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Using an income accounting framework to value non-timber forest products.

Dr. Caroline Sullivan

Centre for Ecology and Hydrology, Wallingford, Oxfordshire, OX10 8BB

Tel:01491-692457 Fax: 01491-692338 Email: csu@ceh.ac.uk

Abstract.

The land-use strategies of many tropical countries have evolved from analyses which are based on a first world perspective, and as a result, many of them have been found to be unsustainable. Methodologies currently used for environmental valuation in developing countries are often inappropriate, and subject to serious degrees of error which inevitably have important policy implications (Markandya and Perrings, 1992). In particular, valuations of resources in tropical forest ecosystems often fail to take account of the full spectrum of forest products and services, since many of these have traditionally been ignored as being insignificant or non-marketed. Resource auditing procedures, which may be useful in other circumstances, fail in this case because of such problems as the lack of clearly defined markets, uncertainty regarding both current and future demand and supply of forest products, and the lack of detailed information about how these resources are used (Daly, 1989). The objective of this paper is to demonstrate a method of assessing the use-value of these non-timber forest products (NTFPs), using an income accounting framework, and by focusing this research on these NTFPs, it is possible to demonstrate an extra dimension to forest valuation which is often ignored.

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Introduction

Today, almost 4% of the earth's land area is managed explicitly to conserve species and ecosystems, (WCED, 87), so the need for conservation is already accepted. The problem we are faced with now is one of determining *how* it can be achieved, both in the best interests of individual nations, and in the interests of the world as a whole. Clearly the objective of any rational government is to achieve economic growth so that the needs of the population are met, and the standards of living (howsoever measured), be improved. In order to achieve this in a sustainable way, changes will be needed in the way countries operate both internally and externally.

The role of tropical forests

Tropical forests are important to the global ecosystem for a number of reasons. Not only do they provide a production function in the form of a wealth of resources, but they also fulfill important regulatory functions such as carbon sequestration and hydrological cycling. Because of the high concentration of flora and fauna in tropical moist forests, these areas function as a major *carbon sink*, along with the oceans, and the atmosphere itself. Estimates of the size of this total global biomass pool are in the range of 550-830 billion tonnes of carbon (Bouwman, 1990), and tropical deforestation is one aspect of human action which is disturbing the functioning of this carbon sink, and contributing to the rise in atmospheric CO_2. Since forests contain possibly as much as 85% of above-ground biomass carbon (Sedjo, 1992), changes in the levels of forest cover will have an effect on both emissions and absorptions of CO_2 .

Other examples of studies where ecosystem functions have been undermined by deforestation include Tanzania (Kaoneka and Solberg, 1994), Thailand (Muttamara and Sales, 1994), and India (Das, et al.,1994). In all of these cases it has been shown that deforestation has been a major factor in bringing about soil erosion, sedimentation, and flooding. Without doubt it can be said that the local, regional and global impact of this systematic reduction in forest cover is having a significant negative impact both on major world ecosystems, and on large numbers of the world's people.

An additional and major role that tropical forests play is that of habitat provision, an essential function for the more than half of the world's species which live there. Although extinction and renewal are a natural part of life, the serious disturbance of habitats occurring today as a result of deforestation has brought about a large rise in the extinction rate. By the year 2050, it is estimated that half of all the species alive today could have disappeared. (WRI, 1994). This is of particular concern since the availability of species diversity may have a very significant impact on future human food sources.

At present, only 20 plant species account for the majority of the world's food supply, and of these 20, most are already suffering from a decline in their genetic diversity (US Agricultural Research Service, 1985). This means that rapid and worldwide starvation could result if a pest or virus was able to attack these 20 species, and only by adopting the use of new species, could we develop pest-resistant strains, or new sources of food. Similarly, over 80% of the world's human population depends on natural plant sources for medicinal remedies, and even most of the state-of-art medicines of the developed world have plant sources as their base (Seager, Reed and Scott, 1995).

Attempts have been made to try to assess the value of these genetic inputs. In one example alone, the contributions of wild genetic material to the productivity of maize and wheat in the U.S.A., (two major crops in the world grain trade), has been estimated

at over $1 billion annually (US Agricultural Research Service, 1985), while in medicine, half of all prescriptions dispensed are for drugs and potions which originate from wild organisms (Farnsworth and Soejarto, 1986). The commercial value of this pharmaceutical output worldwide has been estimated at more than $40 billion a year (Meyers, 1983) and without doubt, the potential for many more products still exists, since less than 1% of all species has been scientifically investigated. (W.C.E.D. 87).

Another much more important reason for maintaining biodiversity is for it's role in ecosystem functioning and resilience, because of the interdependent nature of so many species which participate in such "Macrobiological" functions as nutrient cycling, watershed protection, biological productivity, climatic stabilisation and even the functioning of the food chain itself. It is in this context that the issue of the valuation of non-timber forest products becomes important, since it is through the inclusion of these minor products that a more accurate representation of forest values can be made.

Valuing the Environment.

By determining that the "Environment" is something which affects us all, we need to try to assign some form of *global* value to it, as well as simply taking the sum of it's parts. Some attempt to quantify this has been done (Barde and Pearce, 1991), and the concept of *Total Economic Value* has become accepted. The Total Economic Value of a resource is said to be made up of the Use Value, the Option Value, and the Existence Value, and if these values can be adequately captured, then some possibly acceptable value of the environmental resource can be computed.

This computation is however far from simple. Unlike other goods and services, those provided by the environment are ill-defined, often non-marketed and even to a large extent, undocumented. Statistically, this means that they can be described as "fuzzy" values, which do not fit in well with conventional linear methods of analysis implied by the Marshallian Demand Curve. Trying to understand the world in terms of linear econometric models is very unrealistic, and failing to take account of these "fuzzy' variables makes the analysis unreliable. The use of an alternative method of valuation, not dependent on the explicit identification of the demand curve for environmental goods and services, could alleviate some of the difficulties presently prominent in the valuation debate.

The solution to the valuation problem is an important hurdle to overcome if sustainable development policies are to be achieved. If such a calculation can be made and added to conventional investment appraisal techniques, it could prevent marginal economic activities being undertaken at the expense of irreplaceable natural resources. A classic description of such policy failure in Amazonia has been provided by Binswanger, (1989), where cattle stations were set up in areas of cleared tropical forest. At that time, this was seen as a viable development strategy for the region, because the investment appraisal made, before the development, did not include any evaluation of the environmental effects it would have. This situation was made worse by the Brazilian Government's attempts to develop the region of Amazonia by offering tax-breaks and subsidies for beef production on this totally unsuitable area of land, and the result is that now beef is being produced in the area, but with a productivity rate so low as to make it virtually uneconomical. To make matters worse, the cattle ranching activities have brought about serious soil erosion and now the area can be used for little else, perpetuating and worsening the vicious circle of poverty. Fortunately, this trend has slowed down, with more recent research pointing to more positive strategies for

resource use in that area (Barthem (1995), Hall, (1997), Goulding et al, (1996). Nevertheless, the fact is that if effective valuation strategies are not in place, policy failures may inevitably be the result, as resources with low market values will inevitably loose out in the fierce competition of the free market economy (Pearce, 1996).

