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**FOREST DEPENDENCY AND ITS EFFECT ON CONSERVATION  
IN SUDAN: A CASE OF SARF-SAAID RESERVED  
FOREST IN GADARIF STATE**

**SUMMARY**

The objectives of this study were to (i) identify the socioeconomic factors determining forest dependency of households around Sarf-saaid reserved forest; and (ii) assess the impact of dependency on households' attitudes towards the forest conservation. A sample of 300 households was randomly selected from three villages surrounding Sarf-saaid reserved forest namely Sarf-saaid, Alam and Kisiaba in Galabat locality, Gadarif state in 2012. The data were collected using structured questionnaire interviews, direct observation and group discussion. The data were analysed using descriptive and logistic multi-regression analysis. The results showed that agricultural income ( $p<0.05$ ), household age ( $p<0.05$ ), access to outside market ( $p<0.05$ ), and household size ( $p<0.1$ ) were major determinants of forest dependency. The results also revealed that benefits from the farm trees ( $p<0.05$ ), limited access to forest resources ( $p<0.05$ ), and forest dependency ( $p<0.1$ ) were the significant predictors of households' attitudes towards Sarf-saaid forest conservation. The study concluded that consideration to socioeconomic characteristics of households living around the forest is essential in forestry conservation programs. Therefore, policy measures that aim at increasing agriculture income and generating off-farm employment opportunities for rural communities are important to reduce forest dependency and enhance conservation.

**Keywords:** forest conservation, resource dependency, household attitudes, Sudan

**INTRODUCTION**

Human dependence upon forests is a multifaceted phenomenon due to the fact that forests provide a diverse stream of benefits to humans (Beckley, 1998). Humans depend upon forests directly for timber, non-timber products, and recreational experience and indirectly for things such as air and water quality, water regime regulation, protection of soil erosion, biodiversity, carbon sequestration, and other ecological services. Conservation of biodiversity in protected forest areas of developing countries has become complex and challenging because of higher dependency of population on natural resources for

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agricultural, energy, nutritional, medicinal, and income needs. Sudan, a country of 1.882.000 sq km, with approximately 10% of its land surface under forest areas exemplifies many management challenges relating to reserved areas.

Reserved area managers have relied upon law enforcement approaches to resolve problems (e.g. illegal logging, over-grazing, shifting cultivation) associated with local people. However, the success is very limited because of lack of recognition to the needs of local communities living around the reserved areas (Studsrod & Wegge, 1995). It is now widely recognized that the long-term survival of reserved areas in developing countries will be jeopardized if needs, aspirations, and attitudes of local peoples are not accounted for (McNeely, 1990; Ghimire & Pimbert, 1997). This suggests that understanding the dependency; and conservation attitudes of local people towards reserved forests surrounding them are of great importance to formulate new or modify existing conservation strategies.

Several studies have demonstrated the role of forest resources in the economy of forest inhabitants in different parts of the world (Fernandes et al., 1988; Falconer & Arnold, 1998; Cavendish, 2000; Gunatilake, 1996; Gunatilake, 1998; Godoy, 1993; Hedges & Enters, 2000; Reddy & Chakravarty, 1999, Barham et al., 1999; Bahuguna, 2000; Takasaki et al., 2001; Vedeld et al., 2004; Shackleton & Shackleton, 2006; Shackleton et al., 2008; Tesfaye et al., 2010; Figurek, 2012; Asfaw et al., 2013; Adam et al., 2013). However, very few attempts were conducted to assess the socioeconomic determinants of forest dependency and its impact on people's attitudes toward conservation (Gunatilake, 1998). Therefore, the objectives of this study were to (i) identify the socioeconomic factors determining forest dependency of households around Sarf-saaid reserved forest; and (ii) assess the impact of dependency on households' attitudes towards the forest conservation.

