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ORIGINAL PAPER

Participatory forest management in Burkina Faso: Members' perception of performance

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Abstract: This study examines variations in the performance of participatory forest management programs among four forest management groups (FMGs) in southern Burkina Faso, and assesses the factors that influence their members' perceptions of performance through a household survey of 216 members. Variations in performance scores among the FMGs were analyzed through multivariate analysis of variance while multinomial regression analysis was used to identify factors that influence their perception of the performance. The results reveal significant differences in performance scores among FMGs. Members of some FMGs perceived that the participatory forest management program enabled them to get benefits from the sale of fuelwood while performance scores in the forest conservation and decision-making processes is generally poor. The score for economic performance of FMGs in turn was related to better access to roads and markets. Group size tended to enhance economic performance via its strong influence on annual fuelwood harvest, while the resource base appeared to be inconsequential. Members of the forest management groups perceived that large group size and group heterogeneity, particularly in terms of ethnicity, as well as knowledge and awareness of problems related to the forest environment have no influence on the performance of their respective groups. For rural communities to have a favorable disposition toward sustainable forest management, differences in member understanding of collective actions and their impact before and during the implementation of participatory forest management programs should be considered.

Keywords: Common-pool resources, Collective action, Sustainable forest management, West Africa

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Introduction

Sustainable management of forest resources has been a challenge for many developing countries for several decades. Historically, strategies for forest conservation have been dominated by attempts to exclude people from designated forest reserves (Adams and Hulme 2001). This protectionist approach viewed the development needs of local communities as being in direct conflict with the objectives of biodiversity conservation (Vodouhê et al. 2010). This approach has been pursued as a forest conservation strategy in Sub-Saharan countries during the colonial period and after independence (Guthiga 2008). For example, in the 1930s extensive parts of the North Sudanian zone of West Africa were delimited and protected by colonial administrations to provide sanctuaries for wildlife and prevent expansion of shifting cultivation (Shepard 1992). After independence, forests and woodlands have been preserved through the establishment of state forests for wood production and biodiversity conservation. In Burkina Faso alone, state forest reserves represent 25% of the total area of forests and woodlands, which cover 7.1 million ha or 26% of the country's land area (Kaboré 2004). However, this top-down protectionist approach to forest conservation has not successfully prevented deforestation and associated losses of forest biodiversity in most cases (Guthiga 2008).

In recognition of the continued deforestation and loss of biodiversity associated with the protectionist approach, a new discourse has arisen since the 1980s, emphasizing the need to incorporate the aspirations of local people in forest conservation strategies (Ribot 2001; Hutton and Leader-Williams 2003). This new approach, often referred to as community-based natural resource management (CBNRM), allows local communities in the vicinity of protected areas or state-managed forests to participate in the conservation process and links conservation objectives with the local development needs of the people (Adams and Hulme 2001; Hutton and Leader-Williams 2003). CBNRM has received considerable attention in recent decades, and is being actively pursued across the world as a strategy for promoting natural resource governance (Matta and Alavalapati 2006).

Participatory forest management is one of the strategies for the management of common forest properties, in which people are organized into forest management groups with the aim of fostering sustainable development through collective action. In Burkina Faso, a participatory forest management program, one form of CBNRM, was initiated in 1986 with the assistance of a joint UNDP/FAO project, which particularly stressed the importance of local people participating in managing the natural forests (Ribot 1999). The focus of the program in the country was the area within a 150 km radius of Ouagadougou (the capital of Burkina Faso) to sustainably supply the city with fuelwood. In this participatory forest management program, the villagers entered management agreements with the Forestry Service at the provincial level, mainly through management plans intended to foster ecosystem conservation and biodiversity protection while benefiting the locals (Bellefontaine et al. 2000). A managed forest is divided into several operational forest management units (FMUs), with areas ranging from 2,000 to 4,000 ha, each managed by a Forest Management Group (FMG) with representatives from one or more villages surrounding the forest areas. The forest management activities include controlled early burning; fire-break maintenance; fire-fighting; fuelwood collection and sale; extraction of non-timber forest products (NTFPs); and silvicultural operations involving direct seeding and managing stump sprouts.

While several factors can influence the performance of CBNRMs, cooperation plays a fundamental role in rural development programs (Sunderlin 2006) because the effect of pooled efforts is usually greater than the sum of the effects of individual efforts (Esteban and Ray 2001). The ability of a community to cooperate depends on the inherent ability of the community to create formal and informal frameworks to achieve goals of collective action (McCarthy et al. 2004). The willingness of rural people to collaborate in participatory forest management programs depends on their perceptions of the particular program. If communities are to participate in a sustainable forest management program, they first need to believe that the practices are important, that they provide a safe rural environment, and that they will bring in stable and long-term income. Therefore, measuring members' perceptions of the performance of forest management programs and understanding how factors—such as the resource-base, group characteristics, knowledge of the environment and perceived benefits and losses—influence their perceptions is essential for successful decentralization of forest management.

It is against this background that this study was carried out, with the overall objective to investigate the perception of forest management group members about the performance of the participatory forest management program in southern Burkina Faso and identify the factors that influence their perceptions. The specific research questions addressed in the study were: (1) Do members of different forest management groups (FMGs) perceive any variation in the performance of the participatory forest management program? If so: (2) Is this variation attributable to the resource-base, annual harvest, income from fuelwood sales and/or proximity to the market? (3) Does this variation relate to the perception of group size, heterogeneity, and knowledge of the forest environment of the forest management group members?

