HOUSEHOLD LIVELIHOODS, MARKETING AND RESOURCE IMPACTS: A CASE STUDY OF BARK PRODUCTS IN EASTERN ZIMBABWE

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Contribution of Baobab Production Activities to Household Livelihoods

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Abstract

Baobab production activities play a crucial role in contributing to the livelihoods of rural households. In the face of increasing village populations, commercial use of baobab has been steadily increasing to the point where currently, 43% of sampled households participate in baobab production activities. Commercial use of baobab products is especially important to the poorer households and women. In terms of contributing to household livelihoods, baobab activities are ranked second only to some kinds of agricultural production. Numerical estimates of contribution to livelihoods bear out this result with cash income of approximately Z$5000 per annum received for each participating person, well above the official minimum wage. Opportunity costs of labour make up about four-fifths of this value, leaving one-fifth of the cash income accruing as economic rent. The rent available to households seems to vary widely, as there are households that are well located close to baobab trees, which greatly reduces production costs and increases economic rents captured. The importance of baobabs to livelihoods, combined with the potential ecological importance of these trees in contributing to biodiversity, makes the sustainability of this resource vital. Accordingly, if current use rates are not sustainable (see Romero et al., (in prep) there is scope for investigations into policies and management options that could foster sustainable use.

Introduction

It has been recognized internationally that non–timber forest products (NTFPs) play an important role in enhancing rural livelihoods. Some products (e.g. fuelwood) are used for direct household provisioning on a regular basis. NTFPs are generally most extensively used to supplement household incomes during particular seasons in the year and to help meet dietary shortfalls (e.g. Grenard and Grenard, 1996). Furthermore, this seasonality may reflect availability, needs for additional cash at specific points in the annual cycle or seasonal fluctuations in demand. In particular, these resources are widely important as a substitute and economic buffer (or safety net) in hard times. Hence the importance of forest products may lie more in their timing than in their magnitude as a share of total household inputs.

In many cases, access to forest products may be through self-collection, barter or other forms of exchange. Acquiring NTFPs does not necessarily require the use of cash (Chambers and Leach 1987). However, in some cases, the importance of NTFPs in influencing livelihoods may be enhanced through commercialization. Arguments in support of commercialization of NTFPs suggest that the activity may be sustainable and facilitate increased values of indigenous resources, thereby aiding the conservation of biodiversity. However, Boot and Gullison (1995) state that there are few examples of sustainable harvesting of resources.

Baobab (*Adansonia digitata*) trees are heavily used in the communal areas of Zimbabwe. Moyo (1995) cites a number of NTFPs that come from baobab products. Pulp may be processed to make grain meal substitutes during drought conditions. Seeds may be roasted as a beverage or a sauce (eaten with maize meal). Leaves are eaten as green vegetables. The wood can be used to manufacture paper and as a constituent of fibre-board. The white pulp of the fruit, with its high tartaric acid content, is used to make a refreshing drink. Small quantities of baobab bark are used for medicinal purposes. Bark and roots from young baobabs are used for 'symbolic' fattening of babies. Also, Mukamuri and Kozanayi ((in prep) report that pregnant women use bark from mature baobabs to enlarge their birth canals in order to reduce pain during delivery.

Most of the above mentioned uses of baobab are not heavily commercial, in that such products are generally collected for personal or local use. However, baobab bark processed into fibre is largely used commercially in the making of crafts such as mats, bags, and hats (Mukamuri and Kozanayi (in prep). In this paper, we concentrate our efforts on analyzing the contribution of commercial baobab activities to household livelihoods while making note of some non-commercial uses of baobab.

The search for effective strategies that allow NTFPs to contribute to household livelihoods, while ensuring the sustainability of the resource base, leads us to studies of existing extractive economies and the societies in which they function (Daniel and Stephen 1992). The objectives of this paper are twofold. First we seek to characterize households that are participating in and benefiting from baobab production activities, as well as gender roles. Second we investigate the role of baobab products in contributing to sustainable livelihoods.

In pursuit of these two objectives, we use a combination of Participatory Rural Appraisal (PRA) and household surveys, combined with economic approaches. We begin in the next section by describing the methods used to collect data. Then, as background, we begin with some general results that provide a description of the role of baobab products in the overall local economy. Next, in pursuit of the first objective on characterization of households, we present some socio-economic information. We then describe the gender roles involved with baobab collection activities. Next, we present information about the historic participation in baobab activities. We subsequently present a model that attempts to link the socio-economic characteristics of households with participation in baobab production activities. In pursuit of the second objective on contribution to livelihoods, we present rankings of the importance of baobab products relative to other products of the economy. Estimates of income and economic rent produced by baobab production activities follow. We then discuss

constraints to participation in baobab production activities. We end the paper with a summary and conclusions.

Methods

Economic tools and PRA have been shown to be complementary in studying households and livelihoods from natural resources (Davies et al, 1999). In this study, we used both methods for alternative purposes and for corroboration. At the time of the study US$1 was worth approximately Z$38.

Participatory rural appraisal

Two PRA exercises were undertaken, one at Gudyanga Village and the second at Tonhorai Village. The overall objective of the exercises was to obtain information regarding households' utilization of baobab products. During both exercises women were divided into groups separate from men. This was done to capture perceptions differentiated by gender, and to enable women to discuss issues freely, as experience has shown that women tend not to contribute if they are in the same group as men. Sources of livelihood for the two villages were identified and ranked. The division of labour within households for the harvesting, processing and selling of bark products was also investigated. In both the men's and the women's groups, the same techniques for the generation of information were used.

