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TOWARDS NATURAL RESOURCE ACCOUNTING IN TANZANIA: A STUDY ON THE CONTRIBUTION OF NATURAL FORESTS TO NATIONAL INCOME

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MISSION

The mission of the Centre for Environmental Economics and Policy in Africa (CEEPA) is to enhance the capacity of African researchers to conduct environmental economics and policy inquiry of relevance to African problems and increase the awareness of the role of environmental economics in sustainable development for economic managers and policy makers.

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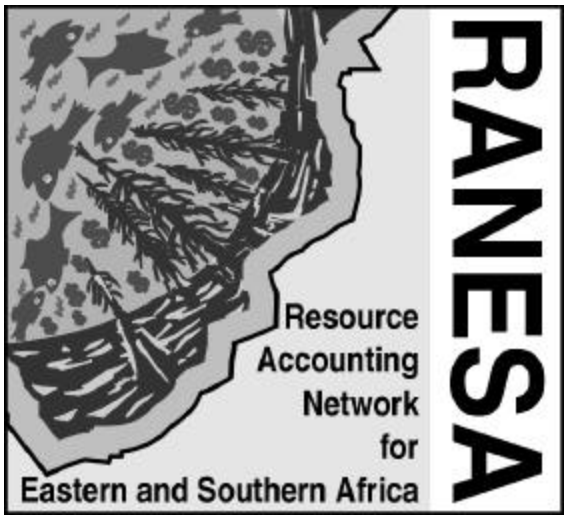

DEDICATION

April 3, 2001

This work is dedicated to those who strive to safeguard the natural resources:

All over the world

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ACRONYMS

NRA	Natural Resources Accounting
SNA	System of National Accounts
GDP	Gross Domestic Product
NDP	Net Domestic Product
PRA	Physical Resource Accounts
WTA	Willingness-To-Accept
WTP	Willingness-To-Pay

ABSTRACT

The aim of this study was twofold: **valuation** of non-marketed forest resources and **proposing means** for generation of modified national accounts that would cover the full value of forest resource production (and consumption). Land cover for the study area was studied for three points in time from 1975 to 1997.

Study area was selected in accordance to Enumeration Areas (EAs) as listed for the 1988 Population Census. Flue-cured tobacco growing areas were purposely selected for this study due to the nature of activities within that are highly associated with the natural forests. Data was collected from household survey of the study area as well as from some relevant secondary sources.

The study showed that 63 percent of the respondents were regular growers of tobacco, a proportion that gives an indication of a high rate of depletion of the surrounding forests. An average cleared forest area for a new season of cultivation was found to be 4.678 ha per household. For the years 1975,1987 and 1997, land cover analysis showed that woodland covered 60, 46 and 39 percent respectively of the land in the study area.

The study also found out that the collection of forest resources for a typical household is influenced by its income, size, time to reach collection area and the total area owned for farming

Total value of natural forests products consumed per household was estimated at $ 2,098, while value per person was $ 350. However, value per household, considering products used for tobacco curing alone, was estimated at $ 662, i.e. approximately 32 percent of the total value per household per annum. The magnitude of this proportion suggests that there is a strong need of revising the methods used for production of tobacco in this particular area and all others in the country that grow tobacco in a similar way, if the forests have to be preserved.

Policies have been recommended that would ensure regular delivery of data from governmental departments, which would facilitate NRA and regular

updates. This would allow environmental accounting to be part of the planning machinery in the country.

1. Introduction and background

1.1 Introduction

Despite of her being in the developing countries bracket, Tanzania is one of a number of countries that has the zeal of planning with substantial backing of figures. The figures are of statistical nature, especially those affecting the human population. As expected, human studies cannot be worked on their own without connection with the environmental surrounding. It is envisaged that research on the contribution of natural forests to the welfare of people, for instance, could to a large extent measure fairly well the forest contribution to the national income.

To that effect, this study has been carried out in order to determine natural forests contribution to the national wealth. In doing so, we expected to achieve many things including laying a basis for Natural Resource Accounting (NRA), which is the measure of environmental activities in an economy. Bearing in mind that Tanzania is not without various records on her natural resources such as forests, fisheries, wildlife, population, climate, soils, agriculture, livestock etc; the information from many records has been used to explore further the environmental issues in question and tap the data on natural resource and environmental values. However, being aware of enormous resources required for this type of studies covering the whole country, we decided to make an attempt of measurement of the anticipated values at district level. In this particular case, Urambo district was earmarked for the exercise. The district was selected on the basis of both its widely recognised ecological importance and notable economic relevance in terms of production of flue-cured tobacco. This crop highly entangles with the natural environment in all its phases of production. It was thus decided that considering tobacco growing and other possible factors influencing the growth of the natural resources, research in economic gains of these activities in the district should be scale-weighed with natural forests loss for the same activities. This allowed us to critically consider issues of opportunity costs of using or conserving our forests when decisions are made to open new farms, for instance, to grow crops at the expense of conserving the biodiversity of the areas to be cleared for agriculture.

In this manner, the study had the following objectives within its scope: (1) to estimate use values of natural forest products for tobacco growing and other

activities; (2) to estimate the rate of depletion of the natural forests as a result of tobacco growing and other factors; (3) to determine the approximate difference between "the value gained" in growing tobacco and "the value lost" in the natural environment as a result of utilization of its products; (4) based on the observations from the district of interest, to suggest means that would allow the system of national accounts to incorporate the environmental depreciation measures using contemporary approaches available, e.g. Vincent and Hartwick (1997); (5) to determine some socio-economic factors that might be associated with the growth of natural forest resources ; and (6) based on the type of data present and the current state of SNA, to put forward recommendations for measures to be taken for a proper integration of the natural resources into the SNA.

Analysis of information collected through the household questionnaires together with secondary data collected from various sources have been used for determination of the value gained and the value lost through tobacco growing (or utilization of natural forests).

1.2 General Description of the District

1.2.1 District profile

Urambo is one of the five districts forming Tabora region. It is located on the western side of the region covering an area of 21,299 km^2. This is nearly 30 percent of the total area of the region. Population is estimated at 300,000. The major economic activity within the district is agriculture. Food crops that are mainly grown include maize, paddy, cassava and beans, while cash crops are tobacco, cotton and (nowadays) groundnuts. The district has 291,144 ha of arable land, and records show that by 1997 about 71,644 ha of this land was being utilised for agriculture. The cultivated land is believed to increase steadily mainly due to tobacco farming. Other activities taking place in the district include bee keeping, animal husbandry, fishing and logging.

The district has four forest reserves covering an area of 994,400 ha or approximately 28 percent of the total area under forest reserves in the region.

The forest covering the district is ***miombo woodland***, which is important for timber extraction as it contains valuable hard wood species of plerocarpus angolensis (Mninga), dalbergia melanozilon (Mpingo), afzelia quanzensi (Mkola), swatzia madagasuariensis (Kasanda) and brachystagia speciformis (Mtundu).

