The Socio-economic factors influencing harvesting of Eembe (*Berchemia discolor*) wild fruits by communal households in the Ohangwena region, Namibia.

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ABSTRACT

This study carried out in 2002, aimed at identifying the socio-economic factors influencing the harvesting of Eembe *(Berchemia discolor)* wild fruits by communal households in the Ohangwena region, in Namibia. Data for this study was generated from a sample survey of 83 communal households from the Oipya, Onengali and Eengava communities in the western part of the Ohangwena Region. Based on the results of the survey, it is estimated that Eembe and its related by-products contributed 7.29% to household income. Using logistic regression analysis, it was found that Eembe wild fruit harvesting was negatively associated with higher levels of off-farm income. This suggests that Eembe wild fruit harvesting is likely to be more common among households with low off-farm income than those with higher off-farm income. This implies that households with lower off-farm income and potentially food insecure are more likely to participate in wild fruit harvesting for survival reasons, such as to get food supplements and for income generation. The results confirm findings from similar studies conducted elsewhere that rural households engage in harvesting wild fruits and other non-timber forest products (NTFPs) as a survival mechanism. However, this study revealed that the income earned from Eembe and its related activities was meagre. The policy implications are that strategies aimed at improving rural livelihoods should consider introducing high income generating activities as alternatives to harvesting low value veld products like Eembe wild fruits in the study region.

Key Words: wild fruit harvesting; socio-economic factors; communal rural households.

1. Introduction

Overview

Ohangwena is situated in north-central Namibia, and extends east-westwards along the border between Angola and Namibia, has an area of 10,703 square kilometres (1.3% of the total area of Namibia) and an estimated population of 227,728 people (12.5% of Namibia's population) with a population growth rate of 2.4% per year (NPC, 2003). It has the highest population density in the country estimated at 21.3 persons per square kilometre. The Ohangwena economy is based on subsistence farming with 80% of the population engaged in crop farming and cattle herding. Farming and labour migration are the major livelihood sources of most households in the region. The region has a high unemployment rate of 36%. The dependency ratio in Ohangwena is very high with every worker supporting 7 dependants as compared to 4.5 dependants per worker in Namibia at large (NPC, 2003). The Human Development Index (HDI) – which gives the degree of progress with respect to life expectancy, adult literacy, school enrolment and per capita income - in the region is at 0.53. In the 2004 NPC regional profile, it is estimated that 9.9% of households in Ohangwena region are extremely poor and 32.4% are poor (NPC, 2004). The main factors contributing to poverty in the region include unemployment, low levels of education, low rainfall or aridity, water scarcity, food shortages and ill health (especially due to HIV/AIDS).

The livelihood of the majority of people in Ohangwena is inextricably linked to the environment because subsistence and livestock farming are the predominant livelihood activities. Apart from agricultural pursuits, most households derive part of their livelihoods from harvesting non-timber forest products (NTFPs) such as firewood and wild fruits from the veld. The NTFPs contribute to the well- being of rural households in terms of direct use, human nutrition and income generation. The trees providing wild edible fruits and nuts are valued culturally for their multiple uses and contribution to household nutrition and food security.

The main types of wild fruits found in Northern parts of Namibia include: bird plum (*Berchermia discolor*), Marula (*Sclerocarya birrea* subsp. *caffra*) and Mangetti nuts/kernels (*Schinziophyton rautanenii)* among others (Hailwa, 2002, p.5). The western part of the Ohangwena Region is however endowed with an abundant concentration of trees bearing Eembe wild fruits (*B. discolor*), and communities engage in collecting bird plums for home consumption and for income generation (NEPRU, 2000). The time of harvesting of Eembe wild fruits occurs around March-April in Northern Namibia. This happens just at the end of the peak cultivation-(weeding)-period for food crops as this time is convenient for most farmers to engage in harvesting of wild fruits without disrupting their farming activities. In addition, the bird plum fruits can be dried, stored and processed later after farmers have finished with seasonal agricultural activities.