Linkage diagrams were used to list the livelihood/income sources and the processes involved in the harvesting, processing and selling of baobab products. Sub-components of each of the livelihood sources were listed on the linkage diagrams. Pair-wise ranking was then used to determine the relative importance of the different livelihood/income sources for the villages, focussing on how baobab products compare with other livelihood sources.

To assess the division of labour within the households, the baobab production activities were listed using linkage diagrams as indicated above. This was followed by the development of a division of labour matrix that illustrated labour inputs by women, men, boys and girls. Group discussions were also held. These covered issues related to the sources for the inputs and marketing of baobab products.

Household survey

On the basis of the PRA results, four villages were identified in the study area for a household survey: Gudyanga; Mzvizvi/Nhachi, Masasi and Mutsiyo Household lists for each of the villages were obtained from the local leaders (kraalheads) of the respective villages. The village lists contained a population of 550 households from which we sampled every third household giving a sample of 186 households. Data were collected by trained local people who interviewed households in their respective villages. The participation rate of the selected households was 100%. We subsequently eliminated 2 observations because of incomplete data.

We began the survey by collecting information on some basic socio-economic household characteristics, such as household composition and wealth indicators. Next, information about household participation in a variety of economic activities was collected. Respondents were then asked whether they participated in any of a variety

of baobab-related activities. If they did, a number of follow-up questions regarding baobab use were posed.

Results

Place of baobab activities in the overall local economy

Figure 1 shows an example of the linkage diagrams for the Tonhorai women's group. The sources of income and/or livelihoods identified by men and women in Tonhorai and Gudyanga villages were similar, except for the importance of the irrigation scheme in the former that was set up in 1998. Baobab activities are shown to be one of several sources of livelihood, with many uses of baobab identified. Baobabs provide bark, fruit, leaves and manure. Bark is a source of fibre, which is woven to make hats, bags and mats. Strings rolled from baobab fibre are also used in the making of whips for driving cattle. The fruit of baobab is mainly used as human food. For example, the fruit pulp is used in making porridge. Seeds can be boiled directly (for about six hours) and eaten. The seed can also be roasted and pounded and used as a coffee substitute. Ashes that result from burning the fruit husk can be used as a substitute for bicarbonate of soda in the cooking of okra. The husk can also be used as a cup in feeding children. Baobab leaves are used as a vegetable as well as browse for livestock. Falling leaves are good sources of organic matter to improve soil fertility. Mature trees that die and decompose (usually within six months of falling) are also sources of fertilizer for cropping fields. One of the points that the women raised that although they ranked the products of the baobab very highly, a large amount of work goes into the harvesting and processing of bark. Harvesting in particular causes backache.

General characteristics of household participation

Socio-economic profiles of sampled households

The average household is made up of 7.9 people, with 1.4 of those members being migrants living elsewhere. Numbers of males and female are roughly equal, with 79.6% of households being male-headed. Resource distribution is quite skewed with a few households generally controlling large quantities of resources (Table 1).

Gender roles

Both men's and women's groups indicate that women carry out most of the activities involved in the bark industry, generally followed by men, then boys, while girls play the smallest role. Adults were said to do most of the work in the bark industry because children cannot undertake the strenuous work and are better left to do household chores or help with sewing. Examples of division of labour matrices drawn by women in both villages are shown Table 2.

Generally, women indicated that they make crafts because some of the men are in town working. Also, weaving and knitting are traditionally women's tasks. Men are just entering the trade now because there are signs that the cash returns are significant. Furthermore, general cross-border and in-country trade has been an area that has been dominated by women. Bark product trade seems to have been incorporated into this practice.

