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Does participatory forest management change household attitudes towards forest conservation and management?

Matiku Paul[1]*, Mireri Caleb[2] and Ogol Callistus[2]

[1]Nature Kenya, P. O. Box 44486, 00100, Nairobi, Kenya.
[2]Kenyatta University, P. O. Box 43844, 00100, Nairobi, Kenya.

The study assessed the impact of participatory forest management (PFM) on household attitudes towards conservation and management of Arabuko–Sokoke Forest. The results obtained show that the impact of the forest on households was positive and higher in households in PFM zones than in those in non-PFM zones. There were higher proportions of households in PFM zones than in non-PFM zones, although it was a good objective to create the forest. They have good relations with the forest, benefit quite a deal from it as they obtain forest-related products from the forest; and want it protected. Also, the land adjacent to the forest has higher positive impact on household livelihood than the land further away. Higher proportions of households in non-PFM zones than PFM zones have poor relations with the forest as they are unhappy with the fact that the forest is linked to livestock deaths through tsetse fly, crop damage by wild animals, and predation of livestock without income generating activities to offset these losses. The study concluded that PFM is an asset for forest conservation in Arabuko-Sokoke Forest.

Key words: Participatory forest management, household, benefit, cost, Arabuko-Sokoke.

INTRODUCTION

In most parts of Africa, forest departments were set up to manage forest reserves in order to maintain colonial authorities' user rights to valuable timber, and in part to protect important watersheds, ecosystems, and habitats (McGregor, 1991a). The governments in eastern and southern Africa failed to evict people and this led to the realization that co-management approaches that involve greater role of local communities, the rural and urban poor as well as the private sector in the management of forests is the only solution (Barrow et al., 2002). In 1991, 96% of households in Arabuko-Sokoke were unhappy with the Arabuko-Sokoke Forest, while 54% wanted the forest completely cleared for settlement (Mogaka, 1991).

Co-management captures the idea that rights and responsibilities should be shared among those who lay claim to the environment or natural resources. Singleton (2002) observes that it would be difficult to find any recent environmental policy initiatives that do not contain prominent references to the need to move away from top-down directives towards consensus-based processes and community participation in planning, implementing, and monitoring new policies. The concept of co-management has evolved with both research and experience (Plummer and Armitage, 2007c). Early definitions and representations focused on dualistic power-sharing between the state and local (or indigenous) resource users and the range of possible arrangements (Pinkerton, 1989; Berkes et al., 1991; Berkes, 1994). Subsequently, the spectrum of individuals potentially involved in co-management was broadened to include a wider array of actors, and co-management was advanced as a continuous problem-solving process (Plummer and FitzGibbon, 2004b; Carlsson and Berkes, 2005; Plummer, 2006). Recently, the dynamism inherent in the co-management process was highlighted in relation

*Corresponding author. E-mail: matiku@naturekenya.org. Tel: 254-20-714741849.

to knowledge generation, social learning, and adaptation for transformative changes (Berkes, 2009).

Although, it is important to recognize that adaptive co-management is not a governance panacea, conditions that contribute to successful outcomes are beginning to emerge from practice. These include well-defined resource systems and small-scale contexts, shared interests by an identifiable set of social entities, clear property rights, access to adaptable management mea-sures, commitment to a long-term process of institution building, availability of training and resources, presence of key leaders or champions, openness of participants to embrace plurality of knowledge, and a supportive policy environment (Armitage et al., 2009).

Previous studies focused on proposals for a range of natural resources management tactics such as providing appropriate development opportunities (Abbot et al., 2001), emphasizing local community involvement (Western, 1994; Getz et al., 1999), adopting shared management (Murphree, 1994), ensuring local autonomy (Muller, 2003), guaranteeing rights to harvest (Fearnside, 1989; Browder, 1992), promoting knowledge (Jacobson and McDuff, 1998), awarding direct cash compensation (Ferraro and Kiss, 2002), and encouraging tourism (Honey, 1999) without emphasizing the impact of the initiatives on the household income of forest-adjacent dwellers. Previous studies also focused on local com-munity dependency on forests (Suda, 1992; Emerton, 1993), the demand for indigenous timber (Rheker, 1992), illegal timber felling (Emerton, 1995a, 1992; Marshall and Jenkins, 1994), and forest costs (Emerton, 1995a; Thomson and Ochieng, 1993; Thomson, 1993) that are usually targeted by participatory forest management initiatives.