Natural forest resources are mainly for timber and fuel wood for tobacco curing, household consumption and building purposes. Non-wood products e.g. honey, beeswax, grass and even wild animals are also provided by the forests. Forest reserve in the district is also an important source of water for Tabora municipality. Villages sampled for this study, as many others in the region, are located within or nearby forest reserves. This makes economic activities based in the villages increase rate of consuming as well as trading natural forests products. In addition, there is influx of migrants from degraded neighbouring lands of Mwanza and Shinyanga regions who create new settlements around the reserves for best pasture of their animals, further increasing the size of population at risk of utilizing and degrading the forest resources.

1.2.2 State of natural forests and Government intervention

As mentioned earlier the forest cover in the region is miombo woodland. There is no estimate available for standing timber, but the woodland is estimated to have a mean annual increment (MAI) of 2.5 m^3 per annum. However, due to depletion, MAI has dropped to approximately 1.2 m^3 per annum. With this rate of increment total production of solid wood per year is about 2,199,600m^3.

Currently, 1,050,000 m^3 of solid wood is harvested as fuel wood and charcoal per annum. Estimated solid wood for curing tobacco is 64 m^3 per ha, thus with an estimated area of 20,000 ha under tobacco cultivation, total amount of solid wood consumed in curing tobacco alone could be as much as 1,280,000 m^3 per season. Besides tobacco curing and household consumption, fuel wood is also used in other activities like fish smoking, brewing and brick making. All uses accounted for; fuel wood consumption might be over 2,330,000 m^3 per annum in terms of solid wood.

Another factor that has been worsening the state of natural forests in the area is the move by the government in 1972, which allowed some 1200 sq km to be occupied by refugees from Burundi. This was supposed to be a temporary move, however, due to political reasons that could not be the case. To date, the settlement still exists and there is an estimated population of 10,000 settlers in the forest reserve area.

Due to the alarming rate of depletion of the natural forests, mostly due to agricultural peasants and timber loggers, the government intervened at various stages in trying to rescue the situation. Efforts for afforestation failed due to the use of afforested land for grazing, among other malpractices. The survival rate of the trees was severely affected and as a result, there was no significant achievement. In addition, the shortage of forest staff seems to aggravate the problem further because it is very difficult to contain the forest reserves invaders or even to ascertain correctness of the quantities of forestry products harvested through licensing. The forestry officials in study areas summed up the following as major problems faced in their day to day activities in the department:

- Infringement of forest reserves through settlements.
- Deforestation due to expansion of agricultural land.
- Livestock by migrating livestock keepers.
- Uncoordinated development plans by natural resources and agriculture officers.
- Ignorance of population adjoining forests on actual forests values.
- Habitation of refugees.
- Non-recycling of revenue earned from forest products.
- Laxity of politicians when handling village programmes and operations.
- Non-observance of the natural resources governing rules.

From the above discussion on the study district, we can reach to the conclusion that deforestation is mainly a result of agricultural and logging activities. The frequency of these activities is on the increase due to lack of control mechanisms and restrictions from the authorities on one hand and some intervening social characteristics of the population on the other.

2. Some related studies and NRA concepts used

2.1 The need for NRA

The life of most people in developing world, and more especially those living in rural areas (who form the majority), depends directly on their interaction with the natural forests' resources. In addition to grazing livestock and cultivation of subsistence crops, rural communities harvest several tangible products from the wild for direct consumption, (Shackleton et al, 1999). For instance, most household energy needs are met by direct collection of firewood from natural woodlands and forests.

Furthermore, the distribution of assets (marketed and non-marketed) is another factor that propagates the use of forest resources. Farmers with 'uneconomic' holdings of land and other natural resources, and who have no other source of income, will tend to overexploit those holdings (Perrings, 1998). It is of some concern, therefore, that there has been a marked and continuing tendency for the distribution of both assets and income to widen over time in many of the low-income countries, reflecting both the erosion of traditional rights of access to the resource base and increasing human population pressure.

However, we sadly note, it is typical that all the values attached to these resources are excluded from the conventional national income accounting. This omission normally has the consequence of underestimating the contribution of natural forests to the gross domestic product and do not account for the social costs or benefits of their environmental impacts (Hassan, 1999). The said omission may also lead to wrong policies and development plans resulting in sub-optimal allocation and unsustainable extraction and use of natural resources (Lange et al, 1998).

The problem is felt more amongst the developing countries, where national accounting as a tool of economic policy and planning has been less used (Peskin, 1989). The paucity of data is well appreciated by anyone who has done research in these countries. But equally important is the conventional emphasis on market transactions. This almost exclusive focus on market may seem largely irrelevant in poor countries where many, if not most, exchanges of goods and

services take place in households or otherwise outside of well-organised markets.

The main objective of most studies under NRA is thus to establish the value of the resources to the society, particularly to the authorities. Natural resources are often sold in markets, and so to some extent are reflected in the conventional national accounts. However, the prices of resources may not always reflect the cost of renewing renewable resources, nor the true (full) costs of depletion of non-renewable resources. Natural assets and their services of resource supply, waste absorption and other amenities of the environment often have no price at all, being treated as "free" goods, so that their use is not fully reflected in the national accounts.

The result is that, in presenting the value of the actual monetary transactions in the economy, the national accounts systematically understate or omit the environmental costs incurred by those transactions, in terms of environmental depletion and degradation. GDP and related indicators thus contain a substantial element of consumption of natural capital, which is unaccounted for as a significant cost of production.

NRA adjusts conventional measures for the missing environmental values and establishes the link between economic activities and their use of natural resources and impacts on the environment. More accurate indicators of well-being and macroeconomic performance are accordingly generated by NRA and the correct signals about environmental impacts of economic activities are then conveyed.

2.2 Model of Forest-Economy Interactions

In his study, Vincent (1999) argued that the complexity of forest-economy interactions makes forest–related adjustments to the national income accounts prone to double-counting and other problems if they are not guided by economic theory. A framework for making internally consistent and theoretically sound adjustments was presented. In the framework, identification of the principal ways that forest resources interact with the economy was suggested as the

starting point for analysing how GDP and NDP should be defined in an economy with forest resources.

The following list was regarded to include virtually all the interactions considered by the FAO survey:

i. Forests as a source of renewable, but potentially depletable, *timber* harvested by logging companies and used as a production input by wood-processing industries;
ii. Forests as a source of tangible *non-timber products* collected and consumed by households but not necessarily bought and sold in markets (e.g., fuelwood, game);
iii. Forests as a source of less tangible *forest amenities* consumed directly by households (e.g., existence values associated with biodiversity);
iv. Forests as a source of *environmental services* that benefit other productive sectors (e.g., watershed protection, which benefits downstream agriculture, and forest-based recreation and tourism);
v. Forests as a disposal site for *air pollutants* that might be damaging to forest health (e.g., acid deposition);
vi. Forests as a sink for and a source of *carbon dioxide,* which potentially damages other economic sectors through global climate change;
vii. Through deforestation, forests as a source of *land* for other purposes, in particular agriculture; and
viii. *Forest management* as an activity involving the use of both variable inputs (labour, material) and fixed factors (human-made capital).

2.3 NRA methods and approaches

As a result of combined contributions of natural sciences and the economics knowledge, a number of approaches to sustainable development have been proposed. NRA represents one of the emerging tools and approaches for integrated economic and environmental management and development planning (Hassan et al, 1999).

