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UNDERSTANDING LOCAL COMMUNITIES' PERCEPTIONS OF EXISTING FOREST MANAGEMENT REGIMES OF A KENYAN RAINFOREST

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Abstract

Current conservation debates place high emphasis on the need to integrate the views and needs of local communities in conservation processes. Understanding local community perceptions of forest management and the factors that influence these perceptions is important for designing management policies that are sensitive to their needs. However, more often than not local communities' perceptions do not receive as much attention as they deserve. This study investigated the perceptions of communities towards three existing forest management approaches in the Kakamega forest in Kenya and further analysed factors that influenced these perceptions. The three management approaches are: a state-led incentive-based approach, a state-led protectionist approach, and a quasi-private, incentive-based-approach. Data was obtained from a random sample of 376 households living within a radius of about 10 km around the forest margin. The results showed that local communities' perceptions were expressed through three common underlying components across the three management approaches. In order of relative importance, these components are: a) involvement in decision-making processes, b) forest extraction and other mitigation measures c) conservation incentives offered. Regression results showed that these perceptions were influenced by different factors across the three management approaches. These factors included: membership in social groups, distance from the forest, farm size, distance from market center, livestock ownership and dependency on forest for extraction. The results provide information that can be applied by forest managers to better address local communities' needs in forest conservation.

Keywords: *forest management regimes, community perception, factor analysis, Kakamega forest, Kenya.*

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Introduction

Many developing countries world over continue to face the challenge of how best to manage and conserve their forests. Management regimes of public forests, whether they are protectionist oriented or incentive-based are important in determining outcomes of conservation and sustainable use (Kant 2000). Historically, conservation strategies have been dominated by attempts to fence off or reserve areas for nature and exclude people from the reserved areas (Adams & Hulme 2001). This protectionist model has been labeled the 'fortress conservation', 'coercive conservation' or 'fence-fine' and for a long time has dominated mainstream thinking in conservation. It involved the creation of protected areas (national parks, game reserves and national forest reserves), the exclusion of people as residents, prevention of consumptive use, and minimization of other forms of human impact. Broadly, this approach viewed development objectives of local communities as being in direct conflict with the objectives of biodiversity conservation.

For a long period of time, this approach influenced conservation efforts in Sub-Saharan Africa both during colonization and continues to do so even in the post independence days. It is widely accepted that protected areas in different forms will continue to play a major role in conservation world wide in the foreseeable future (Brown 2002). In fact, today, about 70% of world forests are still owned and administered by governments (White & Martin 2002). However, in most cases the top-down exclusionary approaches to protected areas have not been successful in preventing deforestation and the associated loss of forest biodiversity which has become one of the major conservation challenges facing the world today (Geist & Lambin 2002).

In recognition of the problems associated with the fortress approach, since the 1980s a new discourse has arisen that stresses the need to incorporate the needs and aspirations of the local people in conservation (Hutton & Leader-Williams 2003). Unlike fortress conservation that viewed people as a 'threat' to conservation, the new approach views them as potential partners in biodiversity conservation (Adams & Hulme 2001). This approach has two distinct elements. First, it allows people in the vicinity of the protected area or others with property rights to participate in the conservation process and second, to link the objectives of conservation with the local development needs of the people (Hutton and Leader-Williams, 2003). This approach recognizes the moral implications of imposing costs on local people and the pragmatic problem of hostility of displaced or disadvantaged local people to conservation organizations practicing fortress conservation strategy (Adams and Hulme, 2001). The approach adopts sustainable development concept and combines both biocentrism arguments and anthropocentric arguments in conservation. However, where it has been applied, incentive based approach has not necessarily resulted in invariably positive outcomes (Agrawal &

Gibson 1999). It has been observed that the success or failure of decentralization depends on a mixture of context and case specific institutional and socio-economic factors (Matose 2006, Agrawal & Gibson 1999). At best the results have been mixed; success has been recorded in some cases but in most cases it has resulted in failure. This has led to a growing discontent with the results of community ownership and management of natural resources and some studies have even proposed that a reversal to the state management should be considered in some circumstances (Buscher & Dietz 2005). From the foregoing it is important to understand forest management models within the context in which they are applied. There are many studies in different parts of developing world that have focused on various aspects of forest management. A few examples of these studies include Agrawal and Gibson (1999), Matose (2006), Mwangi *et al.* (2006), Sekhar (1998), Shretha and Alavalapati (2006), and Walpole *et al.* (2001). However, studies that compare local communities' perceptions of forest management regimes and further identify factors that explain these perceptions are not widespread.

Conservation areas are largely administered by government in developing nations. Efforts are made to meet people's needs in conservation by involving them in decision-making, allowing them to share benefits of conservation, and providing them with measures to mitigate any adverse effects of conservation. However, in many cases people's perceptions of these efforts are rarely elicited, analysed and included in decision-making processes (Chase *et al*. 2004). It is widely acknowledged that communities living within the vicinity of protected areas are critical to the success of conservation efforts (Agrawal & Gibson 1999, Ferraro 2002, Ostrom 1999, Robertson & Lawes 2005, Wiggins *et al*. 2004). Local communities are thought to have the knowledge, information and incentive required to manage and conserve the resources on which they depend upon (Johnson 2001, White & Martin 2002).