The sustainable livelihood framework by Scoones (1998) predicts that if the right policy and institutional framework is put in place, if livelihood resources are identified and their use defined, and if local institutions have the right governance structures, then the use of such resources will adopt sustainable means that will guarantee sustainable livelihood outcomes. Scoones (1998) also defines sustainable livelihood outcomes as taking the form of: (i) improved well-being and capabilities resulting from reduced poverty due to increased household incomes and (ii) ensured livelihood sustainability which results in enhanced household livelihood adaptation, vulnerability and resilience due to natural resource base sustainability. Participatory Forest Management (PFM) is an arrangement where key stakeholders enter into mutually enforceable agreements that define their respective roles, responsibilities, governance, policy, institutional structures, benefits, and authority in the management of defined forest resources (Warah, 2008). The main objective of PFM is to ensure wider local ownership and support for forest conservation. The necessity of ensuring clear incentives for local communities to limit local community resource

usage to sustainable levels, including the provision of non–forest alternative sources of income and subsistence and legitimate participation in forest management are considered as important components of sustainable natural resource management strategies in Kenya (Barrow, 1988; Emerton, 1995a, b, 1996a, b, c; Emerton and Mogaka, 1996).

Despite the prominence of strategies linking conservation and development as primary conservation tools and strong arguments for and against their effect-tiveness (Wells et al., 1992; Barrett and Arcese, 1995; Oates, 1999; McShane and Wells, 2004), there have been few quantitative comparative assessments of their successes and failures. Nkhata et al. (2008) observe that notwithstanding a growing appreciation of the importance of collaboration, little attention has, evidently, been given to the dynamic long-term social relationships that underlie collaborative schemes in the management of natural resources. This void raises an important question: "Is collaborative natural resources management an asset or liability for natural resources conservation?"

The present study assessed the impact of PFM on the attitudes of households towards forest conservation and management in and around Arabuko-Sokoke Forest. The question answered in this study was: "Are the attitudes of households adjacent to PFM zones different from those of households from non-PFM zones around the Arabuko-Sokoke Forest?" The hypothesis tested in study was: "the attitudes of households adjacent to PFM zones are more positive to forest conservation than those of households from non-PFM zones in Arabuko-Sokoke Forest".

MATERIALS AND METHODS

General methods

The study used socio–economic research methods in forestry by Harrison et al. (2002) to collect data on the impact of PFM on household livelihood. Following the method of Harrison et al. (2002), the reference population for interview was selected from the heads of households in the study zones. The heads of households are the people who have the experience, knowledge, and skills to provide reliable information on the study variables. Questionnaires were developed to cover household wealth measures for house-holds living up to 5 km equidistance from the edge of the forest. The questionnaires were administered using personal interview approach which was very good for avoiding non-response biases (Harrison et al., 2002). To validate the questionnaires, errors were eliminated first, and five enumerators were identified on the basis of their ability to understand and interpret the contents of the questionnaires, which were written in simple English language. The five enumerators were trained for two days. Each enumerator was given five test questionnaires to administer as a pilot. The questionnaires were then adjusted to ensure clarity on all the questions. The testing of the questionnaires also allowed a reasonable estimation of the time to be taken to administer one questionnaire. It was established that each questionnaire would require two hours.

