# Factors Influencing Local Communities' Satisfaction Levels with Different Forest Management Approaches of Kakamega Forest, Kenya

**Paul M. Guthiga · John Mburu · Karin Holm-Mueller**

**Abstract** Satisfaction of communities living close to forests with forest management authorities is essential for ensuring continued support for conservation efforts. However, more often than not, community satisfaction is not systematically elicited, analyzed, and incorporated in conservation decisions. This study attempts to elicit levels of community satisfaction with three management approaches of Kakamega forest in Kenya and analyze factors influencing them. Three distinct management approaches are applied by three different authorities: an incentive-based approach of the Forest Department (FD), a protectionist approach of the Kenya Wildlife Service (KWS), and a quasi-private incentive-based approach of Quakers Church Mission (QCM). Data was obtained from a random sample of about 360 households living within a 10-km radius around the forest margin. The protectionist approach was ranked highest overall for its performance in forest management. Results indicate that households are influenced by different factors in their ranking of management approaches. Educated households and those located far from market centers are likely to be dissatisfied with all the three management approaches. The location of the households from the forest margin influences negatively the satisfaction with the protectionist approach, whereas land size, a proxy for durable assets, has a similar effect on the private incentive based approach of the QCM. In conclusion, this article indicates a number of policy implications that can enable the different authorities and their management approaches to gain approval of the local communities.

**Keywords** Forest management approaches · Community satisfaction · Ordered probit · Kakamega forest · Kenya

## Introduction

Management approaches of public forests are important in determining outcomes of conservation and sustainable use. A management approach may take different organizational forms, such as centralized management, where state agencies assume the lead role, decentralized management, where local communities are involved at varying levels, private management where private entities own and manage the resource, and co-management, where state, local communities, and other actors share management functions, rights, and responsibilities (Meinzen-Dick and others 2002; Mburu and Birner 2007). These management approaches not only define and assign property rights to various stakeholders differently, but they also guide use of the resource and consequently determine the conservation outcomes (Oakerson 1992; Meinzen-Dick and Di Gregorio 2004). Among other outcomes, forest management entities ought to meet the needs expected from the resource by the society, ensure equitable benefit sharing, facilitate appropriate conflict resolution and encourage participatory decision-making. Depending on their stated mission, forest management approaches may pursue conservation with direct extraction or strict protectionist conservation, i.e., prohibiting direct extractive use.

Local communities living near forests in many developing countries are important actors in determining success

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or failure of efforts to conserve natural resources (Ostrom 1999; Ferraro 2002; Meinzen-Dick and others 2002; Wiggins and others 2004; Robertson and Lawes 2005). In cases where the forests are managed by state agencies, local communities are normally viewed as custodians of these forests and in many situations they are actually the de facto owners. This is so because in many instances, especially in developing countries, these forests were traditionally owned and managed by the local communities before being taken over for management by state or other external agencies. In many instances, these communities remain culturally attached to these forests and to a varying degree from place to place; the external management agencies involve the local communities in decision-making processes. Thus from a management point of view, local communities can be considered as the "clients" or at least part of the clientele on whose behalf the resource is being managed by the state or any other external agency. In the last two decades there has been a variety of efforts undertaken by governments of developing countries towards adoption of participatory management and benefit sharing with communities living within proximity of forests (White and Martin 2002). However, more often than not, the views of local communities on forest management are not systematically elicited, evaluated, and incorporated in the decision-making processes (Chase and others 2004). Evaluation of forest management interventions or approaches by local communities is crucial for providing information on how best to reconcile conservation objectives with other societal goals. Thus, this study aims to generate different levels of satisfaction of local communities towards three existing management approaches of Kakamega Forest in Kenya. In addition, it identifies factors that influence different satisfaction levels with the three different management approaches.

Kakamega Forest, a tropical rain forest located in western Kenya, presents a unique opportunity or case study to compare local communities' satisfaction levels with different forms of forest management approaches. The forest is currently sub-divided into three parts, each managed by a distinct authority and each using a somewhat different approach of management. Approximately 44 km$^2$ of the forest is managed under a state-led protectionist approach as a national reserve by a state agency, the Kenya Wildlife Service (KWS), on behalf of the central government. This part of the forest is preserved almost in its pristine form as a national reserve and is used for tourist visits, camping, and nature trails. The local communities are not allowed to extract any timber or nontimber products. The bulk of the forest (about 200 km$^2$) is managed under a state-led, incentive-based approach by the central government through the Forest Department (FD). Some regulated forest extraction activities, such as grazing, collection of dead timber for fuel

wood, mushrooms, fruits, and medicinal plants, are allowed for the local communities. Since the early 1900s, a small fragment of the forest (about 130 Ha) has been under an incentive-based quasi-private management of a Quakers Church Mission (QCM) which allows the local communities limited and regulated extraction of forest products. Over the years, Kakamega forest has been subjected to degradation of various kinds, but there is a clear gradient of disturbance with the KWS-managed part being the least disturbed and the QCM fragment being the most disturbed (Bleher and others 2006; Lung and Schaab 2006).