The theoretical foundations of the NRA approach go back to the origins of the concepts of sustainable income and wasting assets in economics, and the

materials balance and ecological limits imperatives of natural sciences. It is based on correcting existing conventional measures of income, wealth and social welfare. This exercise eventually leads to the correction on the measures of economic performance, which will feature environmental values and depreciation of natural assets.

In taking the task of adjusting the conventional System of National Accounts, NRA adopts various approaches. The approaches and methods adopted range from minor adjustments of certain aspects of existing accounting framework, construction of separate satellite NRA to major restructuring of economic accounts. **Physical Resource Accounts** (PRA), represents the earliest attempt to account for the extraction and use of natural resources and generation of waste and environmental externalities in physical terms. PRA were initiated as a simple extension of the national balance sheet accounts to record changes in the stocks of key natural resources and pollution and energy flows.

Monetary Accounts Approaches, on the other hand, represent a step forward from physical resource accounts to correct current measures of income and wealth for sustainability.

Steps involved in this approach towards full environmental accounting include:

- **Treatment of Environmental Expenditures** - common to most industrialised countries, reflecting the prime concern about pollution and environmental quality in these countries;
- **Treatment of Natural Assets Depreciation** - A method adopted on marketed natural resources such as timber and fisheries;
- **Full Environmental Accounting Approach** - a category representing an attempt to accommodate all entries of the more comprehensive PRA in the current system of national accounts with money values assigned.

2.4 Policy matters of NRA and sustainable development

NRA assesses the economic value of a country's natural resources and how they are used (Lange et al, 1998). They provide better measures of economic performance and link problems such as land degradation, groundwater

depletion, or deforestation to the economic activities that cause them, or are affected by them. This encourages the policy makers to regard the nation's natural resources as capital assets rather than unlimited 'free goods' and promotes firm economic decision-making.

National Resource Accounts are, thus, a set of structured accounts, like the national economic accounts, that record stocks and changes in stocks of natural resources, as well as annual use of resources. Like any other accounts, NRA function is to provide a set of aggregate indicators for monitoring changes in wealth and welfare status, as well as a detailed set of statistics; for instance, a figure that tells a country how far it is from the path of sustainable development.

The emphasis of NRA, compared to other sorts of data about the environment, is the direct linkage with economic accounts for integrated environmental-economic analysis. The advantage of a direct linkage over separate analyses of economic problems and of environmental problems is that it forces economists to recognize the links and to take into account tradeoffs between economic and environmental desires.

The contribution of NRA to policy analysis has been primarily at the macroeconomic and sectoral levels as a tool for coordinating policies in different Ministries. Policy-makers at this level have the responsibility for multi-sector strategic planning that requires setting national priorities and policies of all sectors and based on weighing alternatives and tradeoffs among sectors. This is important when allocating resources like water or land among competing needs like crops, livestock and wildlife-based tourism.

3. Data, data sources and collection

3.1 Data Collection

Data collection was facilitated in two stages: Firstly, we approached various agencies for relevant secondary data that we needed. This was to cater for the need of the study to get some available information that could lay foundation for any suggested NRA undertaking in the future. In addition, some constants e.g. the value (forest resources gained/lost) per hectare or per person were some of the indices required by the study; implying the need for reliable information on the prices of the products and services utilized as well as population size of the villages under study. Cartographic representations for different periods since 1970s for the study area have been considered in order to indicate the percentage changes in the different elements of the natural forests. We have relied on the forestry department at both district and regional levels as well as department of agriculture and regional statistical office for most of the secondary data used in this study.

From all this sources we were able to get information on the size of woodlands and forests in the region, population, production of major crops, uses of forest resources and economic performance of the district. This information was supplemented by discussions with the farmers, foresters and other regional workers.

Secondly the study intended to know how different economic activities might be evaluated in view of having direct impact on the growth of the natural resources. We used households located in the study area as units of analysis in studying the effect of tobacco production on the growth of natural forests resources that are directly consumed in the exercise. Households that participated in the survey were selected on the basis of Enumeration Area units (EAs) that have been drawn as primary sampling units for the purpose of National Population Census of 1988. Due to the setting of this study only rural EAs were used to form our sample.

Household questionnaire was employed for data collection in this case; and for facilitation of the study, the questionnaire had a filter separating tobacco

growers from non-growers. This was done in order to capture differences in the use of the natural forests products and services between the two groups. We expected that this could enable us reach some sense of average consumption of the products, for a proper evaluation of the required indicators of value of extracted natural forests products in the study areas. For instance, Peskin (1980) estimated an imputed value of net depletion of forest resources in Tanzania due to fuel wood extraction alone to be 5 % of total GDP. This estimate was based on valuing the average time spent in fire wood collection and an estimate of harvesting in excess of regeneration.

Some questions were included in the questionnaire for taping people's response on how they value their natural resources. The questionnaire was addressed to the head of household.

Wherever appropriate, community questionnaire was administered at some wards and/or villages for collection of primary community data that we thought might be relevant to the study.

3.2 Problems faced in data collection

We faced some problems in data collection. We had problems in the exercise itself as well as on the quality of data obtained. We had to pursue a number of sources for the collection of intended secondary data. Some of the sources could not provide expected information, while others had mix-ups of the intended data. In some cases there were unexplained jumps in series of data. This was a clear indication for us on the quality of data that we could have ended up with.

Complexities of tobacco growing make it difficult to have reliable and consistent data. This is mainly the case for data on expansion of land for tobacco growing. This is due to the fact that in expanding the land for agriculture there are few tricky stages that a farmer undergoes in cutting down natural forests. For instance, in a given year an individual farmer would clear two acres of forest in order to grow tobacco. Whereas the farmer plants tobacco on the cleared area, the bush and trees that are cleared in the same year are used for fuelwood. When tobacco goes ready for curing, the farmer would clear another two acres of forest

in order to get wood/logs for curing the tobacco. In so doing already he would have cleared four acres of forest in one particular year! In the following year he would wish to clear another virgin land so that he may reap a bumper harvest. The process of felling more trees would be repeated unwaveringly and so deforestation goes on for many more acres yearly.

Problems faced in collection of primary data were common to any such exercise. However, with regards to special needs of this study, which were relatively new compared to respondents' past participation in household surveys, we had to face the problems of explaining in detail most of the queries. This was evident in questions on willingness to accept and willingness to pay for some products of the natural forests, which were included in order to have means of estimating their values.

Given that this study is meant to give way for more sound studies on NRA, we hope that despite the above-mentioned shortcomings this goal has been achieved.

4. Results and discussion

4.1 Household Performance

We firstly made a study of household's performance in relation to matters influencing the growth of the natural forest resources from the surveyed area. Table 4.1 shows some characteristics of the sampled households.