In Kenya up to the time of the study, the communities living adjacent to forest were rarely involved in forest management decisions, mainly due to unsupportive legal framework. Since then, a new forest law that provides for community participation was adopted in 2007. In general, forests in Kenya fall under different management regimes with different legal status. Majority of the closed canopy forests are designated as forest reserves and are managed by the Forest Department which falls under the Ministry of Environment and Natural Resources. By definition forest reserves refer to land areas that have been surveyed, demarcated and gazetted either from trust land or unalienated government land. Some closed canopy forests are designated as national parks or national reserves and are managed by a semi-autonomous government agency known as the Kenya Wildlife Service which operates under the Ministry of Wildlife and Tourism. An estimated 100,000 ha of forest

in Kenya are under Trust land and are managed by the Ministry of Local Government through local county councils, which hold the forest land in trust for the local communities. There are indigenous forests that are managed under private ownership either by private citizens, companies or other organizations but whose total area is unknown. Some forests whose biodiversity is threatened, for example Kakamega forest, are managed jointly by FD and KWS based on a memorandum of understanding drawn between the two agencies The memorandum spells out specific areas of cooperation between the FD and KWS and the specific responsibilities of each. In essence, the two agencies try to create synergies in forest management based on each agency's specific areas of competence.

In the case of Kakamega forest, there was scanty literature on previous systematic elicitation of the local people's perception of existing forest management approaches. The Forest presents a unique opportunity to compare local communities' perception of three existing models in forest management: a state-led protective approach under Kenya Wildlife Service (hereafter abbreviated as KWS); state-led incentive based approach under the Forest Department (hereafter abbreviated as FD); and a quasi-private incentive based approach of the Quakers Church Mission (hereafter abbreviated as QCM)[2].

Approximately 4400 ha of the forest is managed under a protectionist approach as a national reserve by the Kenya Wildlife Service on behalf of the central government. The area managed by KWS is conserved in its pristine form as a national reserve with tourist attractions such as camping, picnic sites, and nature trails. The local people are prohibited from extracting any timber or non-timber products from the KWS managed part. The bulk of the forest (about 20,000 ha) is managed under an incentive-based approach by the central government through the forest department. Under the FD management, local people are allowed some regulated extractive activities from the forest such as grazing, collection of dead timber for fuel wood, mushrooms, fruits and medicinal plants. Since early 1900's a small fragment of the forest (about 130 ha) has been under quasi-private management of a QCM which allows local people to extract products on a limited and regulated basis through charging a small price for the extracted products. The QCM management is headed by a Secretary General (SG) who is also responsible for the day-to-day management of the affairs of the mission. Management of the forest falls directly under his office and the forest is managed as a private property of the church with the SG being the official in-charge. The SG has delegated the supervisory functions of the forest to a caretaker who also acts as a patrolman because the church does not have

[2] Despite the different sizes of the different parts of the forest, random sampling ensured proportionate representation of households in the final sample for ease of comparison.

regular armed guards. Local people extract different types of products from the forest such as fuel wood and thatch grass; domesticated animals are also allowed to graze inside the forest. The SG office occasionally sells out some trees in the forest for logging to individuals from the local community. Community participation in its management is rather limited but occasionally the church organizes public meetings to educate people about the importance of conservation.

Over the years, Kakamega forest has been subjected to disturbances of various kinds. The Forest is currently facing ominous threat of survival due to deforestation and associated degradation. Overall, the size of the forest has been shrinking rapidly due to human disturbance that has gradually contributed to the fragmentation and loss of the forest (Fashing *et al*. 2004). Approximately 20% of the Forest was lost in the last three decades (Lung & Schaab 2004)[3]. The main challenge confronting the forest management is reconciling the short term extractive needs with long term conservation interests. But in order to be successful, the cooperation and support of the local communities are needed. Understanding how local communities' perceive forest management[4] by external agencies is important for designing management policies that address the dual goal of community interest and conservation (McFarlane & Boxall 2000, Trakolis 2001, Dolisca *et al.* 2007). Apart from forest management aspects, people's perceptions of conservation issues are likely to be influenced by an array of socio-economic (for example level of education, wealth status and such other) demographic (household size, age of household head etc.), and geophysical (distance of household from the forest or markets etc.) (see Hill 1998, Mehta & Kellert 1998, Gillingham & Lee 1999, McFarlane & Boxall 2000, Racevskis & Lupi 2006, Dolisca *et al*. 2007). Gaining an understanding of these factors can provide information necessary for designing targeted policy measures to address people's aspirations in conservation and sustainable forest management.

It is against this background that this study was carried out, with the overall objective of investigating local people's perceptions of the way the three institutions manage the Kakamega forest and further determine the factors that influence these perceptions. The study is organized as follows; Section 2 describes data collection procedures and analysis, Section 3 presents the results and discussion, while Section 4 draws conclusions and policy implications.

[3] There exists a discernable gradient of degradation with the KWS-managed part of the forest being the least degraded and the QCM fragment being the most degraded (Bleher 2006, Lung & Schaab 2006).