The valuation of Non-Timber Forest Products.

Conventional economic analysis of forest resources has often tended in the past to ignore non-timber products. This is illustrated by their lack of inclusion until recently in the FAO/UNEP *Tropical Forest Resources* reports. Non-timber forest products include any kind of fruit, nuts, honey, bark, fibre, fungi, resin, animal products or organic chemicals which originate in a forest ecosystem. All forests, in both temperate and tropical areas, have some non-timber products, but because of the huge range of plant species found in the latter, the importance of these 'by-products', and the economic potential from them, is much greater in tropical forests. One major advantage of looking at these products as potential income generators is that it is possible to harvest them without significant damage being done to the ecosystem, as long as the harvesting is sustainably managed. In addition, the methods of collection of such products are inevitably labour intensive, and this often means that they are appropriate to the situations found in many tropical forested areas. Furthermore, since indigenous forest peoples are usually familiar with these types of product and the methods of collecting them, they are well-suited to, and indeed skilled in, this type of work. (Ros-Tonen et al, 1995)

When taking all these diverse forms of income generation into account, the potential values from non-timber forest products could be very large, and the actual value that they currently have, is also very significant. From the perspective of a subsistence forest household, forests provide an important source of protein in the form of wild meat and fish, as well as other forms of foods. This has important implications for the generation of sustainable rural livelihoods. Forests can also generate income from the export of plants and flowers, from handicraft items produced by forest dwellers, and from the provision of saleable services for the purposes of ecotourism. On this basis therefore, it can be seen that non-timber forest products generate both monetary and non-monetary values, but, if we fail to include these in our economic analyses of forest potential, it is clear that we reduce the chances of achieving a sustainable system of management of the forest ecosystem.

To date well over 30 studies have examined some aspect of non-timber valuation of forest resources, with the range of estimates of non-timber values varying considerably (Lampietti and Dixon, 1995). This heterogeneity of values has also been shown in literature surveys produced by such writers as Godoy et al. (1993), Adger et al, (1995), and Southgate (1996). Wide variations in the various geographical locations of these studies, and the methodologies used, have been given as an explanation of this variation (Pearce, 1996), leaving the whole problem of valuation of non-timber products and services as yet unsolved. It is with this in mind that this paper attempts to address the problem of valuing non-timber forest products, using an income accounting framework to elicit an estimate of the income flow of use values for forest dwelling people. In this attempt to assess the use-value of these non-timber products, it is important to note that no attempt is made to include the very valuable and important global environmental services provided by tropical forests, which lie beyond the scope of this paper.

Modeling the village economy to calculate the Net Village Product.

The main objective of this work is to examine the extent to which non-timber forest products (NTFPs) are important to forest households, and to estimate the monetary value of their worth in such an economy. In particular, this work makes an attempt to extend the valuation process beyond the monetary sphere, to include the flows of natural capital and ecosystem services which are utilised by households, and to examine these in a way which takes account of the social and biophysical impacts which they may have.

The accounting framework.

Accounting methods are used in almost every country in the world to record the nation's progress in terms of economic production and growth. Today, the United Nations *System of National Accounts* (SNA) has become widely accepted, but there are a number of disadvantages associated with it. The two major ones are the fact that no provision is made either for the inclusion of the value of environmental goods and services, or for the depletion of the resource over time. (Repetto, 1988; Daly, 1989). While this study cannot overcome these problems, it does attempt to include some otherwise ignored values, as well as highlighting the need for a more holistic approach to forest resource assessment. In addition, the data collected here about current rates of use of non-timber forest products could be of use to future researchers attempting to calculate rates of resource depletion.

In order to be able to calculate the value of the *forest inputs* used in these villages, it is first necessary to construct a model of all of the inputs and outputs of the village as a whole. By using an accounting framework, it becomes possible to examine the economic structure of each village in more detail, and evaluate the contributions made to village life by each of the various sectors involved. Through the use of a static equilibrium model, the value of the Net Village Product (NVP)[1] can be calculated. This will be based on the usual accounting framework, as used in such calculations in developed economies, but modified to represent the simpler economy found in a subsistence village. The model of the village economy will be calculated on the basis of the usual equilibrium accounting assumption that:

Value of household inputs = value household outputs

Here:

$$\textit{household inputs} = wL^h + rK^h + \delta K^h + p_f F^h$$

Where:

w = wage rate;

L^h = weighted hours worked by household h (weighted for men, women and child labour inputs);

r = rate of interest for the use of capital in production;

K^h = productive capital used by household h;

δ = capital depreciation rate;

p_f = implicit price of each unit of nature (forest) used;

F^h = implicit quantity of nature (forest) used by household h.

Similarly:

$$household\ outputs = \sum_{i=1}^{n} p_i Q_i^h$$

Here:

p_i = price of the good

i = Counter for NTFPs; hunting, fishing, handicraft & farming outputs, etc.

Q_i^h = quantity of that good produced by household *h*.

All values used here refer to the period of one year, and so for convenience, the time subscript (*t*) usually applied will be omitted. The value of 'savings' (ΔK) would be included in this equation as an output, identified by one of the Q_i^h values, but without intertemporal household data, it is impossible to identify any specific value for capital accumulation by households. As a result, this value is included in the total of 'value added' associated with the use of the forest.

By equating the value of household inputs and outputs, we get:

$$wL^h + rK^h + \delta K^h + p_f F^h \equiv \sum_{i=1}^{n} p_1 Q_h^1 \qquad [1]$$

To build the complete model of the village, we then need to consolidate all the data together, and the Net Village Product (NVP), is obtained by summing across all households *h*:

$$NVP = \sum_{h=1}^{H} (wL^h + rK^h + \delta K^h + p_f F^h) = \sum_{h=1}^{H} \sum_{i=1}^{n} p_i Q_i^h \qquad [2]$$

Determining the value of forest inputs from Net Village Product.

The value of $p_f F^h$ will be derived as a residual from the completed equation of all other inputs and outputs. This residual represents the contribution made to NVP by the various NTFPs, and each of these are in the form of output values from village activities generated by the use of forest resources. This is shown as equation

$$\sum_{h=i}^{H} p_f F^h = \sum_{h=1}^{H} (\sum_{i=1}^{n} p_i Q_i^h - (wL^h + rK^h + \delta K^h)) \qquad [3]$$

Those activities which are forest-dependent clearly make a contribution to the economy of the village, and by examining their monetary value[2], it will be possible to assess the proportion of village output which depends on forest utilisation. The use of this framework therefore permits a calculation of the value of the forest for the households, and by summing across households, a figure for the value of the forest to the village as a whole, can be derived.