Table 4.1 Distribution of the households by some selected characteristics

		Number	*Percent*
(a)	**Sex of the head of household**		
	Male	210	92.9
	Female	16	7.1
	Total	**226**	**100.0**
(b)	**Household size**		
	Up to 4 members	48	21.1
	5 to 8 members	111	48.7
	9 to 12 members	42	18.4
	12+ members	27	11.8
	Total	**228**	**100.0**
(c)	**Number of members over 18 years old**		
	Up to 4 members	164	71.9
	5 to 8 members	57	25.0
	9 to 12 members	7	3.1
	Total	**228**	**100.0**
1.	**Head's occupation**		
	Farmer	215	94.3
	Employed	10	4.4
	Other	3	1.3
	Total	**228**	**100.0**
2.	**Do you grow tobacco?**		
	Yes	142	62.3
	No	86	37.7
	Total	**228**	**100.0**

The study found out that 93 per cent of the households were male-headed. Male-headed households were shown to be more involved in tobacco farming. This implies these households were more likely to be involved in utilization of forest resources than the female-headed ones.

It was further shown, as expected, that farming is the main economic activity practiced by the respondents in the area. About 94 percent of the households were exclusively of farmers. Of these, 63 percent were regular growers of tobacco (they have been growing tobacco for over five years). The proportion of tobacco growers is very big and it gives an indication of the magnitude of the rate of depletion of the surrounding forests.

Each year a farmer would increase his farming area by clearing the forest. This exercise was found to have two major forces behind. First, by clearing a new land (even if not used in that particular time), a farmer would be sending a message to his colleagues that the area is owned, i.e. no one should tamper with it. Second, on clearing the forest, the fallen trees become source of fuel for curing tobacco in all the three phases necessary for the exercise. This means while clearing the forest, the farmer has an idea of how much he should clear in order to get sufficient fuelwood for tobacco curing. Currently, it is estimated that one tone of tobacco requires 18 cubic metres of fuelwood for curing.

The study has shown that out of tobacco growers, 61 percent (n=142) do normally clear a new piece of land each year. The mean cleared land was found to be 3.255 ha. The mean cleared land for the year 1999 alone was 4.678 ha. This implies, at the start of each farming season, at least 280 ha of the forest is being cleared for tobacco farming in the study area. This represents a very high rate of depletion of the forests, which could be as high as 0.13 percent per annum for the whole district, if we consider a minimum of one percent of its households as being of tobacco growers.

Soil fertility is also a factor responsible for this behaviour shown by tobacco growers. Constant use of fertilizers has led to depletion of soil nutrients and thus farmers tend to prefer virgin land for more yield of the crop. The study found

that (76%, n=174) of the respondents were of the opinion that the current state of the soil is worse than it used to be in the past.

More on the depletion of the forests as a result of growing tobacco is shown in Table 4.2. The table shows regional estimates of cleared land for tobacco growing in relation to tobacco production and fuelwood consumption.

Table 4.2 Tobacco Production, Fuel Wood Consumption And Estimated Forest Area Cleared In Tabora Region (1985/86 - 1994/95)

Year / Season	Tobacco production (kg)	Estimated fuel wood consumption (m^3) (stacked)	Estimated area cleared hectares
1985/86	9,672,764.0	173,529.38	4,338.23
1986/87	6,613,252.0	118,641.74	2,966.04
1987/88	6,176,310.0	110,803.00	2,770.10
1988/89	5,640,292.0	101,186.83	2,259.70
1989/90	4,632,817.0	83,112.74	2,077.82
1990/91	5,961,349.0	106,946.60	2,673.67
1991/92	12,122,903.0	217,484.87	5,537.12
1992/93	14,443,381.0	259,114.25	6,477.86
1993/94	11,499,472.5	206,300.52	5,157.50
1994/95	17,133,300.0	307,371.40	7,664.29

As shown from the table, the area cleared for tobacco growing has been increasing yearly. In absence of sound counter-measures, the situation has been growing from worse to worst and to date, it is estimated that about 10,000 km-squared of the forests have been depleted in the period 1965 to 1999. In addition, the time used by residents to move from their villages to the forest for logging or fetching fuelwood provides further evidence of the magnitude of forest depletion through time. The data has shown that, on the average, it takes 12 km to get into a forest that would yield timber for building and carving activities, while it might take a trip of up to 2 hours (on the average) to reach a

forest site that could provide fuelwood for domestic consumption. In other parts of the same region the situation is said to be much worse.

Particularly on the study area, the following land cover maps provide evidence of what has been taking place on this part of the country from early 1970s to late 1990s. Three villages from the study area have their land cover analysed for the said period.

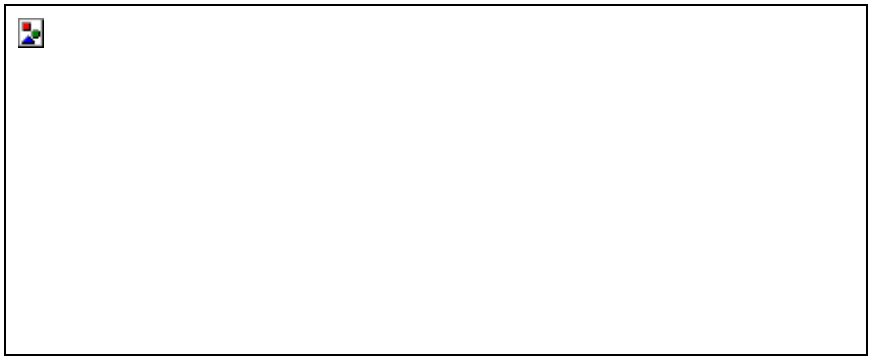
Figure 4.1 Land cover/use for the study area 1975

Figure 4.2 Land cover/use for the study area 1987

Figure 4.3 Land cover/use for the study area 1997

Figure 4.4 gives a summary of the above land cove/use maps by showing the extent of natural forests depletion (by area percentages) in the study area for the three different points in time. We observe a very high rate of depletion of the natural forests. By 1987 the natural forests were all cleared around the area. Consequently, most of the land is shown as being covered by woodlands and mixed cropping activities. All this time flue cured tobacco was the prime commercial crop grown in the region, clearly indicating its influence on the forests.

Figure 4.4 Percent distribution of Land cover for the study area 1975 to 1997



4.2 Extraction of Forest Products

Prior to the estimation of the values, the study made an evaluation on the type as well as extent of use of forest products from the respondents. Table 4.3 shows the results obtained.

Table 4.3 Distribution of respondents by direct benefits derived from the forests

		Frequency	***Percent***
(a)	**Fuelwood**		
	Use	217	95.20
	Do not use	11	4.80
(b)	**Edible food/fruits**		
	Use	22	9.60
	Do not use	206	90.40

(c)	**Charcoal**		
	Use	38	16.70
	Do not use	190	83.30
(d)	**Thatching grass**		
	Use	80	35.10
	Do not use	148	64.90
(e)	**Medicinal herbs**		
	Use	43	18.90
	Do not use	185	81.10
(f)	**Own building timber/poles**		
	Use	148	64.90
	Do not use	80	35.10
(g)	**Commercial timber**		
	Use	27	11.80
	Do not use	201	88.20
(h)	**Building earth**		
	Use	42	18.40
	Do not use	186	81.60
(i)	**Grazing**		
	Use	25	11.00
	Do not use	203	89.00

From the table above we note that there is a wide range of products from the forests that are being utilized by the residents of the surrounding areas. Fuelwood, as expected in rural settings and African sub-urban areas, is shown to be the product with the highest demand. In this area, a typical household would need an average of 2.5 trips per week for fetching fuelwood from the surrounding forests; this makes fuelwood the most frequently derived product from the forests. For the purpose of tobacco curing, fuelwood is normally gathered in large quantities that would require some means of transportation to the burning sites. The study revealed also that, most of the fuelwood collection is done without taking into account the ecological role of the resource in climate modification and watershed protection.