Justification for the study

Despite the abundance of bird plum (*B. discolor*), locally known as Eembe, there have been no studies that have attempted to identify the factors associated with collecting of Eembe wild fruits by communal households in the Ohangwena region.

Knowledge about the effects of household characteristics on the decision to harvest Eembe wild fruits is essential for designing effective measures for conservation, domestication, commercialization and sustainable natural resource management, and for policymakers to evaluate the impact of Namibia's natural resource conservation policies. Household harvesting of wild fruits depend on many factors, including but not limited to the socio-economic and demographic characteristics. Prior to the initiation of this study, there were no studies that had examined the effect of socio-economic and demographic factors on the decision by households to harvest wild fruits in Ohangwena and Namibia at large.

It is therefore imperative that we understand the relationship, if any, between household characteristics and the decision to harvest Eembe wild fruits. The purpose of this study

was to examine the influence of household socio-economic and demographic characteristics on households' decision to harvest Eembe wild fruits in the Ohangwena Region in Namibia. To achieve this goal a logit model is specified and estimated using data collected during the months of June and July in 2002 from a sample survey of 83 communal households in the western part of the Ohangwena Region. The secondary objective was to determine the contribution of Eembe bird plum to household income among communal farmers in the Ohangwena region.

The rest of paper is organized as follows; Section 2 presents the literature review, Section 3 describes the methods used in the analysis and gives a description of the model and data used, Section 4 reports on and discusses the empirical results from the application of the logit model to cross-section survey data of factors, and Section 5 presents the conclusion and implications of the study.

2. Literature Review

In many rural communities, harvesting of wild foods (fruits) and non-timber forest products (NTFPs) makes an important contribution to family food supplies (FAO, 1997) and provides critical support to agricultural production. The farm tree resources in particular fruits provide food and also serve as a source of income and capital – part of which can be used to buy food or invest in future food production. The harvesting varies spatially and temporally according to availability, social and economic status, agricultural potential, yield, and cultural patterns among others (FAO, 1996).

In view of the fact that most people in rural communities in developing countries live in poverty and engage in land-based resource harvesting activities including collection of NTFPs for livelihood or as a survival strategy, discussion of environmental issues have linked poverty with environmental degradation (Price and Campbell, 1998). The implication is that collection of NTFPs, if uncontrolled, can result in some form of environmental degradation, for example, deforestation and loss of biodiversity.

The food security status of the household is an important determinant of whether or not to participate in harvesting of wild fruits. Rodin (1985) pointed out that households consider these wild fruits as their food supplements, which are consumed fresh, dry or as processed products such as cakes, juices and alcoholic beverages. The wild fruits are either consumed at home or sold in the local market for cash income especially by women. Thus, wild fruit harvesting and selling plays an essential role as a source of income and food security. However, the contribution of wild fruits to household income has not been substantial. For example, Shackleton and Dzerefos . (2000) found that in South Africa most households traded in wild fruit, namely mangetti kernels, but very few gained significant income from it. In a South African village, Dovie, Shackleton and Witkowski (2002) found that the contribution of edible fruits to mean gross annual values per household was around 1.4 % whereas NTFPs contributed 19% to the total household income.

Participation in harvesting of wild foods (fruits) is influenced by access and the availability of wild foods (fruits) among other factors. Wild fruits occur seasonally and they serve as a dietary supplement as well as a buffer against crop losses in drought periods (Ashley and La-Franchi, 1997). Access can be through ownership of a number of fruit bearing trees or open access to the fruit trees on communal lands. In a Zimbabwean study, Price and Campbell (1998) found that tree holdings were considerable with 90% of households planting or conserving at least one tree. Although households had more exotic than indigenous trees, the trees were concentrated in homestead areas and most of the indigenous trees conserved in home fields were edible fruit bearing species such as bird plum and Marula. Access can also be affected by distance between indigenous fruit trees and the homesteads. In another study from Zimbabwe, Mandondo (2001) found that most people tend to extract resources from within residential villages. However, in the case of lighter products like wild fruits, mushrooms and medicinal herbs, people extract these from other villages. This depends on the

distances they have to walk to harvest the resources from other villages, availability of substitutes and exclusion to some products by members of other villages.