[4] Over 90% of the local people that were interviewed expressed a desire that the forest should be conserved. They cited various reasons for example. provision of forest product, watershed protection and such others.

Data and Empirical Methods

1. Study Area and Data Elicitation Procedures

Kakamega forest is located in Western Kenya, and covers an area of about 24,400 ha out of which about 10% is plantation forest while the rest is under natural forest. Among the remaining indigenous forests in Kenya, Kakamega Forest occupies a unique place. It is the only lowland tropical rainforest remaining in Kenya and it is famous for the diversity of its unique flora and fauna (Wass 1995). The area surrounding the forest is densely populated and intensively used for farming sugarcane, tea, maize, beans and other crops.

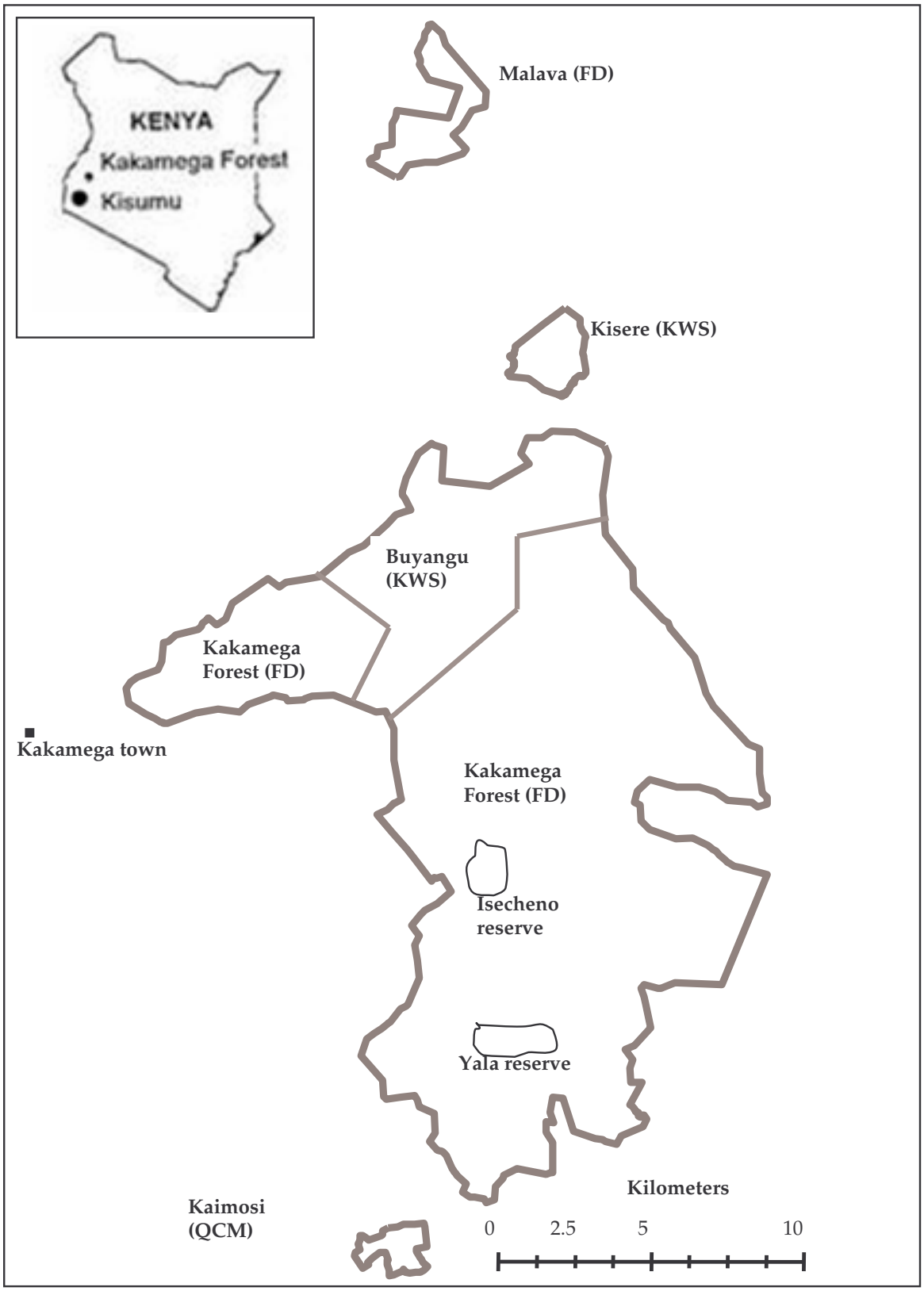
The Forest is currently sub-divided into three parts each managed by a distinct authority using a different approach in management. The Forest is not a single a single block. It consists of a central forest block surrounded by three satellite fragments. Figure 1 shows the location of different satellites, their names and the management authority under which they are managed. Data for this study were collected from a random sample of 376 households living within approximately 10 km radius all around the Forest interspersed among all the three management institutions/agencies. The sampling frame of about 34,000 households was based on all villages within approximately 10 km radius of the forest and was obtained in conjunction with the administrative heads of the villages and other local leaders. Semi-structured questionnaires were administered to household heads or their spouses by trained enumerators in the period spanning the months of September 2005 to February 2006. The questionnaires elicited information on households' demographics, socio-economic & geophysical characteristics, farming activities, kinds and quantities of products extracted from the forest, costs they incur and their perceptions of an array of forest management aspects. Information about the functioning of the three forest management arrangements was obtained from interviews with forest managers and other secondary sources.

