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Development of Forest Valuation Systems Malawi

Policy Briefing Report

March 2013

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To obtain copies of this report or any others produced as part of this assignment, please contact the Malawi Department of Forestry. Copies of all products of this project, including the spreadsheet containing the calculations may also be obtained at www.joyhecht.net/MalawiForests.html.

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List of Acronyms

DoF	Department of Forestry
EU	European Union
FTE	full-time equivalent
GDP	Gross Domestic Product
GNI	Gross National Income
Ha	hectare
IFMSLP	Improved Forest Management for Sustainable Livelihoods Programme
IHS	Integrated Household Survey
ISIC	International Standard Industrial Classification
Kg	kilogrammes
MAI	Mean annual increment
NDP	Net Domestic Product
NSO	National Statistical Office
REDD+	Reducing emissions from deforestation and forest degradation (REDD+ goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks)
SEEA	System of Economic and Environmental Accounts
SNA	System of National Accounts
TEV	total economic value

Executive Summary

Over the past 20 years, Malawi's forests, like those of many African countries, have been subject to significant degradation. The Malawi Department of Forestry (DoF), facing significant challenges in managing these resources, has initiated an analysis of their contribution to the economy, carried out between January and March, 2013 with European Union support through the Improved Forest Management for Sustainable Livelihoods Programme. The work focuses on three related but distinct economic values; the contribution of the forest sector to gross and net domestic product (GDP and NDP), the total economic value (TEV) of the forests, and the contribution of forests to livelihoods.

The results of the analysis are striking. Where the published national accounts statistics calculate forest sector value added at about 8.7 billion kwacha (in adjusted 2010 currency), or just under 1% of GDP, this work puts that contribution closer to 75 billion kwacha, or 8% of GDP. The differences result from inclusion of several major income sources that have not yet been part of the published accounts. By far the most important is the household consumption of fuelwood, which contributes about 65 billion kwacha to gross value added. Other much smaller contributions come from household businesses in the forest sector, value added in provision of fuelwood to institutions and industries, especially brick manufacture, and non-timber forest products. While charcoal also is certainly an important contributor, the available data did not permit estimation of its value.

These increases to GDP come at a cost in the form of depreciation of the country's forest assets, which must be subtracted to calculate NDP. The depreciation of natural forests was valued at 30 billion kwacha, leaving NDP of 45 billion kwacha, still much higher than the official estimates. Due to data limitations, it was not possible to estimate depreciation of plantations; this will reduce the estimates of NDP but will still leave a value far higher than current official statistics.

These calculations were carried out in close collaboration with the National Statistical Office (NSO), which constructs the national accounts. They are working with some of the same data sources that were used for this study, particularly the Third Integrated Household Survey, and were very much interested in how this analysis used those data. They expect to revise their routine calculation of forest value added using input from this work.

The analysis of total economic value is broader than the value added calculations, but because it is not a standardized measure, the results carry less weight. Beginning with NDP, the analysis added in output of other sectors heavily dependent on forests, some multiplier effects, and a lower-bound figure that is related to the benefits of watershed protection. This led to a TEV figure of about 73 billion kwacha. This does not include a full estimate of the watershed services provided by forests. While marginal changes in those services can be valued without great difficulty, valuing the entire flow of watershed services at the national level is conceptually very unclear, and was not attempted by this study because the results would not be credible.

The analysis showed that forests contribute greatly to household wellbeing. Some 33 thousand jobs (full-time equivalents) are heavily dependent on the existence of Malawi's forests, 75% of them in household businesses. Those jobs pay much more than the country's per capita gross national income (GNI); those in household businesses pay fully seven times GNI. Moreover, household use of fuelwood provides a very significant contribution in kind to incomes. Approximately 2.8 million households depend primarily on fuelwood for cooking, and the average value of their consumption is almost 23,000 kwacha per year. This is worth 45% of GNI per capita, and is going to the lowest income households in the country; thus this energy source constitutes a massive transfer of resources to poor households across the country.

Several clear recommendations come out of this work:

- The Ministry of Economic Planning and Development and the Department of Forestry should work with the National Statistical Office to ensure that they are able to adopt the latest forest accounting practices on a routine basis, so that the methods used in this study will be the basis for the published national accounts.

- The Department of Forestry, in collaboration with NSO, is encouraged to strengthen its data collection in order to have more reliable data for future studies of this kind. Such work should focus on household fuelwood and charcoal, because they are by far the largest values in the study and the results are highly sensitive to imprecision in those data. DoF is also encouraged to build more effective management of its own operational data on forest revenues and use, to permit analysis of the depreciation of the plantations and to address other policy questions.

The conceptual problems that kept this study from valuing the watershed services of forests at the national scale mean that it is essential to take an integrated approach to forest and water management. All stakeholders working on natural resources issues must recognize that these are challenges that cannot be overcome through independent action of disconnected agencies; everyone must work together to ensure that resources are used wisely and are protected for future generations.