On the field application of the questionnaires, data on forest benefits and losses were collected following the method of Dosman et al. (2002) who assessed the subsistence use of forest for
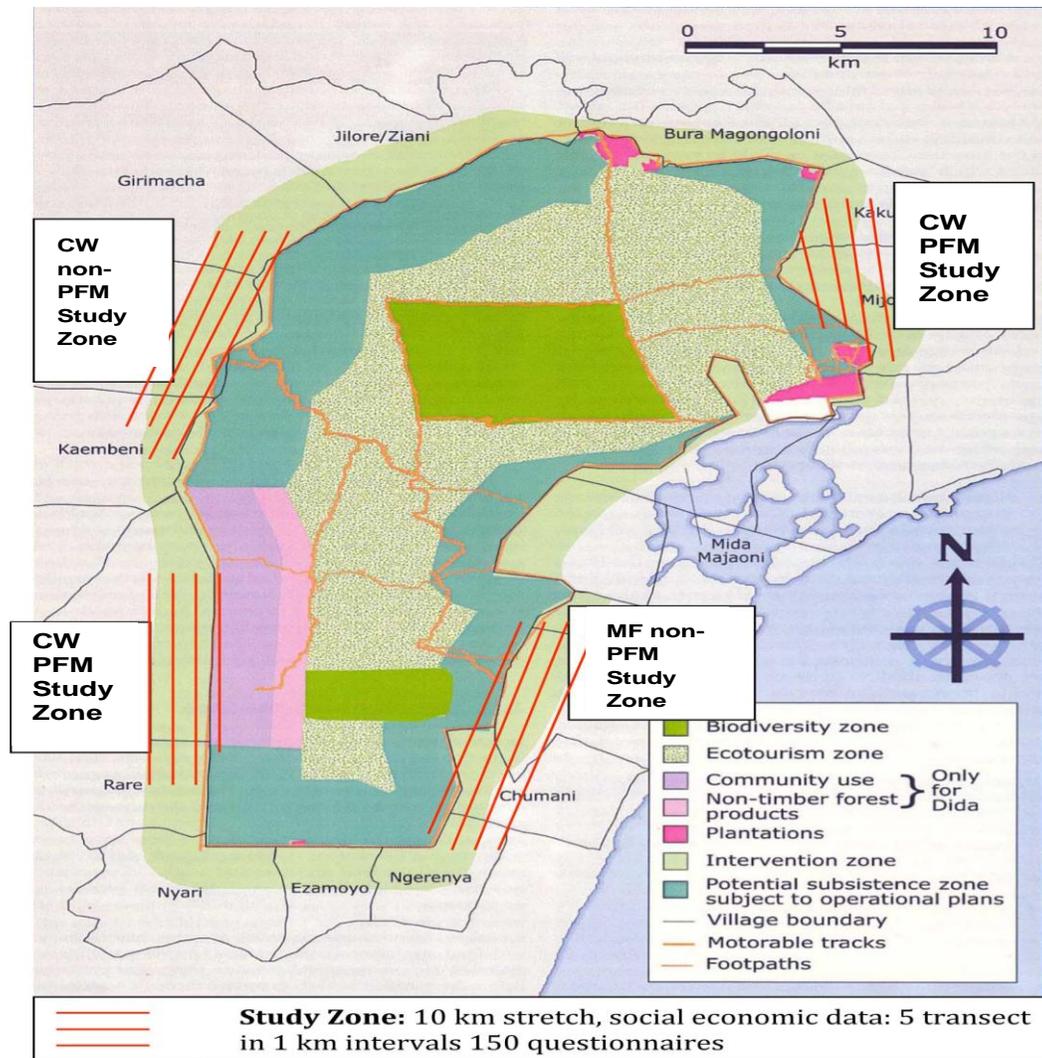
Figure 1. Map showing the data collection zones in the MF and CW of the PFM and non-PFM zones in Arabuko-Sokoke Forest.

aboriginal peoples. The study also used the method of Adamowicz et al. (2004) who assessed subsistence hunting of the Aboriginal people. It equally used the method of Emerton (1992) and Mogaka (1991a) who applied similar techniques to assess subsistence forest uses in Mountain Kenya and Aberdares Forests in Kenya. Data on the impact of PFM on household wealth were collected following the method of Barrett and Arcese, 1995, Brooks et al. (2006), McShane et al. (2004) and Morgan-brown et al. (2009). These used questionnaires and interview methods to assess the conservation efficacy of conservation and development initiatives in different parts of the world.

The sampling frame

Data were collected from 150 households in each of the PFM and non-PFM zones at 1, 2, 3, 4, and 5 km distances from the edge of the forest in both the Mixed Forest (MF) and Cynometra woodland (CW) of the PFM and non-PFM zones, leading to a total of 600 questionnaires (Figure 1). Each transect length was 10 km in each of the four study zones.

At the initial stage, the number of households in the study areas was listed and each household was given a number.

Households were categorised into each of the 1 to 5 km distances as mentioned earlier from the edge of the forest to capture differences in benefits and losses and household perceptions resulting from household distance differences from the edge of the forest over the 10 km transect length. At the next stage, random sampling was used to pick a sample of thirty households from each sampling distance, making a total of 150 randomly selected households for each of the MF and CW in the PFM and non-PFM study zones and resulting in a total of 600 households (Figure 1).