2 Empirical Methods

Respondent's perception was elicited by obtaining their satisfaction ranking with performance of the forest management regimes with regard to several aspects of management. The respondents were specifically asked to rank the performance of forest management authority operating closest to their homestead based on a Likert scale of 1 (very satisfied) to 5 (very dissatisfied) with respect to selected management aspects. A total of 16 different management aspects that were included are summarized in Table 1.

The relevance of the included aspects was determined by considering the mandate of the forest management as described in their legislation and mission statements. It is logical to assume that local peoples' satisfaction ranking of different aspects of forest management can be summarized to

Figure 1: Map of Kakamega Forest and Its Fragments



Source: Schaab (2002).

reveal common underlying views that represent local community's general perceptions of the forest management regimes. Gaining an understanding of these common dimensions could shed light on what the local people consider important hence guide on the general areas that require interventions. In this regard we therefore, applied factor analysis to analyze the local communities' satisfaction levels with different aspects of forest management to understand these common underlying views that represent local communities' perceptions.

Table 1. Description of forest management aspects under consideration

Management Aspect	Definition
EXT_RULE	People's involvement in designing extraction rules
ENF_RULE	People's involvement in designing enforcement rules
DECN_CONS	People's involvement in deciding preservation of unique parts of the forest
GEN_CONF	Resolution of general conflicts
WILD_CONF	Resolution of wildlife-human conflicts
SCHL_OUT	Promotion of environmental conservation education programs in schools
ENV_ACTV	Promotion of environmental improvement activities
ALT_ENG	Promotion of alternative energy sources
TREE_SEED	Provision of tree seedlings
ALTINC_ACTV	Promotion of alternative income activities
STR_RULE	Straightforwardness of extraction rules
CLA_RULE	Clarity of enforcement rules
LEV_EXTR	Level of forest extraction allowed
EMP_LOC	Provision of employment to local people
PREV_CDMG	Prevention of crop damage by wildlife
COMP_CDMG	Compensation for crop damage by wildlife

Factor analysis reduces data set from a group of interrelated variables into smaller sets of uncorrelated factors and achieves parsimony by explaining the maximum amount of common variance in a correlation matrix using the smallest number of explanatory concepts (Field 2000). As described by Hair *et al.* (1998) and Field (2000) factor analysis can be utilized to examine underlying patterns or relationships for a large number of variables and to determine whether the information they contain can be condensed or summarized into a smaller set of factors or components. The relationship between the observed and latent or underlying variables can be represented by the following matrix equation:

$$Y = \kappa \Pi + \delta$$

where, Y is the $q \times 1$ vector of the n sets of observed variables (i.e. management aspects in this case), κ is the $q \times n$ matrix of regression coefficients (also called factor loadings) relating the management aspects to the underlying factors, Π is a 1 x n vector of latent factors (perception score) that are estimated along with the coefficients; and δ is the q × 1 vector of error terms of the management aspects ranking.

Using the perception scores/factors as the dependent variables, several multiple linear regressions were estimated for each management approach to determine which independent variables influenced respondent's perceptions of the three forest management approaches. The regressions were specified as follows:

$$MGT\_PCEP = \beta X + \mu_i$$

where, MGT_PCEP stands for the i-th respondents' perception score corresponding to a given forest management approach; X is a vector of explanatory variables including the demographic, socioeconomic, and geophysical characteristics of the respondent, β is a vector of regression parameters to be estimated and μ_i's are the vectors of disturbance terms in the regression. An increase in the value of the management perception score (MGT_PCEP) implies an increase in the level of dissatisfaction.

Results and Discussion

All factors that were hypothesized to influence respondents' perception of forest management approaches are summarized in Table 2. A close look at the factors reveals that there are some discernable differences in some of the factors across the management models. For example, respondents under KWS management approach had relatively large farm sizes compared to FD and QCM. Compared to KWS and QCM, respondents under FD were on average closer to market centers. In this study we hypothesize that respondents' perception of a given dimension of management is influenced by membership to social groups, distance of the household from the forest edge, the gender of the household head, households' average level of education, a households' dependency on the forest, farm size, livestock ownership, distance from the market center, age of the household head and whether or not a household suffered any crop damage from wildlife attacks.