## Concept of Consumer Satisfaction and Its Application in Forest Management

Traditionally consumer satisfaction studies have been widely applied in marketing, but are increasingly being applied in other areas, such as health services (Fredrik and Jostein 2000; Margolis and others 2003) and recreational services (Akama and Kieti 2003; Whisman and Hollenhorst 1998), but are not widespread in the context of environmental management. A few examples exist, such as a study by Andersson (2004), which assessed the community user satisfaction with forest management in the municipal provision of forestry services in Bolivia.

The theory of consumer satisfaction as applied in consumer research studies can be adapted to analyze the satisfaction levels of local communities with the services provided by forest management. From this perspective, forest management approaches can be viewed as providing "management services," and the local communities as the "consumers" of these services. The first step in generating these satisfaction levels is to define the services offered by forest management (as outlined in their mandates in legislation or mission statement). In the second step, the local people's satisfaction levels with the way services are offered are elicited using an appropriate procedure.

Satisfaction has to be defined and conceptualized in a way that captures the actual assessment of the people about the performance of management approaches. As noted by Giese and Cote (2002), several definitions of satisfaction are found in literature without a single consensus definition. However, in spite of differences in definition, there are three common elements of consumer satisfaction as highlighted by Giese and Cote (2002); first, it is a response (either emotional or cognitive); secondly, it pertains to a particular focus (expectation, product, consumption experience, and such others); and thirdly, it occurs at a particular time (after consumption, after making a choice, or based on repeated interaction). Several other studies have defined satisfaction based on evaluative judgment or response (Fornell 1992; Mano and Oliver 1993; Tse and

Wilton 1988). In this study we defined satisfaction as the evaluative judgment of the respondents about the performance of forest management approaches based on their repeated interaction with them. It is plausible to assume that local people are able to make an informed evaluative judgment based on repeated interactions with the forest management over time.

Satisfaction with a product or a service can be captured through an aggregate (single-item) or attribute (multi-item) level of measurement. Multi-item level measurement of satisfaction attempts to first capture consumer satisfaction toward specific aspects or dimensions of the service or product in question and then aggregates them into an overall score. The main weakness with aggregation is that the researcher has to arbitrarily assign weights (or assume equal weights) for the different dimensions of the service or product. In contrast, an aggregate measure inquires only about a consumer's overall or global satisfaction with a product or service encounter. The aggregate measurement subsumes the attribute measurements and one presumption, therefore, is that the two assessments (aggregate and individual attribute) would yield similar estimates of overall satisfaction. However, the two measures are likely to diverge when consumers engage in partial satisfaction assessment (satisfaction assessment based on evaluation of only some of the features) or where consumers weigh some attributes more highly than others and the researcher has no prior knowledge about the consumer weighting. Aggregate measure allows consumers to impose their own weighting criteria on the elements before responding with an overall assessment of satisfaction (Szymanski and Henard 2001). Attribute by attribute ranking can be used to analyze how the respondent weighs the different attributes with respect to overall ranking. Given the unique importance of each of these measures, this study elicited both aggregate and attribute levels of satisfaction. Thus, we asked respondents first for their satisfaction with specific forest management services/aspects and secondly their overall satisfaction level with the way the forest is managed. For the analysis, we used the overall satisfaction, thus allowing the respondents the freedom to attach their own weights to the different aspects of forest management.

## Study Area and Data Elicitation Procedures

Kakamega Forest is the only remaining patch of Kenya's Guineo-Congolean rainforest, which spanned from west and central Africa, with its easternmost edge in Kenya. It is also among the few remaining indigenous forests in Kenya and possesses a unique diversity of numerous flora and fauna. It hosts a large number of rare animals and even some endemic plant species (Kokwaro 1988). However, human disturbances have gradually contributed to the fragmentation and loss of vast amounts of primary forest during the past century (Fashing and others 2004). A recent study carried out by Lung and Schaab (2004), showed that approximately 20% of the forest was lost in the last three decades.

Kakamega district has an average population density of 461 people per km$^2$, making it one of Africa's most densely populated rural areas (GoK 2001). It is also estimated that the number of people in the district who earn less than a dollar per day account for over 57% of the population (GoK 2001). Thus the forest is under constant threat of degradation since these poor local communities depend on it for fuel-wood, charcoal, building poles, traditional medicinal plants, and grazing land. Even in the well protected KWS-managed part of the forest, there are incidences of illegal logging, charcoal burning, and occasional hunting of small animals. The forest occupies two different agro-ecological zones, and local communities surrounding it are mainly farmers. To the north of the forest or areas surrounding the KWS-managed part of the forest, the main cash crop is sugar cane. The other surrounding areas of the forest are occupied by farmers whose main cash crop is tea. Other crops grown in both areas include maize, beans, cowpeas, and bananas. Due to lack of enough grazing land, livestock keeping is done by rearing the animals around homesteads or grazing in the forest.