The enumerators visited the households walking from one household to the next within the sampled households. Each head of household was interviewed by a trained enumerator who verbally asked each of the questions in the questionnaire in series. The heads of households who could not understand English were asked in vernacular by the enumerator translating the questions verbally into vernacular. Answers were recorded by the enumerator against each of the questions. The heads of households were allowed to engage in discussions and story–telling to better understand the questions and provide answers. The data were collected between

Table 1. Comparisons between Chi-square values of the positive and negative attitudes of households towards the forest and impact of forest on household livelihood.

Parameter	Numbers of HH (A)	Parameter	Numbers of HH (B)	χ^2 (A vs. B)
ASF has +ve impact on livelihood	475	ASF has –ve impact on livelihood	186	41760.5*
ASF has high +ve impact	72	ASF has medium +ve impact	300	25992*
ASF has high +ve impact	72	ASF has low +ve impact	103	480.5*
ASF has medium +ve impact	300	ASF has low +ve impact	103	19404.5*
ASF has high -ve	53	ASF has medium –ve impact	107	1458*
ASF has high -ve impact	53	ASF has low -ve impact	26	374.5*
ASF has medium -ve impact	107	ASF has low -ve impact	26	3280.5*
Higher impact: Land adjacent	258	Higher impact: Land further away	181	2964.5*
Higher impact: Land adjacent	258	No difference in impact	17	29040.5*
High impact: Land further away	181	No difference in impact	17	13448*
It is a good thing to create the forest	490	It is a bad thing to create the forest	7	1.17E+05*
It is a good thing to create the forest	490	Do not know if good or bad to create the forest	2	1.19E+05*
It is a bad thing to create the forest	7	Do not know if it is good or bad to create the forest	2	12.5*
Good relations with ASF	270	Moderate relations with ASF	168	5202*
Good relations with ASF	270	Poor relations with ASF	53	23544.5*
Moderate relations with ASF	168	Poor relations with ASF	53	6612.5*
Get quite a deal of benefits from the forest	252	Do not get quite a deal of benefits from the forest	228	288*

* = Significant χ^2; $p<0.05$; df = 1. HH: Household.

the years 2008 and 2009. Where the head of a household was found to be absent, the next household not included in the sample was chosen for interview.

Data collection and variables

Firstly, a referendum was carried out on all the 600 sampled households to determine the local communities' perceptions on forest protection, involvement in forest management, value of land adjacent to the forest compared to that far away from the forest, and the overall positive and negative impact of the forest on local people. An opinion vote of whether the forest should or should not be protected was also part of the interview and the referendum. The data were collected from the MF in the PFM and non-PFM zones as well as from the CW in the PFM and non-PFM zones to ensure that the diversity of local communities and habitat types in Arabuko-Sokoke Forest were captured. The data were analyzed at two levels: (1) overall household attitudes towards forest

conservation regardless of PFM or non-PFM zones and (2) household attitudes disaggregated into PFM and non-PFM zones. The data were analyzed using simple percentages and Chi-square test, comparing the proportions of household frequencies within each of the test household attitude variables. The analysis was done for the overall household attitudes towards forest conservation and household attitudes disaggregated into PFM and non-PFM zones of the MF and CW sampling zones.

RESULTS

Household attitudes towards forest and livelihood

The results showed that out of the total of 600 households, at least 72% (n = 475) rely on Arabuko-Sokoke Forest for their livelihood, whereas 28% (n = 186) argued that Arabuko-

Sokoke Forest has negative impact on their livelihood. The analysis of Chi-square statistics revealed a significant value for the household groups that have positive attitudes towards the conservation of the forest and livelihood management and the groups with negative attitudes towards the conservation of the forest and livelihood management (χ^2 = 4.18E+04; $p<0.05$; df = 1) (Table 1). Again, 63% (n = 300) of the households thought that the impact of the forest was moderate on livelihood management, while 22% (n = 103) thought that positive impact was low and 15% (N = 72) argued that the impact of the forest was high on household livelihood management (Table 1).

