AN ENVIRONMENTAL ACCOUNTING APPROACH TO VALUING THE SERVICES OF NATURAL FORESTS AND WOODLANDS IN SWAZILAND

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Abstract

Economists and statisticians constructing the national income accounts usually overlook the many benefits derived by communities from natural forests and woodlands. This study attempted to impute a value for the ecosystem services of these resources in Swaziland employing an environmental accounting framework. The current measure of national income was found to underestimate GDP by 2% and under value national savings by 10% by not accounting for the flow and asset values of natural forests and woodlands. The study also revealed a very high dependence of the rural communities in Swaziland on natural forests and woodlands for their livelihoods as they derive more than 50% of the value of total household consumption expenditure from these resources. These results clearly indicate the significant contribution to and crucial role these resources play in the lives and wellbeing of the Swazi people and hence the importance of prudent management and utilisation of this resource sector.

1. INTRODUCTION

Swaziland has a vast forestry sector, covering 0.8 million ha, which is 45% of the total land area of the country. About 86% of this area is under natural forests and woodlands compared to only 14% under cultivated plantations (DANCED, 1999:ii). The livelihood of the vast majority of the Swazi people is dependent on natural forests and woodlands (NF&WL), especially in rural areas where 75% of the population reside and where poverty is very high (DANCED, 2000a:5). Most of the land in Swaziland is communally owned (56%) under the Swazi Nation Land (SNL) (Lasschuit, 1994:1; MEPD, 2002:1). The bulk of the remaining land is Title Deed Land (TDL), which comprises privately owned commercial farms. Since they are private property, access to TDL is limited and controlled by their owners and hence reasonable

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management and utilisation of the NF&WL on them is more likely. On the other hand, access to land and other resources on the SNL is not as easy to control and often open to the predominately free communal use (DANCED, 2000b:4). Thus vast areas of the SNL are vulnerable to overexploitation and hence depletion and degradation of the NF&WL resources on them.

In spite of their crucial importance to the lives of the people of Swaziland, lack of management and overexploitation of indigenous forests has led to their depletion and degradation (DANCED, 2000a:1). There is large-scale land clearing for agricultural production (vast areas of natural forests have been converted to large-scale sugar cane farming), uncontrolled extraction of products from communal land, overgrazing and a growing population that depends on forests for fuel wood in the rural areas (MOAC, 2001:1). Lasschuit (1994:iii) estimated that annual wood consumption exceeds total sustainable wood supply by about 30%. Continued mismanagement and degradation of forests is expected to have serious implications for the welfare of the people of Swaziland, who are highly dependent on forest products for various aspects of their livelihoods, especially in rural areas.

In response to the problems related to mismanagement of natural resources and the environment, the Swaziland Environmental Action Plan (SEAP) was developed in 1997 with the aim of ensuring sustainable development by integrating social, economic and environmental objectives into the development planning process. Three major sectors were identified by the SEAP that required immediate attention in order to fulfil this goal. These were forestry, water and land, and livestock (SEAP, 1997:iii). Among the three sectors, forest resources were considered to be of prime importance in terms of their social, economic and environmental significance.

Unfortunately, the economic importance of the forestry sector is not properly reflected in the national income accounts because many forest values are not reported in the SNA. Direct and indirect use values of many forest goods and services including environmental benefits are currently missing from the SNA. One major reason for the omission of the values of natural forests relate to the fact that natural forests and woodlands are open access resources, the products of which are often not traded in formal markets. Since the SNA mainly accounts for those goods and services that are produced and sold in the market, the significant omissions of the contribution of natural forests render current measures of economic growth and social welfare misleading for policy design and development planning.

The objective of this study is to estimate the total economic value of natural forests and woodlands, and the value of their contribution to the social welfare of the people of Swaziland. The study is organized in four sections. Section two discusses the forest resources accounting framework employed by the study and its methodologies. Section three presents the contribution of these resources to the well-being of the Swazi people. Adjustments to current national accounts as well as implications of the study for policymaking and forests management are made in section four.

2. METHODOLOGY

Natural resource and environmental accounting provides a framework for correcting the national income accounts for deficiencies concerning environmental values. Natural resource accounts (NRA) are an extension of the SNA, providing more detailed economic information on natural resources of interest, without distorting the central structure of the conventional national accounts. Physical accounts, in the form of stock and flow accounts, are constructed for natural assets and for environmental externalities. Physical accounts are then valued using economic valuation techniques to compile monetary accounts, which give a measure of the monetary value of the resource in question. Very little is currently documented in the formal national statistics about the use and values of forest resources, particularly natural forests and woodlands.