## CONCEPTUAL FRAMEWORK OF THE STUDY

In this study the resource use theory provided by Firey (1960) was used as a framework to guide the study. The theory recognizes three value factors or frame of references- ecological, economic, and ethnological/cultural – that interacts with each other and plays a role in determining local perception towards a resource system. Social groups differ in their needs and perceptions with respect to a resource so do their attitudes towards resource systems. There is growing empirical evidence in support of the thesis that local people's support for reserved areas depends on the perceived costs and benefits of conservation.

Off-farm employment opportunities, agricultural income, household size, education and incorporation to outside market are found to influence forest dependency (Gunatilake, 1998; Hedges & Enters, 2000; Asfaw et al., 2013). However, a study by Nepal & Weber (1995) revealed that dependence on reserved area resources leads to negative attitudes towards protection policy. Also Infield (1988) found that poverty leads to negative attitudes towards wildlife protection. Infield (1988) found that benefits from the reserved area and

a better education result in a more positive attitudes in Natal, South Africa. In addition, Heinen (1993) points out that literacy and rights to collect forest products lead to positive attitudes. However, crop damage and restrictions on grazing and collection of fuel wood were shown to have negative impact on the conservation of Kosi Tappu Wildlife Reserve, Nepal. These results have been supported with other findings from various countries (e.g. De Boer & Baquete 1998; Parry & Campbell 1992; Fiallo and Jacobson 1995). In addition, Parry and Campbell (1992) found that crop damage, loss of livestock and greater dependence on wildlife for meat resulted in more negative attitude towards conservation. A study by Gullingham & Lee (1999) points out that gender and wealth influence attitudes. Also, Nepal & Weber (1995) found that landholding size has positive effect on attitude towards the national parks conservation. Finally, the study of Mehta & Heinen (2001) in Nepal revealed that benefit from tourism; wildlife depredation issue, gender, and education level were significant predictors of local attitudes towards conservation.

Drawing on the literature reviewed, a framework is developed to examine the effects of forest dependency on the conservation of Sarf-said reserved forest (Fig. 1).

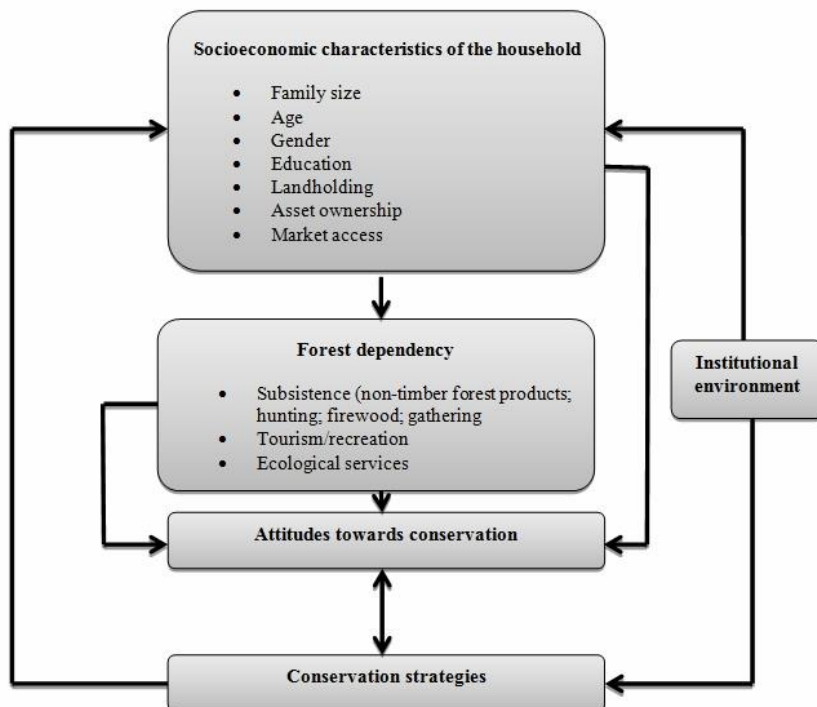


Figure 1. The conceptual framework for the study

This framework consists of two models that are interrelated. Household's socioeconomic and demographic characteristics determine income, the extent of

consumption, production and expenses. Forest dependency is driven by households' socioeconomic and demographic characteristics. Conservation attitudes are influenced by households' socioeconomic and demographic characteristics and the extent of forest dependency. Institutions regulate access to resources in the reserved area and design conservation strategies that have an impact on communities.