With regard to the negative impact of the forest, 58% (n = 107) of the households thought that the

forest has moderate negative impact, while 28% (n = 53) believed that the forest has high negative impact and 14% (n=26) thought that the forest has low negative impact on household livelihood. The proportions of households who thought that the forest has moderate negative impact on livelihood were significantly higher than those who thought that the forest has high negative impact and low positive impact on household livelihood (X^2 = 1458; P<0.05; df = 1) and (X^2 = 3280.5; P<0.05; df = 1) respectively. However, the proportions of households that believed that the forest has high negative impact on their livelihood were higher than those who thought that the forest has low negative impact on their livelihood (X^2 = 364.5; P<0.05; df = 1) (Table 1).

In relation to the impact of household distance from the forest on livelihood, 56% (n = 258) of the households believed that land adjacent to the forest has higher impact on their livelihood than land further away, while 40% (n = 181) of the households thought that land further away from the forest has higher impact on household livelihood than adjacent land and 4% (N = 17) of the households thought that household distance from the forest makes no difference on household livelihood; the Chi-square values were significant in favour of households which argued that land adjacent to the forest has higher positive impact on household livelihood (X^2 = 2964.5; P<0.05; df = 1) (Table 1).

The results showed that 99% (n = 490) of the households thought that it was a good idea to create the forest, while only 1% (n=7) completely thought the opposite; the Chi-square test was significant in this regard (X^2 = 116644.5; P<0.05; df = 1) (Table 1). The number of households that had good relations with the forest was 55% (n = 270), while the number of households that had medium relations with the forest was 34% (n = 168) and the number of households that had poor relations with the forest was 11% (n = 53). The frequencies of households that had good relations with the forest were higher than those of households that had medium relations and those of households that had poor relations with the forest; Chi-squares were significant (X^2 = 5202; P<0.05; df = 1) and (X^2 = 23544.5; P<0.05; df = 1), respectively. On the whole, 52% (n = 252) of the households said that they get quite a deal of benefits from the forest, while the remaining 48% (n = 228) were dissatisfied with the forest. The Chi-square values were significant in favor of those who get quite a deal of benefits from the forest (X^2 = 288; P<0.05; df = 1) (Table 1).

Household attitudes towards the impact of forest conservation

The results showed that PFM zones have higher frequencies of households which perceive that the forest has positive impact on their livelihood, while non-PFM zones have higher frequencies of households which

thought that the forest has negative impact on their livelihood. Households which thought that the forest has a high positive impact in their livelihood were higher in the MF of the PFM zone than in the MF of the non-PFM zone (X^2 = 312.5; P<0.05; df = 1). More households in the MF of the non-PFM zone than in the MF of the PFM zone thought that the impact of the forest on their livelihood was either medium (X^2 = 200; P<0.05; df = 1) or low (X^2 = 392; P<0.05; df = 1). The number of households which thought that the forest has negative impact on their livelihood was higher in the MF of the non-PFM zone than in the MF of the PFM zone (X^2 = 612.5; P<0.05; df = 1). The Chi-square value for those households that regarded the level of negative impact as high was significant in favour of households in the MF of the non-PFM zone (X^2 = 1012.5; P<0.05; df = 1) (Table 2).

The trends were similar in the CW forest where significant Chi-square values favoured the CW of the PFM zone, revealing that more households there thought that the forest has high positive and medium positive impact on their livelihood than the households in the CW of the non-PFM zone (X^2 = 112.5; P<0.05; df = 1) and (X^2 = 512; P<0.05; df = 1), respectively. Again, more households in the CW of the non-PFM zone than in the CW PFM zone thought that the forest has a low positive impact on household livelihood (X^2 = 40.5; P<0.05; df = 1). Similarly, the CW of the non-PFM zone has more households which thought that the forest has negative impact compared to the CW of the PFM zone (X^2 = 72; P<0.05; df = 1) (Table 2).

With regard to the relative distance of households from the forest, Chi-square values are significant in favor of more households in the MF of the PFM zone which think that situating household dwellings on land adjacent to the forest has higher impact on their livelihood than situating them further away (X^2 = 3784.5; P<0.05; df = 1). Significant Chi-square values favour more households in the MF of the non-PFM zone who think that situating household dwellings on land further away from forest has higher impact on household livelihood than situating it adjacent to the forest (X^2 = 3528; P<0.05; df = 1) (Table 2). However, in the CW of the non-PFM zones significant Chi-square value favours more households which think that situating household dwellings on land adjacent to the forest has high impact on household livelihood than it does households in the CW of the PFM zones (X^2 = 220.5; P<0.05; df = 1). Also, more households in the CW of the PFM zone than in the CW of the non-PFM zone wish their household dwellings were situated on land further away from the forest as this has higher impact on household livelihood than land adjacent to the forest (X2 = 12.5; P<0.05; df = 1) (Table 2).