Data collection for this study was carried out in September 2005 to February 2006. Data collection activities targeted an area of approximately a 10-km radius from the forest margin and covered all surrounding areas under the three management approaches. In total, approximately 350 villages were included in the study area. A sampling frame of about 34,000 households was generated after conducting a census in all selected villages. The census was done in consultation with the administrative village heads and other local leaders. A random sample of 361 households was generated from the sampling frame. This sample was interspersed across the three management approaches of the forest. Semi-structured questionnaires were administered to household heads or their spouses of the sampled households using trained enumerators. The questionnaires elicited information on household socio-economic characteristics, farming information, type of products and quantities they extracted from the forest, costs they incur, and their satisfaction levels with functioning of management approaches (both overall and with specific aspects of forest management). Detailed information about the functioning of the three forest management systems was collected through interviews with the forest managers while secondary sources were also used to supplement information on forest management approaches.

## Factors Influencing Satisfaction Levels with Forest Management

A survey of existing literature reveals that an array of social, economic, and institutional factors influence how the local people perceive nature conservation and agencies that carry it out. There is evidence in literature that suggests that a household's wealth status influences conservation perception (Lise 2000). Some studies have found wealthier households to have positive attitudes toward nature conservation (Mehta and Kellert 1998), while others have found opposite effects or no correlation (Gadd 2005). This study therefore attempted to test the effect of a households' wealth on its attitude toward forest management. Since farming is the main economic activity in the study area, it was anticipated that households with larger pieces of land are more likely to be wealthier. It is plausible to assume that the wealthier the households the less likely they will rely on forest for their livelihoods; hence they are likely to be more satisfied with the protectionist management approach. Land size (LAND_SZ) and number of livestock units (LVST_UNIT) were included in the models as proxies for a household's durable assets and disposable assets respectively. A household's location from the forest edge is likely to influence its perception towards forest conservation. There is some evidence in literature that suggest that people living further away from the forest have more positive attitudes towards any form of forest conservation, mainly because they do not suffer crop damage by wild animals (Shrestha and Alavalapati 2006). It is also plausible to postulate that households living closer to the forest edge (FRST_DIST) are likely to be dissatisfied with all three forest management approaches. However, this might not necessarily be the case especially for FD and QCM, which allow local communities to extract from the forest. Formal education has been shown to influence positive attitudes toward conservation with use in several studies (see Lise 2000; Shrestha and Alavalapati 2006), while others indicate an opposite effect (Gadd 2005). Formal education (EDUC_HH) is expected to increase understanding of the importance of conservation hence better evaluative judgment, but it would be difficult to determine a priori the direction of influence. A household's integration into nonfarm economy is likely to have an influence on its perception of forest management. It is plausible to assume that increased integration in nonfarm activities improve respondents' relationships with forest conservation authorities (since pressure on forest resources is reduced) (Thacher and others 1997). Although it was not possible to predict beforehand the direction of its influence on satisfaction level, proximity to market centers (MRKT_DIST) was included in the model as a proxy for a household's level of integration in nonfarm activities. Several studies have found a positive association between forest dependency and perception towards conservation with extraction (McFarlane and Boxall 2000; Racevskis and Lupi 2006). Communities extracting products from the forest are likely to have a more favorable view of forest management approaches that allow extraction (see Bauer 2003; Walpole and Goodwin 2001). Therefore, extraction of nontimber products (NTFP_YES) is postulated to increase satisfaction with FD and QCM management approaches since they both allow extraction. Individuals involved in any forest conservation activities (FRS_ACTV) are likely to have a positive judgment towards conservation and, therefore, their satisfaction with the forest management approaches would be considerably high. Differences in environmental conservation perception between men and women have been noted in several studies (Dougherty and others 2003; Anthony and others 2004; Lise 2000; Hill 1998). Some studies have found a higher concern for the environment among women compared to men (McFarlane and Boxall 2000; Anthony and others 2004). In this study, gender of the household head (HH_SEX) was included in the regression but for the particular case of Kakamega forest, it was not possible to predict a priori how gender would influence satisfaction. The role of local groups and associations in bringing about positive conservation outcomes has been noted in literature (Pretty and Ward 2001). Membership to such groups and the associated values of social relations, in the form of trust, reciprocal arrangement, and locally developed rules, norms, and sanctions could positively influence attitudes towards conservation. Membership to social groups (SGRP_MEM) was hypothesized to influence perception towards management in the positive direction. Some studies have found that larger households, especially those with many children, are more dependent on forest for their livelihood mainly due to low opportunity costs of children's labor time (Abebaw 2006). It was, therefore, postulated that since large households require more resources, the size of the household (HH_SIZE) is likely to positively influence satisfaction with the incentive based approaches of FD and QCM. However, as noted by Shrestha and Alavalapati (2006), household size might lead to positive attitudes toward the protectionist conservation if economic opportunities increase with family size.