## MATERIAL AND METHODS

### STUDY AREA

The Gadarif state locates in the eastern part of the Sudan between 33-37° E longitudes and 12-16° latitudes with an area of approximately 78,000 km<sup>2</sup>. It bounded in the north by Kassala and Khartoum states, in west by Gazera, in the south by Blue Nile state, and shares boundary with Ethiopia from the east. Annual rainfall concentrates in a single relatively short summer season during June to September, and amounts to around 670 mm. Temperature ranged from a mean minimum of 21° C in January to a mean maximum of 36.4° C in April and May. The mean annual temperature is about 28.7° C (Sulieman, 2008).

The natural vegetation cover of the study area classified as an *Acacia seyal* and *Balanites aegyptiaca* woodland Savannah. On the clay plain *Acacia seyal*, *Balanites aegyptiaca*, *Ziziphus orthacantha* and *Acacia senegal* are the dominant trees. Common grasses include *Cymbopogon nervatus*, *Aristida mutabilis* and *Ctenium elegans*. In the drainage depressions also *Hyparrhenia rufa*, *Hyparrhenia hitra* and *Longohocarus laxiferrus* occur. The vegetation on the higher stonier land is less affected by human influences. On shallower soils the trees of *Lannea stumper*, *Acacia campyla-cantha* and *Combretum hartmannianum* are grown. *Sorghum* grasses, *Cymbopogon* spp. And *Sporobolus* grass species dominate areas of fallow or abandoned crop-land (Sulieman, 2008).

Agriculture is the main livelihood activity, followed by livestock rising in the traditional seasonal transhumance pattern. Gum production and trading forest products and charcoal production are other traditional forms of livelihood. Thus, the people derive their income from various livelihood strategies- agriculture, grazing, and forest exploitation (Glover, 2005).

### SAMPLING TECHNIQUE

A sample size of 300 households was selected from three villages surrounding Sarf-saaid reserved forest namely Sarf-saaid, Alam and Kisiaba in Galabat locality, Gadarif state in 2012. Within the selected villages, a list of the households was acquired from the District Council Offices from which a simple random sample was applied to select households. Sampling was done by writing down names of residents' households on pieces of paper and these were put in a box from which names of the household owners were drawn at random based on the location of the wards. The choices of respondents based on the location of the wards were done in order to ensure equal chances of selecting different land uses around the forest (arable farmers and livestock breeders) and location-specific

factors (e.g., distance to the forest). The survey instrument contained both close and open ended questions. The questions asked were related to resource use, perceptions, the demographic characteristics and household socioeconomic data.

#### DATA COLLECTION AND COMPUTATION

The data on household characteristics included were collected. Household's dependence on the reserved forest was calculated as the ratio of annual income earned from forest to the total annual income earned from wealth and other sources (agriculture, off-farm employment). For this analysis, the forest dependents are defined as the households having a positive income from forest related. Forest dependency is classified based on the relative forest income rather than the absolute forest income. Relative income is used because it is difficult to say what level of absolute income determines the forest dependency. Relative dependency is classified as the percentage of total income contributed by forest products while absolute dependency is classified as quantities of forest products collected (Pattanayak et al., 2003).

The impact of age, gender, education, household size, total wealth assets, and number of years living in the area on forest dependency was estimated. The computation of household income was carried out as follows:

- Household annual income =  $\Sigma$  (forest income + agriculture income + return to wealth + wage income).
- Forest income =  $\Sigma$  (fuel wood annual income + wild fruits income + poles income + thatching grass income).
- Agriculture income =  $\Sigma$  (maize income + sorghum income + millet income + groundnut income).
- Wealth (Assets) =  $\Sigma$  (livestock assets + household Assets)
- Livestock assets =  $\Sigma$  (cattle income + goats income + sheep income + donkeys income + chicken income).
- Household asset =  $\Sigma$  (radio price + TV price + bicycle price + tractor price + donkey cart price + car price + mobile price + bed price).