2.1 The forest resource accounting framework

The SNA defines assets as those resources over which ownership rights are enforced and which provide economic benefits to those who own them, including produced and non-produced assets (United Nations, 1993a:8; Vincent and Hartwick, 1997:7). Produced assets include man-made assets such as equipment and structures and natural assets such as livestock and timber plantations. Non-produced assets include land, subsoil assets and natural forests (United Nations, 1993a:9), but only if a particular institutional unit owns them.

2.1.1 Physical forest accounts

Physical forest accounts consist of a set of tables recording physical measures of stocks and flows of forest resources at the beginning and end of the accounting period. Presenting physical unit indicators is more useful and more effective when it comes to policy formulation because it provides more factual information, to which the public has access (Nyborg, 2000:394).

Physical asset accounts record the stocks and changes in physical stocks of forest assets. These include timber, land and environmental assets, i.e. carbon storage. Timber growth or regeneration is often calculated based on forest growth simulation models, when available, or, commonly calculated as net annual increment estimates (Hassan, 2000:163). Harvesting and damage constitute total withdrawals of the timber resource. Harvesting refers to trees felled for commercial and non-commercial purposes and damage refers to the area of forest damaged by fire, pests and other natural causes. Closing stock is calculated as the opening stock plus additions less withdrawals. Changes in stock are the difference between closing and opening stocks, and shows the amount by which the forest resource has accumulated. The closing stock is give by:

Closing Stock (S_{t-1}) = Opening Stock (S_t) + Growth + new planting – harvesting – damage

Physical flow accounts present the current use of the forest resource and flow benefits by various sectors from various sources. Supply and use accounts show the flow of forest products (in both physical and monetary terms) between producers and consumers. These give a better picture of the utilisation of the forest resource and when done at different periods of time, comparisons can be made to detect any changes in patterns of supply and use that may have occurred over time.

2.1.2 Monetary forest accounts

Monetary accounts attach a monetary value to the physical units generated in the physical accounts using various valuation methods. There are various market and non-market methods of valuing environment goods and services. Those used to value flow benefits of forests are different from methods used to derive their asset values (Hassan, 2002:31). Based on the respective method of valuation, the following types of monetary accounts are commonly constructed and used.

Monetary flow accounts, which typically present value added from the flow of timber resources between sectors. These are organised in supply-use tables, which can be used to compute input-output matrices that show the flow of forest products between the different sectors of the economy.

Monetary asset accounts compute the change in value of an asset from one period to another. Construction of monetary asset accounts is based on the physical asset accounts where money values are attached to the physical units

of the accounts. The sources of change in the value of resource assets include: a) changes resulting from physical adjustments to the resource stocks through additions and withdrawals that change the physical stock levels; b) revaluation, which measures the change in the value of assets due to nominal movements such as appreciation or depreciation of prices, etc.

Net depreciation of both produced and non-produced timber assets is valued using various techniques to derive the monetary value of a resource (London Group Meeting, 1996:41; United Nations, 2000; Vincent and Hartwick, 1997:20). The most commonly used are market valuation techniques, which include: the net present value method, net price method, the El Serafy user cost method and the net depletion (change in asset value) method. Calculating depreciation values using these methods was done for the Brazilian Amazon (Da Motta *et al*, 2000:132). El Serafy user cost and the net price method were applied in South Africa (Hassan, 2000:159). By 1997 a number of countries had already conducted depreciation studies on their forest assets. The net price method was used by Malaysia, Indonesia, the Philippines and Nepal, although these did not use the correct version. Asia, Malaysia and Mexico used the El Serafy user cost method (Vincent and Hartwick, 1997:32). Non-market valuation techniques such as stated preferences techniques (contingent valuation) and cost-based valuation methods were also used (Bishop, 1999:19; United Nations, 2000). The appreciation in the value of forested land is due to the fact that it is possible to generate income and economic benefits from forests, such as gathering of forest products, hunting, animal grazing, recreation, etc. (London Group Meeting, 1996:25). This study employed various valuation methods to derive values for the different products and services of forest resources. These were implemented within a forest resource accounting framework to support construction of monetary accounts for the forest sector in Swaziland.