Household attitudes towards their involvement in forest management

The study results showed significant Chi-square values

Table 2. Comparison of Chi-square values for household attitudes towards forest's impact on livelihood.

Parameter	MF PFM Zone (A)	MF non-PFM Zone (B)	X^2 A vs B	CW PFM Zone (C)	CW non-PFM Zone (D)	X^2 C vs D
High +ve forest impact	33	8	312.5*	23	8	112.5*
Medium +ve forest impact	55	75	200*	69	101	512*
Low +ve forest impact	24	52	392*	9	18	40.5*
Mean +ve forest impact	37	45	32*	34	42	32*
High -ve forest impact	1	46	1012.5*	4	3	0.5
Medium -ve forest impact	3	57	1458*	10	37	364.5*
Low -ve forest impact	4	11	24.5*	1	10	40.5*
Mean -ve forest impact	3	38	612.5*	5	17	72*
Higher value to dwellings on land adjacent to forest	97	10	3784.5*	65	86	220.5*
Higher value to dwellings on land further away	27	111	3528*	24	19	12.5*

* = Significant X^2; p = 0.05; df = 1; (A), (B), (C), (D) = Number of households.

were in favor of households in the MF of the PFM zone, which thought that it was a good thing to create the forest (X^2 = 162; P<0.05; df = 1). Significant Chi-square values favored more households in the CW of the non-PFM zone, which thought that it was a good idea to create the forest (X^2 = 648; P<0.05; df = 1) (Table 3). The MF of the PFM zone showed a higher number of households which has good relations with the forest (X^2=1404.5; P<0.05, df = 1). Chi-square values are in favor of more households in the MF of the non-PFM zone, which had poor relations with the forest (X^2 = 24.5; P<0.05; df = 1) and those who thought they got quite a deal of benefits from the forest (X^2 = 242; P<0.05; df = 1).

Higher proportions of households in the CW of the PFM zone than in the CW of the non-PFM zone have good relations with the forest (X^2 = 544.5; P<0.05; df = 1). Unlike the MF, the households which think they get quite a deal of benefits from the forest are more in number in the CW of the PFM zone than in the CW of the non-PFM zone (X^2 = 648; P<0.05; df = 1). Significant

Chi-square values indicate that more households in the CW of the non-PFM zone than in the CW of the PFM zone are unhappy with the forest (X^2 = 2888; P<0.05; df = 1) (Table 3).

The study results showed that higher proportions of households in the MF of the PFM zone than in the MF of the non-PFM zone thought that they are adequately involved in forest management (X^2 = 2450; P<0.05; df = 1). Conversely, higher proportions of households in the MF of the non-PFM zone than the MF PFM zone thought that they are not adequately involved in forest management (X^2 = 1104.5; P<0.05; df = 1).

A higher number of households in the MF of the PFM zone than in the MF of the non-PFM zone thought that the forest is well protected (X^2 = 5512.5; P<0.05; df = 1) and wanted the forest protected (X^2 = 338; P<0.05; df = 1). Similarly, Chi-square values were more in favor of households in the CW of the PFM zone than in the CW of the non-PFM zone, which thought they are adequately involved in forest management

(X^2=112.5; P<0.05; df = 1). Conversely, higher proportions of households in the CW of the non-PFM zone than in the CW of the PFM zone were not involved in forest management (X^2 = 1512.5; P<0.05; df = 1). However, significant Chi-square values were in favor of more households in the CW of the non-PFM zone than in the CW of the PFM zone, which thought that the forest is well protected (X^2 = 2048; P<0.05; df = 1) and wanted the forest protected (X^2 = 760.5; P<0.05; df = 1) (Table 3).

DISCUSSION

Household attitudes towards the forest and forest impact on household livelihood

It may be deduced that households which have poor relations with the forest are unhappy with the forest as it is associated with losses in the form of livestock deaths due to tsetse fly, crop damage by wild animals, especially elephants, and predation

Table 3. Analysis of Chi-square statistics between positive and negative attitudes of households towards creation of the forest and household relations and forest management in the MF (A and B) and CW (C and D) of the PFM and non-PFM zones.