Table 2. Definition of Factors Hypothesised to Influence Respondent's Perception

Variables	Definition and measurement	KWS (N=73)		FD (N=220)		QCM (N=83)	
		Mean	SD	Mean	SD	Mean	SD
FARM_SZ	Farm size in hectares	1.83	1.27	0.89	0.77	0.63	0.72
FRST_DIST	Distance in km of the household to forest edge	2.38	2.06	0.91	0.87	3.38	2.61
SGRP_MEM	Number of social groups that the household head belongs	0.67	0.58	0.60	0.59	0.30	0.58
MRKT_DIST	Distance in km from the household to market center	2.21	2.03	1.15	1.32	2.56	2.58
AV_EDUC	Average years of formal education of the household members	7.4	3.60	8.81	4.21	7.69	3.83
FRST_DEP	If the household extracted product from the forest in the last one year (If yes=1 no =0)	0.13	0.34	0.24	0.43	0.24	0.43
CROP_DMG	If the household suffered crop damage by wild animals (1 if yes, 0 otherwise)	0.15	0.36	0.19	0.10	0.10	0.30
HH_SEX	Gender of the household head (1 if male 0 if female)	0.85	0.35	0.79	0.40	0.72	0.45
LVST_UNIT	Number of equivalent livestock units owned by a household	3.36	1.37	3.14	1.28	2.29	1.61
AGE_HHH	Age in years of the household head in years	51.01	14.44	52.00	15.73	52.00	15.73

1. Local Community Perceptions of Forest Management Approaches

The results of perception analysis for the three management approaches are summarized in Tables 3, 4 and 5 for KWS, FD and QCM respectively. The study retained factor loadings of 0.4 and above because they are considered statistically significant for large samples (Field 2000). Sample adequacy in factor analysis is measured using the Kaiser-Meyer-Olkin (KMO) measure for which values greater that 0.5 indicate that the sample is adequate (Field 2000,

Lise 2000). The KMO values for KWS, FD and QCM models were 0.682, 0.777 and 0.681 respectively indicating sample adequacies across the three management models. All the three models were significant as shown by high chi-square values of the Bartlett's test of sphericity (see Tables 3, 4 and 5).

Under the KWS management, the observed variations in respondents' perceptions of forest management were aggregated into three components. The results in Table 3 show that management aspects such as local community involvement in making rules of extraction, enforcement rules and preservation of unique parts of the forest as well as their perception of straightforwardness of extraction rules and clarity of enforcement of rules were loaded onto perception component 1. Therefore, component 1 was labeled as 'involvement in decision-making' and it accounted for about 30% of the total variation in respondents' perception of KWS forest management. Perception component 2 included issues related to conflicts resolution and mitigation programs and was therefore labeled as 'conflicts resolution and mitigation'. It accounted for approximately 21% of the variation in the respondent's perceptions of KWS forest management approach. Perception component 3, consisted mainly of conservation incentives related issues such as provision of employment opportunities for local people, prevention of crop damage by wildlife and compensation of crop damage hence we labeled it as 'conservation incentives'. Resolution of wildlife-human conflicts also had some loading on perception component 3 which could be due to its close association with issues of crop damage. It accounted for about 12% of the variation in the respondent's perceptions of KWS forest management approach.

Table 3. Factor Analysis of Forest Management Indicators—KWS

Management Aspects	Components		
	Participation in Decision-Making & Extraction	Conflict Resolutions & Mitigation	Conservation Incentives
EXT_RULE	0.524		
ENF_RULE	0.928		
DECN_CONS	0.859		
SCHL_OUT	0.541		
STR_RULE	0.810		
CLA_RULE	0.911		
LEV_EXTR	0.627		
GEN_CONF		0.524	0.470
WILD_CONF		0.531	0.569
ENV_ACTV		0.692	
ALT_ENG		0.755	
TREE_SEED		0.661	
ALTINC_ACTV		0.752	
EMP_LOC			0.808
PREV_CDMG			0.887

COMP_CDMG			0.751
Eigenvalue	4.818	3.340	1.940
% of variance explained	30.11	20.87	12.12
Cumulative % of variance explained	30.11	50.99	63.11

Notes: Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.673; Bartlett's Test of Sphericity Approximate Chi-square = 546.05***

Under the FD management, the observed variations in respondents' perception of forest management were also aggregated into three perception scores. As shown by results in Table 4 management aspects such as local community involvement in making rules of extraction, enforcement rules, and preservation of unique parts of the forests were loaded into perception component 1. In addition, resolution of general conflicts and human-wildlife conflicts had some loading onto component 1 which was labeled as 'involvement in decision-making'. It accounted for about 32 % of the respondent's variation in perceptions towards FD management approach.

Perception component 2 included factors such as promotion of environmental improvement activities, promotion of alternative energy sources, promotion school outreach programs, provision of tree seedlings and promotion of alternative income sources. Therefore this component was designated as 'mitigation' factor and it accounted for about 18% of variation in people's perception of FD's management. Prevention of crop damage by wild animals, compensation for crop damage, provision of employment to the local people were loaded onto component 3 hence it was labeled as 'conservation incentives' which accounted for about 10% of the variation in people's perception of FD.