Forest income: information about collection and sale of forest products was obtained from households. In addition, a list of all non-timer forest products (NTFP) was prepared with key informants and the forestry staff and documents reviews as a checklist to remind respondents about product they might forget. . Income from commercial products was calculated by multiplying the quantities with market prices. Income on subsistence products was computed based on surrogate prices.

Agriculture income: agriculture includes cultivation of crops for purposes of both household consumption and selling. Information on crop yields was gathered from individual households through the questionnaire survey; and prices of crops were obtained from the local auction markets.

Wage income: information on salaried jobs and business was collected from individual members. This also includes other sources of income such as remittances, and pensions for age old people.

Other household assets: The annual rate of return on capital (livestock, tractor, and car) was computed as a product of the price and the interest rate. The interest rate used for this study was 10% which was determined after discussion with relevant departments in the Gedaref state. In certain cases such as prices for cattle, goats and other livestock, the surrogate market price was used depending on the age of the animal. Other assets such as small items such as radios, bicycle, and television, the respondent was asked how much he will be willing to sell that item at the current market. Since there was no basis for assigning the forest dependency index (ratio that obtained from income that forest sector contributes to household or individual divided by total income of household or individual). It is assumed that households whose forest income represents greater or equal to a value greater than 8% of the total income are dependent on the forest, while households whose forest income represents less than 8% of the total income are less dependent. Thus, the variable is assigned a value of zero (0) if the household forest dependency is  $< 0.08$  and a value of 1 if the household's dependency index is  $\geq 0.08$ . The binary nature of the dependent variables suggests that a logit model is appropriate (Gujarati, 1995). The categorical explanatory variables, education are recoded as 0 representing "those with above primary education level as educated (1) and those below primary education level as (0). Gender was also recorded as 1 and 0 respectively, male (1) and female (0).

#### MODEL SPECIFICATION FOR ESTIMATING FOREST DEPENDENCY

The dependent variable, the forest dependency, used in the logistic regression model is a binary variable. The cut off value used to transform the dependent variable represent 40% of the total income. The authors assumed that households whose forest income represents greater or equal to 40% of the total income are highly dependent, while households whose forest income represents lesser than 40% of the total income is less dependent. Thus, the variable is assigned a value of zero if the household forest dependency is  $< 0.4$  and a value of 1 if the household dependency index is  $\geq 0.4$ . Logistic regression model is a statistical technique in which the probability of a dichotomous outcome (such high dependency and lower dependency) is related to a set of explanatory variables that are hypothesized to influence the outcome.

The model used to estimate forest dependency as well as conservation attitude by the sample households is specified as follows:

$$[P_i/(1-P_i)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}$$

Where: subscript  $i$  denotes the  $i$ -th observation in the sample;  $P$  is the probability of the outcome;  $\beta_0$  is the intercept term; and  $\beta_1, \beta_2, \dots, \beta_k$  are the coefficients associated with each explanatory variable  $X_1, X_2, \dots, X_k$ .

Based on the conceptual framework discussed above, the socioeconomic variables definitions and their expected signs for forest dependency is shown in Table 1 below.