With regards to timber, the data suggests that most of the commercial logging is done by outsiders from the study area. This implies, any environmental or economic suffering that might be caused by depletion of the forests through the exercise would be shouldered by the villagers who might not have benefited in any way from the extracted resources. With such a situation, appropriate intervention from the authorities is important for the welfare of the villagers. Examples are drawn from Kenya, where there are plans for provision of licenses for accessing forest resources under specific conditions (Roba, 1998).

4.2.1 Demand for Forest Resources

Table 3 above has shown that the main forest ecosystem resources use by the residents of the study area. These uses would be typical of the uses countrywide if we assume uniformity in some factors including crops grown and climatic conditions.

The study tried to relate the demand for the forest products to some of the suspected factors of influence from a typical household. To estimate the demand for forest products we considered the relation:

$$Q_i = F(Y_i, H_i, L_i, A_i)$$

in which

Y_i = the i-th household's annual income , proxied by the expenditure on food;
H_i = size of the i-th household (members who usually live in the household)
L_i = labour time used in collection of the forest resources (time to the collection point);
A_i = total land area owned by the i-th household.

The Quantity of forests' products is proxied by the income from tobacco, as we have already observed that it is the expansion of land for tobacco cultivation that interferes with the growth of the forest ecosystem resources.
Table 4.4 shows that (Scenario I), collection of the resources is decreased with increased price (here, time used for its collection). This is an expected relationship, which explains that as time goes the forest resources will be located far away from an average household due to continuing depletion of these

resources through time. On the other hand, as also expected, the household size tends to significantly increase the demand (or collection) of the forest resources. In the setting of the study area, as in most parts of the country, a typical family would invest in having many children.

A family with relatively many children is regarded as to have well invested for its household functions, the most important being farming. In relation to this, (Mkanta and Kamuzora, 2000) have shown that households with large family size were less poor than those with small family size: a finding that was taken as a sign of multiple responses to population pressure.

Table 4.4 Factors Influencing Collection of Forest Resources

Variable	Scenario I			Scenario II		
	Coeffi-cient	t	Signifi-cance	Coeffi-cient	t	Signifi-cance
Income	0.113	0.981	0.333	0.131	0.849	0.404
Household Size	0.614	4.595	0.000	0.691	4.373	0.000
Time for Collection	-0.105	-0.889	0.379	-0.155	-0.966	0.344
Total area owned	0.146	1.138	0.262	-	-	-
Size of new land	-	-	-	-0.73	-0.465	0.646
R^2 adjusted	47%			51%		

The collection of resources is shown to increase with the total land area owned, which itself is positively correlated to household's income. In Scenario II, the study evaluates the effect of newly cleared land on the collection of the resources. We note that all the variables used in Scenario I retain their relationship; while a decrease in collection with the size of newly cleared land is observed. Here, we argue, despite the fact that by clearing the land one aims at collecting some of the resources e.g. logs for curing tobacco etc, the satisfaction derived is short-lived and cannot match the satisfaction derived from a standing forest.

The data does not provide the best fit for both models. This is due to a very high rate of non-response on some of the selected variables. For both models, only about 40 percent of the cases qualified for their formulation. However, despite this deficiency on the data, we were able to show the involved relationships in their expected directions. A much wider sample could give more sound results.

4.2.2 Forest Resources Values

From the discussion on the profile of the study district, we have shown that major activities that take place and which have direct impact on the forest resources are peasant farming and logging. In addition, charcoal making, building, grazing, beekeeping, thatching and gaming are also activities deriving forest resources. Before the values were estimated, respondents had an opportunity to react on questions regarding their perception on "how valuable the natural forests are" to their daily life. Table 4.5 shows distribution of the respondents by their perception on the value of the natural forests.

Table 4.5 Distribution of respondents by worthiness of the forests

i. Do you find the existence of the natural forests important to your life?

	Number	***Percent***
Yes	185	82.6
No	39	17.4
Total	**224**	**100.0**

ii. Would it have protected the forests from depletion/misuse if its products were available at a specific cost that you have to incur?

Yes	158	69.3
No	14	6.1
Don’t know	56	24.6
Total	**228**	**100.0**

The above distributions indicate that people find the natural forests important to their existence. In addition, the respect as well as value attached to the forest resources would have been more significant if each had some sense of associated value, which the user will have to incur directly or indirectly as a way of compensating for both its current services and future availability. The current

state where the products are available "at anyone's wish" tend to disregard the contribution of the resources to the welfare of the people and eventually missing a place in the national system of accounting as they don't reflect scarcity of the products to the users. It is worth noting also, that there is a good number of people (about 25 %) who are not certain as to whether or not accessing forest resources at a cost would be a way of preserving them. This calls for introduction of programmes in mass education on issues related to natural resources and environments.

For the estimation of the value of forest products that are directly used by the villagers, the study used a combination of known prices for some products and response on the willingness-to-pay approach for others. The prices were those used in 1999. For the rate of use of the products, the study converted all into 'rates per household per annum'.

Note on willingness-to-pay questions: The study had gathered estimates on the prices of some forests' goods and services prior to the survey. The WTP questions were then asked against these prices; and the response was expected to change or retain the price according to the respondent's perception. Table 4.6 shows the estimated direct use values for forest products used by the respondents.

Table 4.6 Direct Use Values of Natural Forests Products
(1999 Prices: 1 U$=TShs 800)

Product	**Prices (TShs)**	**Rate of use per h/hold per annum**	**Value Tshs (US $)**
Fuelwood:			
Home consumption	342.78 (heap)	130	44,561.40 (56)
Curing: Large size	847.015 (26 cm)	314.50	266,386.22 (333)
Medium size	631.350 (14 cm)	280.60	177,100.69 (221)
Small size	396.824(7.5 cm)	217.20	86,190.17 (108)
* Building earth	21,350 (complete house)	1.63	34,800.50 (44)
* Grazing:			
Wet season	176.66	654	115,535.64 (144)
Dry season	266.66	903	240,793.98 (301)
* Thatch grass	200 (bundle)	180	36,000.00 (45)

Timber: Building Fencing/other	 2806.38 1262.70	 165.31 94.53	 463,922.68 (580) 119,363.03 (149)
* Edible fruits	1,586	13.09	20,760.74 (26)
*Edible herbs and vegetables	2,918	8.83	25,765.94 (32)
Carving timber	4,929.09	9.15	45,101.18 (56)
Beehives	957	2.2	2,105.40 (3)
Total Value			**1,678,387.57 (2,098)**

*** Prices by WTP approach**

From the results above, we were able to compute the following constants: Total value per household was estimated as TShs 1,678,387.57 (US $ 2,098); and based on the average size of 6 persons per household; value per person became Tshs 279,371 (US $ 350). Value per household, considering products used for tobacco curing alone, was estimated at Tshs 529,677.08 (US $ 662). This value represents approximately 32 percent of the total value per annum. The magnitude of this proportion suggests that there is a strong need of revising the methods used for production of tobacco in this particular area and all others in the country that produce tobacco in a similar way, if the forests have to be preserved.

