Socio-economic determinants of forest conservation in Botswana

Lepetu, J.P and Oladele O.I

Botswana College of Agriculture, University of Botswana, Private Bag 0027, Gaborone, Botswana jlepetu@yahoo.com, oladele20002001@yahoo.com

Abstract
In Botswana, due to the pervasiveness of the arid and semi-arid conditions over the country, the conservation of forest and protected areas is crucial to the maitanace of ecosystem services to the nation. Consequent on these conservation practices are the socio-economic characteristics of dwellers around the forest reserves in the country. This study examined the socio-economic determinant of forest conservation in Kasane forest reserve, Chobe district. A simple random sampling technique was used to select 237 households and a structured questionnaire with a reliability coefficient of 0.85 was used to elicit information on socio-economic characteristics of people living around the forest reserve and data were selected on their socio-economic characteristics and involvement in conservation practices. Data collected were described using frequency counts and percentages and a probit regression analysis. The results show that showed more females 61.2% living around the forest, 78.1% were aged between 20 and 49 with 44.3% of the respondents having secondary education. About 67 percent of the respondents were involved in conservation practices by setting aside the forest for tree and animal protection. The paper concludes with suggestion for the right combination of policies, public awareness and appropriate conservation approaches in order to sustain KFR preservation. Significant variables include education (t =6.37), occupation (t = -426), years of residency (t = 5.87), place of origin (t = 2.42), and income (t = 2.68). There is therefore need for public awareness and appropriate conservation approaches among the dwellers around the forest.

Key words: forest conservation, socio-economic characteristic, forest dependence, Botswana

Introduction
Over the past few decades, environmental and developmental concerns have increased interest in forests as an important ecosystem and in the well being of people who live near them. This can be attributed to importance of biological diversity as natural resource capital for economic development, human welfare, and ecosystem sustainability is well recognized. At the same time, forests are subject to high rates of degradation, deforestation and decline in biological diversity. Botswana has at least 2600 species of plants of which 17 are endemic, 150 are mammals, over 500 species of birds, over 1000 species of insects and numerous species of reptiles and amphibians (NFS,1993). To ensure sustainability of this level of biodiversity, about 37% of Botswana's total land area has been reserved for conservation use. Areas under conservation include National Parks, Forest Reserves, Game Reserves, Wildlife Management Areas, wildlife sanctuaries and monuments (CSO 2000).

Natural forest peripheries are surrounded by village communities whose livelihoods are directly or indirectly bound by exploiting resources of the forests as they are economic buffer and safety nets for poor households. Traditionally, people of Botswana are pastoralists; but like in

many developing countries, 65% of the population in Botswana resides in rural areas, where their main occupation is subsistence arable agriculture. However, due to unreliable rainfall, poor soils, frequent droughts and recurring livestock diseases, rural people face difficult livelihood situations, hence the need for alternative livelihood strategies. It has been widely argued that protection of natural resources for ecotourism development or timber harvesting is increasingly threatening the livelihoods of resident populations (TWYMAN 2001). Therefore, multiple resource use for the Chobe Forest Reserves could be a major goal to achieve human welfare and sustainable resource management (NFS 1993).

The management of the Kasane Forest Reserve (KFR), the oldest among the six gazetted forest reserves in the Chobe district, involves local inhabitants in Multiple Use Zoning approach (NFS 1993). The rural communities have always relied partly on the exploitation of its natural resources in the form of plants and animals. However, a recent plan by the Forestry Section to utilize the reserve for tourism operations (ROSS 2001) implies greater restrictions on the resource use by local communities and may intensify conflict (DE BOER AND BAQUETE 1998). The communities living around forests that have been declared as Protected Areas are the most affected. Most communities resent this proposed change in forest use, which might prohibit some of their traditional use rights in the forest reserves. They contend that the benefits from conserving the forest reserve will accrue to certain stakeholders such as private tour operators as opposed to the majority of community members.

Human dependence on forest is a multifaceted phenomenon because forests provide a diverse stream of benefits to humans (BECKLEY 1998). Several studies have demonstrated the role of forest inhabitants towards conservation in different parts of the world, however, it has been proven in many places that it is difficult to manage protected areas (RAO AND GEISLER 1990) because of a higher dependency of the local people on natural resources for various products. Forest dependency also varies across households (MASOZERA and ALAVALAPATI 2005). In some instances, dependency is reduced as a result of alternative sources of income and livelihood (SHACKELETON ET AL. 1998). However, where there is still some dependency, increased awareness of the consequences of not managing and controlling the use of the resource can provide an incentive for local communities towards more careful management. Households may depend more or less on forest resources depending on their socioeconomic characteristics. The identification of the factors affecting forest dependency is an initial step towards formulating policies that are conducive for an equitable sustainable resource management. Socio-economic research has revealed that demographic and socio-economic factors influence the behavior of rural households towards natural resource management (POMEROY ET AL. 1996).