Table 1 Variable definitions and their expected sign for dependence model

Variable	Variable definition	Expected sign
CONAT	(Dependent variable measuring forest dependence)	No assigned
EDU	(Respondent's level of education)	Negative
AGE	(Respondent's age in years)	Negative
GER	(1 if respondent is male, 0 for female)	Positive
LDSZ	(land area in hectare)	Negative
TOICAR	(Total income from agriculture)	Negative
HHS	(household family size)	Positive
MKAC	(distance to nearest market)	Negative

#### ESTIMATION OF FOREST CONSERVATION ATTITUDE

Attitude is defined as organization of beliefs about an object or situation that influence one's response to that object (Rokeach, 1968). The local community's conservation attitude was analyzed as a function of forest dependency and a set of socioeconomic factors. Local communities around the Sarf-saa'id reserved forest expressed their attitudes towards conservation by approving or disapproving several statements. Logistic regression analysis was used to determine which factors were significant in predicting attitude towards conservation. Gillingham & Lee (1999) and Mehta & Heinen (2001) used the same technique to assess the relationship between socioeconomic factors and conservation attitude.

Based on the conceptual framework discussed above, the socioeconomic variables definitions and their and their expected signs for forest conservation attitude is shown in Table 2 below.

Tab. 2. Variable definitions and their expected sign for forest conservation attitude model

Variable	Variable definition	Expected sign
CONAT	(Dependent variable measuring conservation attitude)	No assigned
EDU	(Respondent's level of education)	positive
AGE	(Respondent's age in years)	Positive/neg.
LANDLIM	(1 if respondent's important issue facing the community is land scarcity, 0 otherwise)	Negative
WDFDPN	(1 if respondent's important issue facing the community is wildlife depredation, 0 otherwise)	Negative
FOOD	(1 if respondent's important issue facing the community is lack of sufficient food, 0 otherwise)	Negative
LKACF	(1 if respondent's important issue facing the community is lack access to forest resources/products, 0 otherwise)	Negative
BFFRF	(1 if respondent's family benefits from the reserved forest, 0 otherwise)	Positive
DEPINX	(1 high dependence, 0 otherwise)	Negative
RESIDENCY	(respondent's residency length in year around the reserved forest)	Negative

## RESULTS AND DISCUSSION

### SOCIOECONOMIC FACTORS DETERMINING FOREST DEPENDENCY

Results of the model explaining forest dependency are given in Table 3 and were analysed in terms of overall significance of the model and the impact of each explanatory variable on forest dependency. The Likelihood Ratio test shows that the regression model is significant with Chi-Square statistics of 40.35. This result indicates that the explanatory variables included in the model are significantly related to the dependent variable, forest dependency (FODY). The results show that the model predictions are correct 89.08 % of the time indicating that the explanatory variables allow us to specify the dependent variable, in discrete terms (1, 0), with high degree of accuracy. Therefore, the results can be considered reliable and used for formulating forest conservation policies.

In this model, many explanatory variables have the expected effect on forest dependency. While coefficients on the AGE, TOICAG and MRAC are statistically significant at 5%, variable HHS is significant at 10%. The variable AGE shows a negative relationship to the forest dependency. This suggests that younger households are more dependent on forest resources. This may be due to the fact that forest dependent activities in the Sarf-saaid forest are illegal and it is risky to undertake them. Youth generally take greater risks relative to older people in the community. Furthermore, with limited off farm economic opportunities, younger households rely more on forest resources to meet their basic needs. A study by Andre and Platteau (1998) in Rwanda notes that younger households are being trapped in poverty due to limited alternative economic opportunities.

Table 3 Regression results showing determinants of forest dependency; and descriptive statistics of the model

variable	Coefficients	Standard Error	Elasticity	Mean
Constant	0.766	1.362	0.493	
EDU	0.331	1.069	0.015	2.120
AGE	-0.056**	0.025	-1.447	44.890
GER	0.794	0.712	0.416	0.70
LDSZ	-0.091	0.306	-0.044	1.00
TOICAG	-0.0000331**	0.00001	-0.296	232.82
MRAC	-0.328**	0.100	-0.739	6.22
HHS	0.207*	0.110	0.841	5.74
Maddala R <sup>2</sup>	0.207			
Correct prediction	89.08%			
LR test	40.35			

\*\* Coefficient significant at  $p < 0.05$ , \* Coefficient significant at  $p < 0.1$

The variable TOICAG shows a negative relationship with forest dependency. This implies that households with high total agriculture income are less dependent on forest resources. This finding is similar to the finding of Gunatilake (1998) wherein agriculture income was found to have a negative



impact on forest dependency in Sinharaja forest community in Sri Lanka. Agriculture constitutes the main source of income for rural Rwandan households and contributes substantially to their income. Therefore, poor households with little income from agriculture may be more dependent on the forest (Cavendish, 2000; Godoy, 1993; Gutanilake et al., 1993).