Currently, the following measures have been suggested and attempted in the study area: (1) Introduction of a new cash crop to replace tobacco. The crop, locally known as ***Mlonje***, produces edible oils; and its life-span can last up to 22 years; (2) Taxes on the fuelwood that is consumed for curing tobacco; (3) Fees for the animals that are kept by the villagers while using forest areas for grazing; and (4) Introduction of wood lots for the farmers, so that they can have their own sources of energy.

These measures, though sound good, they are seldom in practice thus not helping much in afforestation programmes, which were meant to benefit from them.

4.2.3 Cost of growing tobacco and Income generated

The second model developed by this study concerns cost of growing tobacco. This model tries to use this cost as the proxy for the environmental value lost due to the nature of tobacco farming as explained earlier in Chapter One. The components of the costs used include fertilizers, insecticides and casual labourers as these have direct impact on the environment. Factors whose relationship with this cost is explored include, the size of land for tobacco farming (which is positively correlated to number of logs for curing in that year and expected quantity of tobacco) and household size (members over 18 years). Table 4.7 shows the results from this model.

Table 4.7 Determinants of the Cost of Growing Tobacco

Variable	Standardised Coefficient	t	Significance
Area grown tobacco	0.440	2.140	0.044
Members above 18 yrs	-0.214	-1.041	0.310

It is shown that the cost of growing tobacco is a contrast between the size of land under tobacco cultivation and the size of household. Cost of growing tobacco is shown to increase with the size of land under its cultivation (a factor which is determinant of the number of logs to be used for curing as well as the expected yield). On the other hand, the concept of investing on family size is clearly seen playing part in this model. Household with more members over 18 years old (potential workers on field), tends to reduce the cost of production as compared to a household with less number of members in this age group. This is due to the fact that most of the work, whose labour would have been hired, is done by the members of the household working as a team for the welfare of their household.

So far, we have shown that the practice of growing tobacco in the study area has led to the depletion of the natural forests. We have also been able to estimate the average direct use value of the forest resources that are consumed by the residents of the area. The study now tries to evaluate the magnitude of the income gained by the farmers as a result of growing tobacco; this will enable us to measure the differences between the gains from tobacco and the losses of the natural forests.

The study found out that the average net income from tobacco farming was **$564 per household** for the year 1999, (lowest earnings were $51, while highest were $2,809). This figure shows that the monetary value of the earnings from tobacco are on the average 15 percent less than the value of the forest resources that are used for tobacco farming. This implies, under the current situation, the forest resources that are used for tobacco farming need a variety of sources for their replacement/maintenance and should not depend solely on the returns from tobacco.

4.2.4 GDP and its possible adjustments

The study tried to extrapolate the findings on the use of the forest resources as obtained from the study area to make some possible adjustments in the national accounts. For five years, 1995 to 1999, Tanzanian National Accounts looked as shown in Tables 4.8(a) and 4.8(b).

Table 4.8(a)Gross domestic product at constant (1992) prices: Shs million

Year	**1995**	**1996**	**1997**	**1998**	**1999**
GDP at Factor Cost	1,345,247	1,401,712	1,448,089	1,505,827	1,577,299
Net Taxes on Products	113,152	122,964	130,210	131,133	117,451
GDP at market prices	**1,458,400**	**1,524,676**	**1,578,299**	**1,636,960**	**1,694,742**

Table 4.8(b) Expenditure on gross domestic product: Shs million

Year	**1995**	**1996**	**1997**	**1998**	**1999**
Household final consumption	1,222,530	1,278,489	1,309,988	1,447,359	1,548,527
Gov't final consumption	202,717	168,886	279,314	318,119	313,215
Gross fixed capital formation	281,793	274,353	275,489	314,264	309,329
Construction	124,263	136,933	138,458	123,364	122,380
Machinery and Vehicles	157,531	137,420	137,031	190,900	186,949

Changes in inventory	3,764	3,794	3,825	3,855	3,886
Less Import Goods/Services	610,243	561,234	402,765	567,397	616,957
Plus ExportsGoods/ Services	327,607	328,884	247,148	271,487	321,915
Net export	-282,636	-232,350	-155,617	-295,910	-295,042
Discrepancy	33,995	35,298	-130,875	-146,873	-181,287
Total expenditure	**1,458,400**	**1,524,676**	**1,578,299**	**1,636,960**	**1,694,742**

For the year 1999, when this study took place, the accounts included an input of 770,509 million shillings as the value from the agricultural sector, which comprised sub-sectors of (1) Agriculture, Crop and Animal Husbandry; (2) Forestry; (3) Fishing; and (4) Hunting. From this input, forestry on its own contributed about 47,164 million shillings ($ 59 million).

We have shown earlier that the gains from tobacco farming are 15 percent less (by value) than the forest resources used for growing the same. If we make a crude assumption that this holds for the whole country. (That is for each region its economic activity produces 15 percent less value as compared to the value of the natural resources consumed), then the value that's shown to be contributed by forestry in the GDP, i.e. 47,164 million shillings is short by 15 percent or 7,075 million shillings. If this shortage was to be accounted for, then the GDP would be increased by 0.4 percent.

However, for a full picture of the contribution of the forest resources to the national economy, we have to consider the whole range of forest products that are used in daily lives of the people. From the study area we note that the average income for a given household (including income from tobacco farming) is $ 1,469. On comparing this value to the total value of the forest products used, we observe a 70 percent discrepancy. On assuming uniform conditions for the whole country as above, then the GDP as shown in Table 4.8, would be short by 33,015 million Shillings, equivalent to US $ 41,000,000.
From these findings the 1999 modified accounts, taking into account the value of forest resources production (and consumption), would have increased the

GDP by about 2 percent. That is, the modified GDP as described above would be 1,727,757 million shillings for the year 1999. This increase is small compared to Peskin (1980), who showed a 6 percent increase on the GDP when he considered fuelwood production into the accounts. We argue that the percent increase on GDP is small in our case because there are aspects of the natural forests and environments that do feature in the accounts beforehand, unlike the time when the same was attempted in 1980.

This implies any attempt to further correct the accounts to accommodate the natural resources and environments, should carefully scrutinize the existing accounts to identify the gaps correctly. This will avoid the problem of double counting that may cause the accounts to be unrealistic.

5. Implication of the results and recommendations

5.1 Implications of the findings

From the above discussion of the results, several implications have been noted. Firstly, to a large extent, the respondents have shown a tendency of valuing the natural forests as they do provide products that are essential to their daily lives. There are indications of a failure by the authorities at all levels in controlling the growth of natural resources in connection with the daily consumption by the villagers. Neither proper means of regeneration of resources nor plans to benefit the villagers now or in next generations through the current extraction of the resources are in place. Only if true costs of forest products are paid by the present generations can the forests be managed for the future.

On evaluation of the direct use values for the products used by the villagers, the study found out that the largest proportion, 32 percent of the total value; and also the largest quantity (more than 215,000 cubic metres of fuelwood annually from 1991 to date), is used for tobacco curing. This finding implies there is a need to introduce different means of treating the crop; or else the efforts by the regional authorities to introduce a different cash crop with minimum forests depletion effect, should receive a strong backing of the central government.

