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Rural Livelihoods and Collective Action in Joint Forest Management in Zambia

FIRST DRAFT

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ABSTRACT

This study examines rural livelihoods and collective action in Joint Forest Management (JFM) in six local forest communities in three of the nine provinces of Zambia. The role of forests and woodlands resources to rural livelihood strategies and rural income is examined and the determinants of collective action are identified and discussed. Our analysis of rural livelihood strategies suggests that both agriculture and forests are important sources of rural livelihoods and contributors to rural income. However, although average income from agriculture is relatively smaller than income from forest products there are more people earning income from the former than from the latter. We also find that although women appear to be more dependent on forests and woodlands for subsistence, it is rather the men who more dependent on forests for commercial income. With respect to the determinants of collective action in local forest management, results from this study suggest that household income and income inequality across households, scarcity of forest products, organizational and social capital, and individual prior experience with collective action programs promote collective action whereas market integration and proximity to urban markets (which some form of regional heterogeneity) weakens cooperation. It was also evident that programs which support both agricultural development and forest conservation will have the greatest impact on local behavior, poverty reduction and long-term local forest management in the study area.

Keywords: ***collective action, community forest, joint forest management, forest income, rural livelihoods, socio-economic heterogeneity.***

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1 INTRODUCTION

The general failure of centralized top-down approach to natural resource management (NRM) to arrest irretrievable losses of biodiversity around the world during colonial and post independence periods led to a search for alternative NRM regimes. The concept of *community*-based natural resource management (CBNRM) arose as an alternative specifically intended to address environmental, economic and social goals within a single program package. It emphasizes the ability of user communities to effectively manage collectively owned natural resources through informal and semi-formal institutional arrangements (Wade, 1988; Baland and Platteau 1996; Ostrom, 1990). The fundamental premise is that transfer of land and land use rights from the central government to local communities improves sustainability of natural resources and enhances the welfare of rural communities.

Community Forestry[1] and the more general topic of decentralized natural resource management are major themes of forest policy worldwide. North American and Western European countries establish local councils to participate in the management decisions of public forests. Experts from developed countries recommend community-based management to developing countries. Rural populations everywhere find the idea of community management appealing, and current political discussions in countries as politically and demographically diverse and geographically separate as Latvia and the Czech Republic in Eastern Europe; Colombia and Mexico in Latin America; Burkina Faso and Mali, Zambia, Tanzania, Botswana and Zimbabwe in Africa; and Indonesia, the Philippines, and Vietnam in Asia debate its merits.

In the last two decades, Zambia has put in place policies and legislation aimed at decentralizing natural resource utilization and management responsibilities to local structures and communities and user groups. The pioneering programs started with community wildlife management in the mid eighties and later spread to forest management. Government's commitment to natural resource decentralization programs is clearly evident and frequently echoed at several forums that:

> "There is need for the central government to reduce its role in the direct ownership and management of natural resources as per the dictates of the current government policy of decentralization. Since the effective manager is not the government official but the small farmer, bee-keeper and hunter, sustainable natural resources management can be achieved by increased devolution of responsibility for natural resource management to local authorities and communities. The role of government would largely remain that of formulating policy, monitoring and enforcement of sound resource use practices and improving incentives that encourage greater efficiency in resource use and regulation*" (extract from the speech by the Vice President of the Republic of Zambia, Lt. Col.*

[1] The terms social forestry, community forestry, joint forest management are used synonymously and interchangeably.

Christon Tembo, on the occasion of the official launch of the Environmental Support Program, 5th February, 1998 in Lusaka).

The countries disappointing failure of centralized management to stir sustainable use and management of forest resources in the country has further been reinforced by government's realization that it neither posses the financial, personnel and administrative capabilities to sustainably manage forest areas all by itself. Fundamental policy and legislative changes have since been made by repealing the Forest Bill of 1964 and 1974 and putting into effect a new Forest Bill and Forest Policy. Both the forest policy and forest bill aims to specifically encourage the private sector, Non-Government organizations and local communities to participate in the management of public forests. Although a clear policy and legislation is in place and JFM programs are being piloted in four of the nine provinces of Zambia modalities for effective implementation JFM programs are yet to be refined.