The figures calculated here to demonstrated the value of non-timber forest products and services in these villages, actually represent the value added to labour and capital inputs by the use of the primary resource, land. This amount therefore is equivalent to the rent of that factor of production. This figure is not insignificant, and it would certainly be important to include such rents in any assessments of alternative development strategies. Since the exploitation of this natural capital in these villages is

small-scale and considered to be non-depleting[3], it is not necessary as part of this analysis, to depreciate the value of this natural capital use[4].

In addition to the fact that livelihoods are generated from the use of non-timber forest products and services, the important point to consider is the fact that this estimated level of rent accruing to land and nature, as a result of this use is, ceteris paribus, an infinite income stream. This has significant implications for sustainability, and it is important that, if the quality of this income stream is to be preserved for future generations, action must be taken to ensure that this common property resource is not depleted by the decisions and actions of both the local residents, and the policy makers of the current generation.

The data

For the purpose of this analysis, data was collected in a participatory manner (Pretty et. al., 1995) from 143 households in three Amerindian villages in North West Guyana, with the assistance of seven Amerindian field assistants. (See map in Figure 1)

Figure 1. A map of the study villages.

During an eight-week period, the field assistants interviewed household members in every occupied house in each village, getting as near to 100% survey results as possible. Interviews were held with men, women, youths and elders, and specific information was

collected from farmers, fishermen, hunters, craft-workers, and palm-heart cutters. Information from respondents was recorded on pre-prepared data sheets, permitting a consistent recording procedure for each household. Interviews between the household members and the field assistants were kept as informal and relaxed as possible, and every attempt was made to ensure that the information recorded was accurate and reliable. During the survey period, householders in each village were asked to complete diaries of all the activities of household members, and these, along with interviews with key informants and other activities, provided a cross-checking mechanism for the data collected.

Estimating household inputs in forest villages.

Household inputs in the subsistence villages of this study will include the input of labour and capital. No account is taken of the cost of land rental in these calculations, since the land used by each householder is part of the Amerindian Reservation, a communally owned land title for which no rent is paid by the farmers.

Household labour inputs.

The supply of labour for the each village has been calculated from the survey data, and converted to an annual total *effective labour supply*[5]. A shadow wage has been calculated at G$70 per hour, on the basis of the *opportunity cost* of labour. This is determined by *what could have been earned* through harvesting Manicole palms *(Euterpe),* the 'heart' of which is bought by a canning company and exported as a luxury foodstuff to Europe. The information for this calculation was taken from survey data of all of those involved in that industry in the study villages. The palm-heart industry represents an unregulated labour market in this region, with free entry and exit for workers, so it thus lends itself to use as the basis for the calculation of shadow wages.

Using this shadow wage of G$70 per hour, the *accounting value*[6] of this labour is then calculated from the number of hours of labour spent in each activity in each household. The resulting figure for the value of labour is then combined with the value for other factor inputs, providing the total value of factor inputs in the Net Village Product. In the case of these villages, the other inputs are limited to the use of the forest resources, and an input of capital.

Calculating the contribution of capital to the household and village production processes.

The items important for production were identified during interviews with farmers, women, and senior male householders. From the number of each of these items listed by each household, it is possible to calculate the monetary value of this productive capital stock. This is done by applying a regionally adjusted price to the various items held by the household. On the basis of this value of household productive capital, the value of capital inputs can be computed. The total household capital cost is made up of the cost of holding the capital itself, and the cost of the depreciation of that capital over time.

The holding of capital has a cost in terms of foregone interest, and so the village opportunity cost of holding capital is ΣrK, where r is the *real rate of interest* for the relevant period, and K is the value of household productive capital. In Guyana, the real rate of interest is in fact a negative rate of minus 7%, since the rate of inflation is 24.5% (Dec 95) while the Cooperative Bank of Guyana agricultural lending rate (June 1996) is 17.5%. The use of such a negative interest rate is not appropriate as an indicator of the

true opportunity cost of capital use in this model, and so to avoid any distortion, a rate of return will be employed which will be more representative of the more usual rate of return to capital. For the purpose of this study, in the calculation of the NVP, an interest rate of 8% will be used [7].

Capital consumption also has a cost associated with it, and this is accounted for in the NVP calculation as the term δK_h , which represents the change in capital stock through depreciation. On the basis of qualitative data collected from the householders, the value of capital stock is assumed to have a life span of 5 years, so for the purpose of this production analysis, a 20% depreciation rate is used. This means that the amount of wealth or capital consumed per year in the process of production is calculated as being 20% of the village total productive capital holdings. The application of the depreciation rate to these figures converts the calculation from the Gross value of Village Product, to the Net Value.

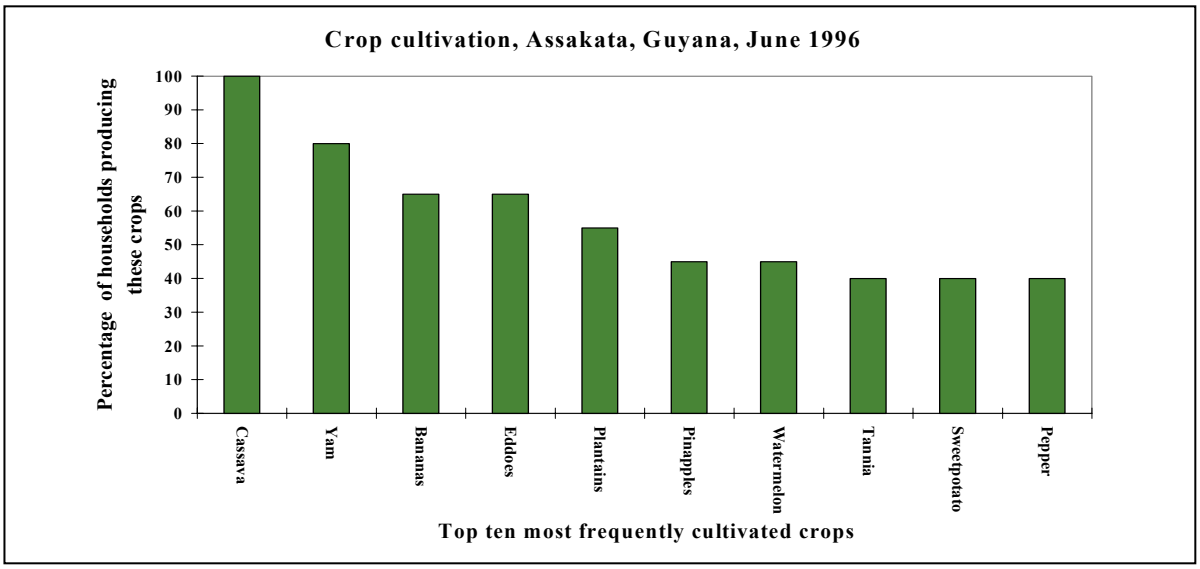
Estimating household outputs.

All household outputs from different activities need to be taken into account. These are the values of outputs from all of the economic activities participated in by the household. It is important to note that as with the standard SNA framework, this does not include any accounting for domestic chores or child-rearing.

Farm output.