1 Introduction

Over the past 20 years, Malawi's forests, like those of many African countries, have been subject to significant degradation. The Malawi Department of Forestry is facing significant challenges in managing these resources, especially in a context of declining public sector support for forestry and a perception that the sector has little to contribute to the economy or to the wellbeing of the population.

In response, the Department of Forestry (DoF) has initiated an analysis of the contribution of forest resources to the economy, carried out between January and March, 2013 by a consultant team working through Cardno Emerging Markets (UK) Ltd. The work is carried out in the context of the European Union (EU) funded Improved Forest Management for Sustainable Livelihoods Programme (IFMSLP). The aim of this assignment is to organize the data and carry out the analysis needed to calculate three different measures of the role of forests in the economy.

This policy brief presents the major results of that study. The study focuses on three distinct economic values, which are closely related but not the same. The first is the contribution of the forest sector to GDP and NDP. This is probably most important of the three components, because it is the one used by the Government of Malawi in making decisions about importance of different sectors of the economy and the resources allocated to working with those sectors. Published national accounts data give the forest sector a very small share of total economic output. The 2007 accounts, the most recent year for which finalized results are available, estimates the sector's output at 4.797 billion kwacha, less than one percent of GDP. While sector output was projected to rise to 6.579 billion 2007 kwacha by 2010, it still accounts for less than one percent of GDP.[1]

The construction of forest accounts – the portions of the national accounts that address the contribution of this sector to the economy – has been the subject of extensive study. The challenges of correctly including forests in the accounts were brought to light in the 1980s after publication of a seminal study of the Philippine economy, which pointed out that if trees were overharvested, the consequent decreased value of the remaining forests had to be deducted from GDP as depreciation.[2] Subsequent work on environmental accounting drew attention to the need to include the value of non-marketed environmental products, such as gathered fuelwood and non-timber forest products.[3] Refinements of industrial classification systems recognized artisanal charcoal production as an activity of the forest sector, whose value should be quantified in the national accounts. All of these developments suggest changes that may be called for in Malawi's national accounts, which are expected to increase the estimated contribution of the sector to the economy as a whole.

A major portion of this study has therefore focused on developing new estimates of the economic output of Malawi's forests, following standard methods for national accounting and environmental accounting that have been developed through the United Nations Statistics Department.[4] This work has been carried out in close collaboration with the National Statistics Office (NSO), specifically with those directly responsible for calculating the forest sector's contribution to GDP. NSO is well aware that their current methods are not as

1 Values at http://www.nsomalawi.mw/index.php?option=com_content&view=article&id=150%3Agdp-by-activity-in-2007-constant-prices-in-mk-million&catid=10&Itemid=54; percents calculated from data on that site.
2 Repetto 1989
3 Hecht, 2005
4 The UN Statistics Department is the international body that coordinates development of methods for national income accounting in general, and, through the work of a committee called the London Group, for environmental accounting. The manuals for the system of national accounts (SNA) and the System of Economic and Environmental Accounting (SEEA) may be found at their website, the SNA at https://unstats.un.org/unsd/nationalaccount/pubsDB.asp?pType=2 and the SEEA at https://unstats.un.org/unsd/envaccounting/seea.asp.

complete as they could be, and that the resulting estimates are too low. They are very much interested in opportunities to improve this portion of the national accounts in the future.

A second measure addressed by this study is what is referred to as the total economic value of the forests, or TEV. TEV is a concept in environmental economics first developed by David Pearce, a leading thinker in the field of environmental economics.[5] It refers to the effort to understand the economic role of the environment by summing four broad elements; the direct use of environmental goods and services, indirect use of the environment, option value, and existence value:

- Direct use is the value of products of the environment, whether they are sold in markets or gathered from nature. In Malawi this means timber, fuelwood, charcoal, non-timber forest products, tourism, and perhaps other items.
- Indirect use includes the value of so-called ecosystem services; in Malawi this primarily includes watershed protection.
- Option value is the willingness to pay for possibility of using the resource even if not actually used. For example, e.g. people might be willing to pay for biodiversity conservation because they might find a use for plants that right now they wouldn't know what to do with.
- Existence value is the willingness to pay for environmental resources to exist, even if they will never be used. For example, Europeans might be willing to contribute to conservation of forests that they will never visit.

The methods for calculating TEV are not standardized in the way that forest accounts are. This gives great flexibility in how this part of the work can be done; at the same time it means that the results are less credible than national accounts figures, precisely because they do not have a standard meaning. Like most work on TEV, this study considers direct and indirect uses of the forests, but does not address option or existence values.

The third component of this study focuses on how Malawi's forests contribute to the livelihoods of its citizens. Like TEV, this is not a precisely defined measure. The study has focused on quantifying several key issues:

- how many people (or households) earn a living from forest-related activity;
- how much they earn;
- the value of resources that are gathered in the environment; and
- how many households depend on such resources.