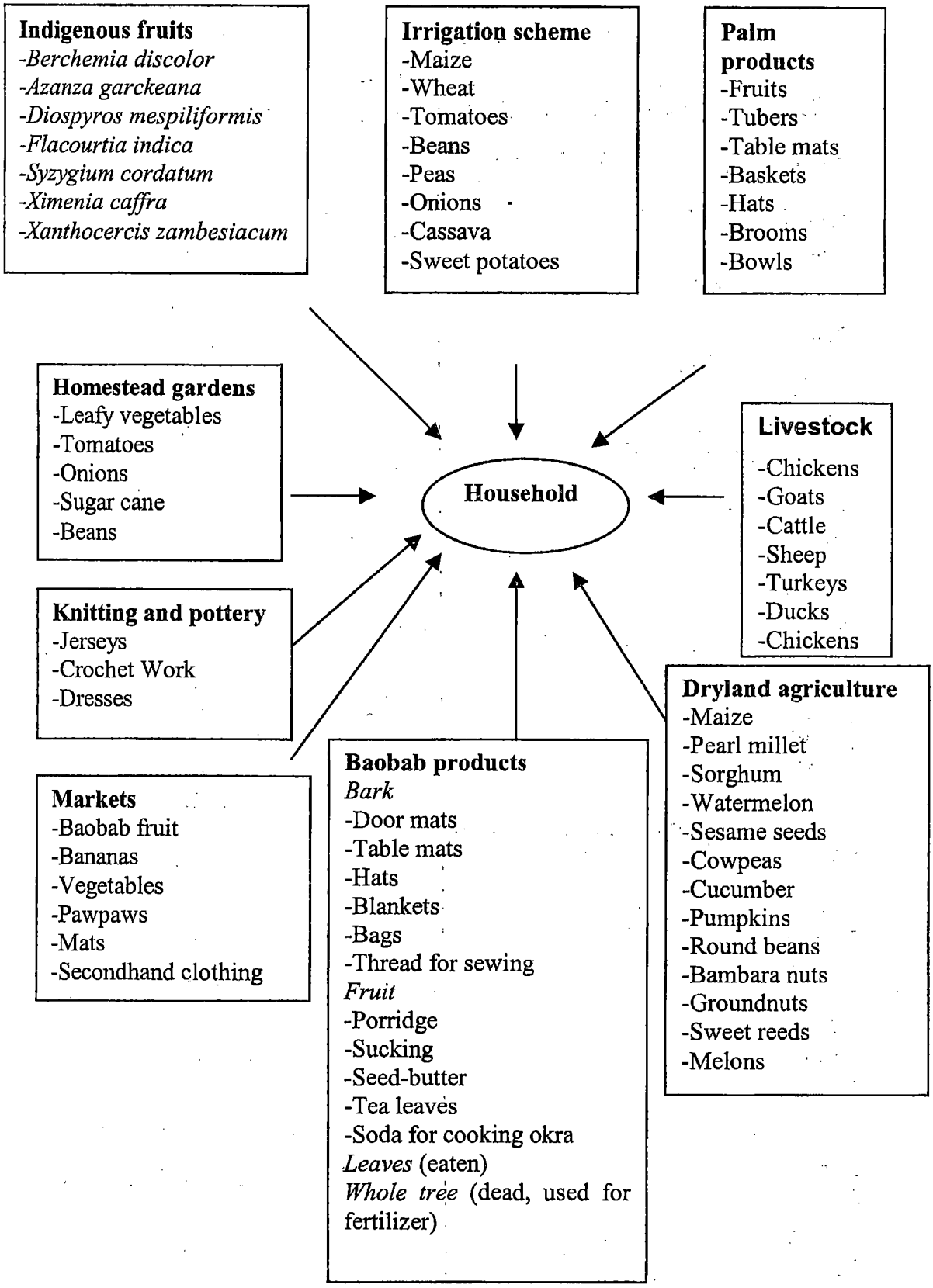

Figure 1: Women's group's livelihoods linkage diagram, Tonhorai village

Table 1: Household characteristics and resource ownership

Characteristic	Percentage of households and average values
Education level[1]	
None	1.6%
Up to Grade 4	3.8%
Up to Grade 7	15.8%
Up to Form 2	14.1%
Higher than Form 2	64.7%
House type	
Pole and mud	46.4%
Pole and mud under tin	4.4%
Brick under tin/asbestos	49.2%
Number of cattle	Avg=3.2
0	55.1%
1 to 5	21.4%
6 to 10	12.3%
>11 to 20	9.1%
Number of goats	Avg=7.8
0	24.6%
1 to 5	32.8%
6 to 10	16.4%
11 to 20	16.4%
>20	9.9%
External employment (number of persons)[2]	Avg=0.667
No-one	50.0%
1 person	38.0%
2 persons	7.1%
3+ persons	4.9%
Size of fields (acres)[3]	Avg=2.8
0	8.2%
1-2	46.4%
2.1 to 3	17.5%
3.1 to 4	7.1%
4.1 to 5	7.1%
>5	13.7%
Size of gardens (acres)[3]	Avg=0.17
0	45.4%
0.1 to 0.25	44.8%
0.26 to 0.5	7.1%
0.51 to 1	2.2%
>1	0.5%
Households with land in an irrigation scheme	24.0%

[1] Highest education level of any household member

[2] Number of people per household with external employment

[3] Acres, rather than hectares, are the local unit used.

Table 2: Division of labour matrix from the women's groups at the PRA (numbers indicate numbers of stones used as counters[2])

	Women		Men		Girls		Boys	
Villages[1]	Gud.	Ton	Gud.	Ton.	Gud.	Ton.	Gud.	Ton.
Activities								
Marking harvestable portion	6	-	3	-	0	-	1	-
Removal of outer bark	6	5	3	3	0	0	1	2
Pounding of bark	6	5	3	3	0	0	1	2
Removing bark from tree	6	-	3	-	0	-	1	-
Processing	-	5	-	3	-	0	-	2
Bark separation	6	-	3	-	0	-	1	-
Dyeing bark	6	-	3	-	0	-	1	-
Drying of fresh bark	6	-	3	-	0	-	1	-
Plaiting	4	-	2	-	2	-	2	-
Making String	5	-	3	-	0	-	2	-
Sewing	4	-	2	-	2	-	2	-
Weaving hats	5	-	3	-	1	-	1	-
Weaving door mats	6	-	2	-	1	-	1	-
Weaving bags	4	-	6	-	0	-	0	-
Weaving carpets	5	-	2	-	1	-	2	-
Weaving	-	5	-	3	-	0	-	2
Transport	7	-	3	-	0	-	0	-
Selling	4	-	3	-	1	-	2	-
Total	85	20	41	12	8	0	17	8

[1] Gud.= Gudyanga, Ton. = Tonhorai

[2] Ten stones were used per activity and distributed for women, men, boys and girls according to their involvement. A score of 1 indicates little involvement while 10 indicates high involvement.

- indicates that the activity was not specified by the villagers in the ranking exercise

In a few instances, men were thought to play a larger role than women. In Gudyanga, men believe they do more of the bark stripping and transport, but women disagree. Women in Gudyanga believe that men weave more bags because it is thought that men make better bags than they do. The men disagree, with no adult male involvement in bag making indicated in their ratings.

Both men and women agree that girls do not play a big role. Women do not feel that they need to apprentice their daughters into baobab craftwork because it does not prepare them to fit well into the broader Zimbabwean economy. Women respondents mentioned that the most important employment destination for their daughters is domestic work in town. This employment opportunity is not generally available to boys, which may explain why more young males are involved in the various stages of bark related work. Women also feel that craftwork is too strenuous for young women who should prepare themselves for marriage rather than wear themselves out with bark craftwork. Furthermore, the lack of participation of girl children may be explained by their being occupied with household chores, which leave them no time to weave.