The wide range of crops farmed by most households reflects the varied nature of an Amerindian farm, where a large number of crops are planted together in an apparently haphazard way[8]. This great variety of crops provides an important degree of food security for the household, as total crop failure is extremely unlikely to occur. Because of the large variety of crops grown by every farmer, the totals for some individual crop outputs may be very small. In such cases, these small amounts have not been counted, ensuring that no over-estimation is taking place. Without very detailed, lengthy and costly agricultural surveys, farm productivity per crop cannot be estimated, and so an assessment of the gross output of all crops per farm is more suitable, and practical.[9] Although over 30 different crops were recorded in farms in these study villages, a general pattern of crop output did emerge, and this is illustrated in Figure 2, which shows the major crops farmed in the village of Assakata, in June 1996.

Figure 2. Major crops grown in Assakata, 1996.



Due to the extreme poverty of these households, almost no livestock is kept, and, for the most part, the only animals in the village are the dogs used by the men when they go hunting, and the tame macaws and parrots used as decoys for trapping purposes. In most households, domesticated animals are simply not found, as they have no capital to invest either in the animals themselves, or in the cost of building pens to house them. Only a few chickens are kept by a few households in each of the villages, although in the case of Sebai, this number is significantly larger than in the other villages.

Once the volume of crop outputs is calculated from data collected from farmers, male heads of households and senior women members of the house, its monetary value can be calculated from the prices for those crops in the village itself, or in the local market. These prices were calculated from farm survey data where farmers reported crop prices, and from observations at the nearest market on six occasions during the study period. Averages of these given and observed prices are used in the calculation of farm output values. By multiplying the household output of each crop by its price, it is possible to estimate the monetary value of farm output, and by summing across all households, the value of village farm output is calculated. As farming represents one of the most major sectors of the village economy, this figure is an important part of the calculation of Net Village Product.

Hunting and trapping.

Traditionally, 'bushmeat' and fish have provided the main sources of protein for these households, and this is still the case today. This fact highlights the importance of the forest for communities such as these, and the fact that its existence contributes importantly to both food security and community health. In addition, it is clear that the value of hunting and fishing revenues should also be included in the assessment of NVP.

In the forest communities of this study, hunting is an activity limited strictly to men. Those who participate in hunting were asked to give their reasons for so doing, and for 67% of them, the major reason to hunt is to supplement household food supplies. In addition, the activity of hunters supplies the household with a certain amount of money

income, especially in the case of those involved in wildlife trapping, and this is an important consideration for the well-being of all the household members. 34% of hunters stated that hunting was important because animals were easy to sell or exchange, and money earned from the sale of wildlife and bushmeat provides cash to enable the purchase of such things as kerosene, soap and hardware items which they are unable to provide for themselves.

In each of the villages, several households do not participate in hunting or trapping activities for various reasons, not least of which is the difficulty of ensuring success. Those households which do not themselves hunt, obtain meat by exchanging something for it, or receiving it as a gift from a family member, friend, or neighbour. This acts as a type of informal inter-household credit market, which serves an important social welfare function in the community, but no attempt is made here to to quantify this.

The value of bushmeat is based on the estimated numbers of animals caught by hunters, and an error term is applied to these catch numbers, calculated from the variation between estimated catch-weights and actual observed catch weights. Since some seasonal variation will occur in any hunting activity[10], the figures are also adjusted for seasonal variation, and computed for the year. Market prices of bushmeat and wildlife catches are calculated on the basis of the prices given by hunters themselves for the various types of animals, and from observations made in the local markets. Averages of these observed and reported prices are applied to the estimated weights of catches, and the resulting figures for each household catch value are aggregated to compute the village total.

The relatively high returns to hunting reflect the skill required to be successful as a hunter, and the steady demand for the meat. In each village, the value of hunting and trapping is a significant figure contributing to the NVP. This highlights once again the importance of the forest to the well-being of these forest dwellers, and it is important to note that any programme to improve the standard of living of these villagers is also likely to have an indirect benefit to the forest ecosystem, as it is likely to lead to a decrease in the consumption of wild animals as a source of food. On the other hand, if the standard of living of the inhabitants of villages such as this fails to improve, it is highly likely that there will be an increasingly unsustainable demand for birds and animals from the forest, once again putting pressure on the integrity of the forest ecosystem itself. The impact of such poverty on ecosystems is already well-documented in many parts of the World, and if the diversity of Guyanese forests is to be maintained, improvements must be made to the standard of living of the people living within them.

Fishing output

It is well-known that deforestation can have a dramatic effect on watersheds and river courses, and as a consequence, the availability of clean rivers with available fish to some extent reflects the efficient functioning of forest ecosystem services. An assessment of the value of the fish is therefore another indicator of the value of those ecosystem services to the people who live there, and of course it also must be included as part of the Net Village Product.

Fishing is an important contributor to the income of many households in these villages, and a wide variety of fish are caught. The most popular method of fishing in the village of Assakata is the seine net, with over 40% of fishermen considering that method most effective. The traditional method of catching fish using fish poison made from forest plants is also important, with 32% of fishermen thinking it is the most

effective method. The use of forest plants such as *Haiariballi* (Alexa spp), *Monkey Ladder* (Bauhinia spp) and *Huria* (Byrsonima crassifolia) again highlights why the forest is considered important to these households, since these plants contribute significantly to fish catches. This same fact also applies to the various fish traps which are commonly in use, as these too, are made from forest plants.

Fishing values are calculated from fishermen's estimates of catch-rates, adjusted by an error term, and for seasonal variation. Market prices are used to calculate the monetary value of the catch, and this figure is included as one of the household output values in equation [1].