Difficulty in getting sufficient data for some modules of analysis that we had proposed implied lack of appropriate policies that would cater for the same. Relevant data for NRA could always be obtained from "the most common" data collection exercises for undertakings of various governmental departments for example forestry, agriculture, natural resources etc. Thus its deficiency in performing NRA is evidence of its deficiency in the departments too. The government should commit itself to provide resources adequate for obtaining sufficient and accurate data with regard to the important natural resources and environments. This would definitely increase the level of understanding of the resources and their relationship to economic activities.

The study also observed the influence of family size on collection of forest resources. We might not be in a position of preaching family planning under the context of this study. However, this result, together with the one showing that people are ignorant of the value attached to the environments, call for authorities to find ways of imparting knowledge (on environmental values) to the people whose life depend on their interaction with the environments.

The study has also revealed that the monetary value from tobacco production is low by 15 percent as compared to the value of environmental products utilized by the household. We cannot argue that our data is crude to some extent especially on estimating the environmental values. However, there is a message sent that we cannot ignore. The data implies that any maintenance of the resources cannot depend on the returns from tobacco, hence a need for improving the methods of farming or else we should introduce an alternative cash crop and/or any other economic activity that would be environmental friendly.

For some of the forest products, e.g. timber, the study have shown that there is a possibility of having the villagers, who reside next to the forests, being deprived of its benefits. This would normally be the case when people from outside these villages, through unofficial means, get access to the forests to harvest the products in unchecked quantities and qualities for their immediate commercial benefits. This habit has now driven some species of hardwood towards extinction as well as causing massive environmental degradation around the villages.

5.2 Recommendations

In view of the findings and their implications so far, the study recommends the following: The government, through the ministry of natural resources, should form a task force to evaluate NRA possibilities. The force should be able to use experiences from other countries to suggest means that will be suitable for enabling integration of environmental values into the existing system of national accounts.

There should be a specific system that would be adopted nationwide; to ensure that for each natural resource derived, there are returns that reflect their worth. In addition, mechanisms should be implemented that would clearly allow residents around forest areas to benefit from the products of the forests. That is, regardless of whether the products are derived for use inside or outside the village, the residents in their totality should derive some satisfaction. For instance, taxes or fees on the products can be used for improvement of social facilities in the villages. In the long-run, such a setup will stop illegal harvesting of the products as everyone would be aware of the benefits of the products to their lives, when legally harvested.

Policies should be formulated to ensure regular delivery of data from governmental departments, which would facilitate NRA and regular updates. This would allow environmental accounting to be part of the planning machinery in the country.

Plans should also be underway to introduce cultivated forests in various parts of the country.

Lastly, the government should introduce some regulations that would safeguard the forests in areas where minimum depletion has occurred. This will enable, as per regulations, true costs of the natural resources derived from the forests to be captured from the largest possible area, unlike from other places where depletion has been going unchecked.

5.3 Conclusions

The study concludes by emphasizing on the need for further research. Any follow-up or similar research should focus on capturing data that would enable generalizations of the country situation. This would allow one to have knowledge of the state of the NRA for the country and more importantly to have means of comparing our performance with other countries. This study aimed at producing some flow accounts (both physical and monetary), for some of the natural resources, but due to the lack of adequate data, the exercise has been reserved. Similarly, on the effect of inclusion of environmental values on SNA, we were only able to give a proportion by which the GDP would have changed. But once again, this was done with a strong cautious mind due to the crude methods of estimations that we have employed.

So the study concludes by a final recommendation that a similar study, with a much wider scope in terms of sample size and coverage should be conducted. The sample should be as much as possible a true representative of the country so as to provide national estimates in view of Natural Resources Accounting.

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APPENDIX I

THE QUESTIONNAIRE

Introduction

i. Questionnaire No. ……...
ii. Village …….
iii. Division ……...
iv. Sex of the Head of HH ……
v. Total number of Household members …….
vi. Members under 18 years …….
vii. Members above 18 years …….
viii. Do you grow Tobacco? Yes ……. No ……..
ix: Household Schedule
(About the people who usually live in your household).
Name ……...
Sex ……...
Relatio n to the Head ……
Marital Status ……..
Occupation ……..

PART A: ECONOMIC ACTIVITIES

A1 Main crops grown
i. Tobacco
ii. Maize
iii. Groundnuts
iv. Paddy
v. Cassava
vi. Vegetables
vii. Beans
viii. Potatoes
ix. Mlonje (Alternative to tobacco)

A2 Total acreage owned cultivated and uncultivated. ……..…(ha)

A3 Do you clear new land each farming season? Yes ……. / No ……..
3a If yes, how many acres do you clear each year? ……...

3b What is the acreage of the cleared land for the current season? …

A4 Do you find existence of the natural forests important to your life?
Yes ……. / No …….

A5 What benefits do you derive from the surrounding forests?

i. Fuel wood ……..
ii. Medicinal herbs …….
iii. Charcoal ……
iv. Grazing areas ……
v. Timber ……...
vi. Building earth ……
vii. Thatching grass …….
viii. Poles ……..
ix. Source of Water ……
iix. Don't know/No benefit at all ……
iiix. Edible plants and wild games ……...
xi. Weather control ……

A6 What evidence could you provide that indicates misuse of the surrounding forests?

i. Uncontrolled tree felling ……...
ii. Massive land clearance …….
iii. Wild fires ……...……...
iv. Overgrazing ……...
v. Destruction of water sources ……..
vi. Felling immature trees ……..

A7 Would it have protected the forests from depletion/misuse if its products were available at a specific cost that you have to incur?
YES ……. / NO ……. / DON'T KNOW……...

PART B: EVALUATION OF NATURAL RESOURCES

B1 How many houses do you have? …….

B2 How many have been built using mud blocks? ……...

B3 Can you tell total number of blocks used in all houses altogether? ……

B4 How many of these have been roofed with grass? ……..

B5 How many bundles of thatching grass have been used in all your houses? ……

B6 How long does it take before replacing the grass? (months) ……..

B7 How many bundles per month/year do you use for other household functions? ……

B8 If you were to employ somebody to cut and bring grass for the complete work of roofing your house(s) how much would you have paid him per bundle? ……

8a Below Tshs 100 (Tshs …….)

8b Above Tshs 100 (Tshs …….)

8c Not above Tshs ……

B9 How many poles were sufficient for all your house(s)? …….

B10 How long do they take before replacement?

Months …….. Years ……

B11 Where do you get your building earth?

11a From the site …….

11b From the forest ……..

11c From other place ……...

B12 How much are you willing to pay someone who brings earth from the forest to your building site up to the completion of your house?

12a Below Tshs 15,000 (Tshs …….)

12b Above Tshs 15,000 (Tshs …….)

12c Not above Tshs …….

PART C:

C1 Do you have a toilet facility in your household? Yes …….. / NO ……

C2 If yes, what type?

2a Traditional pit toilet ……..

2b Ventilated pit latrine …….

2c Own flash toilet …….

C3 If no, what do you do?

3a Go to the Bush/field ……..