Wild fruit harvesting is also influenced by the gender of the participant. A study conducted in a Mozambican village by Chikoko (1999) found that there were differences in ranking of various annual livelihood activities including wild fruit harvesting according to gender. One particular difference was that women included harvesting wild fruits as a major activity but men did not. This indicates that women are more likely to engage in wild fruit harvesting as a land-based livelihood strategy than men. Shackleton et al. (2002) found that in the rural villages in South Africa, woodland resources were extremely important for women and children. Many women were turning the traditional use of resources into opportunities for income generation on both ad hoc and formalized bases. Children supplemented their diets with protein and vitamins obtained from a diversity of wild food resources including wild fruits.

Evidence has shown that rural women contribute greatly to food security at household level. Women do not only produce more than 50% of food worldwide, they also perform the overwhelming majority of the work in food processing in developing countries (Templeman, 1998). Their contributions include natural resource harvesting (e.g. wild fruits), processing and marketing for income generation and for supplementing the food supply of the household. Frequently, women are the preservers of fruits and vegetables produced from farm fields and forests, and possess traditional knowledge of indigenous plants. Dovie et al. (2002) confirmed that the higher the number of female adults and children in a household, the greater the value of the products gained from secondary woodland resources like wild fruits. Women, who in most cases remain the poorest members of society in poor rural settlements, rely more on natural resources than men. Furthermore, in times of crop failure caused by either drought or by floods, children and women often seek out wild foods (fruits) to keep the household alive (Dovie, Witkowski and Shackleton , 2005). According to Campbell (1987), fruit use mainly occurs in the period of seasonal food stress, even though these seasons are not necessarily the periods of maximum fruit abundance and that wild fruits, often the only source of fruit for households, are used mostly by children.

In more developed rural settlements and villages with greater access to urban employment opportunities, a higher proportion of households are willing and able to purchase key NTFPs rather than collect them themselves, and there are more traders either partly or wholly dependent on the resource-base (Shackleton et al., 2002).

In summary, previous studies reveal that many rural households in Southern Africa make use of a wide range of NTFPs including wild fruits from the woodland around them. The types of resources used and the degree of use depend on many factors including, region, resource availability and access, population densities, employment status, income levels, availability of income generating alternatives, market access, family size, age, gender, education, and personal and cultural preferences (Shackleton et al., 2002). Institutional controls or lack thereof also play a vital role in determining whether or not potential use values are realized and resource use is sustainable (Shackleton et al., 1998). However, a paucity of information exists as to how such factors influence harvesting of Eembe wild fruits by households in Ohangwena. Thus, to enhance the understanding of this vital livelihood aspect, the present study attempted to quantify the factors that influence Eembe wild fruit harvesting among communal households in the Ohangwena region in Northern Namibia.

For the analysis of factors influencing harvesting and valuation of NTFPs (e.g. wild edible fruits), previous relevant studies such as Dovie et al. (2002), Campbell (1987), and Shackleton et al., (2002) among others, used mostly descriptive statistics. In this study a multivariate analysis was undertaken to assess the relationship between Eembe harvesting and the socio-economic and demographic factors. Among the multivariate regression techniques, the probit and logit models are the most commonly used.

The logit and probit techniques are used in modelling problems in which the dependent variable is binary or dichotomous as is the case in this study. The dependent variable Y_i assumes a value of one if the farmer takes the decision to harvest Eembe wild fruits, and zero, if the farmer does not harvest Eembe wild fruit. The predicted probabilities under both logit and probit approaches always lie between 0 and 1, and since both approaches are known to yield similar results, the logistic regression approach is used in this paper.