## Analytical Framework

Respondents were asked to rank their overall satisfaction with forest management operating closest to their residence based on a five-point scale (1 = very satisfied, 2 = satisfied, 3 = neutral, 4 = dissatisfied, 5 = very dissatisfied). As noted above, apart from the overall satisfaction, the respondents were also asked to rank their satisfaction with

16 other aspects of forest management. It was conceptualized that a respondent is faced with a choice between assigning his/her satisfaction level among the five ranks which represents underlying utilities $U_1$, $U_2$, $U_2$, $U_4$, and $U_5$, respectively, and which are not observable. The underlying utility can be expressed by equation 1 below:

$$U_{Yi} = V_{Yi} + \varepsilon_{Yi} \tag{1}$$

Where $U_{Yi}$ is the latent, unobserved utility corresponding to satisfaction level Y; $V_{Yi}$ is the explainable part of the latent utility that corresponds to the chosen satisfaction level and a set of characteristics of respondent i, while $\varepsilon_{Yi}$ is the random or "unexplainable" component of the latent utility associated with the choice of satisfaction level Y. Respondent i's choice ordering between the five satisfaction levels of forest management indicators is modeled in the following way: respondent i ranks a management approach in one of the five satisfaction ranking levels based on the following indicator function:

$$
\begin{aligned}
Z_i &= (V_{Y_a i} + \varepsilon_{Y_b i}) - (V_{Y_a i} + \varepsilon_{Y_b i}) \\
&= (\varepsilon_{Y_a i} - \varepsilon_{Y_b i}) - (V_{Y_a i} - V_{Y_b i}) \\
Z &> 0 \text{ if } Y_a > Y_b
\end{aligned} \tag{2}
$$

Where $Z_i$ is the additional utility/satisfaction derived by respondent i from a certain management approach, which he/she assigns satisfaction level $Y_a$ compared to a certain lower satisfaction/utility which he/she would rank as $Y_b$. The respondent expresses very high dissatisfaction level (very poor) if $Z_i$ is below some threshold value of U (say, $\mu_1$), shows dissatisfaction (poor) if $Z_i$ is above $\mu_1$ but below another threshold value $\mu_2$, expresses medium level of satisfaction (neutral) if $Z_i$ is above $\mu_2$ but below another threshold value $\mu_3$ and expresses high level of satisfaction (good) if $Z_i$ is above $\mu_3$ but below another threshold $\mu_4$, expresses very high satisfaction (very good) if $Z_i$ is above $\mu_4$.

Formally, respondent i's choice ordering (denoted by $Y_i$ where Y = 1 implies very good, Y = 2 implies good, Y = 3 implies neutral, Y = 4 implies poor and Y = 5 implies very poor) can be expressed as follows:

$$
\begin{aligned}
Y_i &= 1 \text{ if } Z_i > \mu_4 \\
Y_i &= 2 \text{ if } \mu_3 < Z_i < \mu_4 \\
Y_i &= 3 \text{ if } \mu_2 < Z_i < \mu_3 \\
Y_i &= 4 \text{ if } \mu_1 < Z_i < \mu_2 \\
Y_i &= 5 \text{ if } Z_i < \mu_1
\end{aligned} \tag{3}
$$

Since part of the utility is random in nature, a researcher cannot perfectly predict the choice of an individual. From the researchers' perspective, the problem is inherently stochastic, which naturally leads to formulating the ith individual's choice problem in probability terms:

$$
\begin{aligned}
P(Y_i = 1 \,|\, \text{Choice Set}) &= P[Z_i \\
&= (\varepsilon_{ji} - \varepsilon_{ki}) - (V_{ji} - V_{ki}) > \mu_4) \\
P(Y_i = 2 \,|\, \text{Choice Set}) \\
&= P[\mu_3 < Z_i = (\varepsilon_{ji} - \varepsilon_{ki}) - (V_{ji} - V_{ki}) < \mu_4) \\
P(Y_i = 3 \,|\, \text{Choice Set}) \\
&= P[\mu_2 < Z_i = (\varepsilon_{ji} - \varepsilon_{ki}) - (V_{ji} - V_{ki}) < \mu_3) \\
P(Y_i = 4 \,|\, \text{Choice Set}) \\
&= P[\mu_2 < Z_i = (\varepsilon_{ji} - \varepsilon_{ki}) - (V_{ji} - V_{ki}) < \mu_3) \\
P(Y_i = 5 \,|\, \text{Choice Set}) \\
&= P[Z_i = (\varepsilon_{ji} - \varepsilon_{ki}) - (V_{ji} - V_{ki}) < \mu_1)
\end{aligned} \tag{4}
$$

Under the assumption that the random term $(\varepsilon_{ji} - \varepsilon_{ki})$ follows standard normal distribution, the above probabilistic model is an ordered-probit model (Greene 2003).