3b Sharing facility with neighbour ……

3c Other …….

C4 Type of diseases common to your place

i. Diarrhoea ……...

ii. Vomiting ……...

iii. Typhoid …….
iv. Eyes ……...
v. Cholera ……..
vi. Coughing ……...
vii. TB …….
viii. Dysentery ……..
ix. Bilharzias ……..
x. None ……..

C5 For the past 3 months, what is the cost of medical treatment that you have incurred? Tshs …….

C6 Can you tell us for the past year how much money you have used for medical treatment in your household? Tshs ……

D: TOBACCO GROWING, ANIMAL AND BEE KEEPING

D1 Cost of growing tobacco each year for 1997, 1998 and 1999

i. Total area under tobacco(ha) ……
ii. Fertilizers. Tshs ……
iii. Insecticides. Tshs …….
iv. Casual Labourers Tshs …….
v. Transportation Tshs ……..
vi. Construction of burners Tshs ……
vii. Packing of bales Tshs ……
viii. Other related costs Tshs ……

D2 Tobacco curing each year for 1997, 1998 and 1999

i. Total number of logs used …….
ii. Large size logs ……..
iii. Medium size logs ……..
iv. Small size logs ……..
v. Cost of transporting logs Tshs ……..
vi. Cost of Casual Labourers Tshs …….
vii. Other related costs Tshs ……

D3 Sale of Tobacco each year for 1997, 1998 and 1999

i. Amount sold (kgs) …….
ii. Revenue generated Tshs ……...

iii. Amount harvested (kgs) ……

iv. Amount rejected (kgs) ……..

v. Amount not sold (kg) ……

D4 Animal keeping each year for 1997,1998 and 1999

i. Total number of animals kept ……...

ii. Cattle …….

iii. Goats …….

iv. Sheep …….

v. On soil fertility:

* land more fertile now ……..
* less fertile now ……
* Not changed ……

D5 How many heaps of hay your animals would use?

In dry season ……...

In rainy season ……

D6 How much are you willing to pay for the hay that is used by your animals in dry season?

i. Below Tshs 300 (Tshs …….)

ii. Above Tshs 300 (Tshs …….)

iii. Not above Tshs ……

iv. In wet season ……

v. Below Tshs 300 (Tshs …….)

vi. Above Tshs 300 (Tshs …….)

vii. Not above Tshs ……

D7 How do you construct your beehives?

i. Using tree barks …….

ii. Modern means ……..

iii. Others ……

8 If tree barks, from which type of trees:

Year	Type of trees	Number of beehives	Value of harvested honey
1998			
1999			

For the hives made of tree barks how much do you normally pay the makers. Tshs ……

D10 Value of honey and wax

Year	Honey (volume)	Honey (value)	Wax (weight)	Wax (value)
1999				

E: TIMBER PRODUCTS

E1 Is your household involved in logging? Yes …… / No …….

E2 If yes, which type of trees do you normally harvest?

2a ……..

2b ……..

E3 How far from your household do you normally harvest trees for timber? (km)? ……...

E4 How much timber (in volume) did you harvest last year? ……..

E5 Value of timber harvested last year? Tshs ……

E6 Cost of timber harvesting:

Year	License	Logging	Transportation	Other
1998				
1999				

FOREST PRODUCTS FOR ENERGY

E7 What do you use for energy in your household?

i. Fuelwood ……...

ii. Kerosene ……...

iii. Charcoal ……..…

iv. Solar energy ……..

v. Other ……..

E8 If your household uses fuelwood, how far do you get it from? ……(km)

E9 How long do you take to reach this place? …….. (minutes)

E10 How long does it take to collect enough fuelwood once you reach this location? ……..……(minutes/hours)

E11 If you are buying fuelwood, how much do you pay for a heap? …….

E12 If you are not buying, how much will you be willing to pay for a heap

enough for your home consumption? Tshs……..…….

E13 Do you use charcoal that you produce on your own? Yes ….. / No ……..

E14 If yes, how many units (28 kg sacks) do you produce each year? …….. (units).

E15 What is the total cost of production? Tshs……...…..

E16 If no, how far do you get charcoal for your home consumption? ……..….(km)

E17 If your household uses kerosene, how much do you use per month? .. ……..… (Lts)

E18 What is the cost of kerosene per month? Tshs……..

E19 If your household uses electricity, how much do you pay per month? Tshs……...

F: OTHER FOREST RESOURCES

F1 Quantity of fruits, herbs and game animals:

Item	**Quantity per month**	**Willing to pay (Tshs)**
Fruits (quantity)		
Herbs & vegetables (kg)		
Wild animals and fish (kg)		

APPENDIX II

AREA STATEMENTS FOR THE STUDY AREA

Area Statement for Uyowo/Igwisi –1975			
		Area	
Forest	sq.m	sq.km	%
Natural Forest	5,359,523.0	5.4	2.2
Woodland			
Closed Woodland	127,964,709.8	128.0	53.2
Open Woodland	76,547.4	0.1	0.0
Woodland with Scattered Cultivation	17,327,985.7	17.3	7.2
Bushland			
Dense Bushland	26,475,653.4	26.5	11.0
Open Bushland	62,067.2	0.1	0.0
Bushland with Scattered Cultivation	6,863,075.7	6.9	2.9
Grassland			
Grassland with Scattered Cultivation	8,131,091.4	8.1	3.4
Wooded Grassland	363,018.6	0.4	0.2
Cultivated Land			
Mixed Cropping	47,850,158.7	47.9	19.9
Total	240,473,831.0	240.5	100.0
Area Statement for Uyowo/Igwisi -1987			
		Area	
Woodland	sq.m	sq.km	%
Closed Woodland	93,666,632.1	93.7	39.0
Woodland with Scattered Cultivation	16,770,079.4	16.8	7.0
Bushland			
Dense Bushland	1,905,774.2	1.9	0.8
Bushland with Scattered	58,457,309.5	58.5	24.3

Cultivation			
Grassland			
Grassland with Scattered Cultivation	1,446,499.2	1.4	0.6
Cultivated Land			
Mixed Cropping	68,712,057.0	68.7	28.6
Total	240,958,351.3	241.0	100.2
Area Statement for Uyowo/Igwisi -1997			
		Area	
Woodland	sq.m	sq.km	%
Closed Woodland	60,158,324.3	60.2	25.0
Open Woodland	9,776,881.9	9.8	4.1
Woodland with Scattered Cultivation	54,335,577.6	54.3	22.5
Bushland			
Dense Bushland	836,946.9	0.8	0.3
Open Bushland	341,626.6	0.3	0.1
Bushland with Scattered Cultivation	13,928,713.6	13.9	5.8
Bushland with Emergent Trees	2,901,800.2	2.9	1.2
Grassland			
Grassland with Scattered Cultivation	17,001,366.3	17.0	7.1
Open Grassland	54,316.0	0.1	0.0
Wooded Grassland Seasonally Inundated	3,110,430.6	3.1	1.3
Bushed Grassland Seasonally Inundated	42,606.5	0.0	0.0
Cultivated Land			
Mixed Cropping	78,471,099.3	78.5	32.6
Total	240,959,689.6	241.0	100.0