3. MATERIALS AND METHODS

3.1 Model

Logistic regression is a popular statistical technique in which the probability of a dichotomous outcome (such as harvesting or non-harvesting) is related to a set of explanatory variables that are hypothesized to influence the outcome. The logistic regression model characterizing wild fruit harvesting by the sample households can be specified using the logit model from Gujarati (1995) as follows:

$$L_i = Log\left(\frac{P_i}{1-P_i}\right) = B_o + B_1 X_{1i} + ... + B_k X_{ki} + u_i = e^{(B_o + B_1 X_{1i} + ... + B_k X_{ki} B_o)} \quad (1)$$

Where the subscript i denotes the i-th observation in the sample, P is the probability of the outcome, B_0 is the intercept term, and B_1, B_2, ...,B_k are the coefficients associated with each explanatory variables X_1, X_2, ...,X_k, and u_i is the disturbance term. It should be noted that the estimated coefficients do not directly indicate the effect of change in the corresponding explanatory variables on the probability (P_i) of the outcome occurring. Rather, the coefficients reflect the effect of the individual explanatory variables on its log of odds (ln [P/ (1-P)]). The positive coefficient means that the log of odds increases as the corresponding independent variable increases. The odds ratio refers to the fact that as the explanatory variables change, the probability of the outcome changes by that factor, i.e. variables with an odds ratio of greater than unity would increase the probability of the outcome, while those with a value less than unity would have a negative impact on the outcome. The coefficients in the logistic regression are estimated using the maximum likelihood estimation method. This was achieved in this study by using the Statistical Package for the Social Sciences (SPSS) version 15.

In this study the empirical logistic model of Eembe wild fruit harvesting as a function of socio-economic and demographic variables (viz age of household head, gender, level of education, family size, adequacy of own-produced food to meet household needs and off-farm income) was specified as follows:-

$$P(Z) = \beta_o + \beta_1 AGE + \beta_2 GEN + \beta_3 EDUC + \beta_4 HSIZE + \beta_5 FOODSEC + \beta_6 OFFINC + \epsilon_i \quad (2)$$

Where the dependent variable in the model is a discrete variable with 1 if the household is harvesting Eembe wild fruit and 0 if not, and the explanatory variables are defined and are hypothesized to influence wild fruit harvesting as explained below:

AGE is a continuous variable for age of the household head expressed in years. It is assumed that the relationship between AGE and harvesting of wild fruits is ambiguous.

GEN is the dummy variable for gender with 1 = male and 0 = female. It is assumed that that there is a negative relationship between GEN and harvesting of wild fruits, in that harvesting can be correlated with young age and old age.

HSIZE is the variable for family or household size. It is assumed that HSIZE is likely to be positively related to probability of wild fruit harvesting.

EDUC is a dummy variable for education level of household head, 1 = has formal education and 0 otherwise. It is assumed to have a negative effect on harvesting of wild fruits.

FOODSEC is a dummy variable for food security status of the household in terms of own production satisfying food requirements the whole year, with 1 = yes and 0 = no. FOODSEC is

expected to be negatively related to wild fruit harvesting.

OFFINC is the variable for off-farm income level of the household expressed in Namibian dollars. OFFINC is hypothesized to be negatively related to the probability of harvesting Eembe wild fruits in the study region.

3.2 Data

The study used data collected from a sample of 83 households from three communities situated in the relatively Eembe or bird plum abundant area in the western part of the Ohangwena region. The three communities, namely Oipya, Onengali, and Eengava were purposely selected and from each community 30 household heads were systematically selected for the interview. Both Eembe harvesting and non-harvesting households were interviewed. In total, 83 households were interviewed comprising of 29 households from Oipya, 28 households from Onengali and 26 households from Eengava. The total sample included 17 non-Eembe harvesters (19.5%) and 66 Eembe harvesting households (79.5%). The data was collected through a structured questionnaire administered to household heads by a well-trained enumerator who spoke the local language of *Oshikwanyama*. Information collected included: households' socio-economic and demographic and farming characteristics, aspects of Eembe wild fruit harvesting, processing and income generation from Eembe activities and products. The survey was conducted between June and July 2002.