Historic participation in the production of baobab bark activities

Data from the household survey was used to track the participation rate of households in baobab bark activities. Figure 2 shows that as households in the study area have increased over time, so has the participation in baobab activities. Before 1980, when there were only 36% of the current number of households in the study area, only 3% of the existing households were participating in baobab activities. This number increased to comprise 43% of existing households by the period 1996-1999. Although we do not, in this study, investigate why this has occurred, we would hypothesize that baobab activities have increasingly been seen by households as successful means of increasing livelihoods, relative to other opportunities. The livelihood estimates that follow seem to support this possibility.

Analysis of household participation in bark production activities

While the above sections describe household characteristics and baobab activity participation, including gender roles, they do not provide information about what kinds of household participate. Specifically, are poorer households more likely to participate in bark production than wealthier households? Are households that receive larger sums of employment income more or less likely to participate? Finally, are households in some villages more likely to participate than those in other villages?

We attempt to provide some answers to these questions using a binary logit model. In this analysis, the dependent variable takes on a value of one for the 43% of households that participate in any bark product production activities and zero for households that do not. The model may be stated formally as:

Prob ($Participation = 1$) $= f(\beta_0 + \beta_1 Vil1 + \beta_2 Vil2 + \beta_3 Vil3 + \beta_4 YrArr + \beta_5 EmpInc + \beta_6 Rem + \beta_7 Irr + \beta_8 Wealth)$ (1)

where f is the logistic distribution function and β_0 to β_7 are parameters to be estimated. Positive parameter estimates on a variable would indicate that the variable increases the probability of participation and negative values would indicate that the variable decreases the probability of participation. There were four distinct villages in the study area. In equation (1), *Vil1* through *Vil3* are dummy variables indicating whether the household surveyed lived in village 1, 2 or 3 respectively.

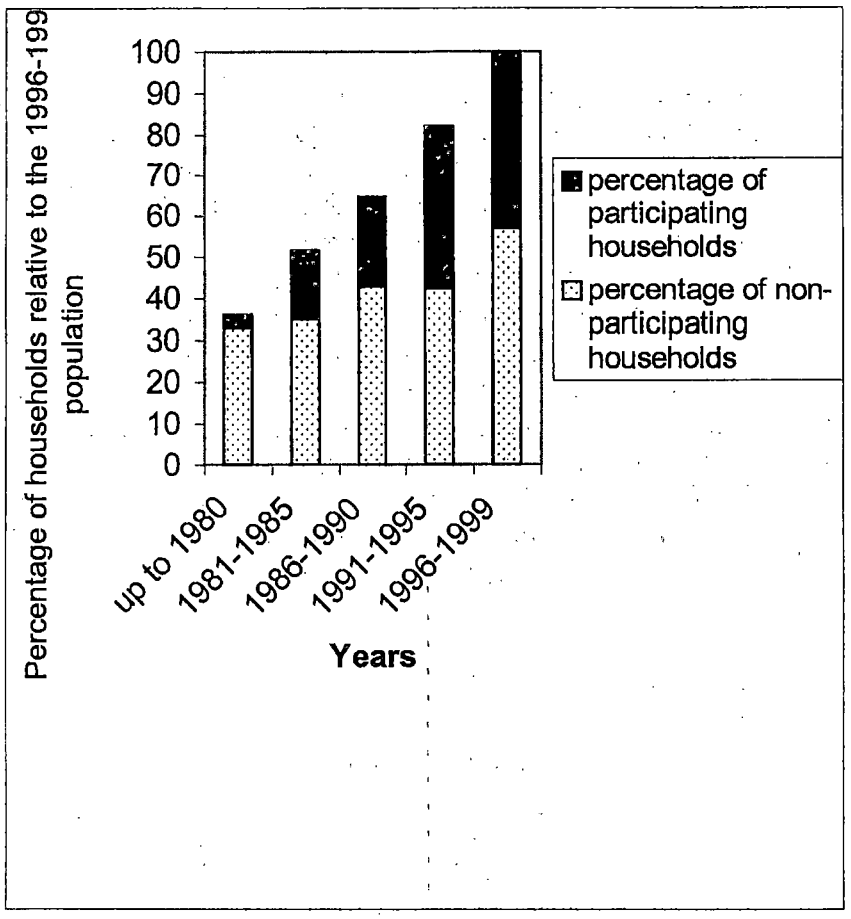

Figure 2: Rise in percentage of participating and non-participating households in the baobab craft industry.

If the values of *Vil1* through *Vil3* are zero, then the respondent is from the fourth village. The year arrival variable (*YrArr)* indicates the year the household moved to the area. The *Empinc* variable represents employment income earned by household members that live in the household. Remittances (*Rem*) represent the number of months that offsite members of the household contribute income to the household. The irrigation variable (*Irr*) is a dummy variable that indicates whether the household has a garden in the irrigation scheme to enhance crop production. Finally, the *Wealth* variable is a composite index of 5 standardized variables: (i) education level, (ii) number of cattle, (iii) number of goats, (iv) type of house, and (v) area of fields and gardens (acres). The coefficients in this index are the derived from the component scores of a principal components analysis of the 5 variables. The index was computed as follows:

Wealth = 0.258*(Education) + 0.367*(Cattle) + 0.325*(Goats) + 0.264*(HouseType) + 0.253*(FieldGarden) (2)

Estimated parameters for the model (1) are shown in Table 3. Overall, the model explains a significant amount of variation in the data as revealed by the significant Chi-square statistic. However, the actual amount of variation is small as revealed by the Nagelkerke R^2 statistic.