Market access (MRAC) has a negative relationship with forest dependency. When local communities are integrated to outside markets they tend to depend less on forest resources. People living in isolated areas with limited access to external markets and infrastructure facilities are likely to remain poor and will continue to depend on surrounding forest resources. On the other hand, communities closer to town may have a wide range of opportunities such as employment in permanent jobs and small businesses. In addition, returns to labor and agriculture may be high in villages closer to the market than those of isolated villages. This result supports the argument of Angelsen and Kaimowitz (1999) that higher rural wage and greater off-farm employment opportunities reduce deforestation.

The variable household size (HHS) has a positive relationship with forest dependency. This suggests that large families tend to depend more on forest resources. Due to higher unemployment in the Sarf-saaid Forest area, large families mostly rely on forest resources to increase their income or to meet their basic needs. Also, forest activities such as fuel wood collection and non-timber forest products are labour intensive and therefore larger households are more likely to undertake these activities. Hedge and Enters (2000) also found the same relationship between household size and income from forest products.

The variables EDU, GER and LDSZ are not statistically significant. The positive coefficient of EDU suggests that formally educated people are more dependent on forest resources. Although this result is somewhat counter intuitive, the reason for this observation may be due to lack of variation in education among households. Also, in the face of limited off-farm opportunities in rural areas, educated people with more knowledge about forest products such as minerals may have greater advantage over illiterate people. The positive coefficient of GER demonstrates that male respondents are more dependent on forest resources. The negative coefficient of LDSZ suggests that respondents with larger landholdings are less dependent on forest resources. This is consistent with the findings of Reardon and Vosti (1995) that in Rwanda, land-poor are also poor in off-farm capital and therefore cannot afford to continue sustainable agriculture. Therefore, land poor will rely more on forest resources to meet their livelihood needs.

The elasticity at the means of explanatory variables are reported in Table 3. The elasticity column shows the odds of being high forest dependent in response to a unit change in the mean value of an explanatory variable. For example, a household whose TOICAG exceeds 232.82 USD per year is approximately 29.6 % more likely to be less dependent on the Sarf-saaid reserved forest than those with lower income. Similarly, the MRAC has an elasticity of

0.739 indicating that households with market access index higher than 6.22 are 73.9 % more likely to be less dependent on the Sarf-saaid reserved forest than those who live in rural/remote areas.

#### ASSESSMENT OF CONSERVATION ATTITUDE

In response to questions such as: “What kind of impact do the conservation activities have on you? Is it an improvement or a detriment? etc”, about 58% of respondents held positive attitude toward the Sarf-saaid forest conservation program. On average 60% of respondents expressed that they have had problems with animals from the forest, 54% of respondents believed that limited access to forest resources is the most important issue facing their community, 89% believe that land scarcity is an important issue in their community, 91% perceived the lack of sufficient food as an important issue in the community and only 35% reported that their families benefit from the Sarf-saaid reserved forest. Since collection of forest products in the Sarf-saaid reserved forest is prohibited, few respondents reported that they collected resources from the forest. The estimated coefficients from this model are presented in Table 4. The  $R^2$  value (Maddala = 0.114), the likelihood ratio test statistic (chi-square value = 21.20), and the percentage of correct predictions (68.97%) suggest the model has limited explanatory power. However, Gujarati (1995) suggests that  $R^2$  as a measure of goodness fit is not well suited for the dichotomous dependent variable models.