Conceptual background

The conceptual framework for the emergence of collective action can be useful for analyzing the determinants of forest management group capacity in the context of southern Burkina Faso. Here, the term collective action is used *sensu* Scott and Marshall (1998) as ''action taken by a group (either directly or on its behalf through an organization) in pursuit of members' perceived shared interests." In collective action, members may act individually, but more often they act through a group or an organization, either independently or with the support or encouragement of external agents, e.g., governmental bodies, non-governmental organizations (NGOs) or representatives of development projects (Meinzen-Dick et al. 2004). The literature often refers to the concept of social capital for collective action, defined as "the shared knowledge, understandings, norms, rules and expectations about patterns of interactions that groups of individuals bring to a recurrent activity" (Ostrom 2000). Pretty and Ward (2001) have identified four aspects in the formation of social capital: (1) relations of trust; (2) reciprocity and exchange; (3) common rules, norms, and sanctions; and (4) connectedness, networks, and groups. Therefore, social capital and collective action are closely linked, and several studies have shown that social capital facilitates collective action (Ostrom 1994). Social learning is also viewed as an essential component of participatory natural resource management. Schusler et al. (2003) define social learning as occurring "when people engage one another, sharing diverse perspectives and experiences to develop a common framework of understanding and basis for joint action".

Involving group members in various ways in common actions (e.g., fuelwood collection, fire break maintenance, silvicultural operations, etc) in Southern Burkina Faso could achieve shared goals of the program. In addition, the forest management process in Burkina Faso can be seen as social learning, through which group members gain knowledge by jointly defining problems in collaboration with foresters as well as seeking and implementing solutions to problems related to forest management. The interac-

tions that occur during cooperation or collective action also provide feedbacks to the social learning process and change the nature of social capital. Social capital is postulated to lower the cost of working together, thereby facilitating co-operation, since it gives people confidence to invest in collective activities, knowing that others will also do so. Moreover, for individuals to participate in collective action, the possible benefits of cooperation (e.g., access to forest resources and employment opportunities) need to be visible to them.

However, the efficiency of participatory forest management in the field is highly variable. The success or failure of decentralization depends on a mixture of context- and case-specific institutional and socio-economic factors (Matose 2006); and the success of a "common pool" resource management program is a function of the attributes of the resources and the management group (Ostrom 2005). Scholars generally agree that the attributes of a resource (e.g., scarcity, size, species diversity, and proximity to roads and markets) affect the success of a community forest management program (Bardhan 1993; Meinzen-Dick et al. 2002; Pagdee et al. 2006). We hypothesized that FMGs with large forest cover, relatively high annual harvests and incomes, as well as those close to markets, are likely to perform better than others. Group characteristics (size and heterogeneity) are also thought to affect both the capacity to cooperate in general and the incentive to undertake a particular action. Group size has been postulated to affect collective action. Olson (1982) stressed that in the absence of any special arrangements, large, heterogeneous groups of rational individuals will be unlikely to act in their group's interest. In addition, socially homogeneous communities may have greater capacity to solve problems associated with collective action since all members have similar tastes. On the contrary, members of heterogeneous communities may find it difficult to reach agreement about characteristics of the common good, and thus be less likely to cooperate in its provision (Esteban and Ray 2001). Furthermore, individuals may dislike working with people outside of their group, making cooperation less likely in heterogeneous communities (Alesina and La Ferrara 2000). Notably, ethnic heterogeneity reportedly raises difficulties in terms of organizing and sustaining cooperation within user groups (Chhetri and Pandey 1992). This is also true for residence status in a given village, which is correlated with ethnicity to some degree in the study area, where migrants (Mossi and Fulani people) have less access to forest products than indigenous Nuni people (Coulibaly-Lingani et al. 2009).

For the above reasons, social heterogeneity has been hypothesized to have a negative effect on cooperation because different norms may make the creation and enforcement of decisions most costly (McCarthy et al. 2004). Small, ethnically homogenous groups may be better at working together in the study area, and hence engage in collective actions more effectively than large, diverse groups. In addition, community members' access to knowledge related to forest resource management and their under-standing could be a function of their perceptions of collective action, which could differ between individuals. In the context of community forest management, collective action could also be a function of individual members' assessments of the costs and benefits associated with it, which will depend upon their knowledge and understanding of the associated issues. Furthermore, for individuals to participate in collective action, the possible benefits of cooperation need to be evident to them. Clearly, members' knowledge of the forest environment would influence their perception of the performance of the participatory forest management program. Our final hypothesis was that even if there is a willingness to collaborate, the success of their collective action will be influenced by factors such as resource size and access to roads and markets.

