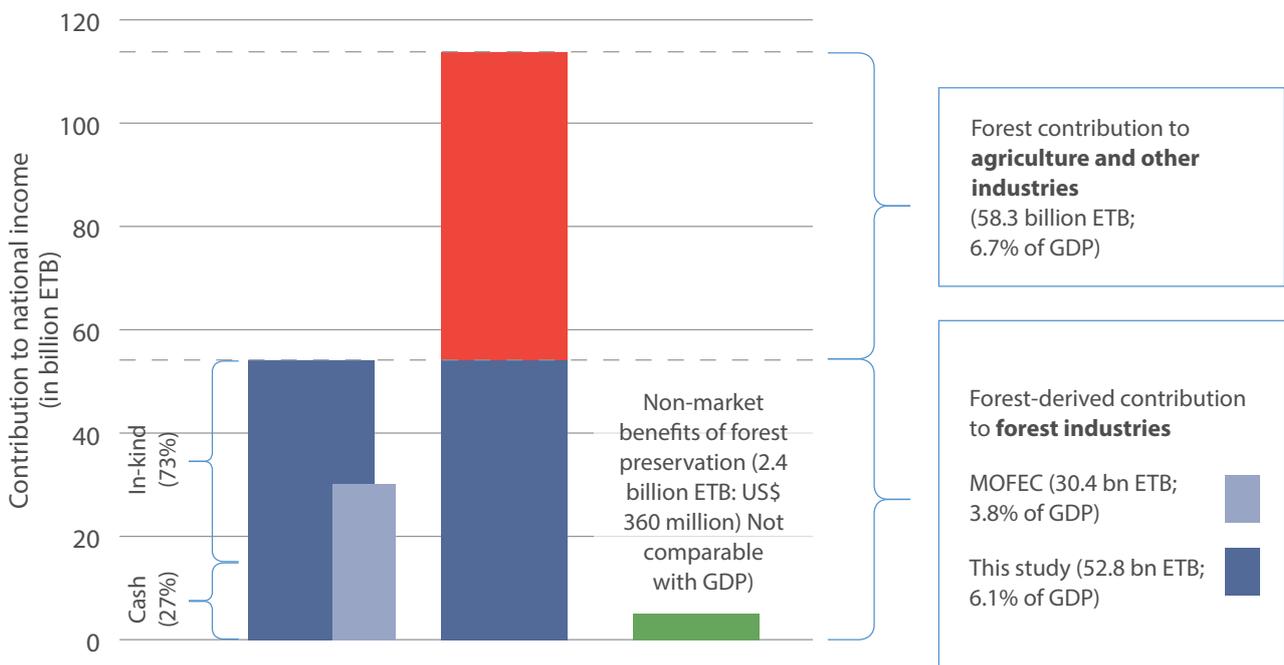
The overall results of the assessment are summarized in Table 1 below.

Table 1: Summary of results

Good/service	Contribution to national income, 2012-13			Currently measured in Ethiopian SNA?				Income type			
	million ETB	million USD	Share	Yes		No		Direct		Indirect	Non-market
				Directly	Implicitly	Data gap	Out of scope	Cash share	In-kind share		
1. Provisioning goods and services											
1.1. Timber forest products											
1.1.1. Wood fuel	39,078	5,858	4.52%	Forestry				18%	82%		
1.1.2. Roundwood	12,700	1,904	1.47%	Forestry				53%	47%		
1.1.3. Bamboo	172	26	0.02%	Forestry				15%	85%		
Total, timber forest products	**51,950**	**7,788**	**6.01%**								
1.2. Non-timber forest products											
1.2.1. Livestock fodder	29,900	4,482	3.46%		Livestock agriculture					X	
1.2.2. Coffee	12,060	1,808	1.39%	Crop agriculture				99%	1%		
1.2.3. Honey	1,400	210	0.16%	Livestock agriculture				77%	23%		
1.2.4. Beeswax	191	29	0.02%	Livestock agriculture				100%	0%		
1.2.5. Medicinal plants	1,230	184	0.14%	Crop agriculture				44%	56%		
1.2.6. Gums and resins	175	26	0.02%	Forestry				91%	9%		
1.2.7. Spices	310	46	0.04%	Crop agriculture				56%	44%		
1.2.8. Thatch	706	106	0.08%	Forestry				12%	88%		
1.2.9. Wild meat	461	69	0.05%			X		9%	91%		
1.2.10. Wild edible plants	257	39	0.03%			X		22%	78%		
1.2.11. Civet musk	0.4	0	<0.01%			X		100%	0%		
1.2.12. Silkworm cocoons	0.5	0	<0.01%	Livestock agriculture				n/a	n/a		
1.2.13. Dyes and tannins	n/a	n/a	n/a			X		n/a	n/a		

Item					Beneficiaries					
Total, non-timber forest products	**46,691**	**7,000**	**5.40%**							
Total, provisioning goods and services	**98,641**	**14,788**	**11.41%**							
2. Regulating services										
2.1. **Carbon sequestration**	2.8	0	<0.01%			X		100%	0%	
2.2. **Pollination**	5,013	752	0.58%		Crop agriculture					X
2.3. **Water flow control**	n/a	n/a	n/a		Crop agriculture, electricity and water					X
2.4. **Soil erosion control**	6,647	996	0.77%		Crop agriculture					X
2.5. **Reservoir sedimentation control**	n/a	n/a	n/a		Crop agriculture, electricity and water					X
Total, regulating services	**11,663**	**1,748**	**1.35%**							
3. Cultural and recreational services										
3.1. **Protected-area tourism**	850	127	0.10%		Hotel and restaurant, travel and communication, public administration			100%	0%	
3.2. **Trophy hunting**	19	3	<0.01%		Hotel and restaurant, travel and communication, public administration			100%	0%	
Total, cultural and recreational services	**869**	**130**	**0.10%**							
Grand total, forest-derived goods and services	**111,173**	**16,666**	**12.86%**							
Non-use forest benefits*	2,400	360	n/a				X			X