The study calculated direct use values of natural forests and woodlands, indirect use values of carbon storage and cultural and aesthetic values were also estimated. Other environmental benefits of forests, such as watershed protection and biodiversity were not estimated by this study because of data limitations.

Detailed information about the patterns and use of natural forests and woodland resources is sparse and no time series information was available. For this reason information was gathered from other studies, such as the use of fuel wood by rural households (Lasschuit, 1994:9), use of plants by traditional healers (Makhubu, 1978), and the value of non-timber forest products (DANCED, 2000a). In addition a household survey was conducted to collect more detailed information on the use values of natural forests and

woodlands. The following section describes the design of the survey and its implementation.

2.2 Survey design and sampling procedures

Multistage stratified simple random sampling was used to select survey sites in which households were surveyed. The Central Statistical Office 1997 Census provided the sampling frame from which enumeration areas (EA) and households were selected (CSO, 2001). The first layer of stratification was based on rural areas versus urban classifications of the CSO census EA. This was important for reflecting the large variation between rural and urban communities in terms of their degree of dependence on these resources.

The average household size in rural areas is 7.6 persons compared to 3.8 persons in urban areas (CSO, 1995a:13). About 77% of the country's population live in rural areas. Rural households depend on natural forests and woodlands in many different ways. These households practice subsistence farming and have large livestock populations. They use wood structures for buildings (51% of houses have walls made of mud wood) and use wood for cooking and heating (90% use wood as the main source of energy for heating and cooking) suggesting that they are more dependent on natural forests and woodland resources than their urban counterparts (CSO, 1995a:36). 66% of the rural population live under poverty (CSO, 1995b:10) and hence the critical importance of natural forests and woodlands for their livelihood and survival. Another factor contributing to the dependence on natural forests and woodlands is the high rate of unemployment (25%) (CSO, 1995a:26). Accordingly, the survey focused on rural areas for estimating natural forest and woodland values. The CSO 1997 census framework shows that there are in total 1340 enumeration areas in rural areas from which 15 were selected (about 1%).

Classification by vegetation type provided the second layer of stratification used with the aim of capturing diversity in species of trees and plants utilized and harvesting practices of natural forests and woodlands. The Forest Inventory studies (DANCED, 1999:33; Hess *et al*, 1990) identified 8 broad classes of forests and woodlands, which when using narrower definitions of woodlands, increase to 13 categories of natural forests and woodlands in the country. 12 of these categories were considered for the survey, excluding plantations as they were covered by a different survey. The Forest Resource Assessment (DANCED, 1999:33) classifications were used for the survey because they provided more detailed classifications of the woodlands. Out of the twelve categories of vegetation types, ten were surveyed. The two

vegetation types not surveyed were Riverine forest (found along riverbanks) and Dense Dry Acacia because they are relatively small and difficult to sample (Hassan *et al*, 2002:29). In total, 15 enumeration areas were selected and an average of 8 households per enumeration area were interviewed, making the total number of households surveyed 119. The survey was carried out in year 2001 when households were interviewed to find out the variety of products and volumes they harvest from natural forests and woodlands.

Additional information (including prices) was collected from various markets spread throughout the country. The two large markets surveyed were found in the two major cities of the country, Mbabane and Manzini. The other large market surveyed was in Ezulwini, half way between the two cities. Information on products was also gathered from smaller markets scattered along the main roads, selling handcraft products and firewood. Information gathered from these markets gave an indication of the kinds of products sold by communities to the markets and the products that come from forests.

Using information from the respondents, markets and secondary sources, the study estimated the amount of forest products (timber and non-timber) demanded (in kg) by each person per year. The average rural household size used was 7.6 persons (CSO, 1995a:13). It was assumed that structures are reconstructed every five years and thirty head loads of thatch grass were assumed required for each house. Three cartloads were assumed to be the quantity required to build a house and two cartloads were required for constructing a fence or kraal[2]. Derived estimates were then aggregated by ecological region and by vegetation type.

3. THE VALUE OF NATURAL FORESTS AND WOODLANDS

The survey indicated that the biggest burden of collecting products of natural forests and woodlands in Swaziland falls on women and children. It is worth noting that there is a high unemployment rate in rural areas (25%) where the rate is higher among females than males (CSO, 1995a:26). It is traditionally the duty of women to carry out household chores such as cooking and cleaning, which require collection of products of natural forest and woodland. The men (family or hired) usually collect timber to be used for construction purposes. However, there are also single men and unemployed males who collect natural forest and woodlands products to carry out household chores.