Materials and methods

Site description

The study was carried out in Sissili and Ziro provinces, which are located ca. 160 km from the capital (Ouagadougou) in southern Burkina Faso (11°02'−12°00' N and 01°30'−2°80'W), West Africa (Fig. 1). The study area, part of Sudanian or south-Sudanian ecological zone, is characterized by low relief with an average of 300 m above sea level (White 1983). According to data collected from the in situ mini-weather station at Leo (the provincial capital of Sissili) for the years 1976 to 2007, the mean annual rainfall in the area amounted to 883±147 mm. Mean daily minimum and maximum temperatures ranged from 16 to 32 °C in January (the coldest month) and from 26 to 40 °C in April (the hottest month). The population consists of an indigenous ethnic group, Nuni, and several groups of migrants, mainly Mossi (originating from the centre and northwest of Burkina Faso) and Fulani (originating from northern Burkina Faso). According to the 2006 general population and housing census by the National Institute of Statistics and Demography, the average population density is 28 inhabitants per km2 in both Sissili and Ziro provinces. The agricultural system is characterized by traditional subsistence farming, together with cultivation of cash crops (cotton and cashews), intensive fuelwood extraction and ranching. The natural vegetation in both provinces includes Sissili State classified forest, a forest buffer zone bordering the Sissili forest, forest management units (FMUs,) and unprotected forests.

The present study focused on four FMUs: FMU nos. 9 and 3 in the Sapouy- Biéha management scheme (or planning area), and the FMUs in Korabou and Ly, both in the Southern-West Sissili management scheme. The four FMUs were all established in 1996 and differ in a number of attributes (Table 1). The biggest is FMU 9, followed by the FMU in Korabou, the FMU of Ly and FMU 3, and each FMU has 15 plots for rotational cutting of fuelwood. In terms of group size, FMU 9 is the largest, followed by FMU 3, and Korabou and Ly FMUs, which are the same in group size. In general, the number of FMG members has increased since their establishment. The mean annual harvest of fuelwood and the associated income for the period 2005-2009 were the highest for FMU 9, and successively lower for FMU 3,

Ly and Korabou (Fig. 2). The FMUs in the Sapouy-Biéha management scheme are located along the main road connecting the province to the capital, Ouagadougou, and close to the main fuelwood market while the FMUs in Korabou and Ly are located distantly from the main market. All the FMGs benefited from the financial and technical assistance of the joint UNDP/FAO/BKF/85/011 project between 1986 and 2001. When the project ended, management of all the schemes was transferred to the Union of Forest Management Groups, and the Ministry of the Environment through its regional and provincial offices in charge of providing technical support. All the FMGs received support (equipment and some funds for operations) from the Regional Program for the Traditional Energy Sector (RPTES) between 2001 and 2004 (Ouédraogo and Nianogo 2003), and subsequently from the Support Program for the Energy Sector (Projet d'Appui au Secteur de l'Energie (PASE) between 2006 and 2009 (oral communication, Regional Director of the Environment for the Centre-West region, 2010). Christian Relief and Development Organization (CREDO), an NGO, also provided support for biodiversity conservation work.