4. Results and discussion

4.1 Socio-economic characteristics of surveyed households

A summary of descriptive statistics of selected characteristics of surveyed households is given in Table 1. The sample consisted of 79.5 % *Eembe* harvesters and 19.5% non-harvesters. More than two-thirds (69%) of respondents were female and about a third (31%) were male. The average age of a respondent in the total sample is 57.7 years indicating that the household heads interviewed were old. The study area has large households with an average of 10.1 persons per household. The level of education among the households was low; around 62% of respondents had some formal education mostly at primary school level and 38% of households with no formal education.

The mean size of the farm operated by the household in this area is 4.7 hectares. In terms of crop production, the households were growing pearl millet (100%), followed by sorghum (90%), beans (90%), and Bambara nuts (56%). Pearl millet being the principal staple crop in the study area, occupied nearly 90% of the average cultivated area per household. The remaining 10% of the average cultivated area is occupied by other crops namely sorghum, beans and Bambara nuts. About 80%, of households were rearing cattle, 90% kept goats and pigs, and 99% kept local chickens. For land preparation about 50% of respondents used oxen and 55% used donkeys. Only about a quarter (24%) of the households indicated that they had enough food from own production to satisfy household food needs (food security) for the whole year. This indicates that most surveyed households in the Ohangwena region were food insecure and that food from own production could only satisfy food requirements for an average of 6 months of the year. For the rest of the year households had to use alternative coping strategies such as reducing the number of meals per day, harvesting of wild fruits, and relying on off-farm income to purchase foods for the household.

Table 1: Descriptive Statistics (frequencies, mean values) of selected variables for sample households

Variable	Mean	Std. Deviation
Bird plum Harvester (yes=1, no=0)	0.8	0.41
Age (years)	57.7	12.3
Gender (male=1, female=0)	0.31	0.47

Variable	Mean	Std. Deviation
Education (yes =1, no=0)	0.63	0.49
Household size (persons)	10.1	3.1
Farm size (hectares)	4.7	1.5
Cultivated land (hectares)	3.9	1.2
Cattle herd size (number)	9.3	8.4
Enough food produced (yes=1, no=0)	0.24	0.43
Total Household income (N$)	11321.7	18715.7
Farm income (N$)	231.6	954.7
Off-farm income (N$)	10670.5	18322.4
Eembe income from fruit and wine (N$)	405.7	431.2

The average household income for the sample is N$ 11,321 per year. This translates into N$ 1,132 per capita, which is consistent with the estimates reported by the Ohangwena Poverty Profile Report by NPC (2004). This income includes salaries and wages, remittances, pension and farm income. The largest portion of the household income is from off-farm sources. The average income generated from sales of Eembe fruits and wine (liquor) is about N$406 which is about 7.29% of household income among Eembe wild fruit harvesters. However, fruit income accounted for only 2.8% of total household income in this study. The average quantity of Eembe wild fruits harvested per household was about 4.7 latas equivalent to 57.4 kg, with a range of 1 -18 latas. A lata is local unit of measurement referring to a 20 litre tin or container and 1 lata of dry eembe fruits weighs about 12.216 kg (Bille, 2006).

4.2 Results of the logit model

The results of the application of the linear logistic regression model of the likelihood of harvesting Eembe wild fruits on household characteristics are presented in Table 2 below. The Nagelkerke R^2- (goodness of fit measure) is estimated at 0.45. The model Chi-square test of significance of the estimated parameters is 27.545 (p = 0.000) and the likelihood ratio test is 56.158. The results indicate that the specified model explained significant non-zero variations in the factors influencing the farmer's decision of Eembe wild fruit harvesting in the Ohangwena Region in Namibia. The model correctly predicts 95.4% of households that harvest Eembe wild fruits and 52.9% of non-harvesters of Eembe wild fruits. The model has an overall correct prediction rate of 86.6%.