With these three measures at their disposal, and with a thorough understanding of what they mean and how they were calculated, the Department of Forestry will be in a stronger position to argue clearly for the importance of the sector both to the overall economy and to the well-being of many Malawian citizens, particularly many of the poorest citizens in the country. This should help the Department obtain more support for forest conservation and development, to the benefit of the whole country.

2 Calculation of Forest Contribution to GDP and TEV: Stocks vs. Flows

The measurement of economic values can take two distinct forms; measuring stocks or measuring flows. A stock is a measure of wealth or assets, whether it be the wealth of an individual (their savings, the value of their home, and so on); the value of the productive assets of a business (the machinery it uses to manufacture items for sale); or the total value of a country's assets. A flow, in contrast, is the income accruing to that system – a person's

[5] See, for example, Pearce and Moran 1994

salary plus the interest on their assets; the income flowing to the business from the sale of the items it manufactures; the income generated in the economy as a whole.

GDP, and the other entries in the national income accounts, are measures of flows; the accounts track the income of the country rather than its total wealth. The calculation of GDP builds in changes in the country's wealth (that is, depreciation or appreciation in the value of its assets), but does not include the total value of those assets. TEV is less precisely defined than GDP, so it could be understood either as a stock or as a flow value. However it is usually measured in flow terms. In order to make the comparison of TEV and the contribution of forests to GDP clear, this study takes the same approach, measuring the total benefits obtained from Malawi's forests in a single year rather than estimating their value in asset terms.

The decision to value flows rather than stocks means that the study focuses on how forest resources were used, or the services they provided, in a specific year. This is not a cost benefit analysis; there are no assumptions or options for future policy choices embedded in the study or the values it calculates. The study values the goods and services provided by standing forests in one year, without making any predictions as to how they might be valued in the future, what markets might exist for their products down the road (e.g. for REDD+), how prices could change in the future, or how the forests might be degraded or improved as a result of future policies or development projects.

3 Choice of Base Year

When valuing flows rather than stocks, a base year must be chosen. If data actually apply to a different year, they may need to be adjusted in order to estimate their value for the base year chosen, if that is possible. Two different base years were considered, 2010 and 2012. Two of the key data sources used for this work, the Third Integrated Household Survey (IHS) and the Forest Resources Mapping spatial data on land use/land cover, were collected for a base year of 2010. This is a compelling argument for using 2010 as the base year.

On the other hand, the fees assessed by the Department of Forestry for the use of the forest products under its jurisdiction were substantially increased effective the beginning of 2011. The change in these prices has significant implications for revenues from government plantations and for assessment of the value of a number of forest goods and services. Estimating the value of the forests based on earlier prices for forest products may not make sense if the results are to be used in a post-2012 economic climate. This argues for updating the household survey and land use / land cover data to 2012, and choosing that as the base year for the study.

However, some key Department of Forestry data for all of 2012 were not available at the time of this study, due to lags in reporting or in tabulating the data. Therefore while it could make sense to carry out the study based on the new prices, in fact this was not possible. Consequently, the calculations have all been carried out for the base year of 2010. Once 2012 DoF revenue data are available, this work can be updated if desired.

4 Calculating GDP: Forest Income

This study sought data about several categories of forest-related value added and wood use:

- Department of Forestry revenues from plantation forests
- Department of Forestry revenues from indigenous forests
- Value of fuelwood gathered by households for their own use
- Value of charcoal production, and use of charcoal by households and businesses

- Value added from household businesses in the forest sector
- Value of fuelwood consumed by businesses (as a proxy for value added by those supplying wood to businesses)
- Value of gathered non-timber forest products

Table 1: Basic Structure of the Calculation of Value Added in the National Accounts

	Revenue
less	Intermediate consumption (material inputs, services purchased, etc.)
less	Subsidies
equals	Gross Value Added (or contribution to GDP)
less	Consumption of fixed capital (that is, depreciation of productive assets)
equals	Net Value Added (or contribution to NDP)
Less	Compensation of employees (wages, salaries, and benefits)
Equals	Net operating surplus (or profit)

This policy brief does not detail the data sources and calculations; those who are interested may consult the technical report and the spreadsheets in which the calculations were done, which are available from the Department of Forestry. A simple explanation of how the national accounts calculate the value added in each sector of the economy is essential, however; this is shown in Table 1. The gross value added of a sector (i.e. its contribution to GDP) is equal to the revenue from the sector, less the cost of goods and services purchased and any subsidies received. Thus value added is roughly equivalent to salaries plus profits. Net value added, or contribution to NDP, is gross value added less the depreciation of capital assets. Net value added less salaries gives net operating surplus, or the profit of the sector. This framework is important to understand which values are included in estimates of forest sector contributions to GDP and NDP, and which are part of TEV.

The components of forest sector NDP are summarized in Table 2, in thousands of current kwacha; each component is discussed below.