Table 4. Factor Analysis of Community Perception of FD

Management Aspects	Components		
	Involvement in Decision-Making	Mitigation	Conservation Incentives
EXT_RULE	0.766		
ENF_RULE	0.845		
DECN_CONS	0.492		
GEN_CONF	0.466		0.412
WILD_CONF	0.508		0.525
SCHL_OUT		0.733	
ENV_ACTV		0.782	
ALT_ENG		0.749	
TREE_SEED		0.780	
ALTINC_ACTV		0.541	

STR_RULE	0.528		
CLA_RULE	0.748		
LEV_EXTR	0.689		
EMP_LOC			0.762
PREV_CDMG			0.911
COMP_CDMG			0.882
Eigenvalue	5.165	3.010	1.643
% of variance explained	32.28	18.81	10.27
Cummulative % of variance explained	32.28	51.09	61.36

Notes: Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.777; Bartlett's Test of Sphericity Approximate Chi-square = 1246.57***

Similarly, under the QCM management, the observed variations in respondents' perception of forest management were aggregated into three factors scores as summarized in Table 5. The results show that participation in designing extraction and enforcement rules, resolution of conflicts, and also outreach programs are loaded onto component 1 which we label as 'involvement in decision making and conflicts resolution' factor. It accounted for about 34% of the variation in local community perception of QCM management approach. Perception component 2 mainly included rules related mainly to the aspects of management; straightforwardness of extraction rule, clarity of enforcement rules and level of extraction allowed as well as mitigation related aspects. It was therefore, labeled as 'extraction and mitigation' component and it accounted for approximately 14 % of the variation in respondent perceptions of QCM management approach. The third and last perception component mainly consist of conservation related factors such prevention and compensation for crop damage, provision of employment for local people as well as people's involvement in conservation decision. This component was labeled 'conservation incentives' and it accounted for about 11% of the variation in respondents' perception of QCM management approach.

Table 5. Factor Analysis of Community Perception of QCM

Management Aspects	Components		
	Involvement in Decision-Making & Conflict Resolutions	Extraction & Mitigation	Conservation Incentives
EXT_RULE	0.842		
ENF_RULE	0.839		
GEN_CONF	0.798		
WILD_CONF	0.796		
SCHL_OUT	0.606	0.482	
ENV_ACTV	0.454	0.625	

ALT_ENG		0.555	
TREE_SEED		0.632	
ALTINC_ACTV		0.583	
STR_RULE		0.767	
CLA_RULE		0.781	
LEV_EXTR		0.617	
DECN_CONS			0.619
EMP_LOC			0.645
PREV_CDMG			0.795
COMP_CDMG			0.828
Eigenvalue	5.488	2.184	1.769
% of total variance	34.30	13.65	11.05
Cumulative % of variance	34.30	47.95	59.00

Notes: Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.681; Bartlett's Test of Sphericity Approximate Chi-square = 739.49***

Overall, factor analysis results show a strikingly common pattern of local community perceptions of the three forest management approaches. In general, local community perceive the performance of the three forest approaches in three common dimensions; participation, mitigation and incentives in order of relative importance. In all the three management approaches, participation in decision-making emerged as the most important factor in explaining perception. This finding concurs with many studies which have pointed at the importance of involving local people in decision-making (Agrawal & Gibson 1999, Lise 2000, Kellert *et al.* 2000). The finding also fits well with the new approach of co-management that FD is currently in the process of initiation after the new Forest law was passed in 2007. Under the new law, the community will play a lead role in deciding all matters concerning conservation and use of the forest while FD will play a facilitation role.

2. Regression Analysis of Community Perceptions of Forest Management Approaches

The identified perception components were regressed against a set of explanatory variables that were postulated to influence the respondents' perceptions. The results of OLS regression for respondent's perception of KWS, FD and QCM management approaches are summarized in Tables 6, 7 and 8 respectively. Identical independent variables were used in all the nine regressions except in perception component 1 in FD from which crop damage (CROP_DMG) was excluded because it was deemed irrelevant in explaining the model.

As shown by the results, different variables were significant in influencing different perceptions across the three management approaches. This indicates

uniqueness of each perception in the different management approaches since they could not be predicted by the same variables. With the exception of component 1 and 2 under KWS, the models had low R^2 values. This can be attributed to respondent specificity of forest management perceptions. Low R^2 actually indicates the relevance of underlying factors in the sense that the perception components, when contrasted to the individual characteristics, contain additional information for the characterization of respondent's profile (Nunes 2002). In addition, regression based on cross-sectional data generally results in low values of R^2 (Greene 2003). All the models had significant values of F-statistic indicating that all the coefficients of the independent variables were significantly different from zero.

The gender of the household head (HH_SEX) had a positive influence on people's perception of 'involvement in decision-making and conflict resolution' under KWS but it had no significant influence on any dimension of perception under FD and QCM.