In empirical estimation, the indicator $Z_i$ for the respondent i is modeled as a function of his/her socioeconomic and other relevant attributes and can be expressed as:

$$
\begin{aligned}
Z_i &= \beta'X + V_i = \beta_o + \beta_1 x_{i1} + \beta_2 x_{i2} ... \beta_k x_{ik} + v_i \\
&i = 1, 2, ..., n
\end{aligned} \tag{5}
$$

where: $x_{ij}$ = j[th] attribute of the ith individual; $\beta = (\beta_0, \beta_1, ..., \beta_k)$ = the parameter vector to be estimated; and $v$ = random error or disturbance term. At the empirical estimation stage, both the $\beta$-vector and the $\mu$'s are estimated jointly using the maximum likelihood estimation (MLE) procedure. The estimated $\beta$-coefficients of equation (5) do not necessarily represent the marginal effects of the independent variables on the probabilities of choice (Greene 2003). This is because ordered probit is a nonlinear regression model and, therefore, the $\beta$-coefficients are not the marginal effects as in ordinary linear models. This makes the marginal effects very important to evaluate the effects of a marginal change in the independent variables on the dependent variable. In the case where the explanatory variable is discrete or categorical in nature, the marginal effect of such a variable is obtained by evaluating the probabilities at alternative values of $x_{ij}$ (Greene 2003).

Table 1 summarizes the factors ($x_i$'s) that were postulated to influence satisfaction levels of the respondents.

## Results and Discussion

### Satisfaction Levels with Different Forest Management Approaches

Levels of satisfaction with forest management approaches were elicited by asking the respondents to score their overall satisfaction with the way the forest nearest to their

**Table 1** Variables postulated to influence satisfaction levels

| Variables | Description | FD (n = 220) | | QCM (n = 83) | | KWS (n = 61) | |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | Mean | SD |
| FRST_DIST | Distance in km of the household homestead from the nearest forest edge | 3.80 | 3.70 | 0.91 | 0.88 | 3.93 | 3.05 |
| MRKT-DIST | Distance in km from the household to the nearest market center | 2.69 | 3.04 | 1.09 | 1.29 | 2.74 | 3.25 |
| NTFP_YES | If a household collected NTFP's from the forest in the last one year (If yes = 1, otherwise = 0) | 0.24 | 0.43 | 0.24 | 0.43 | 0.13 | 0.34 |
| FRS_ACTV | Involvement in forest conservation activity one year preceding the study (if yes = 1, otherwise = 0) | 0.11 | 0.31 | 0.17 | 0.38 | 0.33 | 0.48 |
| HHH_SEX | Gender of the household head (1 if male, 0 if female) | 0.79 | 0.40 | 0.72 | 0.45 | 0.85 | 0.35 |
| EDUC_HH | Years of formal education of the household head | 7.61 | 3.56 | 8.64 | 4.29 | 7.73 | 3.45 |
| HH_SIZE | Number of resident household members | 5.49 | 2.01 | 5.43 | 2.38 | 5.12 | 1.92 |
| SGRP_MEM | Number of social group memberships | 0.72 | 0.56 | 0.28 | 0.53 | 0.67 | 0.57 |
| LVST_UNIT | Livestock units owned by a household | 3.14 | 1.28 | 2.29 | 1.61 | 3.36 | 1.37 |
| LAND_SZ | Total land holding in hectares | 1.00 | 0.62 | 0.65 | 0.74 | 1.66 | 1.11 |

residence is managed. The results of means and frequencies of satisfaction levels are summarized in Table 2.

Generally, the satisfaction levels showed that respondents were relatively more satisfied with the performance of the protectionist approach (mean level of 2.23 for KWS) than the incentive-based approaches (2.64 and 2.72 for FD and QCM, respectively). For the FD and QCM management approaches, the satisfaction levels were more or less neutral. The difference of the means for the three levels was also tested. It was found that the level for KWS approach was significantly higher than that of FD and QCM. However the latter two were not significantly different from each other. The results thus indicate that although the local communities ranked FD and QCM approaches lowly, they did not express strong dissatisfaction with their performance. They are management approaches that the

communities can live with most likely due to the benefits they derive from extraction of nontimber forest products.

Since taking over the management of one part of the forest 20 years ago, KWS has transformed what used to be a degraded forest into an almost fully regenerated one as shown by recent studies (Bleher and others 2006; Lung and Schaab 2006). Among the three management approaches, only KWS has recorded an overall increase in forest cover through regeneration of formerly degraded areas and lowest rates of forest disturbance (Lung and Schaab 2006). The ranking of KWS performance as highest overall is not altogether surprising. Some other studies have reported a good convergence between scientific and public view of forest health (see, for example, Patel and others 1999 in a Canadian study). It should, however, be noted that although the local communities ranked FD and QCM approaches

**Table 2** Frequency and mean satisfaction level with forest management

| Management approach | Mean | SD | Frequency | | | | |
|---|---|---|---|---|---|---|---|
| | | | V. satisfied | Satisfied | Neutral | Dissatisfied | Very dissatisfied |
| FD (n = 220) | 2.64 | 0.86 | – | 47.9 | 37.5 | 13.9 | 0.7 |
| QCM (n = 83) | 2.72 | 1.06 | 3.6 | 54.2 | 16.9 | 16.9 | 8.4 |
| KWS (n = 61) | 2.23 | 0.64 | 8.2 | 11.5 | 62.3 | 16.4 | 1.6 |

lower than that of KWS, they did not express strong dissatisfaction with their performance. This implies that the communities are willing to live with these management approaches most likely due to the benefits they derive from extraction of nontimber forest products.