Plantation revenue: This figure covers the period from July 2010 to June 2011, and includes the revenues from sale of plantation logs and firewood, plus royalties and concession fees. This is treated by the NSO as value added, without deducting any intermediate consumption, so we have done the same.

Depreciation of plantations: Depreciation, for forests, is a measure of how actual harvests relate to sustainable yield. If harvests exceed sustainable yield, then the asset will be depleted, and future yields will be lower than they are now. In the case of the Malawian plantations, this should be measured by comparing the areas of forest clear-cut with the areas replanted. If replanting is not sufficient to replace what has been cut, the forest should be depreciated by the difference between the two. However, data were not available to determine current harvest and replanting. We made some calculations using other methods but the results were quite inconclusive in light of information from other sources indicating that the plantations are being cut rapidly without replacement. Therefore this table shows that no value is available.

DoF revenues from indigenous forests: This quite modest amount, which includes royalties on sales of indigenous logs.

Household use of gathered fuelwood: As immediately jumps out of the table, this is an extremely large value, accounting for 85% of gross value added. It was calculated based on data in the Integrated Household Survey, which asks households what their main fuel is, what share of their consumption is purchased, and what their consumption would cost them

if they had to purchase all of their wood. The responses to those questions are used to estimate the value of both gathered and purchased fuelwood for household use.

The numbers involved are very large. Of 3,072,525 households surveyed, 2,370,364 reported that gathered wood was their primary cooking fuel, while another 323,078 primarily depend on purchased wood. On average, they report the value of their wood consumption to be 458 kwacha per week. There is clearly much uncertainty in these values, especially when households that never buy wood are asked to estimate how much it would cost if they bought it. These uncertainties are magnified by the number of households involved and by converting from weekly to annual values. A 10% margin of error would change the contribution of the forest sector to GDP by over six billion kwacha – almost the entire value of the sector in the official statistics. This means that future work to improve statistics on use and value of forest resources should place primary attention in this area, because the consequences of error are so great.

Table 2: Components of Forest Sector (ISIC 02) Net Domestic Product

Item	Contribution to Value Added	Source / Discussion
Plantations:		
DoF Plantation revenue	299,864	DoF revenues from firewood, log sales, license fees, and concessions. Data were provided by the DoF. They cover the period from July 2010 to June 2011; data for January-June 2010 were not available
Less Depreciation of Plantations	not available	All evidence indicates that plantations are being harvested at an unsustainable rate; however the available data did not enable us to calculate it
Use of natural forests:		
Department of Forestry revenues from natural forests	32,264	DoF royalties on indigenous timber sales (from natural forests). Data provided by the DoF, covering July 2010 to June 2011
Household use of gathered fuelwood	63,375,930	Data from the Integrated Household Survey; this is the gathered share of the national total of what households would have spent on fuelwood had they purchased all that they consume
Household fuelwood purchases	4,285,134	This value, calculated based on IHS data, captures the value added of those who sell wood to households
Household charcoal consumption	not available	See discussion in technical report about the problems with charcoal price data in the IHS
Charcoal consumption by business		
Value added from household forest-based businesses	97,049	Data from the Integrated Household Survey
Provision of wood to institutions and industry (from which value added from household forest-based businesses has been subtracted)	6,698,556	Data on wood use by institutions and industry come from several sources; it is valued using the government's price per m3 for indigenous firewood
Bamboo and poles	22,181	Data from the Integrated Household Survey; this includes both gathered and purchased consumption of these products
Grasses for thatch	52,240	
Gross Value Added	**74,863,217**	**Sum of the previous items**
Less depreciation of natural forests	(30,090,210)	See discussion in Section 5 of this paper
Net Value Added, ISIC 02	**44,773,008**	**Contribution of the forest sector to NDP**

Charcoal consumption: Data are not available on the value of charcoal. The IHS tells us that 272,406 households primarily cook with charcoal, and asks how many households use charcoal in case of a power outage. Unfortunately that result is inconsistent; the number using charcoal in case of blackout is more than twice the number of households that report

having electricity in the first place, which suggests some questions were misunderstood. Moreover, the reported charcoal expenditure by households using it in case of a blackout is more than six times the expenditure by households using it all the time, which is also totally inconsistent. As a result, it is not possible to estimate the value of charcoal consumption. The NSO came to the same conclusion in their calculations from the IHS; they also do not have any monetary values for charcoal. This item is maintained in the table as a placeholder, to remind us that we are missing a value that would increase the contribution of forests to GDP.

While the total value of charcoal will be much lower than that for fuelwood, since so many fewer households depend on it, it is of great importance locally and its production has significant environmental impacts. Improving data in this area is therefore quite important.

Household businesses: The IHS provides data on sales, intermediate consumption, and employment in household businesses, organized by industrial sector; by subtracting intermediate consumption from sales, we can estimate value added. The survey specifically identifies those businesses that depend on forest products, including not only actual logging activity, but also sawmilling, furniture making, trade in forest products, and other sectoral activity dependent on forests. Value added from the portion that actually falls within the forestry sector is included here in GDP; this is a fairly small value.