A number of insights can be gained from the model parameter estimates. The only significant village effect is for *Vil1* (P-value <0.1). The negative sign on this coefficient means that members of this village appear to have a significantly lower probability of participating in bark product production than the other three villages. Mukamuri and Kozanayi ((in prep) also draw attention to how baobab activity levels differ markedly among villages, a phenomenon they attribute to cultural and historical differences. The wealth and employment income variables are significant at the p-level of 0.1. The coefficient estimates are negative which suggests that the probability of participation in bark product production is lower in the more wealthy households and in households that have members in employment, than in poorer households and in households that have no employment possibilities. Access to irrigation may also be thought of as a significant indication of wealth. The irrigation variable was a highly significant variable in the logit model. The coefficient was negative, indicating that those households with access to irrigation were less likely to be participating in bark product production.

Table 3: Model Estimation Results

Variable	Parameter Estimate	Standard Error	P-value
Constant	51.6	28.09	0.07
Vil1	-0.84	0.43	0.05
Vil2	1.8	1.17	0.13
Vil3	0.22	0.41	0.60
YrArr	-0.03	0.01	0.07
EmpInc	-0.0004	0.0003	0.08
Rem	0.01	0.02	0.41
Irr	-0.97	0.46	0.04
Wealth	-0.34	0.20	0.09
Model Chi-square	24.71 (8 df)		0.002
Nagelkerke R^2	0.17		

Remittances from household members in other locations did not seem to have an effect on participation in bark activities. Finally, the year of arrival variable was significant at a p-value of less than 0.1. The coefficient estimate is negative which suggests that households who moved to the study area more recently are less likely to be involved in bark production activities than those who have been there some time, perhaps related to the cultural and historical reason alluded to above.

Household livelihoods

Estimates of the relative importance of baobab activities in the overall economy

Table 4 shows the relative importance attributed to each of the activities in contributing to household livelihood for men's and women's groups in both villages. In general, both men and women list crops (either irrigated or non-irrigated) as most important. The women said that crops are key to subsistence in the area and that they hardly have any surplus to sell. The crops that are grown are (in order of importance) millet, sorghum, maize and sunflower. Baobab activities were generally ranked second highest to cropping activities, except by women in Tonhorai who are involved in the irrigation scheme and therefore tend to concentrate their efforts in food production, including marketing. Livestock was also valued highly. Cattle, goats, sheep and chickens were given as the livestock types common to the area, in order of importance. Brick moulding was another important area. It was noted that this activity yields good returns, Z$300 for 1000 bricks.

Table 4: Livelihood Source Rankings in Women and Men's groups during PRA

	Women Ranks		**Men Ranks**	
Villages[1]	Gud.	Ton.	Gud.	Ton.
Livelihood Sources				
Crops (irrigated)	-	1	-	-
Crops (non-irrigated)	1	3	1	1
Homestead Gardens	-	4	-	-
Livestock	6	2	2	7
Baobab	2	6	3	2
Ilala palm crafts (mats, baskets)	4	8	6	3
Employment	-	-	4	-
Reed mats	-	-	4	-
Others	-	-	7	-
Berchemia discolor (dye)	-	-	8	-
Brick Moulding	3	-	-	3
Markets	5	5	-	5
Sanseveria spp fibre	6	-	-	-
Beer brewing	8	-	-	8
Brachystegia boehmii fibre	9	-	-	9
Indigenous Fruits	-	7	-	-
Sisal	-	-	-	6

[1] Gud.= Gudyanga, Ton. = Tonhorai

- indicates that the activity was not specified by the villagers in the ranking exercise

Estimates of economic contribution of baobab production to household livelihoods

One means of estimating the contribution of baobab products to household livelihoods is to estimate the income derived from the sale of such products. Although estimates of incomes do not account for benefits derived from goods and services produced and used in the household, these numbers do give us an idea of the contribution to cash income (Table 5). The major products produced for sale from baobab are contained in the first column of Table 5. These include bundles of fibre, large mats (defined as being greater than 1.5 meters in width or diameter), small mats (defined as being smaller than 1.5 meters in width or diameter), bags and hats. The second column indicates price information.

Table 5: Contribution of Baobab Products to Household Incomes

Product	**Price (Z$)**	**Quantity Produced per annum by the sampled 184 households**	**Total baobab income per annum received by the sampled 184 households**	**Total baobab income per annum received by the population of 553 households**
Bundles[1]		12,559	35,091	104,893
Avg.	2.79			
Std.	0.99			
N=	119			
Large Mats		1,518	520,899	1,557,035
Avg.	343.15			
Std.	164.92			
N=	54			
Small Mats		6,544	336,607	1,006,162
Avg.	51.43			
Std.	85.8			
N=	64			
Bags		842	25,400	75,925
Avg.	30.17			
Std.	16.6			
N=	12			
Hats		1,256	14,863	44,426
Avg.	11.83			
Std.	4.76			
N=	12			
Total			932,860	2,683,548
Total per household				4853
Total per participating household			13,139	
Total per participating person			4,998	

[1] Bundles are largely purchased within the village for further production into mats, hats and bags. Accordingly, these amounts represent cash transfers between households within the study area, whereas for other products, the cash is coming from outside the study area from tourists and middlemen.

In most cases, there is significant variability in prices, with standard deviations approximately one-half of the estimated averages. Variation is especially high for small mats, likely because of large variations in sizes within this category. The third column shows the total number of each product produced by the sample of 184 households. Multiplying the price and the total quantity gives the estimated total income of the sampled 184 households. The amounts from the sample (n=184) are then extrapolated to the population of households (n=553) to produce the final column.