Informal interviews conducted among key informants in the community largely mirror these findings; KWS is viewed as committed to conserving the forest by implementing its rules firmly and transparently as evidenced by strict protection against extraction and arrest of those who break the law. On the other hand, FD and QCM are viewed as falling short of communities' expectations in implementing conservation rules fairly, firmly, and equally despite allowing some level of regulated extraction from the forest. Therefore, the results of satisfaction ranking could also be interpreted as an expression of peoples' verdict on how the forest management approaches apply and enforce their rules. Although not common, it is not surprising to find instances where people prefer protection-oriented state led conservation to community conservation. For instance, Obiri and Lawes (2001) found that among costal forest users of Eastern Cape in South Africa, preferred protection-oriented state-led forest conservation over community-led conservation mainly due to weak local governance institutions.

The mean satisfaction ranking levels of 13 dimensions of forest management are summarized in Table 3.

The results of mean satisfaction ranking for different management services reveal that across the management approaches, the respondents are unsatisfied with the handling of human-wildlife conflicts (WILD_CONF), efforts to

promote energy saving technologies (ALT_ENG), prevention of crop damage by wild animals (PREV_CDMG), and provision of employment opportunities for local people (EMP_LOC). It is important to note that there is a clear discrepancy between mean overall satisfaction (OVERALL_SAT) as elicited from the respondent and the average satisfaction (Average_SAT) calculated as a simple average of the satisfaction ranking of all aspects of management (see Table 3). This means that the respondents did not attach the same weight to all the aspects of forest management. The next section gives more insight on what kinds of factors would have affected the different levels of satisfaction.

## Determinants of Different Satisfaction Levels in Different Approaches

Ordered-probit regressions were estimated for each of the three management approaches. As argued by Greene (2003), coefficients of variables in ordered-probit regression do not necessarily show the marginal effects of the independent variables. Therefore, marginal effects for different levels of satisfaction were computed and the results of FD, QCM, and KWS management approaches are summarized in Table 4, 5, and 6, respectively. In all the three models, the chi-square values for the log-likelihood functions were significant indicating that all coefficients of the included independent variables were significantly different from zero. The goodness of fit of an ordered-probit regression is measured by the McFadden/pseudo $r^2$ which is analogous to $r^2$ in conventional regression. A zero value of pseudo $r^2$ indicates lack of fit, while value of one indicates perfect fit. However, it is important to note that measure of fit for pseudo $r^2$ is not chosen so as to maximize the fitting criterion of dependent variable as it is in the classical regression but rather the joint density of the observed dependent variables (Greene 2003). Empirical evidence suggests that it is generally acceptable to have values of pseudo $r^2$ between 0.2 and 0.4 (Pindyck and Rubinfeld 1981; Mbata 1997). The values of the pseudo $r^2$ for the three models were: 0.26, 0.23, and 0.31 for FD, QCM, and KWS, respectively, and, therefore, the models could be regarded as having a fairly good fit of the data. It should also be noted that marginal effects were computed for only 4 levels out of the 5 levels for each model due to either very few respondents or none at all assigning certain satisfaction levels to the management approaches. For example, as shown in Table 2, there were no respondents who ranked their satisfaction with FD as very satisfied.

Generally, the results of the ordered-probit regression showed that in each model, only three factors were significant in explaining satisfaction levels. Under incentive

**Table 3** Mean satisfaction levels by management approaches

| Variable | FD | | QCM | | KWS | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| OVERALL_SAT | 2.64 | 0.86 | 2.72 | 1.06 | 2.23 | 0.64 |
| Average_SAT | 3.85 | 0.51 | 3.75 | 0.48 | 3.43 | 0.41 |
| EXT_RULE | 3.41 | 0.93 | 4.46 | 0.65 | 4.78 | 0.42 |
| CONS_DEC | 2.89 | 1.20 | 2.39 | 1.16 | 2.17 | 1.04 |
| GEN_CONF | 3.88 | 0.76 | 3.77 | 0.79 | 3.68 | 0.72 |
| WILD_CONF | 4.12 | 0.73 | 3.85 | 0.74 | 4.10 | 0.71 |
| SCHL_OUT | 3.54 | 1.04 | 3.70 | 0.94 | 2.97 | 1.05 |
| ENV_ACT | 3.57 | 1.00 | 3.58 | 0.93 | 3.39 | 0.69 |
| ALT_ENG | 4.25 | 0.76 | 4.11 | 0.84 | 3.91 | 0.64 |
| TREE_SEED | 3.82 | 0.93 | 3.70 | 1.00 | 3.78 | 0.70 |
| ALTINC_ACT | 4.36 | 0.60 | 4.19 | 0.84 | 4.17 | 0.57 |
| CLA_RULE | 3.44 | 2.97 | 3.40 | 0.99 | 2.31 | 1.16 |
| LEV_EXTR | 3.54 | 1.01 | 3.59 | 0.91 | 3.19 | 0.93 |
| EMP_LOC | 4.45 | 0.67 | 4.11 | 0.88 | 4.58 | 0.55 |
| PREV_CDMG | 4.58 | 0.60 | 4.46 | 0.65 | 2.69 | 0.99 |