Table 2: Parameter estimates of the Logistic regression model for participation in *Eembe* wild fruit harvesting

Variable	Estimated coefficient	Standard error	Wald	Significance level	Exp(B)
Constant	0	3.38	3.75	0.05	701.8
AGE	0.02	0.04	0.23	0.63	1.02
GEN	0.82	0.95	0.74	0.39	2.27
EDUC	-0.74	0.99	0.56	0.45	0.48
HSIZE	0.13	0.14	0.95	0.33	1.14
FOODSEC	-0.89	0.83	1.13	0.29	0.41
OFFINC (Ln)	0	0.29	7.61	0.01	0.45
Model chi-square (df=6)	27.55			0	
Likelihood ratio	56.16				
Nagelkerke R Square	0.45				
Percent correctly predicted	86.6				

*** is significant at 1%, ** is significant at 5% and * is significant at 10% level.

The findings show that five out of six socio-economic and demographic characteristics, namely age, gender, education, household size, and adequacy of own produced food, have no significant influence on the probability of a household to harvest Eembe wild fruits. The only factor found to be significant is off-farm income which has a negative relationship with the probability of harvesting Eembe wild fruits.

The apriori expectation was that age has an ambiguous effect. In this result, age has a positive but insignificant effect on Eembe wild fruit

harvesting. This suggests that there is no statistically significant difference in mean age among and between Eembe harvesters and non-harvesters. Further data analysis revealed that the majority of surveyed farmers belong to one age group of 45-60 years with a mean age of 57.7 years. Thus, the insignificant effect of age on wild fruit harvesting can be attributed to the nature of the sample data used in this study.

The effect of gender on wild fruit harvesting was also found to be insignificant, contrary to findings of other studies for example Chikoko (1999). This suggests that there is no significant difference in participation in Eembe wild fruit harvesting between male and female farmers. It can also imply that there are no differences in gender composition between Eembe wild fruit harvesters and non-harvesters. This again can arise due to the nature of the sample data used in this analysis which is dominated by females comprising 69% of the sample.

Regarding the influence of education on likelihood of harvesting of wild fruits, other studies have shown that more educated the individual, less the desire to engage in wild fruit harvesting. This is because more educated individuals tend to have higher income earnings and are more likely to be buyers than harvesters of wild fruits (Shackleton et al., 2002). In this study, education has the expected negative sign but has no significant effect on the likelihood of harvesting Eembe wild fruits. The insignificant effect of education can be explained by the fact that the majority of the surveyed households have low levels of education mainly at primary level (48%) and some with no education (37.3%). It is known that higher levels of education are necessary to get one into higher off-farm income opportunities which are highly correlated with reduction in likelihood to engage in harvesting of NTFPs including wild fruits. Thus, the relatively large percentage of households with low to no education in the present sample may underestimate the effects of higher education on the probability of harvesting wild fruits.

Although other studies (Dovie et al., 2005) found a significant positive correlation between household size and the value of extracted secondary woodland resources (including wild fruits), in this study, household size has no significant influence on Eembe wild fruit harvesting. The insignificant effect of household size can be attributed to the fact that Eembe harvesting requires relatively less labour. It is conducted in fields near the homestead and it is done when there is less competition for family labour, usually soon after the end of the peak cultivation period for food crops in March and April. In addition, the effect of household size on Eembe harvesting may be limited by other factors such as access, ownership of fruit trees, population densities, and short season of resource availability.

The food security variable has the expected negative sign but an insignificant effect on Eembe wild fruit harvesting. This is contrary to findings of some previous studies that food security is an important determinant of wild fruit harvesting (Rodin, 1985). It is possible, however, that the estimated coefficient is understated because food security is significantly positively correlated with household off-farm income ($r=0.311$, $p=0.004$) and negatively correlated with household size ($r=0.278$, $p=0.011$).