Methodology
The study was carried out in Kasane Forest Reserve (KFR) which is a gazetted forest reserve (Forest Act, Chapter 38:04, 1968) and 1 360 km^2 in size; located at the extreme northern corner of the country in the Chobe District, adjacent to the Zimbabwe international border and very close to Chobe River, which is also an international boundary between Botswana and Namibia. Three most prominent villages around KFR are Kasane, Kazungula and Lesoma and they have 2657 households (CSO, 2001). For each village, a list of the households was obtained from the District Council Offices and using a stratified sampling technique, 237 households were selected. Data were collected with a structured questionnaire that was subjected to face validity among socio-economic and natural resources management research experts and pre-tested with a reliability coefficient of 0.85. The survey instrument contained questions on socio-economic characteristics and forest conservation activities.

Descriptive statistics was used to analyze the socio-economic features of respondents while the Probit model was used to identify which of the socio-economic characteristics determine conservation activities of the respondents. The relationship between the probability of forest conservation Pi and its determinants q is given as: $Pi = \beta qi + \mu i$, where $P_i=1$ for $X_i \geq Z$;

i=1,2 ......,n; qi is a vector of explanatory variables and β is the vector of parameters. The probit model computes the maximum likelihood estimator of β given the non- linear probability distribution of the random error μi. The dependent variable Pi is a dichotomous variable which is 1 when a respondent is willing to participate and 0 if otherwise. The explanatory variables are: X_1 = dummy variable for gender (Male =1, female =0), X_2 = age in years, X_3 = dummy variable for educational level (educated=1, not educated=0); X_4 = dummy variable for occupation (farming =1, others =0); X_5 = number of years of residency, X_6 = household size in number of persons, , X_7 = dummy variable for place of origin (Motswana=1, others=0), X_8 = income in Botswana Pula (BWP) X_9 = dummy variable for plot ownership (owner = 1, others = 0), and X_{10} = dummy variable for livestock ownership (Yes =1, No = 0).

Results and Discussion
Figure 1 present the results of selected socio-economic characteristics of the respondents. There are more females (60 percent) than males. This implies that there is need for gender sensitive approaches in the conservation of Kasane forest. In terms of age, about 59 percent of the dwellers around the forest are less than 40 years –an active age group that would explore several income generating activities from the resources around the. It is important therefore that alternative income generating activities that are less dependent of the forest resources are introduced if these dwellers will not over exploit the forest resources in a bid to earn income and enhance their survival. More than 80 percent of the respondents have one form of formal education. This scenario will enable the use of several media for information dissemination of best practices on forest conservation activities. From 122 respondents that indicated their occupational status, 51.5% are unemployed while those employed either by government or tourism related enterprises are 40.9% and self employed 7.6%
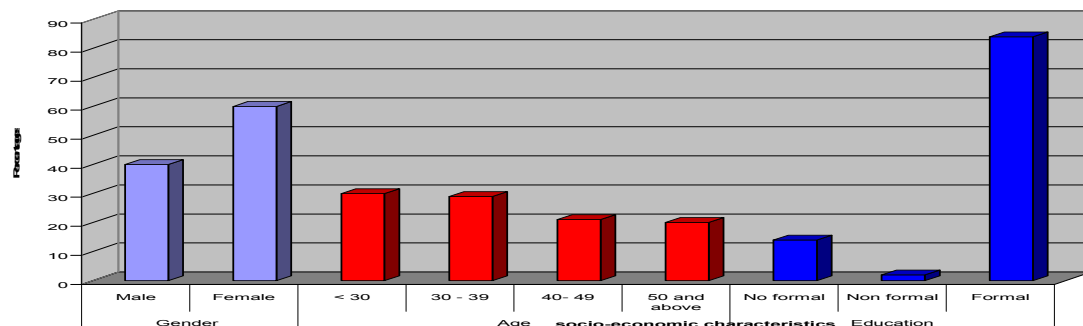