Palm-heart cutting

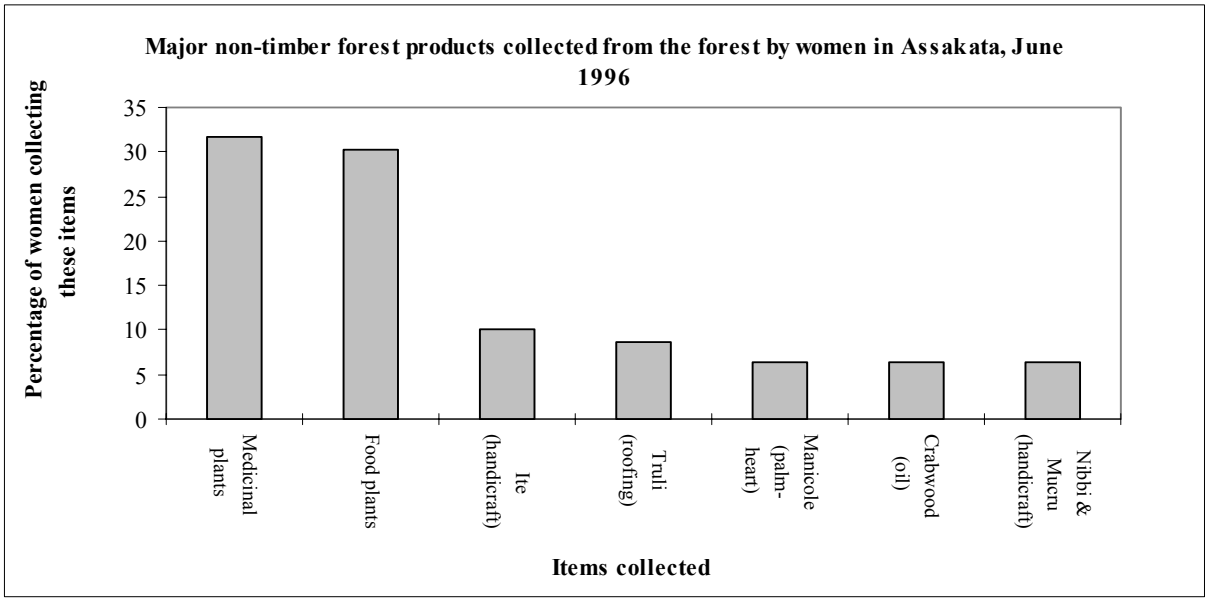
The harvesting of wild Manicole (*Euterpe*) palms is an important activity for 65% of households in Assakata, with average monthly earnings per collecting household being G$8,713. In the other villages, this is not such a major activity, and as a consequence, more time is spent in alternative forms of work such as handicrafts, hunting or fishing. The value of palm-heart harvesting is calculated on reported harvesting rates, and market prices for each heart as paid by company buying agents in the region. Figures for harvesting rates have also been cross-checked from the buying company records, and these showed the estimated rates to be surprisingly accurate. The annual value of palm-heart harvesting represents an important source of cash income to the villagers, and must be included in the calculation of NVP.

Forest food and drink

A variety of plants are collected from the forest for a number of uses. Some of the major ones collected are shown in Figure 2. Food and drink coming from the forest is usually not marketed, but nevertheless it does make an important contribution to the household diet, and thus needs to be included. 31% of households regularly collect food plants from the forest, and in addition, villagers, especially children, consume forest foods on every occasion they are in the forest. Although no account is taken of this informal individual forest food consumption, an attempt is made here to include the value of regularly collected forest foods[11].

The monetary value of these forest foods can be calculated on a household basis, and then summed across all households to give the total value of forest food and drink for all the village. The monthly weight of collected food and drink plants are estimated from responses of both male and female villagers, and the annual value of these is calculated using the market price of a regularly collected forest fruit as a proxy for all forest food and drink plants. Summed across all households, this amount is included in the NVP.

Figure 2.



Notes: 1. *Ite* palm is used for making fibres used in handicraft, and fruits can be eaten. **2.** *Truli* palm is used as a roofing material. **3**. *Crabwood* seeds are used to make a valuable oil used for its medicinal properties. **4.** *Nibbi* and *Mucru* are used for basketry and other handicrafts.

Roofing materials

Several forest plants may be suitable for use as roofing materials, but over time people in this area have come to prefer the shelter provided by certain species over others. This is due to the broadness of the individual leaves, and the resilience of the plant to pest infestation and weathering, when used as a roof for a house. Those harvested most frequently for the purposes of roofing are predominantly the *Truli* and occasionally the *Turu*, which is not as long-lasting. Other plants (such as *Mukru*) are used to bind the roof together, and a substantial quantity of that is required for each roof.

Usually families collect their own *Truli*, but some people in other areas make a living from collecting and selling it. For a household of the type found in the study villages, it would take 4 to 7 days to collect the materials, with each tree providing a maximum of four leaves. The average house would require leaves from approximately 130 *Truli* trees.

The value of the roof in terms of the forest inputs can be calculated as being the number of *bones* (branches) of *Truli*, priced locally at G$1 per foot, plus the value of the *Mucru* binding. The *Truli* leaves are harvested from the forest, and then cut into *bones* each usually 5 feet in length. These are then laid out overlapping each other, and stitched together with the *Mucru* so that it becomes possible to pick up a whole section of what will be the roof, in one piece. Several pieces like this are then placed into position on the frame of the roof, and then bound securely with *Mucru* vine. The resulting roof is likely to last between 5 and 12 years, depending on the closeness of the *bones*, and the quality of the binding. Most families collect their own *Truli* on an

ongoing basis, and simply repair damage as it occurs, rather than having a major roof overhaul from time to time.

The size of the average house in these villages would require on average 500 *bones*, each at G$5, giving a total cost of *Truli* at G$2500, with another estimated $G2500 being the cost of the approximately 120 *Mucru* plants required for the job. This total cost of G$5000 represents the materials cost for an average house roof which in general lasts for 5 years before repairs are needed. On this basis, the cost of the NTFPs used for the roof would be G$1000 per household per annum, a figure which should be included in the value of forest products used by the households.

Medicinal Plants

Of the women included in this study, 95% felt that the forest was important to the family, for medicinal plants and as a source of materials for handicrafts, as well as food. 39% of women regularly collect medicinal plants or Crabwood oil and seed, and on average, women knew of and regularly used at least 8 different medicinal plants from the forest. Some of the main uses of medicinal plants are shown in Table 1. According to the men of these villages, 37 % felt that medicinal plants would be one of the most important losses they would suffer if the forest was to disappear. These views highlight the importance of these forest products to the well-being of households, and so a value should be estimated to cover this benefit.

Table 1. The uses of a small sample of commonly collected medicinal plants.

Name of medicinal plant	Medicinal use
Boyari *(Aristolochia daemonioxia)*	Birth control, antispasmodic, treatment for TB
Ubudi (Anacardium giganteum)	Cancer, cancerous ulcers, diarrhoea, syphilis.
Crabwood (Carapa guianensis)	Ulcers, rheumatism, diarrhoea ,thrush, swelling.
Monkey ladder (Bauhinia scala-simiae)	Skin disease, back-ache, fever, aphrodisiac.
Congo Pump (Cecropia spp)	Kidney disorders, bush yaws and ulcers.
Huria (Byrsonima crassifolia)	Snake bites, fever.
Bulletwood (Minilkara spp.)	Dysentery
Horse eye (Mucuna urens)	Worms
Mora (Mora excelsa)	Uterine infections, dysentery and antiseptic
Greenheart (Ocotea rodiaei)	Malaria, febrifuge.

Note: A considerable number of the plants harvested for medicinal purposes are parts of large trees which have important commercial value for loggers. Examples here include Greenheart, Ubudi, Mora, Crabwood and Bulletwood.

Using the same method described above for the calculation of forest foods, a market value of medicinal plants used can be estimated. Determining a shadow price for these is not easy, as within the villages, the plants are usually not sold. In Georgetown, the capital, they are sold, but the market price there is not truly representative of their value because of a number of other factors such as transport costs, etc. To overcome this

problem, the price of *Crabwood* seeds which are traded, is used as a proxy for all medicinal plants in this calculation. This price is then applied to the estimated weights of medicinal plants collected by householders. The total value elicited by this method is undoubtedly a conservative estimate, which is likely to be much higher if a surrogate pricing method[12] based on the costs of conventional malaria treatment were to be used. Since these medicinal plants represent another household output, this estimated value is to be included in the value of the total NVP

Fuelwood consumption

The collection of fuelwood is a very important household activity in all three villages, since it provides the main source of energy for cooking. The duty of collecting fuelwood varies from house to house, with some households relying on child labour for this, while in others, it is an activity in which all family members participate. The value of fuelwood collected by households is fairly constant across all households, with an average of 1.3 *effective hours* of labour being spent on this per day.