Table 6. OLS Results of Respondent's Perception of KWS Management

Variables	Involvement in Decision-Making & Conflict Resolutions	Extraction & Mitigation	Conservation Incentives
Constant	0.3766 (1.0193)	-1.3929 (1.2181)	2.5947 (2.0497)
HH_SEX	-0.7693* (0.3949)	-0.5409 (0.5637)	-0.9088* (0.6799)
AGE_HH	0.0095 (0.0097)	-0. 0034 (0.0119)	-0.0026 (0.0168)
AV_EDUC	-0.0472 (0.0504)	0.4326*** (0.0806)	0.2338** (0.0946)
SGRP_MEM	-0.8591*** (0.2599)	1.4947*** (0.3736)	0.8116** (0.3511)
FARM_SZ	0.1001** (0.466)	-0.4084***(0.0975)	-0.1599 (0.1096)
LVST_UNIT	0.0047 (0.0204)	-0.0878*** (0.0219)	-0.0110 (0.1650)
FRST_DIST	0.1444 (0.0996)	-0.5005 (0.1048)***	0.1698 (0.1274)
MRKT-DIST	-0.0891(0.0807)	0.0964 (0.0815)	-0.2158 (0.1492)
FRST_DEP	0.6097* (0.3226)	-0.6977 (0.3496)	-0.8144 (0.7170)
CROP_DMG	0.3268 (0.3154)	0.7212* (0.3269)	-1.6722*** (0.5460)
F-statistic	6.25***	7.93**	3.04**
ADJ R^2	0.88	0.83	0.45

Notes: ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10% level

This means that male household heads were more likely to have positive perception about their involvement in decision-making under KWS. This could be explained by cultural setting of the study area where men are more involved in decision-making than women. Age of the household head (AGE_HH) had a negative influence on perception about 'involvement in decision-making and conflicts resolution' under the QCM forest management but it did not have significant influence in any other dimension of perception across the management approaches. This means that older farmers were unsatisfied with the current level of involvement in decision-making under

QCM. The average education level of the household (AV_EDUC) had a negative influence on people's perception about 'extraction and mitigation' and 'conservation incentives' under the KWS management approach. It also had a negative influence on 'mitigation perceptions' in FD and 'conservation incentives' in QCM but it positively influenced 'extraction and mitigation' under QCM. Overall, education increases the respondent's awareness of conservation matters and many studies have found positive association between education and conservation attitudes (Lise 2000, Shrestha & Alavalapati 2006). High level of education is likely to raise a respondent's expectation of the performance of forest management performance hence more likely to increase negative perception if these expectations are not met.

Membership to social groups (SGRP_MEM) had a significant influence on perception only under the protectionist-oriented management approach of KWS despite relatively similar levels of membership to social groups under the FD approach (66%) compared to 61% in KWS. SGRP_MEM had positive influence on people's perception about their 'involvement in decision-making and conflict resolution' but it had a negative influence on 'extraction and mitigation' and 'conservation incentives'. 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 cannot be ignored in conservation debates. It could be argued that respondents who belonged to social groups could have used the groups as avenues for lobbying for more participation in making conservation decisions and resolving conflicts. On the other hand, people who did not belong to social groups lacked safety nets hence their negative view of extraction, mitigation and incentive efforts of KWS.

Table 7. OLS Results of Respondent's Perception of FD Management

Variables	Involvement in Decision-Making	Mitigation	Conservation Incentives
Constant	0.9133* (0.5265)	1.0966 (1.1502)	-0.4426 (1.0998)
HH_SEX	-0.1186 (0.2545)	0.1006 (0.2861)	0.4932 (0.2799)
AGE_HH	-0.0014 (0.0067)	0.0075 (0.0072)	0.0036 (0.0073)
AV_EDUC	-0.0446 (0.0402)	0.1219*** (0.0429)	0.0013 (0.0412)
SGRP_MEM	0.1426 (0. 1925)	-0.1046 (0.1907)	0.1811(0.1903)
FARM_SZ	0.0692 (0.0613)	-0.1839**(0.0888)	0. 0936 (0.0855)
LVST_UNIT	-0.2095**(0.0961)	-0.0459 (0.0964)	0.0595 (0.0968)
FRST_DIST	0.0878**(0.0375)	-0.0539 (0.0402)	0.1148*** (0.0377)
MRKT-DIST	-0.2185*** (0.0416)	0.0033 (0.0481)	0.0131 (0.0458)
FRST_DEP	0.3991* (0.2365)	-0.5269***(0.2641)	-0.2982 (0.2582)

CROP_DMG		-0.7789(0.5026)	-0.4425 (1.0999)
F-statistic	4.48***	1.67*	3.34***
ADJ R^2	0.25	0.07	0.21

Notes: ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10% level

Farm size (FARM_SIZE) negatively influenced perception about 'involvement in 'decision making and conflict resolutions' under KWS but it had a positive influence on 'extraction and mitigation' in KWS, 'mitigation' in FD and 'involvement in decision making and conflict resolution' in QCM. Number of livestock units (LVST_UNIT) had a positive influence on 'extraction and mitigation' under KWS and 'involvement in decision-making' under FD. Since both FARM_SIZE and LVST_UNIT measured the level of household's resource endowment it means that wealthier households were satisfied with the existing protectionist approach of KWS but were dissatisfied with their involvement in decision-making. Under FD wealthier households were satisfied with the current mitigation efforts while in QCM they were satisfied with the current level of their involvement in decision making. Generally, wealthier households are satisfied with extraction allowed and mitigation but are not with their current level of participation.