[2] *A summary of weights and prices (E) used is presented in the Appendix.*

Most construction timber is collected by cartloads (44.3%) followed by the head-load (32%), which is used to collect most other products of natural forests and woodlands with some variation in the relative importance of these two means between ecological regions. The common purpose for which the head-load is used is for collecting firewood. Although the cartload is usually used for collecting construction timber, it is also sometimes used for collecting firewood.

About 40% of the households have easy access to forest products as they live very near the natural forest and woodland resource. However, it takes two to three hours to get to the forest, collect the products they want and return home for 31% of the surveyed households, while about 21% of the households have to travel long distances (i.e. whole day) to collect products of natural forests and woodlands.

The prevalence of the dependence of rural communities on natural forests and woodlands is illustrated by the frequency of visits to the forest. More than 22% of the households collect forest products three times a week and 36% collect construction timber once every five years being the time interval at which timber structures are replaced.

3.1 Physical accounts for natural forests and woodlands in Swaziland

3.1.1 Physical flow accounts

Information collected from the above-described surveys was used to construct the physical flow accounts for natural forests and woodland resources. The study identified six categories of direct uses of natural forests and woodlands. Timber forest products were harvested for energy (cooking and heating), construction (houses, fences, kraals) and handcraft (craft wood) purposes (Table 1). Non-timber forest products were harvested for thatching, direct consumption (fruits, insects), medicinal and handcraft (weaving) purposes. Almost all rural households (93.9%) extracted wood for cooking and heating, which compares well with estimates (90%) from the 1995 Household Income and Expenditure Survey [HIES] (CSO, 1995a:36). More than 55% of the surveyed households used timber for house construction (the HIES estimated that 51% of houses have walls made of mud and wood). About 40% of households were found to use thatch grass for roofs and 29% of households collected fruits and vegetables for consumption purposes. A lower proportion (7.6%) used plants for medicinal purposes, and some households practice handcrafting as an income-generating activity. The proportions presented in Table 1 were also used to calculate the user population for each direct use type, calculated as the product of the proportion of households using a forest resource and size of the population in an ecological region.

Table 1: Products harvested for various uses in rural Swaziland (2001) by ecological region (% of households collecting products)

	Highveld	Middleveld	Lowveld	Lubombo	All sample average
Firewood	91.7	91.7	94.5	100.0	93.3
House construction	66.7	52.8	52.7	50.0	55.5
Kraal construction	8.3	16.7	32.7	25.0	22.7
Fence construction	8.3	19.4	23.6	25.0	19.3
Thatch	45.8	44.4	32.7	75.0	40.3
Edibles	20.8	27.8	34.5	25.0	29.4
Medicinal	4.2	2.8	12.7	0.0	7.6
Craftwood	4.2	8.3	0.0	0.0	3.4
Weaving grass	12.5	8.3	3.6	0.0	6.7

Source: survey data.

While results on volumes of timber and non-timber products harvested by households can be reported by ecological region, it was necessary to rearrange the survey data by vegetation type. The reason was that annual timber supply could only be estimated by type of vegetation as the capacity for natural regeneration and growth is different for different tree species dominating different vegetation types.

The per capita demand for forest products by vegetation type is presented in Table 2. Firewood is still the highest purpose for which timber is collected from all vegetation types at an average of 376 kg/person/annum. The Wattle Forest woodland has the highest per capita demand for firewood, showing that timber use for energy purposes is prevalent. This vegetation type is also dominant in its use of timber for construction purposes. The Open Acacia woodland also showed a high demand for forest products, and these woodlands are found in the lowveld region of the country, where there is high dependence on wood for construction. Using the conversion factor of 1 m^3 = 0.78 ton, these estimates were converted to m^3. This conversion enabled regeneration and extraction figures to be compared and therefore net accumulation (in m^3 and per ha) could be calculated. To derive population data by vegetation type at national level, estimates were derived from an overlay of the map of enumeration areas (which provides population figures) on the map of the different woodlands in the country using geographic information systems (GIS) spatial analysis tools.

The EA map was based on the 1985/86 Population Census and therefore the 1997 population data was consolidated to correspond with the 1985/86 enumeration areas. The digital EA and population maps were then overlaid on the vegetation map. To estimate the population per woodland class, some manipulation was necessary as each EA contained more than one woodland

class. Therefore, the population density for each EA was computed. Then the density was multiplied by the area of each woodland type found in the EA to get the population in the woodland type. Unclassified population[3] (area without a particular woodland type) was distributed evenly among the other vegetation classes. The population per woodland (user population) figures were used to obtain national aggregates of wood harvested by woodland type (Table 3).