Provision of wood to institutions and industry: A mix of sources enable us to estimate wood consumption by schools and other residential institutions, brick-making, ceramics, tobacco curing, and a few other key industries. We have priced this wood at the 2011 government price for indigenous firewood in order to estimate the value added generated by those who supply it. Because the account already includes the value added by household businesses in this sector, however, we deduct that amount to avoid double counting.

Consumption of bamboo, poles, and grasses: The total value of these forest products is included in GDP.

Gross Value Added: Sum of the previous income items

5 Calculating GDP: Depreciation of Natural Forests

The depreciation of natural forests is calculated in several steps. The first is to estimate sustainable yield from the forests. Next, wood use by all consumers about whom we have data is summed. This is then compared with sustainable yield to estimate physical depreciation. A price is then chosen to put a monetary value on depreciation, and the resulting value is deducted from gross value added to calculate net value added from the forest sector.

Sustainable yield is estimated by multiplying the total area of natural forest by its per hectare productivity. The area of Malawi's forests in 2010 was available from the land cover mapping project carried out through the Department of Forestry with Japanese support. Based on a review of studies of miombo woodland productivity, three productivity values were identified: 2 m^3/ha for the southern region, 3 m^3/ha for the central region, and 4 m^3/ha for the northern region. The sustainable yield of natural forests was then calculated as shown in Table 3.

Table 3: Sustainable Yield as of 2010, in m3

Location	Area in ha	Sustainable Yield
Malawi	2,296,700	7,132,200
Northern region	914,300	3,657,200

Central region	710,200	2,130,600
Southern region	672,200	1,344,400

The quantities of wood consumed by different users were calculated using different methods; these are described in detail in the technical report. The estimation of wood consumed by households excludes wood gathered in household and community woodlots, because it is assumed that they are too small in area to have been classified as forest through the land cover mapping project. Consequently, that consumption does not have to be deducted from the sustainable yield shown in Table 3 above.

Total consumption of wood is summarized in Table 4. As it shows, fuelwood harvests exceed sustainable yield by almost six million cubic meters per year.

Table 4: Calculating Depreciation of Natural Forests

Total use of wood from natural forests, in m3	National	North	Center	South
Household fuelwood consumption:				
Total consumption	11,240,264	1,491,599	4,665,043	5,083,622
Less wood gathered from household and community woodlots	-3,378,142	-265,098	-2,088,327	-1,024,717
Household charcoal consumption	2,434,218	121,655	841,699	1,470,864
Institutional and industrial use of firewood, except brick-making	1,075,411	138,956	455,210	481,245
Brick-making	1,708,074	220,703	723,010	764,360
Total, natural forests	**13,079,823**	**1,707,814**	**4,596,635**	**6,775,374**
Sustainable yield, natural forests	**7,132,200**	**3,657,200**	**2,130,600**	**1,344,400**
Excess harvesting from natural forests	**-5,947,623**	**1,949,386**	**-2,466,035**	**-5,430,974**

The economic value of forest depreciation is valued using a weighted average of the prices of household fuelwood and institution and industrial wood, which comes to 5,115 kwacha per cubic meter. This leads to a total value of depreciation of just over 30 billion kwacha, as shown in Table 2 above, and to net value added from the forest sector of just under 45 billion kwacha.

These results are very different from the published national accounts data for 2010. The comparison is shown in Table 5, which shows the published 2010 values converted to current kwacha in order to permit a comparison with the study values. The published figures estimate the forest sector's value added at 8.7 billion kwacha, and its share of GDP at 0.99%. The study estimates gross value added of forestry at 75.9 billion kwacha, which would constitute 7.95% of GDP adjusted to include the higher forestry values. Malawi does not calculate depreciation or NDP, but even forestry net value added as estimated by this study is far higher than the NSO's published estimate.

Table 5: Comparison of Published and Study Estimates of Forestry Gross Value Added

	National Accounts, in 10^3 current kwacha	Study Results
Forestry Gross Value Added, 2010	8,664,496	74,863,217
GDP	875,873,009	942,071,731
Forestry Share of GDP	0.989%	7.947%
Source: http://www.nsomalawi.mw/index.php?option=com_content&view=article& id=150%3Agdp-by-activity-in-2007-constant-prices-in-mk-million&catid=10&Itemid=54		

6 Calculating GDP: Methodological Comparison with Published National Accounts

The calculations of this study differ from those of the published national accounts in many ways. The published accounts are based on only one data source, the DoF sales of plantation wood. Intermediate costs are not deducted from this value, since the plantation activity carried out by government rather than the private sector. The revenue figures provided by the Department are expanded to the values shown in the national accounts data, in an effort to estimate the value of wood used throughout the country; the exact method used to extrapolate to the whole population is not clear.