A number of factors obviate the concern for sustainable local forest management in the developing World. From the governance perspective, complexities in indigenous forest management arise from several factors that are intrinsically embedded in the very nature of forest resources, the nature of rights of access among different interest groups targeting different forest values and the nature of forest benefits and costs. The interaction of these factors generates conditions that make forest governance a highly contested and interest-laden political process. The slow growth of tropical trees and the multiple benefits (which are often incompatible and rival in nature) that are derived from tropical forests, which are also important long-term repository of wealth that is at the same time easy to liquidate, make forest management particularly difficulty for most governments. Forest governance problems in Zambia are compounded by the fact that those multiple benefits and costs of forests involve market and non-market attributes that span across subsistence, commercial and environmental (local and global) interests. Moreover, whereas some aspects of forest benefits can be compensated and restored, many others are irreversible once developed. In Zambia, forest governance institutions face additional challenges of managing private activities or extractions on publicly owned forests on the one hand and the insecure rights of access to forest resources by the poor for whom those forests is most critical. This complexity puts forest governance in wider frame of reference, as a sector of important insight on the theme of public governance.

Although decentralized management of local forests appears attractive success is not easily achieved. In fact, most developing countries lack much formal experience with decentralized management of public forests and the evidence of its success is mixed-with some great successes and some significant failures. Nonetheless, depending on institutional arrangements and the characteristics of agents (users, stakeholders) and physical characteristics of the forest resource, community forestry can potentially contribute to sustainable management and community welfare. Although these characteristics or features vary from one country to another and across communities and user groups, Dangi and Hyde (2002) observe that community forestry will have the greatest impact on sustainable management and welfare when: *i)* forest resource values at risk exceed some critical level of importance to local users, ii) the conflict between local user groups is minimal; *iii)* the cost of local management are low but returns are rapid; and *iv)* the transfer of rights to the community is simple and complete. These characteristics have been observed in many field and laboratory environments (Ostrom, 1990; Ostrom et al, 1994; Campbell et al, 2002; Dangi and Hyde, 2001; Twyman, 2000; Dayton-Johnson; 2000) but the

empirical evidence on many of these is less conclusive. Moreover, while some scholars posit that poor villagers, compared to non-poor households, are more dependent on forest resources as sources of safety-nets and sustenance, in absolute terms, their dependency and impact on forest conditions is much lower than that of the non-poor households. Nonetheless, the characteristics of dry forests and woodlands and high levels of rural poverty create unique conditions which determine the importance of indigenous forests to local livelihood activities and the development process of rural economies. The empirical evidence of the impact of dry forests to household income is mixed (Campbell *et al,* 2001). This investigates the determinants of collective action in community forestry and the contribution of forest products to rural household income in Zambia.

2 STUDY SITES, DATA COLLECTION AND METHODS OF ANALYSIS

Joint forest management program in Zambia was first piloted in three provinces; Luapula, Central and Copperbelt provinces. JFM program is intended to facilitate the transfer ownership and management rights of local forest reserves from government to local communities. The program also encourages local communities to bring more open access forests under community or joint management with others stakeholders (government and private sector). Some open forests have already been surveyed and demarcated for JFM. These new forest areas intended for community management include Nyampande Open Forest Reserve in Eastern Province. This study targeted two of the three JFM pilot provinces namely Luapula and Central provinces and one open forest (Nyampande Open Forest) in Eastern Province. Three communities living around three local forest reserves in Central Province and two others in Luapula Provinces were purposively selected for the survey. In order to capture regional variations and forest utilization patterns and differences in forest conditions we included in the sample Nyampande Open Forest reserve. We anticipated that local participation to vary across the landscape and forest communities. In addition, differences in social and physical infrastructure and proximity to urban markets determine to some extent the livelihood strategies pursued and specifically how and what forest products are harvested both own consumption and for sale.