Figure 1: Distribution of respondents according to gender, age and education

From the results of the Probit model presented in Table 1, the Chi-square value was used to determine the goodness of fit of the model. The value is statistically significant at one percent level. The result also shows that 8 variables are statistically significant at 5%. These are gender (t = 11.00), age (t = 2.50), education (t = 2.28), occupation (t = -2.14), years of residency (t = 3.38), income (t = 2.27), plot ownership (t = -1.88), and livestock ownership (t = -1.73). It can be deduced that the more the number of women living around the forest, the older the resident becomes, the higher their education qualification, longer the years of residency around KFR, and higher income, the more forest conservation activities will be carried out. A positive relationship between forest conservation and household income suggest that if people have other sources of income, they are likely to participate in forest conservation. Furthermore, the inverse relationship between forest conservation and income suggest that if alternative income generating activities are available and viable, dweller will conserve the forest. Also, the more dweller owns plot and livestock within and around the KFR, the lower the conservation that will be carried out as there will be tendency to open up more fertile areas for farming and livestock feeding purposes. Of these 8 significant variables, 3 are inversely related to forest conservation . This indicates that an

increase in any of these variables will lead to a decrease in the probability of conserving the forest.

Table 1: Parameter estimates of Probit regression analysis

Parameters	Regression coefficient	Std. Error	t	p
Gender of respondent	0.070	0.006	11.00	0.00
Age of respondent	0.005	0.002	2.50	0.02
Education qualification	3.033	1.32	2.28	0.00
Occupation	-0.419	0.196	-2.14	0.00
Years of residency around KFR	0.027	0.008	3.38	0.00
Household size	0.013	0.016	0.80	0.42
Place of origin	0.161	0.066	0.96	0.51
Monthly income (BWP)	0.098	0.043	2.27	0.005
Plot ownership	-0.016	0.008	-1.88	0.04
Livestock ownership	-0.185	0.111	-1.731	0.08
Intercept	-3.15	0.44	-7.16	0.00
Pearson goodness -of- fit Chi- square	4214.15			
DF	225			
p	0.00			

Conclusions

This study has shown that socio-economic characteristics influence forest conservation among dwellers in KFR in Botswana. However some of the socio-economic characteristics can be explored in planning sustainable approaches to forest conservation in the study area. Also, in cases of which total elimination is not possible, control and regulation should be applied in order to sustain the forest conservation activities.

References

BECKLEY, T. 1998. Moving toward consensus based forest management: A comparison of industrial, co-managed, community and small private forests in Canada. The Forestry Chronicle, **74** (5): 201-213.

CENTRAL STATISTICS OFFICE (CSO). 2001. Statistical Bulletin, 26(1). Gaborone, Botswana.

CENTRAL STATISTICAL OFFICE. 2003. Tourism Statistics 2002. Gaborone, Botswana: Government Printer.

DE BOER, W.F., AND D. S. BAQUETE. 1998. Natural resource use, crop damage, and attitudes of rural people in the vicinity of the Maputo Elephant Reserve, Mozambique. Environmental Conservation, **25**(3):208 –218.

MASOZERA, M.K., AND J.R.R. ALAVALAPATI. 2004. Forest dependency and its implications for protected areas management: A case study from Nyungwe Forest Reserve. Scandinavian Journal for Forestry Research, 19: 85-92.

NORWEGIAN FORESTRY SOCIETY (NFS). 1992. Chobe forests inventory and management plan. Gaborone, Ministry of Agriculture. Botswana.

POMEROY, R.S., R.B. POLLNAC, C.D. PREDO, AND B.M. KATON. 1996. Impact evaluation of community-based coastal resources management projects in Philippines. Research Report No. 3. International Centre for Living Aquatic Resources Management, Metro, Manila.

RAO, S.K., S. NAUTIYAL, R.K. MAIKHURI, AND K.G. SAXENA. 2000. Reserve people vs people in Nanda Devi Biosphere Reserve (NDBR): an analysis of conflicts. Mountain Research and Development, 20: 320-323.

ROSS, S. 2001. An ecotourism feasibility study of the Chobe District forest reserves. Draft Report. Kasane, Botswana.

SHACKELETON, S., G. VON MALITZ, AND J. EVANS. 1998. Land reform and agririan change in Southern Africa. An occasional paper series. School of Government. University of Western Cape. South Africa.

TWYMAN, C. 2001. Natural resources use and livelihoods in Botswana's wildlife management areas. Applied Geography, **21**: 45-68.