At present the published accounts data for forestry do not include several other categories of income:

- The value added of the major timber companies; all of this is classified as manufacturing activity in the sawmills sector. Disaggregating forestry and manufacturing activities of those companies, and classifying the corresponding value added in two different industrial sectors, would require revisions to the surveys used to gather economic data about such enterprises. The NSO is interested in exploring this possibility.

- Estimates of household fuelwood use, based on IHS data. The NSO is working with those data, and plans to use the results to revise the accounts estimates for 2008 through 2010; these results have not yet been published. They are interested in exploring the methods of this study in determining how they use the IHS data in their revised accounts.

- Estimates of charcoal use and value. The revised 2008-2010 accounts of the NSO will not include the value of charcoal for the same reasons that this study does not, the inconsistency of the charcoal expenditure data in the IHS.

- Value added from provision of wood by household businesses or those supplying institutions and industry. The revised 2008-2010 accounts do not include this either; the NSO is expected to review the results of this study in those areas, and perhaps consider including them in their revised accounts.

- Estimates of the value of non-timber forest products based on IHS data. The revised 2008-2010 accounts include the same estimates shown here.

- Most importantly, forest depreciation. National accounts are based on monetary data; the calculation of sustainable yields, physical quantities consumed, and harvesting beyond sustainable yield goes beyond the scope of that work or the expertise of the national income accountants. However the NSO may recognize from the results of this study the importance of including depreciation in order to produce valid economic accounts for forestry in the future.

7 Total Economic Value

The components of TEV are summarized in Table 6, in thousands of kwacha. As expected, this is greater than forest sector NDP, as it includes many items that are not included in that measure. Each component is described below:

Contribution of forest sector to NDP: This is the final value from the GDP calculations.

Output of forest-based household businesses: This is the total sales of all forest-based household businesses except those on ISIC 02. Unlike the NDP calculations, here intermediate consumption is not deducted, so TEV includes the value of goods purchased by the forest-based activity in addition to the value added by the forest-based activities themselves. However because, the value added from ISIC 02 activities is included in the contribution of the forest sector to NDP, only intermediate consumption for that sector is included here to avoid double counting.

Table 6: Components of Total Economic Value, in 10^3 kwacha

MIC	ISIC Code	Description		Value
Contribution of Forest Sector to NDP (ISIC 02)				44,773,008
Output of forest-based household businesses				
11	01	Mixed farming		5,846
12	02	Forestry and logging	Intermediate consumption only; value added from these businesses is included in the contribution of the forest sector to GDP, above	37,223
29	5 to 9	Mining and quarrying		189,084
31	10 to 12	Food, beverage, and tobacco processing		989
32	13 to 15, parts of 16	Textiles, cord & twine		675,116
33	16, 31	Wood-based manufacturing, sawmills, furniture		5,594,290
36	239	Bricks, cement, concrete		49,878
38	23, 24	Metal products and hand tools (a)		13,418
62	47	Retail		17,006,489
63	55, 56	Restaurants and hotels		551
69 to 75, 85	93	Education, medicine, professional services, etc.		413,423
Total, output of household businesses				23,986,308
Output of formal sector forest-based businesses				
33	16	Sawmills		977,049
33	31	Furniture		227,266
Total, output of formal-sector businesses				1,204,315
Government expenditure on the Department of Forestry				
	8413	"Regulation of and contribution to more efficient operation of businesses (Department of Forestry Portion)		
			DoF salaries 1,034,701	
			DoF Operating Costs 101,605	
			Less Forest Revenue included in ISIC 02 (332,128)	
			Public expenditure on forestry sector	804,178
DOF Revenue not from ISIC 02				40,663
Protected Area Revenues				45,572
Expenditure in Malawi by forest-based inbound tourists				1,976,979
Watershed protection: costs now imposed by degradation of the Shire River				484,680
Total Economic Value				**73,315,703**

Output of formal-sector businesses: The annual economic survey provides data on some large enterprises engaged in forest-related activity; their final output is summarized here. Interestingly, it is much less than the household businesses in the same sectors; value added from these enterprises is also much lower than that of the household businesses. If the NSO decides to separate forestry and sawmilling in future economic surveys, then the part of the value on ISIC 16 would show up on ISIC 02, as forestry.

Government expenditure on the Department of Forestry: The national accounts would deduct intermediate consumption (operating costs in this table) to calculate value added by government; following the approach to calculating TEV in this study, those costs are included here. The government treats DoF revenues (included in forest contribution to NDP) as a subsidy to the treasury, so it is deducted here.

DoF Revenue not from ISIC 02: This includes revenues from items such as seeds, publications, tuition for courses, lodging, and so on.

Protected Area Revenues: This includes estimates of park entry fees, concession revenues, shop revenues, and so on. The national parks certainly contribute far more economic value than this, but there is no simple way to value it.

Expenditure by inbound forest-based tourists: This is an estimate of the share of total tourism expenditures that can be attributed to tourists who come to the country in order to visit forests, based on the share of vacationers who visit protected areas. Given inadequate data, it is a lower bound; the actual value is certainly higher. It is not the contribution of such tourism to NDP, since it is final consumption rather than value added; the contribution to NDP would be lower.