3.1.2 Physical asset accounts

Asset accounts measure the net change (appreciation or depletion) in standing forest and woodland stocks. This was calculated using the difference between additions to and withdrawals from opening stocks. As shown earlier in section 2.1, the Closing stock is derived as the sum of standing (opening) stock plus additions minus withdrawals. Additions comprise of growth and reforestation and withdrawals are made up of harvesting and damage caused by natural factors such as fire, pests, etc. In the case of natural forests and woodlands no time series data were available on standing stocks, reforestation and damage. Accordingly, natural growth was estimated using scientific knowledge on the biological capacity of different forest types to regenerate to measure additions, whereas volumes harvested were used as withdrawals representing the demand for products from natural forests and woodlands as described in the physical flow accounts presented above.

3.1.2.2 Total supply and net change in timber asset stocks

Tree growth models adopted from Ethiopia (DANCED, 1999:14) were used to calculate change in timber supply (growth). These are presented in the row labelled "annual growth" in Table 3. The annual growth volume for each vegetation type was multiplied by the area under the vegetation type to get the annual volume increment (additions) of the vegetation type that can be used by the communities. Deducting the withdrawals from the volume of additions provided an estimate of the net accumulation (or net depletion) of natural forests and woodlands during the year. Natural forests and woodlands grew by a total volume of 622.4 thousand m^3 per year while communities

[3] *Table on population per vegetation type in the Appendix.*

Table 2: Volume of direct use products harvested in rural Swaziland (2001) by vegetation type (kg/person/annum)

	Montane and Highland		Mixed Woodland		Acacia Woodland		Dry Acacia Woodland	Bushland		Wattle	Average
	Dense	Open	Dense	Open	Dense	Open	Open	Dense	Open		
Firewood	234	288	510	218	725	677	429	272	274	1154	376
House construction	93	84	64	123	140	101	168	184	112	252	130
Kraal construction	0.0	0.0	44	37	56	37	37	50	37	37	31
Fence construction	37	37	37	37	37	37	37	37	37	0	34
Thatch	13	0.0	12	16	28	11	28	33	38	32	20
Edibles	20	0.0	43	12	43	27	0.0	12	124	189	26
Medicinal	0.0	71	0.0	0.0	0.0	12	208	6	12	19	23
Craftwood	0.0	0.0	24	38	0.0	0.0	0.0	0.0	0.0	19	6
Weaving grass	0.0	0.0	38	88	19	0.0	38	0.0	0.0	19	14

Source: survey data.

Table 3: Net accumulation of timber stocks (000 m3/annum

	Montane and Highland		Moist Mixed Woodland		Acacia Woodland		Open Dry	Bushland		Wattle	Total
	Dense	Open	Dense	Open	Dense	Open	Acacia	Dense	Open		
Area (ha)	10 510	26 046	52 971	116 649	10 293	168 020	34 328	55 683	177 271	26 440	678 211
Annual growth (m^3/ha)	1.0	1.5	1.0	1.0	0.2	0.7	0.2	0.2	0.2	8.7	
Additions (000 m^3)	10.51	39.1	52.97	116.65	2.06	117.61	6.9	11.14	35.45	230.03	622.4
Withdrawals (000 m^3)	35.2	32.3	95.9	61.9	56.4	166.3	76.6	47.5	122.6	128.6	823.3
Net annual change (000m^3)	-24.7	6.8	-42.93	54.7	-54.4	-48.7	-69.7	-36.4	-87.2	101.4	-201.1
Net annual change (m^3/ha)	-2.35	0.26	-0.81	0.47	-5.28	-0.29	-2.03	-0.65	-0.49	3.84	-0.30
Population density (Person/ha)	4.1	0.6	1.2	0.3	1.6	0.8	1.8	0.8	1.3	1.0	1.1

Source: own calculations, DANCED (1999).

harvested 823.3 thousand m^3 per year. This means that each year there is total net depletion of 201 thousand m^3 of natural forests and woodlands. Natural forests and woodlands resources are reduced at an average annual depletion rate of 0.30 m^3/ha.