Parameter	MF PFM Zones (A)	MF non-PFM Zone (B)	X^2 A vs B	CW PFM Zone (C)	CW non-PFM Zone (D)	X^2 C vs D
Good thing to create forest	129	111	162*	107	143	648*
Good relations with forest	92	39	1404.5*	86	53	544.5*
Moderate relations with forest	37	30	24.5*	12	89	2964.5*
Poor relations with forest	1	40	760.5*	11	1	50*
Forest is an asset to livelihood	71	93	242*	62	26	648*
Forest is not an asset to livelihood	59	13	1058*	40	116	2888*
Adequately involved in forest management	71	1	2450*	48	33	112.5*
Not adequately involved forest management	57	104	1104.5*	57	112	1512.5*
Yes, forest is well protected	108	3	5512.5*	55	119	2048*
Forest is not well protected	23	103	3200*	55	18	684.5*
Yes, protect the forest	130	104	338*	104	143	760.5*
No, destroy the forest	1	0	0.5	0	0	0

* = Significant X^2; $p<0.05$; df = 1; (A), (B), (C), (D) = Number of households.

of livestock like chicken. The households who think they get quite a deal of benefits from the forest are expected to engage in genuine forest conservation, while those who do not support forest conservation could pose a major threat to the Arabuko-Sokoke Forest.

The results of the study show that household attitudes have changed since pre-PFM initiatives in 1991 when Mogaka (1991) found that 96% of the dwellers adjacent to the forest were unhappy with the forest, and 54% wanted the forest completely cleared for settlement. The study of Mogaka (1991) was done at a time when there were no conservation and development initiatives with any conservation-based-income-generating activities. Therefore, the difference between the findings of this study and that of Mogaka (1991) could be strongly attributable to change of community attitudes influenced by incentives

arising from a diversity of forest conservation tactics, especially income-generating activities, community education, awareness, and capacity building for PFM. Though, the results showed that the non-PFM zones are a liability, while the PFM zones are an asset, households in the non-PFM zones want the forest protected nevertheless, clearly indicating that the dwellers adjacent to forest want the forest protected whether or not the net effect of the forest on their livelihood is positive. This observation may indicate that the local households may not be aware of the costs-benefits equilibrium. As a result, households display skewed attitudes towards the forest benefits which they consider to have irreplaceable values. The households in the non-PFM zones may also be supporting forest conservation in anticipation of the incentives provided in the PFM zones. However, the findings of the study showed

that the fact that some 48% of the households adjacent to the forest think that the forest benefits are not enough to offset the costs (that is, they do not get quite a deal of benefits from the forest) does present a worry for the forest conservation managers as they would be expected to continue engaging in unsustainable forest extraction.

Household attitudes towards the impact of forest conservation

The PFM zones were characterised by households who extract butterflies for export, harvest honey from bees in the forest, and engage in mushroom farming and eco-tourism initiatives. This may be the single most important reason why households in the PFM zones perceive the forest as an asset to livelihood and

why they want the forest protected. The results agree with those of Alvard (1998) and Robinson et al. (2000) who noted that sustainable harvesting of some forest species can be a viable strategy in natural resources management. As PFM not only builds capacity, but promotes the sustainable use of some biodiversity components for example bees for honey, butterflies, and mushrooms there is no reason why such households should not support and engage in forest management consistent with the sustainable livelihood framework developed by Scoones (1998). This explains why higher proportions of households in PFM than non-PFM zones think that land adjacent to the forest has higher positive impact on household livelihood.

The fact that households in the PFM zones value their closeness to the forest due to the benefits that come from PFM investment in the form of livelihoods improvement agrees with the findings of Brooks (2006). The results further support the sustainable livelihood framework developed by Scoones (1998), which perceives sustainability from a multi-dimensional perspective. According to Scoones (1998), sustainable livelihood results from policy and institutional frameworks that support livelihood strategies and guarantee livelihood improvement and sustainability of the natural capital. This is in line with the PFM objectives in Arabuko-Sokoke Forest.