Table 4 Regression results showing determinants of conservation attitude; and descriptive statistics of the model

variable	Coefficients	Standard Error	Elasticity	Mean
CONAT	0.460	0.966	0.188	0.58
AGE	0.0109	0.012	0.201	2.12
EDU	0.061	0.067	0.053	44.89
BFFRF	1.049**	0.367	0.153	0.89
LKACF	-0.778**	0.348	-0.172	0.60
DEPINX	-1.065*	0.609	-0.040	0.54
EDU	0.061	0.067	0.053	0.35
LANDLIM	-0.278	0.580	0.102	0.10
CRRID	-0.343	0.344	-0.084	0.91
RESIDENCY	0.005	0.009	0.067	31.08
Maddala R2	0.114			
Correct prediction	68.97%			
LR test	21.20			

\*\* Coefficient significant at  $p < 0.05$ , \* Coefficient significant at  $p < 0.1$

Overall, the majority of the variables had expected signs. Coefficients on BFFRF and LKACF are statistically significant at  $p < 0.05$ . The variable forest dependency (DEPINX) is negative and statistically significant at  $P < 0.1$  suggesting that households with high level of dependency are more likely to hold negative attitudes towards the conservation of the Sarf-saaid reserved forest. This

is consistent with Nepal and Weber (1995) finding that people who are dependent on protected areas for their livelihood are unlikely to support conservation efforts.

The variable representing reserved forest benefits (BFFRF) is positive and highly significant, suggesting that families who realize benefits from the reserved forests have more positive attitudes towards the forest. The establishment of reserved forest has affected communities around it differently. On one hand, people who live close to the reserved forest with off-farm economic opportunities have positive attitudes because the reserved forest provides them with fuel-wood. On the other hand, people who live far away from the reserved forest without economic alternatives perceive the reserved forest primarily as a limitation for the expansion of their agriculture into the reserve. Some people are against the reserved forest because the government has expropriated their land in order to establish the plantations.

The variable representing limited access to forest (LIMAC) shows a negative relationship with conservation attitude. This suggests that households who perceive restrictions on the use of the forest as a concern hold a negative attitude. In the face of widespread poverty and limited economic opportunities in rural areas, it is quite natural that restrictions on the use of forests and other natural resources will lead to a negative attitude. Similar situations have been noted in other reserved areas of developing countries. For example, Fiallo and Jacobson (1995) found that people who perceive personal benefits from Machalilla National Park in Ecuador held positive attitudes towards it than those who believed that the park affects them negatively. Mehta & Heinen (2001) also found a positive relationship between tourism benefit and households attitude towards conservation in Nepal.

The variable limited land (LANDLIM) shows a negative relationship with conservation attitude. This result suggests that landless households perceive conservation programs as a limitation to meet their subsistence needs and therefore are likely to hold a negative attitude. The same result was observed in Nepal by Nepal and Weber (1995). Crop raiding (CRRID) has shown to have a negative relationship with conservation attitude but it is not statistically significant. This result suggests that people who suffer with wildlife depredation hold a negative attitude towards the conservation of the reserved forest. Given the scale of wildlife damage in the midst of widespread poverty it is likely that people-animal conflicts will result in less favourable attitude. This is consistent with other studies (Parry & Campbell, 1992; Heinen, 1993 and Mehta & Heinen 2001) that found a negative relationship between wildlife depredation and conservation attitude.

The variables AGE and EDU are not statistically significant but show positive relationship with conservation attitude. These results suggest that older people are more likely to hold favourable attitude towards conservation. This is explained by the fact that younger households with limited economic opportunities are more affected by restrictions associated with the reserved forest

conservation. This result is in contradiction with findings from Ecuador and Tanzania where older inhabitants were less likely to support the reserved forest areas than younger households (Newmark, et al., 1993; Fiallo & Jacobson, 1995). However, the positive relationship between the level of education and conservation attitude support the findings of Heinen (1993); Fiallo and Jacobson (1995); and Mehta & Heinen (2001).