The value of this fuelwood collection is based on the assumption of collection rates being on average 12 lbs per hour. This figure is based on informal assessments of fuelwood loads collected during the survey period. Using the local price of kerosene as a shadow price for fuelwood, the monetary value of the wood can be calculated. From observations in the village, and on the basis of statements of householders, it can be assumed that 10lbs of wood is equivalent to one litre of kerosene, in terms of how much cooking service it can provide. On this basis, 10 lbs. of fuelwood can be valued at G$70[13], and thus the household and village consumption of this can be calculated. For aggregation to annual values, it is assumed, on the basis of interviews with key informants, that fuelwood is collected by householders on 360 days per year, since it is used every day to provide cooking services to the household.

Handicrafts from forest products.

Handicrafts are fundamental to the Amerindian way of life, as it is through the use of various handicraft items that food is processed and produced. The most important of these is the *matapee*, a woven squeezing device made from the *Mucru* plant, used to extract the starch and poisonous toxins of the *bitter cassava,* the staple food of this region. *Mucru* is also used to make the *quake*s (baskets), *maswa* (fish traps) and sieves and sifters found in almost every household, while bamboo is used to make the *kuyama* (another kind of fish trap), as well as sleeping mats and small fans used to heat the cooking fires. The skills of the craftsman are also important in the production of other essential household items, such as the hammock, traditionally made from *tibisiri* fibre (from the *Ite* palm), or from home-grown cotton. Some specially skilled craftsmen also make canoes and paddles, both for their own use and for sale.

The number of households actually considering handicrafts as an activity in which they regularly participate varies in each village. To calculate the value of the craft items produced, craft workers were asked to estimate the approximate average monthly earnings from their work. This was compared to the values of items produced per month by each craft worker, based on the market price of items made. From this an error term was calculated and applied to the estimated value. These figures were then aggregated across households to get the total village value for handicraft output.

The low monetary value accounted for by handicraft in the villages reflects the relatively small number of households considering handicraft as a source of income. One of the reasons for this is the problem of transportation to the nearest market. Taking

goods to a very uncertain market involves a 12 hour round trip paddling in a canoe, or walking, and it seems likely that this reduces the incentive to involve oneself in this work. Nevertheless, handicrafts do have a very important additional non-monetary value to households, and as output, the value of any handicraft production must be included in the calculation of the NVP[14].

The value Village Output

Tables 2 and 3 show a breakdown of the contributions made by the various economic activities to the Net Village Product of the three villages in this study. While Table 2 gives the total values for the villages as a whole, Table 3 shows how this is distributed across the village, showing the average values by participating household[15]. Although the values for the whole village are useful, the size differences in the villages means that it could be misleading to take these figures alone. (In the village of Assakata there are 23 households, in Sebai there are 31, and in Karaburi there are 89). It is for this reason that the average values have been included. From these figures it can be seen that there is some variation in economic structure between the villages themselves, and within the households.

Table 2.

Total value of household outputs in three Amerindian villages in Guyana, 1996										
Village	**Farming**	**Fishing**	**Hunting**	**Palm Heart**	**Handicrafts**	**Medicinal plants**	**Food and drink from the forest**	**Fuelwood collection**	**Truli roofing**	**Total value of outputs**
Assakata	4,893,726	2,822,269	4,687,466	1,348,970	552,500	181,467	242,481	1,054,134	23,000	15,806,013
Sebai	12,907,689	6,766,606	10,465,432	92,000	965,000	387,915	356,994	1,209,978	31,000	33,182,613
Karaburi	26,058,800	5,709,020	7,808,030	217,350	4,746,500	373,327	552,935	3,613,502	89,000	49,168,462

Note: Figures in G$ where £1=G$208 in June 1996

Table 3.

Average value of outputs, by household, in three Amerindian villages in Guyana, 1996										
Village	**Farming**	**Fishing**	**Hunting**	**Palm Heart**	**Handicrafts**	**Medicinal plants**	**Food and drink from the forest**	**Fuelwood collection**	**Truli roofing**	**Total value of outputs**
Assakata	212,771	166,016	468,747	89,931	69,063	15,122	11,547	45,832	1,000	687,218
Sebai	416,377	233,331	436,060	46,000	160,833	18,472	12,750	39,032	1,000	1,070,407
Karaburi	292,796	219,578	300,309	43,470	139,603	10,980	8,378	40,601	1,000	552,455

Note: Figures in G$ where £1=G$208 in June 1996

The average figures shown above reflect the importance of the various sectors. It is clear that overall, Sebai households have a higher output value than the other villages, and this can mainly be put down to the higher prices for these outputs in that area. This applies especially to farming, fishing and hunting outputs, and is mostly due to the influence of the sizeable market in the town of Port Kaituma, where most inhabitants work for a large timber company and have to buy their food from traders.

It is interesting to note that in Assakata, where significant effort is put into palm-heart harvesting, the earnings from this are almost double what is earned from it in the

other villages. At the same time, householders in the other villages earn significantly more from handicrafts than do those in Assakata. This illustrates the possible trade-offs which may exist in this type of economy, and the variety of livelihood choices which are available to households. It is clear that there may be environmental implications resulting from these choices, and it is through a more detailed analysis of some of these that some progress may be made in the achievement of 'sustainability'.

The Net Village Product, and deriving the value of NTFPs

Table 4 shows the values of the various household inputs in each village, the total value of output, and the value of the forest residual as computed using equation [3] above.

Table 4

Value of inputs, outputs and forest residuals in three Amerindian villages in Guyana, 1996

Village	Number of households	Population	Labour values	Capital cost per annum (8%)	Depreciation (20%)	Total value of inputs	Total outputs (NVP)	Total forest residual
	Total values per village							
Assakata	23	167	10,460,108	45,630	114,075	10,619,813	15,806,013	5,126,544
Sebai	31	201	12,936,693	112,104	280,260	13,329,057	33,182,613	19,853,556
Karaburi	89	559	27,249,367	230,416	576,041	28,055,824	49,168,462	21,112,638
	Average values by household							
Assakata	23	7.3	454,787	1,984	4,960	461,731	687,218	222,893
Sebai	31	6.5	417,313	3,616	9,041	429,970	1,070,407	640,437
Karaburi	89	6.3	306,173	2,589	6,472	315,234	552,455	237,221

The computed value of $p_f F^h$ is shown as the *total forest residual*, and in the last column of Table 4, this is shown as a % of total net village product. This is the contribution made to the production process by land, i.e. the rent. It also can be described as the 'value added from nature', or the use-value of the forest resource to the Amerindian people of these villages. In the case of these particular villages, the total gross value of output from the three villages is G$98,157,088, and of this, the net value added from nature is G$46,092,738, this representing the value generated by the anthropogenic use of *non-timber products* from the forest. It is important to note here that no account has been included for the value of *timber products*, as these are not commercially used by the community, and the number of trees used for timber by them on a regular basis, is relatively[16] small.