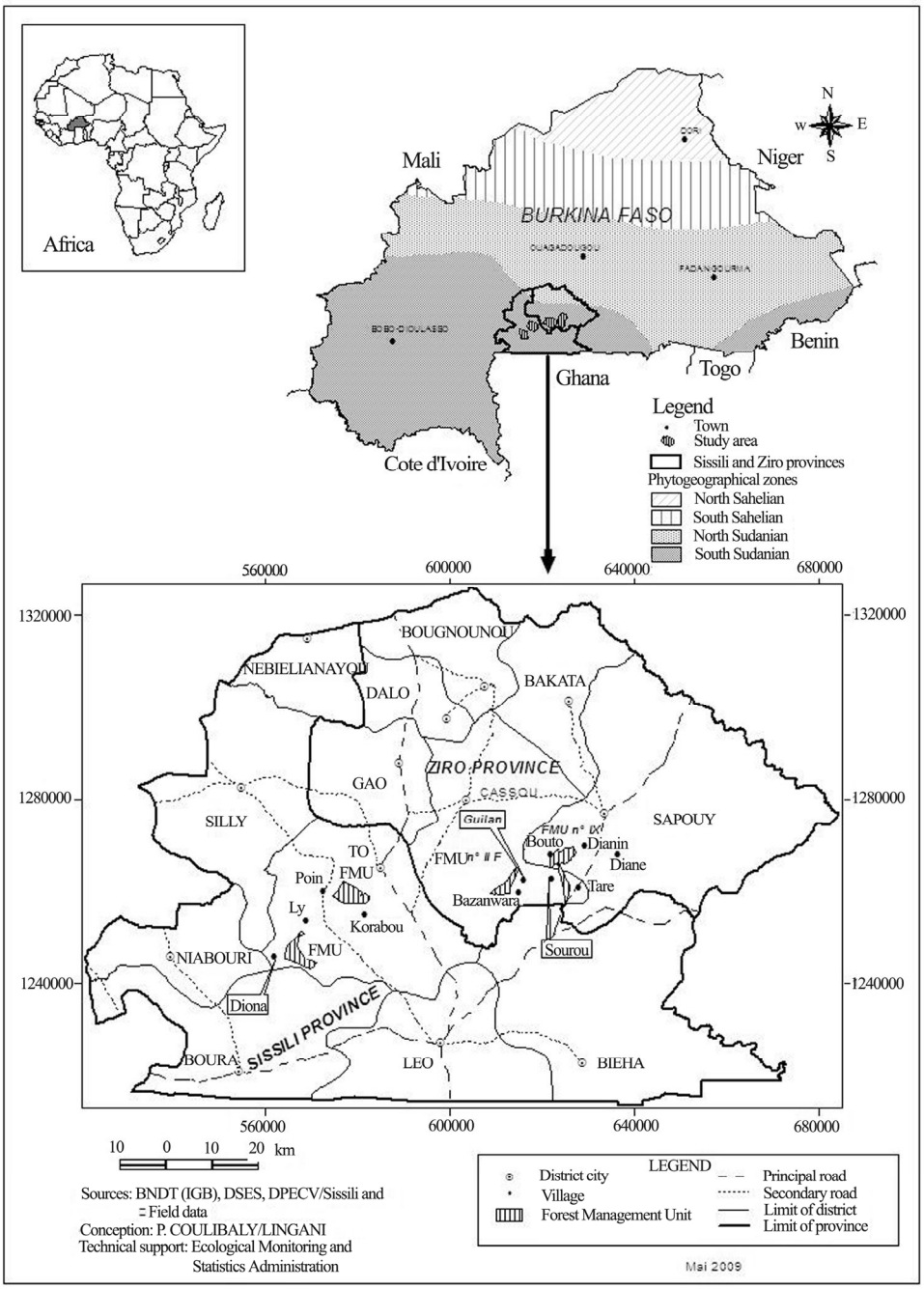

Fig. 1: Location of the study areas.

Table 1: Forest area, number of members, mean annual harvest of fuelwood and income (2005-2009), and distance to the main fuelwood market, Ouagadougou of the forest management units investigated in the present study.

Attributes	Forest management Units			
	Sa-pouy-Biéha-No.9	Sa-pouy-Biéha-No.3	Korabou	Ly
Area (ha)	2 436	1 185	2 222.2	2 038.8
Harvest (m3)	140	55	35	35
Group size (no.)	2 442	1005	185	556
Income (Euro)	8 280.7	2 693.4	618.07	1 860.8
Distance to market (km)	122	140	168	206

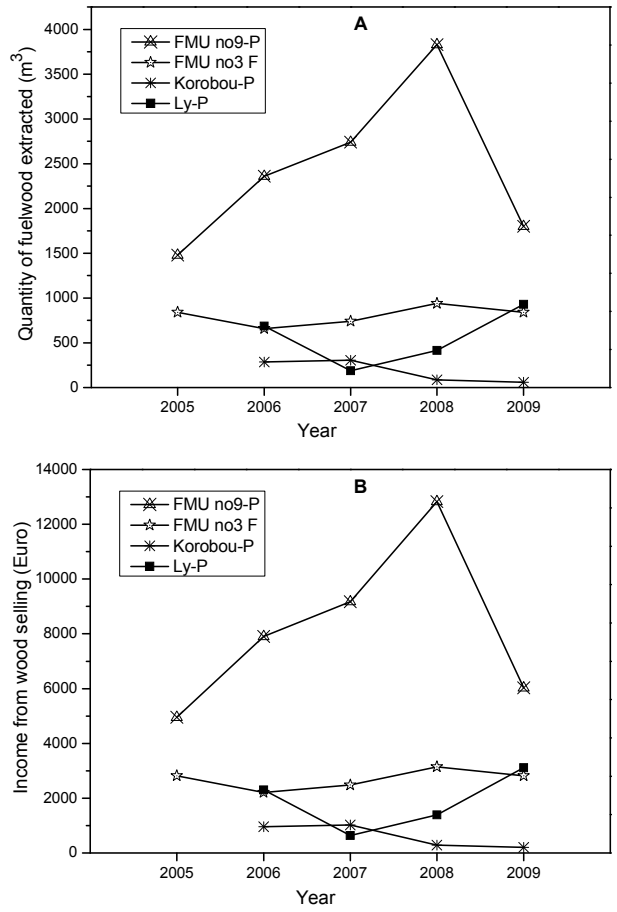

Fig. 2: Fuelwood production (A) and income from fuelwood (B) at four forest management units in Southern Burkina Faso

Data collection

Group discussions were held and a household survey was conducted during May and June 2009 to collect data on how members of the four forest management groups described above perceived participatory forest management. To prepare for the survey, focus group discussions were held with the leaders of the forest management groups, local government officers, and NGOs to obtain qualitative information concerning the performance of the participatory forest management program. Various questions were posed to the respondents, allowing them to express their own views and responses regarding the addressed research problems. This procedure permitted an exploration of what they knew or thought about the research problems that the questionnaire would cover, and it verified, confirmed and added depth to the results of the household survey.

From the information obtained through focus group discussions, 15 indicators of performance of participatory forest management were identified (Coulibaly-Lingani et al. 2010) and subsequently used in constructing the questionnaire. The indicators were further grouped into three main categories; namely indicators of economic performance, forest conservation and decision-making (empowerment). Indicators pertaining to economic performance included benefits from fuelwood sale, extraction of NTFPs, generation of household income, creation of employment opportunities, and enablement of micro-economic activities. Indicators pertaining to forest conservation included forest regeneration, maintenance of firebreaks and forest protection. Indicators pertaining to decision-making included meetings attendance, frequency of meetings, suggestions during meetings, ability to influence decisions in meetings, agreements on decisions during meetings, equity in benefit allocation, and forest monitoring and evaluation.