The variable residency length (RESIDENCY) is positive but not significant. This suggests that short-term stay is more likely to hold negative attitudes towards reserved forest. This is explained by the fact that short-term residents are younger and landless. Therefore, they depend on forest resources to meet their livelihood needs. These results are in contradiction with the findings of Newmark et al. (1993) and Fiallo and Jacobson (1995) that long-term residents hold negative attitude than short-term residents. The variable limited food (FOOD) shows a negative relationship with conservation attitudes suggesting that people who cannot afford to meet their basic needs such as food are unlikely to appreciate conservation of the Sarf-saaid forest. This is because it limits their ability to collect food and other forest products. Infield (1988) found similar results that poverty leads to needs which results in negativity toward setting land aside for wildlife protection.

### **CONCLUSIONS**

Understanding household forest dependency is critical for designing conservation strategies. This study reveals that household dependency on Sarf-saaid reserved forest is driven by many factors. The results show that agriculture income and access to outside markets will reduce forest dependency. Also, younger households and larger families are more dependent on forest resources. In addition, people living in isolated areas with poor infrastructure are likely to be more dependent on Sarf-saaid reserved forest. Consequently, in the face of social and economic problems, rural poverty will exacerbate the need for access to natural resources in the Sarf-saaid reserved forest and increase the conflicts with the forest management. Therefore, policy measures that aim at increasing agriculture income and generating off-farm employment opportunities for rural communities are needed to reduce forest dependency and enhance forest conservation. This study also shows that forest dependency, limited access to forest resources, and lack of benefits from the reserved forest is the major factors that hinder the positive attitude toward the conservation of Sarf-saaid reserved forest. Therefore, any conservation programs relating to the reserved forest must consider the socioeconomic characteristics of households around the forest.

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## **ZAVISNOST OD ŠUMA I EFEKTI NA OČUVANJE ŠUMA U SUDANU: SLUČAJ ŠUMSKOG REZERVATA SARF-SAAID U DRŽAVI GADARIF**

### **SAŽETAK**

Cilj ovog istraživanja je bio da se (i) identifikuju socio-ekonomski faktori koji definišu zavisnost od šuma domaćinstava oko rezervata šuma Sarf-saaid; i (ii) da se ocijeni uticaj zavisnosti na stav domaćinstava vezano za očuvanje šuma. Uzorak od 300 domaćinstava je nasumično odabran iz tri sela koja se nalaze oko šumskog rezervata Sarf-saaid, tj. Sarf-saaid, Alam i Kisiaba na lokaciji Galabat, država Gadarif 2. Sakupljeni su podaci pomoću strukturiranih upitnika, direktnim posmatranjem i grupnom diskusijom. Podaci su analizirani pomoću deskriptivne i logističke multi-regresivne analize. Rezultati su pokazali da poljoprivredni prihod ( $p < 0.05$ ), starost domaćinstva ( $p < 0.05$ ), pristup spoljnom tržištu ( $p < 0.05$ ) i veličina domaćinstva ( $p < 0.1$ ) predstavljaju glavne determinante zavisnosti od šuma. Rezultati su takođe pokazali da benefiti od drveća na farmi ( $p < 0.05$ ), ograničen pristup šumskim resursima ( $p < 0.05$ ) i zavisnost od šuma ( $p < 0.1$ ) predstavljaju značajne faktore za predviđanje stava domaćinstva prema očuvanju šuma Sarf-saaida. Istraživanje je dovelo do zaključka da je uzimanje u obzir socio-ekonomskih karakteristika domaćinstava koja žive oko šuma od suštinskog značaja za programe očuvanja šuma. Prema tome, mjere politika čiji je cilj povećanje prihoda od poljoprivrede i stvaranje mogućnosti zaposlenja van farmi za ruralne zajednice su značajne za smanjenje zavisnosti od šuma i unapređenje očuvanja.

**Ključne riječi:** šumski rezervat, zavisnost od resursa, stav domaćinstva, očuvanje, Sudan.