**Table 4** Factors determining satisfaction level for FD management approach

| Variable | Satisfied dy/dx | Neutral dy/dx | Dissatisfied dy/dx | Very dissatisfied dy/dx |
|---|---|---|---|---|
| FRST_DIST | 0.0062 (0.0089) | 0.1418 (0.1338) | −0.0634 (0.0644) | −0.0807 (0.0772) |
| MRKT-DIST | −0.0014 (0.0018) | −0.0317[a] (0.0124) | 0.0142[c] (0.0079) | 0.0180[b] (0.0081) |
| NTFP_YES | 0.0164 (0.0243) | 0.2203 (0.1643) | −0.1121 (0.1033) | −0.1214 (0.0862) |
| FRS_ACTV | 0.0032 (0.0105) | 0.0614 (0.1617) | −0.0293 (0.0832) | −0.0339 (0.0861) |
| HHH_SEX | −0.0015 (0.0080) | −0.0332 (0.1585) | 0.0152 (0.0740) | 0.0187 (0.0887) |
| EDUC_HH | −0.0018 (0.0025) | −0.0420[c] (0.0231) | 0.0188 (0.0128) | 0.0239[c] (0.0142) |
| HH_SIZE | −0.0024 (0.0033) | −0.0552 (0.0385) | 0.0248 (0.0196) | 0.0314 (0.0230) |
| SGRP_MEM | −0.0124 (0.0169) | −0.2818[c] (0.1729) | 0.1265 (0.0874) | 0.1603 (0.1109) |
| LVST_UNIT | 0.0006 (0.0027) | 0.0107 (0.0591) | −0.0048 (0.0264) | −0.0061 (0.0338) |
| LAND_SZ | −0.0066 (0.0089) | −0.1493 (0.0943) | 0.0670 (0.0477) | 0.0850 (0.0590) |
| Log-Likelihood | −41.16 | | | |
| Pseudo $r^2$ | 0.26 | | | |
| LR Chi-square | 29.53[a] | | | |

[a] significant at 1%; [b]significant at 5%; [c]significant at 10%

Figures in parentheses are the standard errors

**Table 5** Factors determining satisfaction level for QCM management approach

| Variable | Satisfied dy/dx | Neutral dy/dx | Dissatisfied dy/dx | Very disatisfied dy/dx |
|---|---|---|---|---|
| FRST_DIST | 0.0065 (0.0091) | 0.1309 (0.1305) | −0.0635 (0.0666) | −0.0674 (0.0677) |
| MRKT-DIST | −0.0014 (0.0017) | −0.0278[a] (0.0114) | 0.0135[b] (0.0073) | 0.0143[b] (0.0068) |
| NTFP_YES | 0.0145 (0.0221) | 0.1876 (0.1668) | −0.1024 (0.1073) | −0.0919 (0.0770) |
| FRS_ACTV | 0.0080 (0.0158) | 0.1137 (0.1448) | −0.0615 (0.0887) | −0.0555 (0.0674) |
| HHH_SEX | −0.0054 (0.0109) | −0.0913 (0.0314) | 0.0469 (0.0758) | 0.0459 (0.0701) |
| EDUC_HH | −0.0019 (0.0025) | −0.0386[c] (0.0218) | 0.0187 (0.0125) | 0.0199[c] (0.0120) |
| HH_SIZE | −0.0009 (0.0019) | −0.0191 (0.0314) | 0.0093 (0.0156) | 0.0099 (0.0164) |
| SGRP_MEM | −0.0059 (0.0092) | −0.1189 (0.1272) | 0.0576 (0.0637) | 0.0612 (0.0686) |
| LVST_UNIT | −0.0004 (0.0029) | −0.0083 (0.0569) | 0.0040 (0.0277) | 0.0043 (0.0292) |
| LAND_SZ | −0.0081 (0.0103) | −0.1632[c] (0.0902) | 0.0793[c] (0.0495) | 0.0840 (0.0531) |
| Log-Likelihood | −46.25 | | | |
| Pseudo $r^2$ | 0.23 | | | |
| LR Chi-square | 27.23[a] | | | |

[a] Significant at 1%; [b]Significant at 5%; [c]Significant at 10%

Figures in parentheses are the standard errors

based management approaches of FD and QCM, increasing distance from the market centers had a negative and significant effect on the probability that a respondent would be neutral and a positive and significant influence on the probability that a respondent would be dissatisfied or very dissatisfied (Tables 4 and 5). This implies that the further away the respondents were from market centers the more likely they were to express dissatisfaction with incentive-based forest management approaches. Based on the assumption that respondents further away from market centers are likely to have less off-farm income earning opportunities, especially in commerce, they are likely to

be more dependent on the forest. This finding concurs with that of Shrestha and Alavalapati (2006) who found a more negative attitude toward incentive-based conservation among households who are more dependent on the forest.