The sampling methods applied in the household surveys were as follows. The target population was defined as members of the four FMGs from 11 surrounding villages; three of the FMUs were managed by two nearby villages, while FMU # 9 was managed by five surrounding villages. These villages were selected based on their involvement in the participatory forest management program. The executive committee of the forest management groups in each village provided a list of their members. Through random sampling, 20 respondents were selected in each village except one where the total number of group members was 16. Therefore, a total of 216 respondents from 11 villages were surveyed. The respondents were all heads of their households and included both men and women.

The questionnaire was pre-tested and used for collecting information; the interviews were carried out by one researcher and two skilled field assistants in the respondents' native language to ensure that answers would be relevant locally. Respondents were interviewed individually and care was taken to ensure that fellow villagers could not overhear or interfere in the interview process. The questionnaire consisted of questions designed to assess members' perceptions of the participatory forest management program; specifically, the respondents' knowledge and awareness of any problems related to the forest environment, and their opinions about the influence of group size and ethnic dissociation on the performance of their village forest management program. In addition, respondents were asked to score each performance indicator of the collective action on a 4-point Likert-type scale: 1 = bad, 2 = satisfactory, 3 = good and 4 = very good.

Data analysis

The variation in scores of the performance of the participatory forest management among FMGs was analyzed using multivariate analysis of variance. The datasets were checked for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multi-collinearity. No serious violations of assumptions of the applied tests were noted. The magnitude of effects of the examined variables was determined by a statistic called partial eta squared (ηp2), and the effects were considered small, moderate, or large if the value of this statistic was 0.01, 0.06 or 0.14, respectively (Cohen 1988). Pearson correlation analysis was performed to examine the relationship between scores of each performance indicator and resource-base, group size, and proximity to the main fuelwood market.

Multinomial regression analysis was performed to evaluate whether the variation in performance of the participatory forest management program among FMGs was associated with members' knowledge of the forest environment, their perception of group size, and heterogeneity. The dependent variables were scores for each performance indicator and the mean of each set of economic, conservation, and decision-making indicators, which were regressed on the independent variables according to the following model.

$$Y_i = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + error$$

where Y_i is the value of the dependent variable, α is a constant, and β_s are the coefficients of the explanatory variables, knowledge of the forest environment (x_1), perception of group size (x_2) and perception of group heterogeneity (x_3). During the model construction, variables with F values $\leqslant$ 0.05 and $\geqslant$ 0.100 were entered, and removed, respectively.

Results

Variation in the perception of performance among FMGs

The results of the multivariate test of differences among the groups on their perceptions of how well the participatory forest management program performed indicated that there were statistically significant differences, in the combined dependent variable between the four forest management units ($F[9, 636] = 5.32$, $p < 0.0005$; Pillai's Trace = 0.21) with moderate magnitude of the effect ($\eta_p^2 = 0.07$). When the ranks for each performance indicator were considered separately, significant differences were observed for economic performance and forest conservation scores. Performance scores for decision-making did not vary significantly between FMGs (Table 2). Inspection of the mean scores for each indicator revealed that members of the Sapouy-Biéha FMG reported higher scores of perceived economic performance than members of the Korabou and Ly FMGs, while the perceived performance score for forest conservation ranked least in Ly compared to Sapouy-Biéha and Korabou (Fig. 3). As a whole, the score for economic performance was higher than those for forest conservation and decision-making.

Further analysis of economic indicators showed significant inter-FMG differences in benefits from fuelwood cutting, generation of household income, creation of employment opportunities and enablement of micro-economic activities, while extraction of NTFPs did not significantly differ between FMGs (Table 2). The scores of perceived performance for these economic indicators revealed that members of Sapouy-Biéha FMG benefited well from fuelwood sales; and the forest management program enabled members of this FMG to improve their household income and to start up micro-economic activities more than members of the Korabou and Ly FMGs (Fig. 4).

Table 2: Summary of MANOVA output for comparing significant differences in economic, forest conservation and decision-making performances among four forest management units in Southern Burkina Faso.

Performance indicators	$F_{(3, 212)}$	P-values*	Effect size
Economic	13.56	<0.0005	0.161
Benefit from fuel wood cutting	8.04	<0.0005	0.102
Exploitation of NTFPs	2.81	0.036	0.038
Generating household income	20.80	<0.0005	0.227
Creating employment opportunity	5.43	0.002	0.071
Enabling micro-economic activities	6.27	<0.0005	0.081
Forest conservation	4.68	0.003	0.062
Forest regeneration	5.52	0.001	0.072
Maintenance of firebreaks	2.99	0.032	0.041
Forest protection	4.30	0.006	0.057
Decision-making processes	3.19	0.025	0.043
Attendance to meetings	2.18	0.092	0.030
Frequency of meetings	1.16	0.325	0.016
Suggestion during meetings	3.39	0.019	0.046
Ability to influence decisions in meetings	1.98	0.118	0.027
Agreements on decision during meetings	5.82	0.001	0.076
Fairness (transparency) in benefit allocation	3.16	0.026	0.043
Forest monitoring & evaluation	Np	Np	Np

*significant based on Bonferroni adjusted probability level of 0.01. Np = computation was not applicable due to similar ranking for this variable in all FMUs.