The study unit was a household and household heads or their spouses if married were interviewed. In addition, focus group discussions where held with VRMC and traditional leaders in all forest areas covered by the study. These focus group discussions provided useful information on local participation in community projects, agro-forestry programs and on existing traditional land tenure and resource governance systems. In total, six forest communities were included in the study, of which five were from the PFAP JFM pilot areas and one was an open forest reserve. Open forest reserves are not local forest reserves; they are open forests which have been demarcated for community management. These six study areas are located in five districts in three provinces and capture a diverse socially diverse and ecological heterogeneous landscape.

2.1 Local forest reserves

This section briefly describes the main features of the five forest reserves sampled. Mwewa forest reserve (2,066 ha) is located north of Samfya district while Lukangaba forest (7,163 ha) is located in Mansa District. Myafi forest reserve is almost the same size as Mwewa forest reserve and occupies 2080 hectares land, of which 80 ha is planted with exotic trees. This forest is located southwest of Mkushi district in Central Zambia. The forest is intact with average

stocking of 107.8 m^3/ha and has over 68 different plant species measuring at least 7 cm Dbh (i.e. diameter at breast height) (PFAPII, 2002).

Chibwe forest reserve is located in Kapiri-Mposhi District in Central Zambia. The forest reserve was established on 48,780 ha of land acquired from customary authorities in 1957. About 75% of this forest reserve land has been degazetted and converted to agriculture and human settlement. The remaining 11,837 ha is well stocked with over 650 plant species. The main reason for setting up this forest reserve was to ensure sustainable supply of timber to the Mine and fuelwood to mine workers. The Great North Road and a rail line that connects various parts of Zambia and to its neighboring countries pass through Chibwe forest reserve. Sustainability of this forest will largely depend on effective management and on government policy and political will to discourage conversion to other competing land uses.

Chaba forest reserve is another unique forest that requires quite different management approaches. It is located on prime agricultural land in Mkushi Farming Block east of Mkushi district. Prominent commercial farmers who compete for different forest uses surround this forest reserve. The forest provides habitat to a significant population of wildlife and is critical to the local watershed and also to the prevention of soil erosion. The forest is highly valued for game ranching and eco-tourism, livestock grazing and for its wood and non-wood forest products (NWFP). Local communities are located at the periphery of the forest reserve and value the forests for fuelwood, construction poles and other Non-Wood Forest Products (NTFP). Due to conflicting forest user interests, efforts to manage the forest reserve at the local level have proved difficulty and adaptive and innovative participatory management systems are currently under development.

As one would expect open access forests are not as well stocked as well managed local forest reserves. The Nyampande Open Forest was demarcated for JFM only recently and although it has never been formally managed the forest is well stocked with valuable timber and other forest products. Cutting of hardwood timber from surrounding open forests was evident and substantial income results from this activity in addition to other non-destructive subsistence forest uses. In general, all the sampled forest areas are ecologically stable and fairly well stocked, but most tree species have low timber values.

2.2 Data and methods

A survey was developed, pre-tested and administered to residents of randomly selected sparsely populated villages, some of which comprised less than 20 households. This feature of rural settlements made data collection a time consuming exercise and costly exercise. It also raises the cost of organizing households and may hinder collective action[2]. Research assistants were recruited and trained to help conducted face-to-face interviews with local communities. All the assistants were closely supervised throughout the data collection process. District forest officers accompanied and introduced the research team to VRMC who in turn introduced us to

[2] In view of this, the department of forestry and its cooperating partners purchased bicycles for each VRMC in Luapula province (Lukangaba and Mwewa forest reserves) to enable communities to organize and attend meetings with district forest officers more regularly. We were pledged to use these each more distant villages in Mwewa forest reserve were we faced transport problems.

households. This encouraged households to truthfully respond to the survey but still some households under-reported illegal harvesting of wood for timber and charcoal production.

A total of 289 households were interviewed. Of these, ten surveys were incomplete and therefore discarded. Twenty four (24%) percent of valid responses were collected from communities leaving around Chaba and Myafi forest reserves, 26% from Lukangaba and Mwewa forest reserves and 28% and 22% from Nyampande Open forests and Chibwe forest reserve respectively.