Watershed protection: This is a very important item that cannot be valued accurately. It should measure willingness to pay to prevent further forest degradation, which would be approximated based on how much downstream costs would increase with more forest loss. However, for both practical and conceptual reasons, this is very difficult to value. On the practical side, we know the actual expenditures by ESCOM and other businesses to cope with sedimentation and weed infestations in the Shire River, but there is no simple link between current costs with the existing state of the forests and future costs with greater forest loss. Even if we knew how much of the Shire River Basin had been deforested and how much forest cover remained (which we do not), we can't calculate a per hectare cost for current degradation and multiply this by the area of remaining forested area; this is simply not correct.

A more complex conceptual problem also makes it very difficult to put an economic value on the watershed protection services offered by forests at the national level. To put it metaphorically, human life and society form a complex structure standing on a number of pillars - water, food, shelter, clean air, and so on. If any one of those pillars were pulled out, the structure would collapse. But the fact that the structure would collapse if one pillar were pulled out does not mean that the entire value of the structure can be attributed to that pillar. The structure depends on all of them, and there is no clear logic for allocating its value among the many pillars on which it depends.

When we are dealing with a marginal shift in one pillar - in this case some change in forest cover leads to some sedimentation of the river, which contributes to (but is not the sole cause of) problems in electricity generation - we can measure and value the impact of the change on the final output. Thus we can see how much ESCOM has to spend to deal with the current level of degradation of the river; that is a measurable response to a marginal change in river quality. But we have no clear way to go from observing and quantifying a marginal change to valuing the entire asset, whether that asset is the clean river or the intact forest. What works to value a marginal change does not work to value the asset as a whole.

For all of these reasons, both conceptual and practical, we cannot come up with a value for the watershed protection services currently provided by existing forests in Malawi. In the absence of such values, we have treated the costs now being imposed on ESCOM as a lower bound for costs that would be borne if there were further forest degradation, and thus the value of the watershed protection services now provided by the forests. This is, of course, in no way a measure of the value of the remaining forest; however it is better to show some value, if only as a place-holder, than to leave it out altogether. The study therefore offers this value as a lower bound on the actual value of the watershed protection services of the forest. Because of the integrated nature of the pillars that contribute to clean water and the human and economic activities that depend on it, however, it is essential that

these challenge be addressed in an integrated fashion by all actors concerned; these are not matters for one government agency or sector to address independently of the others involved in supporting the overall structure.

8 Contribution to Livelihoods

So far this paper has shown that forests are more significant to Malawi's economy than is often recognized. Their contribution to livelihoods brings home the importance of these resources to the people of the country. As Table 7 shows, the forests are responsible for the creation of 33 thousand

Table 7: Contribution of Malawi's Forests to Livelihoods

	Number of households affected	Number of jobs (FTEs)	Value	Average value per household
Employment				
Large companies		2,914	398,447,000	136,757
Household businesses	92,464	24,898	9,035,751,902	362,913
Government		5,207	1,034,701,116	198,713
Total employment		33,018	10,468,900,018	317,063
Consumption of gathered forest products				
Fuelwood	2,831,916		63,375,929,593	22,379
Bamboo and poles	26,748		16,370,579	612
Grasses	45,935		37,814,954	823
Total	**(a)**		**63,392,300,172**	
(a) The number of households is not summed because there may be substantial overlap among households gathering the different forest products.				

Full time equivalent (FTE) jobs, three quarters of them in household businesses. Measuring FTEs underestimates the number of households that are bringing in revenue from these businesses, however; some 92 thousand families earn a part of their living through home-based businesses dependent on the country's forests. In comparison, formal sector employment dependent on the forests, in private companies and the government, has much less impact on the citizens of Malawi, accounting for just over 8 thousand jobs; still, this is a significant source of employment. All of the forest-related jobs pay well over per capita income, moreover; the average annual compensation for a full-time equivalent position is 317 thousand kwacha. The compensation for work in home-based businesses is significantly higher than those of salaried jobs, averaging nearly 363 thousand kwachas per year. Clearly forests are a significant contributor to earnings, both in the number of people benefiting and in the rate at which they benefit.

Gathered forest products also contribute very significantly to the well-being of Malawian households, with a total value of more than 63 billion kwacha. The impact of gathered fuelwood is particularly striking. In 2010-2011 it was valued at an average of 22,379 kwacha per household. In a country whose gross national income per capita was $330, or MWK 49,629, in 2010, this adds 45% to effective household income. If households were not able to gather that wood, they would be very hard pressed to come up with the resources to purchase fuel with which to cook their meals.