Performance in forest conservation also showed significant differences among FMGs in activities involving forest regeneration and forest protection, but not in maintenance of firebreaks (Table 2). The performance scores for forest regeneration and forest protection were slightly higher for Sapouy-Biéha FMUs than for the Ly FMU (Fig. 5). Although perceived differences in decision-making processes were generally not significant, further analysis of each indicator revealed significant differences in agreement on decisions during meetings (Table 2). The scores for this indicator showed there was better agreement on decisions in the Sapouy-Biéha FMUs than in the Korabou and Ly FMUs, and the ranking for forest monitoring and evaluation was similar (and poor) across all FMUs (Fig. 6).

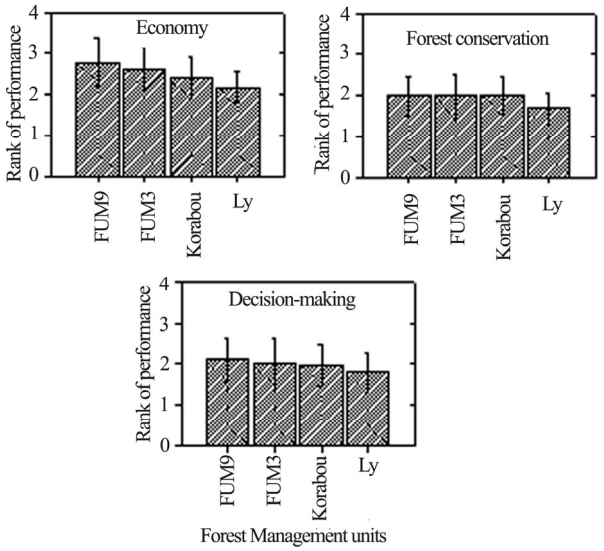

Fig. 3: Scores (1-4) for overall performance of forest management groups in terms of economy, forest conservation and decision-making processes (mean ± SD)

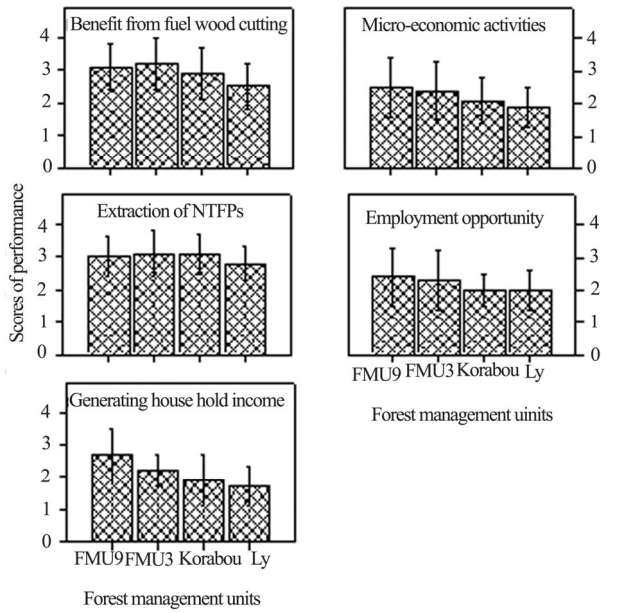

Fig. 4: Scores (1-4) for perceived economic performance of four forest management units in Southern Burkina Faso (mean ± SD)

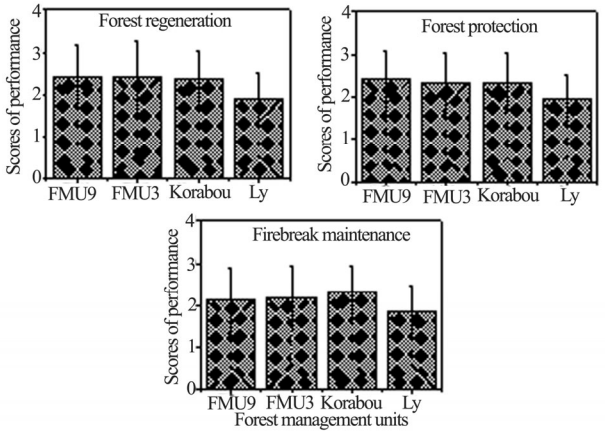

Fig. 5: Scores (1-4) for perceived performance in Forest conservation by four forest management groups in Southern Burkina Faso (mean ± SD).