Baobab products seem to be contributing quite significantly to household incomes, with large mats, small mats, and bundles, being the largest contributors. Households participating in baobab production activities earn an estimated average of over Z$13,000 per year. If we consider that for each household, participation in some form of baobab production activity includes an average of 1.31 adult females, 0.62 adult males, and 0.69 children, the average return per participating person is almost Z$5000 per year. This compares favorably to the minimum wage of less than Z$1000/month, especially when considering that for many of these household members, baobab activities are undertaken on a part-time basis.

Although estimates of income may give us some indication of the contribution of baobab products to household livelihoods, included in these numbers is a great deal of time and effort, that could be used undertaking other productive activities. If we subtract the cost of production time, we can come up with a measure of economic rent attributable to the baobab resource in its ability to produce baobab products over time (Economic rent may be defined as the surplus value attributable to the resource over and above all of the costs necessary to bring a resource into production). The rent represents contributions to the livelihoods of the households for which nothing has to be given up.

To estimate economic rents, times involved with manufacturing bundles, large mats and small mats were multiplied by wage rates, and subtracted from gross incomes (bags and hats were dropped from the analysis because of the relatively small contribution that they make to household livelihoods). Table 6 shows the average amount of time involved in the various production activities. In producing bundles of fibre, the first column of numbers reflects those households that collect and sell bundles of fibre. The second column of numbers reflects not only those households that sell fibre, but also those that do not sell fibre but that collect fibre to make value-added baobab products. For every product, the large standard deviations associated with the time spent per household per year reflects the fact that there are significant variations in the degree to which households are involved in producing baobab products. The standard deviations in the "per product" columns indicate a fair degree of variation in the production times between households. In particular, standard deviations of times associated with collecting bundles are large relative to the average amount, reflecting differences in travel times to baobab trees between households. In contrast, standard deviations for the production of a large or a small mat, relative to the average times, are small, as spatial travel advantages of households relative to the resource base are not reflected. The hours presented in Table 6 for large and small mats do not include fibre collection, as data on numbers of bundles used and prices per bundle were used to subtract these costs from gross revenues.

Table 6: Time required (hours) in Baobab Production Activities

	Bundles		Large Mats		Small Mats	
	Per Household Per Year	Per bundle	Per Household Per Year	Per large mat	Per Household per year	Per small mat
Avg.	325.7	0.9	1800.8	84.9	1359.4	15.5
Std.	897.9	1.35	1867.6	68.9	2430.5	13.5
N=	27	48	53	53	69	69

The rental calculations could have been made using times for bundle collection and wage rates instead of using bundles required and fibre prices. However, given that more information was available for prices of bundles than for wages, quantities of bundles and fibre prices were used. For small mats an average of 7.0 bundles are required (std=7.6, n=69) while large mats require an average of 37.9 bundles (std=22.2 n=53). Using these quantities and the average prices contained in Table 5, it becomes apparent that large mats realise Z$9.05 per bundle while a small mat realises Z$7.35 per bundle. A difference along this order of magnitude would be expected, as larger mats are generally of a higher quality with more intricate designs.

Instead of using sample averages for rent calculations, as was done with incomes in Table 5 above, values were calculated on a household by household basis, and then averaged over the sample. Accordingly, prices and work hours, cited by individual households, were used to calculate rents, before taking averages. This allowed us insights into the profitability of baobab activities on a household-by-household basis. Calculating amounts on a household basis turns out to be significantly different than using averages. For example, in Table 5, where the incomes are calculated with averages, the total income of the population received for bundles is shown to be $104,892. This number may be compared to the total rent amount in Figure 3 with a wage rate of zero where calculations are based on household-by-household data. In Figure 3, the comparable amount is $184,463. The number is higher in Figure 3, as there are a few households, producing large numbers of bundles that are receiving higher than average prices. Figures 3 and 4 present, respectively, the total annual rents and the rent per product that households derive from the baobab resource. The figures disclose that the amount of rent for most resources depends heavily on how the time of the labour is valued, with rent values generally disappearing at wage rates of about $12 per hour. A notable exception occurs with bundles, where a few large producers, with baobab trees privately controlled close-by in their fields, are still collecting significant amounts of rent at high wage rates. Given that the actual local wage rate is likely somewhere between Z$2 and Z$4 per hour, the total rent derived from baobab products is about Z$500,000. That is, subtracting out the costs of producing baobab products causes the rent for baobab to be about one-fifth of the total household income.

Calculating rents on a household-by-household basis also allows us to estimate conditions under which households will produce. If we assume that a household will produce it's current quantity so long as benefits are greater than costs, and will produce nothing if costs are greater than benefits, then we can calculate the quantities associated with the producing households at varying wage rates. Figure 5 presents the results of such calculations.