These results also agree with a range of other past studies, including Borgerhoff et al (2005) who recommended that conservation initiatives should address the welfare and cooperation of the people living in and around protected areas; Abbot et al. (2001) who said that such strategies should provide a mix of conservation and development objectives; and Western (1994) and Getz et al. (1999) who recommended employing a range of tactics such as providing appropriate development opportunities. The studies conducted by Murphree (1994) called for local community involvement which adopts shared management; Fearnside (1989) and Browder (1992) indicated that local people should be guaranteed the rights to harvest; Ferraro and Kiss (2002) recommended awarding cash compensation to offset conservation costs; and Honey (1999) encouraged tourism for livelihood improvement. In Arabuko-Sokoke Forest, the PFM process is a means of compensating for forest conservation costs through improving livelihood for forest conservation. While the results of the study agreed with past literature and though households supported forest conservation because of the benefits they received, the scale of benefit would be of significance if Arabuko-Sokoke Forest competed with other land uses.

Household attitudes towards forest management

The study results show that households in the MF of the

PFM zone, but not the CW of the PFM zone support the creation of Arabuko-Sokoke Forest. The results from the MF of the PFM zone agree with that of Ferraro and Kiss, (2002) who recommended awarding cash compensation to offset conservation costs and with that of Honey (1999) who encouraged tourism for livelihood improvement as a means to engage local people in forest conservation. It may be argued that due to the lack of forest protection enforcement usually associated with PFM, in the CW of the non-PFM zone, households have not been denied access to the forest and so they perceive the forest as a free resource that supplements their livelihood.

It may be argued that because of awareness creation associated with PFM investment, households in the CW of the PFM zone are aware that the forest resources are limited and the losses arising from the forest should be offset by nature-based enterprises. Since PFM resources are limited, until the time PFM resources become available in right scales, the households in the CW of the PFM zone would continue to view the forest as a liability to their livelihood since their welfare has not been addressed. Borgerhoff and Coppolillo (2005) recommended that conservation initiatives should address the welfare and cooperation of the people living in and around protected areas, while Abbot et al. (2001), Western (1994), and Getz et al. (1999) called for a mix of conservation and development objectives.

Murphree (1994) calls for local community involvement adopting shared management and Fearnside (1989) and Browder (1992) indicate that local people should be guaranteed the rights to harvest. The costs of forest conservation should be offset in the lines proposed by Ferraro and Kiss (2002) who recommend awarding cash compensation to offset conservation costs and Honey (1999) who encourages tourism for livelihoods improvement. In this study, results in the MF PFM zone where there has been significant PFM investment showed that PFM is a true asset to household livelihoods and is a tactic for improving the household attitudes towards forest conservation.

The results of this study agree with that of Brooks et al. (2006) who found that more community input in implementation is, indeed, linked with behavioural success, and that greater involvement in decision-making is associated with both behavioural success and ecological success. The study supports the claims of community-based conservationists (Western and Wright, 1994) and allied approaches of Morgan-Brown et al. (2009) who studied butterfly farming in East Usambaras in Tanzania. They found that more than 80% of butterfly farmers believe forests are important for butterfly farming and that common illegal resource extraction activities pose a threat to wild butterflies. Furthermore, they found that more than 80% of butterfly farmers believed resource extraction activities such as pole cutting and logging were dangerous for wild butterfly populations, and that butterfly farming would be very difficult if forests were cleared.

It is imperative that the results of the study support the view of Morgan-Brown et al. (2009) that butterfly farmers, beekeepers and mushroom farmers in Arabuko-Sokoke Forest do fear that clearance of Arabuko-Sokoke Forest will make them lose their livelihood. While there is undeniable evidence that many natural resources cannot withstand utilization (Alvard, 1998; Robinson and Bennett, 2000), sustainable harvesting of some species, as in the case of Arabuko-Sokoke Forest, can be a viable strategy in some cases where institutions regulating sustainable management are strong or when population sources remain protected (Hill et al., 1997).

Form the foregoing, it was deduced that that PFM investment is an asset to household livelihood and is a tactic for improving the household attitudes towards forest conservation. Community input in PFM implementation and extraction of forest products and capacity building is, indeed, linked with behavioural success leading to change of household attitudes necessary for their support towards forest conservation objecttives. The study also concludes that PFM investment should be high enough to deliver tangible benefits to participating dwellers adjacent to the forest, if they are to support forest conservation objectives.

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