These findings highlight the considerable importance of the forests to the well-being of Malawi's citizens. From an employment perspective, from the perspective of generating economic activity through the creation of private business, in terms of their provision of in-kind income to those who gather fuelwood, and simply in terms of the sheer number of households who depend directly on the resources, the Malawi's forests must be recognized as a key contributor to the livelihoods of the country's citizens. Their management must reflect the importance that is clear from these figures.

9 Conclusions and Recommendations

This study allows us to draw a number of interesting conclusions about the role of forests in Malawi's economy. First, a more comprehensive construction of forest accounts would show the contribution of the forest sector to GDP and NDP to be much higher than is shown in the published national accounts data. While direct comparison with NDP is not possible, the study's estimate of gross value added of the forest sector is more than seven times the published national accounts estimates. Instead of representing less than one percent of GDP, the study results suggest that forestry actually accounts for almost 7.5% of GDP, giving the sector a far more important role in the economy than is usually acknowledged.

The deduction of depreciation of natural forests decreases this estimate significantly, but the study's estimate of net value added from forestry is still far higher than the published national accounts data would suggest. The study estimate would be lower if the available data had made it possible to evaluate the depreciation of plantation forests as well as natural forests. Unfortunately, this was not feasible; however it will be important for the Department of Forestry to analyse the sustainability of current plantation management practices, and to calculate more complete estimates of total forest depreciation and NDP.

The study results show the total economic value of the forests to be considerably higher than net value added of the sector. However, this result is less useful for policy purposes than the GDP and NDP calculations, because TEV is not a standard measure with a clearly defined meaning. Moreover, while watershed protection should be a very important part of TEV, conceptual factors make it impossible to actually calculate its value. This further limits the utility of TEV as an indicator of the economic significance of Malawi's forests.

The study estimates of the contribution of forests to Malawian livelihoods show very clearly the importance of the sector to well-being as well as its importance to economic output. The livelihood values make a strong case for the dependence of the population on effective management of the forests, and the need for increased public resources to make this possible.

Several recommendations for Government of Malawi action can be derived from this study:

- NSO has collaborated closely with the team carrying out this study, and is very much interested in bringing their forest accounting practices into line with international standards. The Ministry of Economic Planning and Development and the Department of Forestry should work together to ensure that these changes are made, providing technical support to NSO if needed to assist them in updating their forest accounts.

- The Ministry of Economic Planning and the Department of Forestry should ensure that NSO is able to NSO to develop and implement a new survey form for forest industries, providing technical assistance if needed. This will ensure that the economic statistics recognize all forest industry activities in ISIC 02, forestry, rather than classifying them with ISIC 16, manufacturing.

- The DoF would benefit from strengthening the management of its own financial flow data, so they can be used to accurately quantify revenues and harvests, assess pricing policy for all forest products, and be used more effectively for policy, planning, and management.

- DoF should build its own capacity to collect and manage statistical data, so that it can play a more active role in producing reliable data about the state and use of the forests. The development of statistical systems is a shared responsibility, between statisticians in the National Statistical Office and subject matter experts in the line ministries. In building

its own statistical capacity, the DoF would aim to strengthen its ability to produce new information about the forests and to provide that information to the NSO so it can be integrated into broader statistical systems about the country and the economy.

- DoF investments in better data collection should focus on household use of fuelwood and on charcoal. While the IHS provides much better data on fuelwood than has been available in the past, the sheer magnitude of the numbers means that estimates of the forest sector's role in the economy are highly sensitive to small or moderate errors in the fuelwood data. A ten percent margin of error in the IHS results on household fuelwood use would swing the calculation of forest value added by more than the sector's total value in the published GDP figures. If the aim is to obtain reliable value added estimates, therefore refining the fuelwood data will be more important than any other refinements of the available data.

- Although far fewer households use charcoal than fuelwood, investment in data on charcoal is essential because its manufacture has devastating environmental impacts in urban areas. Use of this fuel will increase as Malawi urbanizes, so building the information base to manage this fuel source will be very important if any forests within reach of the cities are to be protected.

- For both fuelwood and charcoal, two kinds of data development would be useful. First, systematic, one-time surveys of the quantity of charcoal and fuelwood used per household would complement the data in the household survey. For charcoal, in particular, such a survey must collect more reliable expenditure figures than were available in the IHS. Second, it is important to introduce ongoing tracking of urban and rural markets for both of these energy sources, gathering data about the quantity of fuel sold and its prices. The DoF should collaborate with the NSO in this area, ideally integrating biofuels (and perhaps other forest products) into market survey work that is already routinely undertaken throughout the country.

- More broadly, it is essential that the complex structure of economic activities and human survival dependent on the pillars of forest health, clean water, and other factors be supported in an integrated way by all of the government agencies and sectors of society involved. The same complex interrelationships that make it impossible for this study to tease out the economic contribution of forests alone to watershed protection, require holistic problem-solving and a recognition that these are challenges that cannot be overcome through independent action to shore up one pillar at a time. Everyone's wellbeing - indeed survival - depends on the strength of all of the pillars, so everyone must work together to keep the whole structure standing.

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