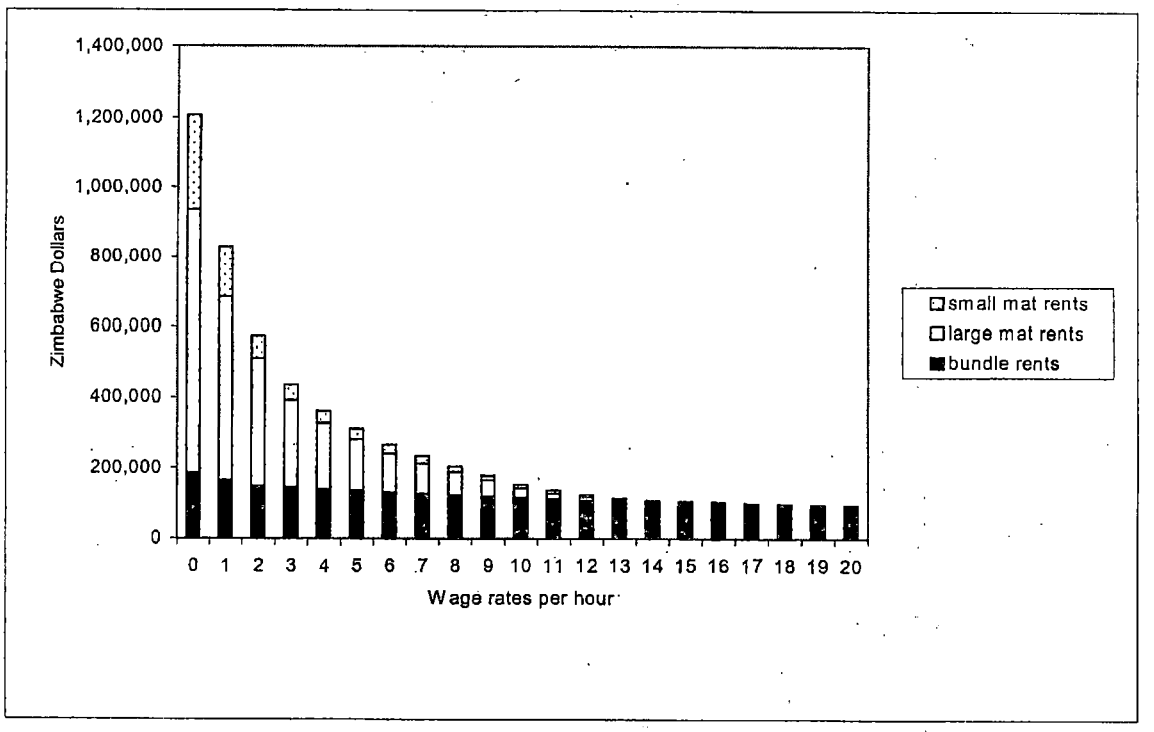

Figure 3: Total annual rents for baobab products (total over the population of households)

The quantity results tend to reflect the rent results above, in that quantities of mats tend to be highly sensitive to increases in costs, whereas for bundle production, some producers with large rents keep on producing, even at high wage rates.

Problems and constraints in household bark production activities

In both Gudyanga and Tonhorai villages, the major constraint that households experience is the lack of markets for their products. Tourists are their major customers while the local (Zimbabwean) customers often bargain for price reduction and get the products for very little. In Tonhorai participants preferred being involved in irrigation rather than bark production, because irrigation products can be consumed if they are not marketed. Bark products, on the other hand, are designed especially for urban customers and cannot be used locally if they are not bought. For example, respondents noted that local dogs might find it "funny" sleeping in dog baskets made from baobab bark!