Education had the same effect on overall satisfaction in the incentive based management approaches of FD and QCM. Higher levels of education increased the probability of a respondent being very dissatisfied while decreasing the probability of being neutral. This finding somewhat fits with a priori expectation that high level of education would enhance positive attitudes toward more strict conservation.

**Table 6** Factors determining satisfaction level for KWS management approach

| Variable | Very Satisfied dy/dx | Satisfied dy/dx | Neutral dy/dx | Disatisfied dy/dx |
|---|---|---|---|---|
| FRST_DIST | −0.0016 (0.0026) | −0.0270[c] (0.0156) | 0.0211 (0.0158) | 0.0067 (0.0065) |
| MRKT-DIST | 0.0043 (0.0067) | −0.0701[b] (0.0328) | −0.546 (0.0357) | −0.0175 (0.0165) |
| FRS_ACTV | −0.0038 (0.0014) | −0.0634 (0.0567) | 0.0445 (0.0445) | 0.0199 (0.0256) |
| HHH_SEX | −0.0553 (0.0757) | −0.2970 (0.1916) | 0.3305 (0.2392) | 0.0196 (0.0209) |
| EDUC_HH | 0.0021 (0.0034) | −0.0348[b] (0.0175) | −0.0271 (0.0188) | −0.0087 (0.0081) |
| HH_SIZE | −0.0006 (0.0014) | −0.0098 (0.0186) | 0.0077 (0.0149) | 0.0025 (0.0051) |
| SGRP_MEM | −0.0010 (0.0037) | −0.0168 (0.0336) | 0.0131 (0.0443) | 0.0042 (0.0145) |
| LVST_UNIT | 0.0017 (0.0034) | −0.0272 (0.0352) | −0.0212 (0.0297) | −0.0068 (0.0102) |
| LAND_SZ | 0.0009 (0.0015) | −0.0150 (0.0107) | −0.0117 (0.0100) | −0.0037 (0.0039) |
| Log-Likelihood | −27.41 | | | |
| Pseudo $r^2$ | 0.31 | | | |
| LR Chi-square | 24.88[a] | | | |

[a] Significant at 1%; [b]Significant at 5%; [c]Significant at 10%

Figures in parentheses are the standard errors

Membership to social groups increased the probability of a respondent being neutral with the incentive-based approach of FD without any significant effect on satisfaction or dissatisfaction. Respondents with larger pieces of land had a higher probability of being neutral or dissatisfied with incentive-based approach of QCM. This finding fits well with our priori expectation that land being a proxy for wealth would influence the respondents' to favor more strict conservation.

Under the protectionist approach of KWS, increasing distance from the forest edge decreased the probability of a respondent being satisfied with the approach (Table 6). Although somewhat surprising, it could be argued that since respondents who were further away from the forest are likely to have less interaction with the forest management, they lack first hand information about its performance.

Similarly, increasing distance from market centers and increasing education both decreased the probability that a respondent would be satisfied with the protectionist approach. The effect of education on satisfaction with protectionist approach of KWS was not expected but not necessarily surprising. Although the protectionist approach has successfully managed the forest, it has done so without involving the participation of the local communities. It could be argued that the more educated respondents might be dissatisfied with the processes of achieving the goal of conservation without necessarily being dissatisfied with its achievement.

## Conclusions

This study provides an understanding on the levels of overall community satisfaction with performance of the three management approaches of Kakamega forest and factors that influence them. The results of descriptive analysis of satisfaction levels showed that the protectionist approach was ranked slightly higher than the incentive-based approaches. This finding implies that local communities have an interest in forest conservation despite the pressing need to extract from the forest. Ordered-probit analysis revealed that there were some differences among the three management approaches with regard to factors that influence satisfaction. Distance to market centers and level of education influenced satisfaction across all the three management approaches. The results showed that educated households and those located far from market centers were likely to be dissatisfied with all the three management approaches. The distance of the households from the forest margin had a negative effect on the satisfaction with the protectionist approach. Land size, a proxy for durable assets, negatively influenced satisfaction with the private incentive based approach of the QCM.

The results of this study indicate that despite the dependence on forest, local communities have an interest in conservation even where they have to be excluded from extracting. Therefore, the current policy of designating parts of the forest as nonextraction zones, as was practiced by KWS, has potential for success in the future. However, it is also important to note that fair and equal application of extraction rules is equally important as revealed by informal interviews. Since distance to markets and education are important in explaining satisfaction with all the three forest management approaches, they deserve special attention by policy makers. The overall national development goals of increasing incomes earning opportunities by integrating communities in modern economy could favor strict conservation efforts. Forest managers ought to pay more attention to the views of the more educated members

who invariably expressed dissatisfaction with the three forest management approaches.

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