The values for forest use as elicited by this calculation do represent actual use-values, and include all types of forest use including the use of plants for roofing materials, medicine, fuelwood, food and drink, and income generation through the production of handicrafts etc. As a result, a very comprehensive assessment of NTFP values in these villages has been produced, and it is interesting to note this value is similar to the higher estimates produced by other studies[17] (Adger et al, 1995).

The social value of non-timber forest products

Throughout this study, a considerable amount of qualitative data has been collected from all participating households. Although detailed analysis of this is not relevant to this particular paper, it is worth noting some basic points which do shed some light on the additional non-monetary importance of these minor forest products. The figures illustrating this for the village of Assakata, are shown in Tables 5 and 6 below.

Table 5. Attitudes to life in a forest village. Assakata, 1996

How people feel about aspects of life	% men	% women
Plants from the forest are considered essential to life	100	100
Life in the future is considered to be harder than at present	43	37
Feel happy with life	86	92
Think children should stay in the village	85	67
Think their lives would improve with a job or more money	24	43
Forest makes an important contribution to family life	89	95

Table 6. Inter-generational perspectives on the environment, Assakata, 1996

Observation from the last 10 years, for heads of household, or lifetime, for elders.	%Head of household	Village elders %
Think there are **less** animals in the forest now than before	42	83
Think there are **more** birds in the forest now than before	47	80
Think there are **more** insects around now than before	58	83
Think the standard of living is **better** than before	53	34

These figures indicate some interesting points on how the villagers of Assakata feel about the forest, and their lives within it. 100% of villagers think that forest plants are essential to their way of life[18], with over 90% believing that the forest makes an important contribution to their families. The majority of both men and women describe their lives as 'happy', and want their children to stay in the village rather than move elsewhere, but women especially seem to feel that life would be better if they had more money, while men see this as less important. Some men are pessimistic about the future, with 42% thinking that life will be harder then, but by contrast, women seem to be less worried, with only 37% of them feeling that life in the future would be more difficult.

In terms of intergenerational comparison, 53% of male householders think that the standard of living is better than before, but village elders do not agree, with only 34% of them feeling that life is better now than before. Men seem to believe that although there may be more insects and birds in the forest than in earlier years, the number of animals is declining. Village elders seem to be more acutely aware of these changes in bird, animal and insect stock, with 80-83% of them noticing a worsening of this situation over their life-time. These superficial observations do suggest that both gender and intergenerational differences do exist in attitudes to life in the forest. These differences may have important implications for development, but they need to be examined further if this significance is to be fully understood.

Attitudes to forest functions

How forests are perceived by people is an important concern when considering values. What some people feel is important may be insignificant to others, and this can have important policy implications. When questioned about forest functions, some gender

differences appear to exist in these villages, and as a preliminary investigation into villagers' perceptions of forest functions, some brief analysis is here presented.

Table 7. Gender differences in forest functions.

Forest functions:

1. Shade
2. Money income
3. Source of fuelwood
4. Source of building materials
5. Influences rain and weather
6. Source of medicine
7. Source of food
8. Hunting place
9. Burial Ground
10.Affects water flows
11. Spiritual place
12. Culturally important

Forest function:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Men's mean score	4.55	3.20	5.00	4.85	2.70	3.95	4.25	4.80	1.85	3.25	2.50	4.15
S.D.of men's scores	0.69	1.70	0.00	0.67	1.59	1.19	0.97	0.89	1.46	1.45	1.82	1.50
Women's mean score	3.62	3.71	4.29	4.67	2.29	3.90	3.48	4.10	1.90	2.19	2.00	2.19
S.D. women's scores	1.72	1.31	1.19	0.73	1.68	0.89	1.50	1.51	1.41	1.29	1.64	1.57

Table 7 shows the mean and standard deviation of scores given by men and women for each forest function[19], and when analysed using *t* tests, there appears to be a significant difference between men's and women's responses at the 5% level. This suggests that gender differences do exist in perceptions of forest functions, and it seems that men assign a higher 'value' than women to all of the functions tested. Men seem to be more conscious of the forest as a source of food than women do, (item 7), although it is mainly women who collect food from the forest for the household. Responses from interviews with key informants indicate that this may be due to the fact that men may perhaps have experienced being in the forest with only forest food for survival, more than women have. When considering the value of forest for '*shade'* (item 1), as 'a*ffecting water flows'* (10) and as being '*culturally important'* (item 12), the differences are especially significant. Given the dominant role of women in childrearing, this gender difference in 'values' may have some important implications for sustainability.

Policy Implications

Taken across the total population of the villages of this study, the monetary value of forest use per household is G$322,327 per annum (£1550[20]) .This is an imputed accounting value which can be of use to policy makers, and also could have important implications for people who live in such villages. Estimates like this could be used as an indicator of the amount of compensation which would need to be paid *in perpetuity*[21] in

the event of such villagers losing their access to the forest as a household input. This situation may arise, for example, in a location which was due to be taken over for the purpose of developing a national park, a logging concession, or any other activity which may result in the loss of access to products and services of a forest resource. When combined with conventional timber values, the figure could also be used as a guide for the purpose of evaluating the cost of a forest fire, flooding, or other such ecological disruption.

In order to fully understand the policy implications of this study, it is of course important to consider how these estimated returns compare with conventional use-values based on timber revenues. This is clearly an important question, and one which is beyond the scope of this paper, but for the purposes of simplification it is worth noting that according to most recent information (Pearce, 1998), logging rents in Guyana are currently negative. In effect this means that for every M^3 of timber produced in that country, the people of Guyana are providing a subsidy, and this means that they are effectively paying for other people to benefit from the exploitation of their national stock of natural capital. Given the degree of poverty already in evidence in that country, this clearly is situation which urgently needs to be reversed.

Since it is known that poverty is a major contributor to environmental degradation, policies to alleviate this would be a step forward in the achievement of sustainability. Often, for people in villages such as these, the problem is not in producing output, but in selling it at reasonable prices, so product storage, marketing and transport strategies are areas which urgently need to be addressed if progress is to be made in the improvement of the standard of living. Through improved transport and marketing, it would become feasible for farmers in these forest communities to become more involved in the national economy, and increase the level of value added which they can generate through the use of the natural resources at their disposal.