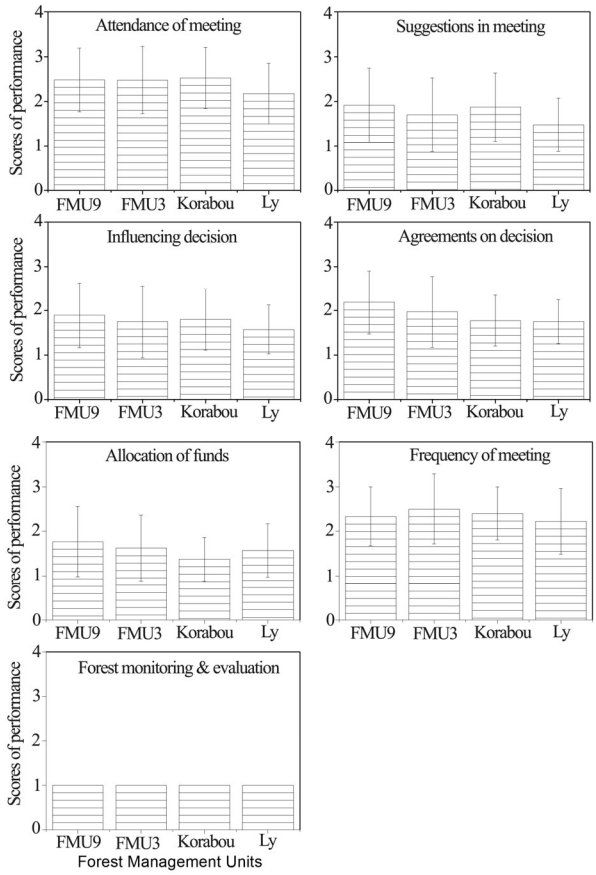

Fig. 6: Scores (1-4) of perceived performance in decision-making by four forest management units in Southern Burkina Faso (mean ± SD).

Is this variation associated with the resource, group size and proximity to market?

The correlation analysis revealed that proximity to the main fuelwood market significantly influenced the economic performance, the decision-making process and the overall performance (Table 3). FMUs that are located far from the fuelwood market (Korabou and Ly) performed less well than those close to the main fuelwood market, SUCH AS Sapouy-Biéha (Table 1). Although the between-FMUs differences were not statistically significant, since there were few cases (n = 4), the mean annual

harvest for the period between 2005 and 2009, the associated income, and group size seemed to strongly correlate with economic performance and decision-making processes as well as the overall performance. The total forest area of FMUs seemed to poorly correlate with all performance indicators, but the per-capita resource (forest area divided by group size) negatively influenced the economic performance, decision-making process, and overall performance. The performance in forest conservation did not correlate well with proximity to the market, while other factors appeared to be more influential (Table 3). Group size correlated with mean annual harvest (r = 0.981, P = 0.019) and with mean annual income (r = 0.988, P = 0.012), resulting in a significant correlation between economic and decision-making performance (r = 0.968, P = 0.032).

Is the variation in performance among FMGs dependent on members' knowledge of the environment and perception of group characteristics?

The regression analysis did not show a significant relationship between the performance scores of the participatory forest management program and member knowledge of the environment and perception of group characteristics (Table 4). Most of the members reported that their knowledge of the forest environment has little impact on the performance of the participatory forest management program. The members also perceived that group size does not have any influence on the effectiveness of the participatory forest management program. However, ethnic dissociation was perceived as an essential condition for effective performance (Table 4).

Table 3: Correlations between performance indicators and resource-base, proximity to the main fuelwood market and group size (n = 4).

Attributes	Pearson Correlations	Decision - making	Economic indicators	Forest conservation	Overall performance
Area	Coefficient (r)	0.088	-0.080	-0.037	-0.038
	P-value	*0.912*	*0.920*	*0.963*	*0.962*
Harvest	Coefficient (r)	0.730	0.788	0.304	0.653
	P-value	*0.270*	*0.212*	*0.696*	*0.347*
Income	Coefficient (r)	0.703	0.745	0.274	0.614
	P-value	*0.297*	*0.255*	*0.726*	*0.386*
Proximity	Coefficient (r)	-0.986*	-0.996 **	-0.837	0.988*
to market	*P-value*	***0.014***	***0.004***	*0.163*	***0.012***
Group size	Coefficient (r)	0.785	0.797	0.400	0.700
	P-value	0.215	0.203	0.600	0.300
Area per	Coefficient (r)	-0.765	-0.895	-0.037	-0.038
size	*P-value*	*0.235*	*0.105*	*0.963*	*0.962*

**. Correlation is significant at the 0.01 level (2 tailed); *. Correlation is significant at the 0.05 level (2 tailed)

Table 4: Estimated regression standardized beta coefficients (β) of the latent variable equations for participation in forest management.

Description	Overall		Decision making		Forest conservation		Economic benefit	
	B	t-values	β	t-values	β	t-values	β	t-values
Constant	2.05	10.61*	2.07	10.81*	2.66	9.87*	2.82	12.15*
Knowledge of environment	0.001	0.02	-0.04	-1.35	-0.05	-1.14	0.01	0.21
Group size	0.04	0.81	0.01	0.31	0.03	0.38	-0.05	-0.82
Group composition	-0.003	-0.09	-0.05	-1.61	-0.12	-2.62*	-0.04	-1.20
Coefficient of determination (R^2)	**0.003**		**0.028**		**0.047**		**0.011**	