Distance from the forest edge (FRST_DIST) was significant in explaining at least one dimension of perception in all the three management regimes. Under the KWS management people further away from the forest had a positive perception on 'extraction and mitigation'. This finding is consistent with previous studies which found that people living further away from the forest had more positive attitudes towards conservation, mainly because they did not suffer crop damage by wild animals (Shrestha & Alavalapati 2006). In the FD distance from forest had a negative influence on people's perception of 'involvement in decision-making' and 'conservation incentives'. This finding is expected because with increasing distance from the forest people are likely to have increasingly less interaction with forest management. Under QCM management, increasing distance from the forest positively influenced perception about 'extraction and mitigation' component. Distance to market (MRKT_DIST) had a positive influence on perception of 'involvement in decision-making' under the FD management approach. It means that respondent that were closer to market centers were more satisfied with the current level of their involvement ion decision making under FD.

Dependency on forest (FRST_DEP) influenced at least one of the dimensions of perception across all the three management approaches. This indicates that dependency on forest is an important factor in determining respondents' perceptions of forest management. It had a negative influence on perception about 'involvement in decision-making and conflict resolution' in KWS and 'involvement in decision making' under FD. On the other hand,

FRST_DEP had a positive influence on 'mitigation' perception under FD and 'extraction and mitigation' under QCM.

Table 8: OLS Results of Respondent's Perception of QCM Management

Variables	Involvement in Decision-Making & Conflict Resolution	Extraction & Mitigation	Conservation Incentives
Constant	0.4887 (1.9003)	-0.1367 (0.8969)	1.1380 (1.8122)
HH_SEX	0.2602 (0.3457)	0.2137 (0.2715)	-0.0870 (0.3726)
AGE_HHH	0.0345***(0.0122)	0.0422***(0.0102)	-0.0081 (0.0136)
AV_EDUC	0.0775 (0.0671)	-0.1511***(0.0526)	0.1581**(0.0721)
SGRP_MEM	-0.3838 (0.3598)	-0.1598 (0.3385)	-0.2324 (0.4621)
FARM_SZ	-0.7600*** (0.2978)	0.1224 (0.2376)	0.1443 (0.3437)
LVST_UNIT	0.0023 (0.1551)	0.0599(0.1190)	0.1737 (0.1584)
FRST_DIST	0.5061 (0.5888)	-1.3384***(0.2722)	0.6532 (0.6211)
MRKT-DIST	0.1971 (0.1261)	-0.1754 (0.2135)	0.2424 (0.2860)
FRST_DEP	-1.0642**(0.4958)	-1.2345***(0.4288)	0.1974 (0.5733)
CROP_DMG	-0.0103 (0.9845)	0.5392 (0.4722)	-1.3780 (0.9958)
F-statistic	2.31*	6.19***	2.03*
ADJ R^2	0.26	0.67	0.27

Notes: ***Significant at 1 % level; **Significant at 5 % level; *Significant at 10% level

This means that respondents who did not depend on the forest were unsatisfied with their involvement in decision making in both KWS and FD. On the other hand, those who depended on the forest were happy with the mitigation and extraction offered by FD and QCM. This finding fits well with other studies which have found positive attitudes towards conservation where individuals obtain some direct economic benefits (Bauer 2003, Michelle 2005, Walpole & Goodwin 2001).

As expected crop damage (CROP_DMG) had a negative influence on respondents' perception of 'extraction and mitigation' but surprisingly it had a positive influence on respondent's perception of 'conservation incentives' under KWS management. Although unexpected, it is not all together surprising to find positive attitudes despite crop damage. A study in India by Sekhar (1998) found that people had positive attitudes towards the Sariska Tiger Reserve despite crop damages because of the tangible extractive benefits such as fuel wood and fodder as well as cultural/religious reasons. For the case of Kakamega forest, the results could be explained by the success of KWS management has achieved in protecting the forest.

Conclusions and Policy Implications

This study provided an insight into the perceptions of local communities about the three existing management models in the Kakamega forest. The study applied factor analysis to understand the underlying dimensions of

satisfaction ranking of 16 different aspects of forest management. Further, the study applied ordinary least squares regression to determine the effect of a set of hypothesized factors on these perceptions.

Results of the factor analysis showed that 16 aspects of management could be reduced into 3 perception components in all the three forest management approaches. Despite some differences in factor loadings across management approaches, issues of community involvement in decision making processes in forest management were loaded onto the first component in all the three management approaches. This is indicative of the relative importance that people put on their involvement in decision making and therefore forest management ought to widen opportunity for community participation in decision making process in forest management. Other important components included 'mitigation'/'extraction', 'conflict resolution' and 'conservation' incentives in various combinations.

Regression results showed that perception components were influenced by different set of demographic, socioeconomic, geophysical and biophysical characteristics of the respondents such as farm size, membership to social groups, distance of household from forest margin, distance from market centers and whether or not the household suffered any crop damage by wild animals. This implies that in order to address people interest in forest conservation, there is need for forest managers to pay attention to these factors.

Broadly, investment in education could increase conservation consciousness of the people hence promote long term conservation goals. Membership to social groups could increase peoples' collective bargaining power for more involvement in decision-making processes of forest management. Offering people direct forest extraction incentives could increase more positive attitudes towards conservation but this must be accompanied with strict enforcement to prevent forest degradation. Therefore, the results of this study provide the forest managers with a good understanding of the general perception of the local communities towards the management and also provide further information on possible areas of intervention.

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