The negative sign of the coefficient for off-farm income is consistent with apriori expectations. The result suggests that the probability of engaging in Eembe wild fruit harvesting decreased with increasing off-farm income of the farmer. For example, the probability to engage in harvesting Eembe wild fruit dropped by 45% when off-farm income increased beyond the mean level. Conversely, the probability to engage in wild fruit harvesting is likely to be higher among households as off-farm income decreases.

The findings in this study are similar to research findings by Dovie et al., (2002) that poor people engage in land-based resource harvesting activities including collection of non-timber forest products (NTFP) for livelihood or as a survival strategy. According to Rodin (1985), households consider these wild fruits as their food supplements for own consumption and for sale to generate income.

Similar to other studies, the contribution of wild edible fruits to household income is not

substantial (Shackleton and Dzerefos, 2000; Dovie et al., 2002). Furthermore, the FAO (1996) report indicated that farmers in Sub-Saharan African engage in wild fruit harvesting for livelihood based on availability of fruit trees, social and economic status, agricultural potential, yield, and cultural patterns. From our findings, it could be inferred that the farmers engage in wild fruit harvesting on the grounds of economic status (off-farm income) more than other reasons. Typically these farmers have low skills, education and limited off-farm income or employment opportunities.

5. Conclusion

This study has shown that Eembe wild fruit harvesting is a minor source of income for livelihood in the Ohangwena region. The study determined that the probability of engaging in Eembe wild fruit harvesting is significantly negatively related to off-farm income. The other factors such as age, gender, education, household size and adequacy of own produced food as a measure of food security have no significant influence on the farmers' decision to harvest Eembe wild fruits.

The decrease in the household's off-farm income, lead to a greater probability for the household to engage in Eembe wild fruit harvesting. This implies that households with lower off-farm income are more likely to participate in wild fruit harvesting. It is clear that such households engage in Eembe wild fruit harvesting for survival reasons. Wild fruits contribute to their livelihood through food supplements and income generation which implies that those concerned with designing of strategies for improved utilization and management of NTFPs including wild fruits, need to understand the important role of these resources in the livelihood of the poor and food insecure rural households. Although households engage in Eembe harvesting for income generation, it has been found that Eembe and related NTFPs have made a minor contribution to household income. This implies that, strategies aimed at improving rural livelihoods should consider introducing more lucrative income-generating activities as alternatives to harvesting of wild fruits and related NTFPs in the study region.

The strength of the results in this study lies in the nature of the data collected. The insignificant effects of most variables included in the model can be attributed to some limitations in the sample data used. Some farmer characteristics like education and food security were measured as categorical variables when continuous measures and a large sample would be more desirable. Geographical and temporal coverage are limited to the Ohangwena region and for one season. Hence, this limits making of more general inferences about other regions in Namibia. It is suggested that comprehensive surveys covering other regions and a broader range of NTFPs be carried out to get a fuller understanding of the socio-economic factors that influence harvesting of NTFPs in the Northern and other regions of Namibia. Furthermore, instead of using a logit or probit model which only indicates association between the binary dependent variable and independent variables, other methods such as multiple regression analysis could be employed to understand the causal relationships between the dependent variable and other variables in the model. Future studies of a household's decision to participate in harvesting NTFPs should address these limitations.

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References

Ashley, C. (2000). *Applying Livelihood Approaches to Natural Resource Management Initiatives: Experiences in Namibia and Kenya,* ODI Working paper 134. UK.

Ashley, C. and LaFranchi, C. (1997). *Livelihood Strategies of Rural Households in Caprivi: Implication for conservancies and*

natural resource management. DEA Research Discussion Paper # 20, MET Windhoek.

Bille, G.P. (2006). Personal Communications.^

Campbell, B.M. (1987). The Use of wild Fruits in Zimbabwe. *Economic Botany*, 41(3), 375-385.

Chikoko, K. (1999). Women play critical role in the conservation of wetlands. *The Zambezi*, 2 (3), 4-5.