* Statistically significant at $p < 0.05$

Discussion

Our research shows that collective action in participatory forest management in south Burkina Faso varies between the FMGs, based mainly on their proximity to market. Members of the Sapouy-Biéha FMGs reported higher scores for economic performance than those of the Korabou and Ly FMGs, particularly for benefits accrued from fuelwood harvest and sales, because the Sapouy-Biéha FMGs are located close to the main road connecting the province with the capital, Ouagadougou. Distances to forests and market are among the common external forces that have made it easier for FMGs to increase the scale of fuelwood production and thus create employment opportunities and foster micro-economic activities (Verburg et al. 2004). This is evident from the increasing annual harvests of fuelwood in Sapouy-Biéha FMU 9 over the past five years since 2005 (Figure 2A). The associated increase in income from selling fuelwood (Figure 2B) has enabled members of this FMU to start up small-scale businesses, including shops and selling cereals), particularly by migrant members, who have little land for agricultural activities. Members of the Korabou and Ly FMUs mentioned that the lack of good-quality roads and poor market facilities have strongly influenced their performance. For example, piles of harvested fuelwood often remained unsold, even if the price was reduced compared to that of other FMUs. Although resource attributes have been shown to influence the performance of forest management programs (Sekher 2001; Ostrom 2005), the forest area and per-capita resource appeared to be less influential than market access in southern Burkina Faso. The findings are consistent with previous studies that have emphasized the role of proximity to roads and market in the economic performance of common-pool natural resource management

(Bardhan 1993; Meinzen-Dick et al. 2002; Pagdee et al. 2006).

The performance in terms of forest conservation was slightly lower than economic performance, which might be related to the low level of participation in forest conservation activities. According to group discussions, most of the activities related to forest conservation (forest regeneration and protection of the forest from illegal cutting) were mainly undertaken by the members voluntarily, and were not remunerated. Only members participating in the maintenance of firebreaks were specifically paid, because this activity requires intense physical effort (digging holes), so remunerating such activity could be motivational. It could be cautiously assumed that forest conservation has low priority, although recent inventory data were not available to check the reportedly low performance against the current stocking density. The strong correlation between economic performance and decision-making process also suggests that the emphasis was more on the economic aspects (mainly fuelwood cutting) of the forest management program.

Performance in the decision-making process did not vary among FMGs. However, there was a difference between members with regard to the ability to influence decisions in meetings. According to the focus group discussions, the executive body had more prerogative than other members of the groups. Members of the Sapouy-Biéha FMGs perceived that there were better agreements on decision-making during meetings than members of Korabou and Ly FMGs, suggesting that there were more relational problems between the executive body and the other members in the latter FMGs. Across the FMGs, the executive body (sometimes in close collaboration with the foresters) made most of the decisions, and members were called upon to undertake desired activities without rigorously discussing the issues beforehand. The leaders, who usually know how to read and write, consider themselves the right people to make decisions. Further, the low performance score for forest monitoring and evaluation across all FMGs investigated in the present study could be explained by the fact that the forest monitoring and evaluation was undertaken by a committee (including members of the executive committee, foresters, etc.) charged with assessing the forest condition, seedling establishment following direct seeding and conditions of coppices. Thus, the reporting appears to have been unsatisfactory and follow-up action lacking.

Knowledge and awareness of problems related to the forest environment strongly influence environmental activism intentions, i.e., "people who believe the environment is unhealthy and that they can do something about it are more likely to express intentions to engage in environmental activism and to act upon those intentions" (Lubell 2002). In the present study, members of the FMGs reported that their awareness of the forest environment had no influence on the performance of the group. This might be related to the fact that the forest monitoring and evaluation tasks were performed by the monitoring committee, and the lack of proper communication of the findings among the members of the groups (personal communication, local forest officer).

Group characteristics are among the factors that influence the performance of collective action. "Group size and heterogeneity affect prospects for developing trust among participants, and hence chances of collective action, due to their effects on the divergence of interests" (Agrawal and Gibson 1999). Social heterogeneity also adversely affects cooperation, since different social norms may increase the costs of creating and enforcing decisions (McCarthy et al. 2004), and cultural difference are sometimes used by individuals to exclude members of a group from benefits of resources, despite apparently shared economic interests (Balland and Platteau 1998). Hence, less participation is generally expected in a group of people from different ethnic backgrounds. However, members of the FMGs investigated in the present study perceived that large group size has no influence on the performance of their respective FMGs but group heterogeneity (particularly ethnicity) does. This is further corroborated by the significant correlation between group size and mean annual fuelwood harvest and the associated income. In the FMGs we examined, the group size varied between 16 and 36 at individual village level, and the ethnic composition of the groups was not so diverse, as the forest management groups were dominated by the indigenous group (Nuni), with few members of migrant groups (Mossi and Wala). Members thought that having a group with people from different ethnic backgrounds would not be beneficial, indicating that homogeneity is indeed a desirable trait for successful co-operation in the forest management program, which further explains why the marginalization of minorities is often a problem in common-pool natural resource management.

Conclusion

The findings from this study provide evidence that the performance of the participatory forest management among units varies, depending on their proximity to roads and markets (which plays a primary role in the economic performance of common pool forest management). Members' perception of the participatory forest management program seems to focus on their ability to generate income to support their livelihood, while less emphasis is placed on forest conservation. It appears that flow of information about the state of the forest down to each member is limited, thus the management body should strive to ensure that each member is aware of the current state of the forest and the need to improve it. The decision-making process also needs improvement, to promote member involvement of as often as possible. One policy measure that would be helpful is the reinforcement of membership of community-based forest management associations, such as forest management groups, through increasing incentives and (thus) willingness to participate. To improve the economic performance of the FMUs, much attention must be paid to improving the quality and accessibility of the roads and thus the FMGs' access to markets. To enhance forest conservation activities, the FMGs should also allocate some of the management fund to remuneration of the actively participating members. For successful participatory forest management, forest managers clearly need to consider these issues.

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