As in most subsistence economies, these villages exhibit a high labour-capital ratio, of on average 130:1., and qualitative data from the study confirms that capital market failure is common in this type of village economy. This capital market failure is a major factor contributing to poverty in villages of this type, and is a serious problem which is unlikely to be solved if left in the hands of the free market, since transport and security costs in such remote areas are very high. Although it cannot be certain that an increase in financial development is a prerequisite to national economic development (Dimitriades and Hussain, 1997), it is certain that in this particular circumstance, the lack of regional financial development is a significant hindrance to the development of rural communities in Guyana.

For the government, the implication of this is that action could be taken to promote the development of rural banking and credit markets, to facilitate an increase in the use of capital and appropriate technology in these villages. This could be achieved by the development of 'village banking', where the government, or NGOs could provide loans to villages as a whole, these then being distributed to householders as small loans on an individual basis. Through this system, householders are also encouraged to make small-scale savings, and as a result, a gradual mobilisation of credit within the community is developed. Pioneered by the Grameen in Bangladesh, microbanking systems such as this have already been implemented in over 25 countries in Latin America, Asia and Africa, and in most cases the loans range between US$80-US$100(SEEP, 1995). An estimated total of US$2.5 billion has already been successfully mobilised world-wide for these small-scale loans, and repayment rates consistently exceed 90% (World Bank,

1997). This is now seen as an important way of helping poor communities, and in particular it is seen as a way of empowering women in rural areas, which, according to the President of the World Bank, James Wolfensohn, is "absolutely essential to the development of both economic and social justice in our world".(Wolfensohn, 1997)

Conclusions

The attempt to investigate the problem of forest valuation, through the examination of NTFP values appears promising, and some preliminary observations can be made. Taken across the 143 households in this study, the ratio of forest inputs to total output indicates that on average, 47% of output results from the inputs of nature, in the form of traditional forest use. These figures confirm the importance of the use of non-timber forest products and services for the Amerindian people of this region, and suggests that it would certainly be in the interest of Guyanese policy makers to look more carefully at *total forest income potentials*, rather than concentrating solely on the *timber income potentials* when evaluating alternative development options.

The figure computed here for the value of the forest residual $p_f F^h$, actually represents the value added to labour and capital inputs by the use of the forest. This amount is equivalent therefore to the rent earned by that factor of production. This figure is not insignificant, and would have a negative impact on village wellbeing should access to it be lost. Furthermore, this estimated level of rent accruing to nature as a result of the use of these non-timber forest resources is, *ceteris paribus*, an infinite income stream. Having important implications for sustainability, it is essential that the quality of this income stream be preserved for future generations. Action must be taken now to ensure that such resources are not depleted by the decisions and actions of either the policy makers of the current generation, or indeed the local residents.

There is no doubt from this analysis, that the economic importance of non-timber forest products and services has been highlighted. It has been shown that the existence of the forest is important for food security in forest villages such as these, and the qualitative data included here indicates that non-timber forest products are essential to the lifestyle of these forest dwellers. Without this contribution of non timber forest products and services, the way of life of Amerindian people would become insupportable, and another dimension of both economic and social sustainability would be lost.

Notes

[1] Through depreciation of capital inputs, the Gross values of Village Product becomes the Net value of the Village Product.

[2] In all calculations, the exchange rate of UK£1 = G$208, is used. (Rate for June 1996)

[3] At this time it is still uncertain if the exploitation of palm-heart is occurring at a non-depleting rate. Biological data on regrowth rates of the *Manicole* Palm is being collected as part of the Tropenbos-Guyana Sustainable Forestry Project, but details of the analysis from this are as yet unavailable.

[4] If it were to be considered as a resource depleting activity, however, the value of natural capital use would have to be depreciated in the same way that manufactured capital is depreciated over time.

[5] This term is used to indicate that a weighting system has been used to take account of the different productivity levels of men, women and children, and their relative earning potentials. This weighting has been calculated from information from those involved in palm-heart cutting, which is used as the basis of the calculation of the shadow wage.

[6] It is very important to bear in mind that these accounting values do not represent actual monetary income from labour for the household, but the *imputed* value of that labour.

[7] It may be interesting to investigate the effect of selecting different rates of interest for the basis of this calculation. If the rate of interest used was 3%, the cost of capital use would come to a sum of G$17,111, while if it was 15%, the cost of capital use would amount to G$85,556. Due to the very small capital to labour ratio, (In Assakata the ratio is 1:229), the choice of interest rate in this case has little significant effect.

[8] Although the positioning may appear random to an outsider, often the crops are strategically positioned (according to traditional management practices) in relation to other crops or nearby trees which contain some insecticidal properties. An example of this in Guyana is the *Kunaparu* Bush, a deadly poisonous plant used for fish poison, but also known to keep away the highly destructive *Acoushi* ants.

[9] Both the practicality and cost of any social science research methodology is an important consideration when conducting fieldwork. The use of participatory research methods not only can reduce costs, by allowing more efficient collection of data, but can also increase the effectiveness of any resulting policy measures. Since the local community are not only involved in the collection of the information, but are also given the opportunity to think about it and contribute to it, they are more likely to be well-informed about the possible outcomes of the various policy options. As a result, they may be more willing to take the necessary action to implement the selected policies, assuming these are sensitive to their needs and cultural heritage.

[10] A more accurate assessment of hunting and fishing catches could be made by making a long-term anthropological study of fishing and hunting practices, but since the object of this study is to produce a reasonable estimate for these activities, which does not over-state their value, the above methodology is considered acceptable.

[11] The nutritional value of food and drink from the forest cannot be calculated at this time, since a large number of the plants used have never been evaluated nutritionally.

[12] An alternative method of valuing these medicinal plants would be to use the conventional cost of malaria treatment as a substitute price for them. Using the cost of the treatment of malaria as a proxy, an estimate of the value of medicinal plants could be made. It is important to note that this method may also *underestimate* the value of forest plants used for medicine, as they are also used widely for many other medical problems. This method of using a substitute pricing system is not possible at this stage, since information on the cost of malaria treatment in N.W. Guyana has yet to be obtained.

[13] The price of 1 litre of kerosene in Moruka in June 1996

[14] The very small value of handicrafts done on a casual basis by other *non-handicraft* households has not been included in these estimates.

[15] Not all households are involved in all economic activities, so averages are based only on those households which do participate in any particular activity.

[16] Relative to the consumption of timber by commercial logging activities.

[17] Many other studies of NTFP use are restricted to individual crops such as Brazil nuts, Tagua nuts, Rattan, or essential oils. As a result, the values thus obtained tend to be lower than that generated by a comprehensive study such as this one.

[18] This is true in the sense that in order to eat the staple food of *Bitter Cassava,* it needs to be processed to extract poison and it is only through the use of handwoven squeezers made from Mucru plants that this can be done in these villages. In addition, the *Truli* Palm provides roofing for their houses.

[19] Respondents were asked to assign a score from 1 to 5 on each of the forest functions, according to how important each was. (100 % of households represented.) Since bead counters were used to assign scores, the numbers obtained are implicitly on an interval scale, thus amenable to parametric testing.

[20] At 1996 exchange rates of £1=G$208

[21] Assuming an infinite income stream accruing from sustainable subsistence livelihoods

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