However, the distribution of depletion is not even and varied significantly between woodland classes. The highest total depletion is occurring in the Open Bushland and Open Acacia, whereas standing stocks of Wattle forests, Open Montane and Open Mixed woodlands are increasing. This may be attributed to the relatively low population density in these three woodland classes as well as high growth rate (8.7 m^3/ha/annum) of the Wattle forest.

The pressure however, is highest in the Dense Acacia woodland (5.28 m^3/ha) since harvesting by a relatively large population is supported by smaller area of woodlands with very low regeneration rates.

3.1.3 Carbon stock accounts

The importance of taking inventories of carbon (and other greenhouse gases) is growing as the world faces global climate change and hence the focus is therefore increasing on carbon storing vegetation such as trees and grass. Information on the carbon absorption rates of natural forests and woodlands is very limited. This study adopted the Scholes and Walker (1993) ratio of 45% carbon content of timber in natural forests and woodlands. Multiplying the net depletion of timber rate of 201 thousand m^3 of Table 3 a net depletion of carbon stocks of 71.1 thousand ton of carbon.

3.2 Monetary accounts

This section, constructs the monetary accounts, which derive the monetary values of natural forests and woodland resources to the people of Swaziland.

3.2.1 Monetary flow accounts

3.2.1.1 Direct use values of natural forests and woodlands

Monetary flow accounts estimate the value of the flow of natural forests and woodlands resources as they are used in various economic activities during the period under study. Although communities harvest products of natural forests and woodlands for own use, some are sold in the market and on the roadside. Prices collected from market surveys were thus used to estimate the value of direct use benefits of natural forests and woodlands.

The results showed that on average, rural communities in Swaziland derive a total value of E[4] 428 per person every year in the form of timber and non-timber products of natural forest and woodland resources. This amounted to about 44% of the average rural household consumption expenditure in the country at 2001 prices[5], suggesting a very high reliance of rural communities in Swaziland on these resources for their livelihood. According to Table 4, the highest contribution to rural households' budget came from the value of firewood. We consider our estimates to be conservative as a number of other benefits derived by rural population from natural forests and woodlands are not captured in this study. Examples of important direct use and non-use benefits include livestock grazing, tourism, etc. When only livestock benefits were added using estimates of E 157/person per annum livestock grazing values derived for South Africa (Shackleton *et al*, 2002:64), the total contribution of natural forest and woodland resources to rural household income in Swaziland jumps to 57%. It is also important to note that our estimates of medicinal benefits (based on estimates of direct harvesting by rural households for own use) excludes the value of services provided by healers (Sangoma and Inyanga[6]) to thousands of people who do not directly collect and use medicinal products. One should further remember that this contribution excludes the value of indirect benefits and ecological services provided by these resources, such as watershed protection, nutrients supply, pollination services, carbon sequestration and biodiversity.

Per capita value estimates were combined with *user population* figures in the four ecological regions to derive an estimate of the total contribution of natural forest and woodland resources to the economic wellbeing of rural communities in terms of flow benefits (Table 5). To derive national estimates, user population and not total population figures were used to aggregate per capita values. User populations were derived based on percentage households harvesting the product.

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[4] The local currency of Swaziland (Emalengini-E) is pegged to the South African Rand -R at one E to the R.

[5] Using the CSO 1995 household income and expenditure survey estimates adjusted for inflation to year 2001

[6] While Inyanga refers to traditional healers who use forest products for strictly medical treatment purposes, Sangoma refers to those traditional healers who combine forest products with spiritual and religious processes for healing.

Table 4: Total value of woodlands' products harvested for various purposes in rural Swaziland (2001) by ecological zone (E/person/year)

	Highveld	Middleveld	Lowveld	Lubombo	Average	% share total
Firewood	291	181	257	427	289	40
House construction	27	25	30	12	24	3
Kraal construction	8	9	10	8	9	1
Fence construction	8	8	8	8	8	1
Thatch	23	24	39	12	24	3
Consumption	7	3	13	6	7	1
Medicinal	6	24	13	0	11	2
Craftwood	15	25	0	0	10	1
Weaving grass	103	47	36	0	46	6
TOTAL					428	100

Source: Survey data.

3.2.1.2 Indirect use values of natural forests and woodlands

In addition to the above tangible timber and non-timber benefits, the study made an attempt to derive estimates of the value of a number of other direct and indirect services of natural forests and woodlands. Those included carbon sequestration and cultural values of natural forests and woodlands.