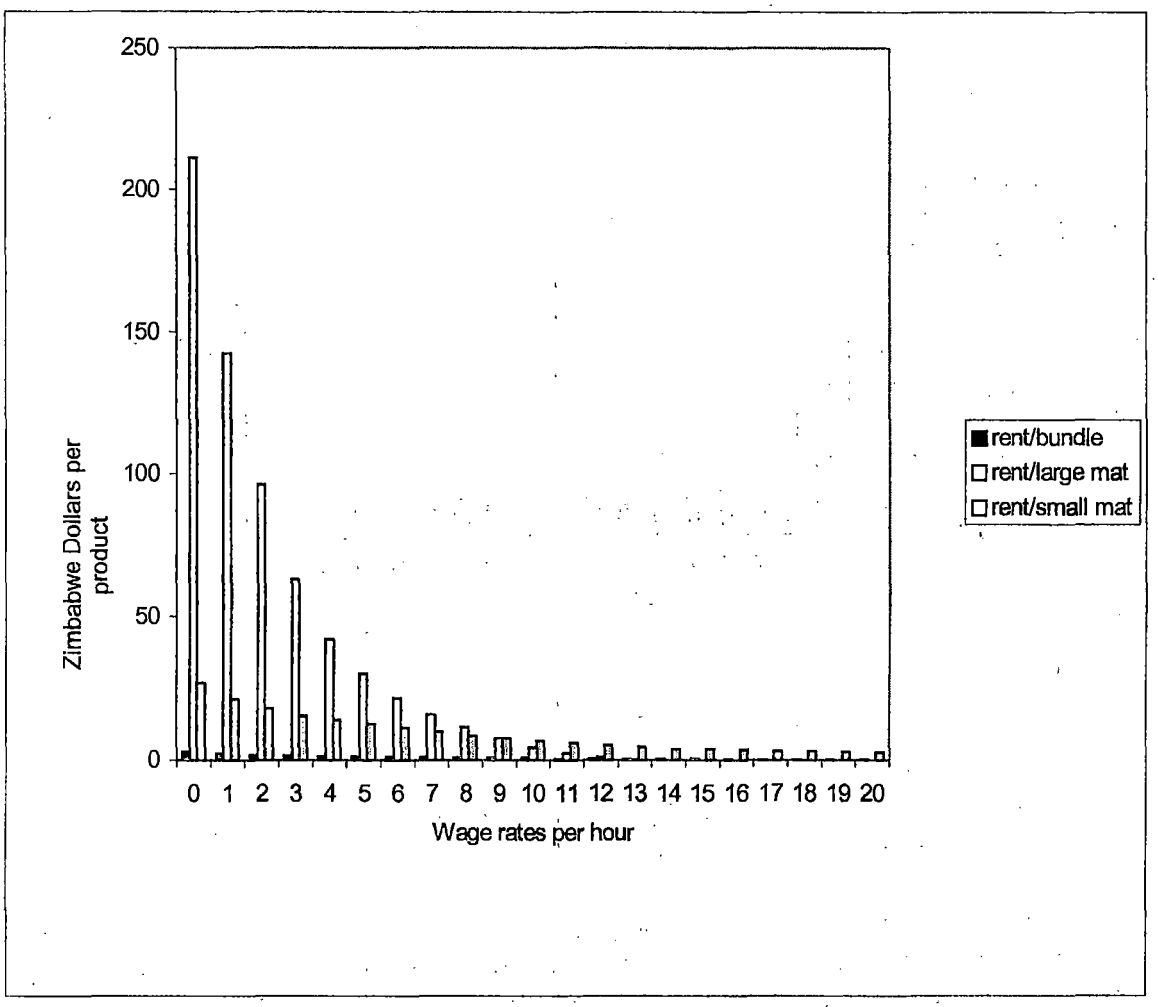

Figure 4: Rent per baobab product

Summary and conclusions

Baobab production activities play a crucial role in contributing to the livelihoods of rural households. Numerous subsistence uses of products from baobab trees, including food, medicinal, fertilizer, and fibre products, contribute to household livelihoods. There are also a number of fibre products that are made and sold commercially for cash income.

In the face of increasing village populations, commercial use of baobab has been steadily increasing to the point where currently, 43% of existing households participate in baobab production activities. Commercial use of baobab products is especially important to the poorer households and women. In villages characterized by significant breadth in the distribution of wealth, participation in commercial baobab activities is more often associated with poorer households, households who do not have access to irrigation schemes, and people who are long time residents of a given village. Women generally play the largest role in baobab activities, followed by adult males, male children, and female children.

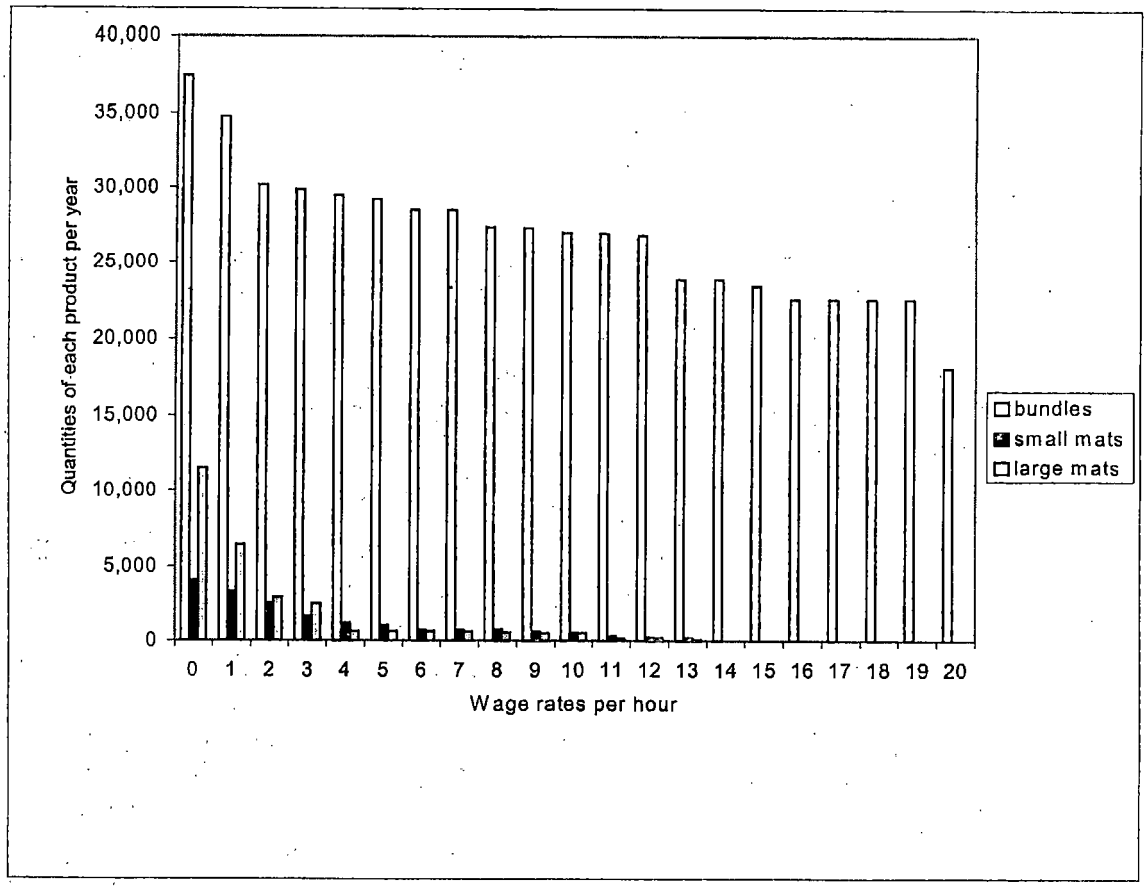

Figure 5: Quantities of baobab products produced at various wage rates

In terms of contributing to household livelihoods, baobab activities are ranked highly, generally ranked second only to some kinds of agricultural production. Numerical estimates of contribution to livelihoods bear this out with cash income of approximately $5000 per annum received for each participating person, well above the official minimum wage. If opportunity costs of labour are subtracted, this figure decreases by about four-fifths leaving one-fifth of the cash income accruing as economic rent. The rent available to households seems to vary widely, as there are households that are well located close to baobab trees, which greatly reduces production costs and increases economic rents captured.

In short, the contribution of baobab activities to rural livelihoods in the study area appears crucial. This conclusion, combined with the potential ecological importance of baobab trees in contributing to biodiversity, makes the sustainability of this resource vital. Accordingly, if current use rates are not sustainable (see Romero *et al.*, (in prep) there is scope for investigations into policies and management options that could foster sustainable use.

Acknowledgements

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