Dovie, D.K.B, Shackleton, C.M. and Witkowski, E.T.F. (2002). Direct–use values of woodland resources consumed and traded in a South African village. *International Journal of Sustainable Development & World Ecology*, 9(3), 269-283.

Dovie, D.K.B, Witkowski, E.T.F and Shackleton, C.M. (2005). Monetary valuation of livelihoods as indicator for understanding the composition and complexity of rural households. *Agriculture-Human Values*, 22, 87-103.

Food and Agricultural Organization of the United Nations (1996). *Forestry and Food Security* Rome. United Nations.

Food and Agricultural Organization of the United Nations. (1997): *Agriculture, Food and Nutrition for Africa. A resource book for teachers of Agriculture.* Rome. Food and Nutrition Division.

Food and Agricultural Organization of the United Nations. (1998). *Women's contributions to agricultural production and food security: Current status and Perspectives; Overview.* Rome.

Guharati, D. (1995). *Basic econometrics*. Third edition. New York. McGraw Hill Inc.

Hailwa, J.S. (2002). Namibia country paper. Presented at a workshop on Tropical Secondary Forest Management in Africa: Realities and Perspectives, ICRAF and CIFOR, Nairobi, Kenya, 9-13 December 2002. Available:http://www.Fao.Org/Docrep/006/J0628e/J0628e58.Htm,

Jaenicke H., Simons A.J., and Maghembe J. A. (2000). Domesticating Indigenous Fruit trees for Agroforestry in proceedings of the 25 International Horticultural Congress. Part 13. New and specialized crops and products, botanic gardens, and human-horticulture relationship. Brussels, Belgium. *Acta-Horticulturae*. 2000, vol. 523, 45-51.

Kueh H.S. and Voon B. H. (2000). The Nutritional value of Indigenous fruits and vegetables in Sarawak. *Asia- Pacific journal-of-clinical-nutrition*, Vol.8, 24-31.

Mandondo, A. (2001). Use of woodland resources within and across villages in Zimbabwen communal area. *Agriculture-and – Human values* 2001 Vol.18(2), 177-194.

National Planning Commission. (2004). *Ohangwena Regional Poverty Profile*, Namibia, 2003 – Summary Report, Windhoek.

National Planning Commission. (2003). *2001 Population and Housing Census*. Census Office, Windhoek.

Price, L. and Campbell, B.M (1998). Household tree holding: A case study in Mutoko Communal area, Zimbabwe. *Agroforestry Systems*, 41, 205-210.

Quisembing, A.R., Brown, L.R., Felstein, H.S., Haddad, L., and Pena, C. (1995). *Women: The key to Food Security*. Food Policy Report. International Food Policy Research Institute, Washington, DC.

Rodin, R. J. (1985) The ethnobotany of the Kwanyama Ovambos. Monograph in *System Botany*, Vol. 9. Missouri Botanical Garden.

Schade K., Kalili N., Simpson R. (2000). A survey of subsistence farmers in Ohangwena Region. By The Namibian Economic Policy Research Unit. Windhoek.

Shackleton C.M., Dzerefos C.M. (2000). The use of and trade in indigenous edible fruits in the Bushbuckridge Savannah Region, South Africa. *Ecology of Food and Nutrition,* 39, 225-245.

Shackleton S.E., Shackleton C.M., Netshiluvhi, T.R., Geach, B.S, Balance, A., and Fairbanks, D.H.K. (2002). Use patterns and value of savanna resources in three rural villages in South Africa. *Economic Botany;* Vol.56 (2), 130-146.

Shackelton, S., von Maltitz, G. and Evans, J. (1998). Factors, Conditions and Criteria for the Successful Management of Natural Resources Held under a Common Property Regime: A South African Perspective. *Land reform and Agrarian Change in Southern Africa: An Occasional Paper Series* .

SPSS. (2007). *Statistical Packages for Social Sciences (SPSS Version 15).* Inc. Chicago, Illinois.

Templeman D.E. (1998). *Rural Women and Food Security in Africa: current situation and perspectives*. Rome.