Social and cultural values

There are many cultural activities involving the use of natural forests and woodlands in Swaziland. Among those important social activities are the Sangoma and Inyanga initiations, funerals, weddings, the Reed Dance and the Incwala ceremonies. However, detailed information on the use of these resources in cultural ceremonies is not documented. This study attempted to impute values of some of these ceremonies.

The Incwala and Reed Dance are annual ceremonies in which an increasing number of the youth participate. It is estimated that 30 000 girls participated in the Dance in 2002 (Times of Swaziland, 2002). The whole ceremony takes about a week. During the first day the maidens walk (a distance of about 15km) to the area designated for cutting of the reed during that year. The following day is dedicated to reed cutting, then a walk back to the royal residence on the third day. Day four is a resting day and day five is the main day of the Reed Dance. The study used an estimate of about 30 000 maidens participating annually in this event and an average time spent in cutting the reed of one hour. An average rural wage rate of E2 per hour was used to estimate the total value of the time spent on cutting the reed to be E60 000. This estimate was used because no market price could be established as the reed is not sold at any market. Thus the opportunity cost of time spent was

used as a proxy for the value of the reed harvested from natural forests and woodland resources.

Preparation for the Incwala ceremony also involves cutting of the lusekwane (*dichrosachys*) species of trees in which young males participate. Only one night is dedicated to this activity, where the young men walk to the area designated for cutting of lusekwane and each one cuts a branch for himself (which takes on average 30 minutes) and carries it back to the royal residence. This is then used to build the cleansing hut during the Incwala ceremony. An estimated average of 12 000 males participate in this activity (Hassan *et al*, 2002:36). As the lusekwane species is used as firewood, the average price of firewood was used. However, it is difficult to estimate the quantity harvested, and hence the opportunity cost of time spent during harvesting was used as an alternative to estimate the value of this particular species of tree. The average rural wage rate of E2 per hour was used to derive a total value of E12 000 making total cultural values add to E72 000.

Tourism

Nature-based tourism is an important economic activity and source of income and foreign exchange in Swaziland. Nevertheless the economic value of the contribution of the natural environment to this activity (scenic beauty) is already (at least partially) accounted for in the SNA. This is because the value of what tourists pay for visiting such sites within the country is captured as income by a number of sectors and activities servicing the tourism industry, such as hotels, restaurants and transport sectors. Implicit in that value is some marginal contribution of the natural environment (forests, rivers, wildlife, and mountains). While total expenditure by tourists contributes to an average of 1% of the total GDP, decomposing total tourism values captured in the SNA to isolate the contribution of forests and woodlands was beyond the means of this investigation.

3.2.2 Monetary asset accounts

Net depletion in timber and carbon estimated in the physical assets accounts above are converted to money values to derive the monetary asset accounts. The net price method was used to value timber assets, which is equal to per unit revenue (gross price) minus per unit harvesting costs. A gross price of timber of E 0.54/kg (E 691.3/m^3) was derived as an average of the firewood and construction timber prices using percentage shares in total physical depletion quantities as weight factors. Since own labor is the major input in harvesting of timber from open access resources, it is assumed that the net price of timber is 80% of the gross price (e.g. opportunity cost of labor and

other inputs such as tools represents only 20% of the gross value)[7]. This gave a total value of E 111.2 million of the annual depreciation of timber stocks in 2001. A carbon price of E 40.13/ton of C (Hassan *et al*, 2002:50) at 2001 prices was applied to woodlands' carbon stocks to derive a total value of net depletion of carbon of E 2.85 million.

4. CONCLUSIONS AND IMPLICATIONS OF THE STUDY

Current national income accounting in Swaziland is deficient in estimating the contribution of the forestry sector to national income and wealth. This is because many direct and indirect benefits of forest resources are not accounted for in the SNA. Employing a natural resource accounting approach, the present study developed and used a forest resource accounting framework to correct the SNA in Swaziland for the omission of key forest values. Study results showed that forest and woodland resources contribute substantially to the economic and social wellbeing of the people of Swaziland.

Measures of domestic income (VAD) and capital formation were corrected in Table 5 for omissions of the forest and woodland resources' values calculated above. Adjustments of current accounts (GDP) were done for year 2000 in Table 5, which required that flow benefits of natural forests and woodlands be adjusted to 2000 prices. The measure of GDP for 2000 rose by 2.2% when corrected for flow benefits of natural forests and woodlands with timber products making 90% of this increase. The missing flow benefits of natural forests and woodlands were equivalent to about 20% of the contribution of agriculture to GDP and more than 400 times the contribution of plantation forestry to GDP in 2000 (Table 5). The fact that the national accounts include the contribution of plantation forestry as the only value attributed to the forestry sector in Swaziland indicates the high underestimation of the value of natural forest and woodland resources to the people of Swaziland, especially the rural poor. This omission is the major reason behind underestimating the opportunity cost of converting forests and woodlands into other land uses leading to over conversion and excessive removal of the country's tree cover.