*Non-use benefits are not included in the total because they are conceptually inconsistent with the other values reported. Non-use benefits were measured using the results of willingness-to-pay surveys that result in the inclusion of consumer surplus in the estimate. All other values were measured on the basis of market prices, which exclude consumer surplus.

The results of the assessment show that, of the goods and services considered here, the provision of forest-derived products made the greatest contribution to national income in 2012-13. The most important forest product was wood fuel (39.1 billion ETB; USD5.9 billion; 4.5% of GDP), followed very closely by livestock fodder (29.9 billion ETB; USD4.5 billion; 3.5% of GDP). The importance of these products results from their widespread use in the economy and, in the case of fodder, the importance of agriculture as a component of GDP. The income associated with fodder is not currently measured directly in GDP, though it is implicitly included as part of the value added of the livestock agriculture industry. The value of wood fuel production, on the other hand, is directly measured as part of GDP, though the findings here suggest that it is substantially undervalued due to an incomplete accounting of subsistence use by households in the GDP estimate prepared by MOFED. MOFED estimates the value added of wood fuel production in 2012-13 to have been 25.5 billion ETB, or 65% of the value estimated in this study.

Following fodder and wood fuel, roundwood production made the next most important contribution to income (12.7 billion ETB; USD1.9 billion; 1.5% of GDP). Roundwood is used by households to meet needs for construction materials, tools and furniture. It also serves as a raw material for the production of processed wood products like sawn lumber and plywood. About half of the income derived from roundwood is in-kind income resulting from subsistence use by households. A sizeable (but unmeasurable) share of this income is the result of illegal and/or unreported harvesting of roundwood. As with wood fuel, the findings here suggest that MOFED's estimates of roundwood value added are too low due to incomplete accounting for illegal/unreported roundwood production and household subsistence use of it. MOFED estimates the value added of roundwood production in 2012-13 to have been 4.1 billion ETB, or 31% of the value estimated in this study.

The next most important forest-derived product is coffee, which is estimated here to have generated 12 billion ETB of income in 2012-13 (USD1.8 billion; 1.4% of GDP). Nearly all coffee income is cash income to the farmers that produce it; just 1% is in-kind income associated with subsistence consumption of coffee. Coffee is directly measured in GDP, though no estimate is produced by MOFED specifically for forest-derived coffee.[5] Rather, it estimates the value added of coffee in general (forest-derived plus non-forest) and reports this as part of the value added of "stimulants". Though it is not possible to compare the estimate of forest-derived coffee value added with any of MOFED's published figures, none of the results of this assessment suggest that MOFED's estimates of coffee value added fail to capture forest-derived income.

Of the remaining forest products considered in this assessment, honey/beeswax, wild medicinal plants and thatch for roofing on traditional houses are the most important. Together, they accounted for about 3.5 billion ETB in income in 2012-13 (USD530 million; 0.4% of GDP). When compared with MOFED's estimates, forest-derived honey appears to be fully captured in GDP as currently measured. Thatch appears to be somewhat undervalued in GDP currently and wild medicinal plants appear to be significantly undervalued in MOFED's estimate. It is worth noting that none of these products contributes significantly to national income overall, so any errors in their estimation in the ESNA will not have major consequences for the size of measured GDP or its growth rate.

The remaining forest-derived products (gums and resins, spices, wild meat and edible plants, civet musk, silkworm cocoons, and dyes and tannins) are all estimated to make small contributions to national income. Combined, they are found here to have generated about 1.2 billion ETB in income in 2012-13 (USD174 million; 0.1% of GDP). Except in the case of gums and resins (which are mostly sold for cash income), these products result mainly in in-kind income from subsistence use by households.

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5.   Though the majority of coffee produced in Ethiopia is considered forest-derived, some coffee plantations exist outside of forested areas.

After forest products, forest regulating services made the next largest contribution to national income. The control of soil erosion on cropland (6.6 billion ETB; USD996 million; 0.8% of GDP) and pollination of agricultural crops by forest insects (5 billion ETB; USD752 million; 0.6% of GDP) both made significant contributions. Neither the value of the forest water-flow control service nor the value of sedimentation control in reservoirs could be estimated based on available data. MOFED does not estimate the value of any of these services directly in GDP, though their values are implicitly included in the value added of the agriculture and utility industries that use them.

Cultural and recreational services are estimated to have made the smallest contribution overall to national income. Tourism to Ethiopia's protected areas is estimated to have generated 850 million ETB in 2012-13 (USD127 million; 0.1% of GDP), all of which is cash income flowing to the hotel and restaurant, travel and communications, and public administration industries. The contribution of Ethiopia's small trophy hunting industry is found to be negligible.

In addition to these recreational benefits, the value of preserving Ethiopia's forests as a source of well-being for its citizens is found to have benefits equivalent to 2.4 billion ETB (USD360 million). This benefit is not conceptually coherent with GDP and therefore is treated as a separate category here.

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