More over, the fact that asset values of woodland resources are not captured in the SNA results in generation of incorrect indices and measures of economic

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[7] *Resource rents are the proper price to use for valuing natural resources' asset stocks. Theoretically, however, in the case of pure open access and common pool resources such as this, resource rents are believed to be zero, meaning that value added will be equal to the opportunity cost of labor and capital. Nevertheless, there is a net price value of the resource (naturally growing timber) equivalent to revenue minus labor and capital costs as used here.*

performance and wellbeing such as the rate of savings and capital formation, sending wrong signals to policy design and development planning. When net accumulation in asset values was accounted for, the SNA measure of domestic savings dropped by 38% as a result of net depletion of natural forest and woodland resources' timber and carbon stocks. This implies that the country is liquidating its natural capital by depleting its forest resource stocks through over extraction by rural and urban communities, which is another piece of information critical for sustainable management and exploitation of these resources that is missing from the SNA.

The results of this study show very clearly how forest and woodland resources can be mismanaged and over exploited leading to resources' depletion and degradation as a result of excluding or underestimating the true contribution of such resources to human wellbeing. In order to generate proper indicators of welfare change, current measures of income and wealth must be corrected for net accumulation (depletion) in natural resource assets and the total value people directly or indirectly derive from their use. Genuine measures of sustainable income, savings and capital accumulation provide more appropriate information that is crucial for sustainable development planning and design of sound policies for economically efficient and sustainable use of natural resources such as the forests and woodlands of Swaziland.

Table 5: Accounting for the true economic contribution of natural forests and woodland resources in Swaziland (E million)

	Natural forest and woodlands	Total
Based on 2000 data		
Reported measure of GDP		9 673
Agriculture GDP		1 074
Forestry GDP		48
Missing flow benefits	212.5	212.5
Timber products	193.4	
Non-timber products	19.2	
Green GDP		9 885.5
% change		2.2%
% of agriculture GDP		19.8\ %
% of forestry GDP		439.4%
Based on 1998 data		
Gross Domestic Savings		245.3
Net asset accumulation	-93.1	-93.1
Timber assets	-90.77	
Carbon assets	-2.33	
Genuine gross domestic savings		152.2
% change		-37.95

The value of natural forests and woodlands can be updated on regular basis by the CSO so that over time there will be time series data on the values of these resources. This can be done by incorporating questions related to the use of natural forests and woodlands in one of the surveys regularly conducted by the CSO, such as the Demographic Survey (conducted at five-year intervals) and the annually conducted Agricultural Survey. Incorporating these questions in the said surveys requires no significant additional costs.

The national accounts of Swaziland are still in the process of implementing the SNA 93 and hence the necessary adjustments cannot be fully implemented yet. It is recommended that upon completion of the transition process to SNA 93, corrections for forest values be made to the respective accounts immediately. For example, gross savings for 2000 need to be adjusted with the value of net accumulation in timber and carbon stocks of natural forests and woodlands. Incorporating the above reported missing values of natural forest and woodlands represents a first step towards production of green national income accounts on a regular basis and serves as a foundation for expanding the accounts to incorporate other environmental values.

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APPENDIX A

Distribution of user population by vegetation type

Class	Population	User rural population	User urban population
Background/Unclassified	337 389		
Dense Montane and Highland	2 355	0.932773	0.233
Open Montane and Highland	722	0.554622	0.139
Dense Bushland	76 224	0.07563	0.019
Open Bushland	90 676	0.033613	0.008
Riverine Forest	10 905	0.033613	0.008
Open Mixed Woodland	34 177	0.193277	0.048
Dense Mixed Woodland	31 487	0.226891	0.057
Wattle Forest	35 056	0.067227	0.017
Open Acacia Woodland	19 218	0.294118	0.074
Dense Acacia Woodland	2 752	0.403361	0.101
Open Dry Acacia Woodland	17 178	0.07563	0.019
Dense Dry Acacia Woodland	396	0.07563	0.019