The survey captured demographic and socio-economic characteristics of rural peasant farmers, their dependency on and use of forest resources, existing institutional settings they use to resolve social dilemmas, the number of community organizations and level of community and individual participation in community projects. This information enabled us to analyze how prior organizational experience affects the level of participation and collective action in local forest management. Positive organizational experience (an aspect of social capital) provides fertile grounds for local mobilization, participation and cooperation in other social spheres. The survey contained in addition a series of contingent valuation questions eliciting information on willingness to participate and to contribute financial or material resources towards local forest management. Ecological and inventory data was collected from the Forestry Department's inventory assessments surveys and forest cover satellite images. This data is yet to be analyzed and is not presented in this report.

Statistical analyses are used to compare and contrast six JFM areas in terms of forest conditions, forest utilization and management and how this is affected by household and community characteristics and institutional and organizational attributes of forest communities. This information was important for understanding community overall needs and how local forests and woodlands contribute to individual and collective welfare. Households were asked to indicate the type of local organizations operating in their communities/villages and to list those for which they are members. Additional information was collected on community projects accomplished and period of time these community organizations have been in existence. Based on this data, a proxy index of organizational intensity and prior organizational experience of villagers was computed.

Information on ethnicity and religious affiliation was collected and used to create an index of socio-heterogeneity. Respondents were asked to indicate, on the scale of 1 to 5, the condition of open access forests and the local forest reserve and to compare them using the rank for the latter as a reference point. Information on membership to Village Resource Management Committees, attendance levels and household willingness to contribute financial and material resources for local forest management was collected. Design features of the draft JFM guidelines, including revenue allocation mechanisms, were discussed during focus group discussions with VRMC and with traditional leaders.

Information from a participatory rural appraisal (PRA), focus group discuss and information from key informants was used to examine among other things local interests in local forest management, what communities expect from JFM and the level of local cooperation and compliance with existing government and traditional regulations governing access to and utilization of forest resources in the area. Both statistical and econometric techniques were used to conduct the analyses and to test several hypotheses.

3 THEORETICAL FRAMEWORK AND EMPIRICAL MODELS

3.1 Theory of collective action

The key issues that surround deforestation and forest degradation and rural livelihoods can perhaps be described by looking at collective action aspects of human management of forestland. Collective action refers to concerted actions of people that share a common interest, perceive that interest and act to achieve it (World Bank, 1998). Collective action is an important mechanism for coordinating individual resource users towards achieving socially accepted outcomes by assigning management responsibilities that correspond with simple and complete ownership rights.

We can conceptualize the challenges of motivating collective action in JFM and common pool resource (CPR) management in general by analyzing the supply and demand side problems associated with a CPR. From the supply side, we face the general problem of ensuring efficient provision of (local) public good aspects of the forest among different users. On the demand side, we face two fundamental problems: Firstly, we face the problem of defining and assigning property rights to forest users. Heterogeneity of users, diversity of local preferences and the multiple goods and services forests provide make the assignment and enforcement of property rights particularly difficult and increasingly beyond the capacity of most traditional governance systems in Sub-Saharan Africa. Secondly, harvesting of forest products from a communally owned forest generates appropriation externality problems. Resolving the externality problem requires a careful design of incentives and enforcement mechanisms intended to promote cooperative behavior and compliance. Such a design must be based on a comprehensive understanding of both household economics and socio-cultural dynamics of the community. Determining how the burden of monitoring and enforcement and benefits from joint management ought to be distributed across user groups is non-trivial in community based management programs in developing countries.

All societies, including modern ones, depend on self-enforcement, customary law and value systems to prevent the general conditions of open access and destructive individual wealth seeking behavior (Eggertsson, 1990, p.285). Voluntary enforcement and voluntary agreements result from numerous dimensions of collective action processes. Schelager and Blomquist (1998) identifies two major dimensions or concepts: (a) jointness in production, which refers to the number of agents and their positions (influence, resources of actors, authority etc) that are explicitly or implicitly embraced in the collective arrangement and; (b) the notion of captuarability, which refers to the ability of cooperating partners or actors to capture sufficient benefits to make their collective endeavor worthwhile.

The number of agents or actors is particularly important for stimulating collective action. If only few actors need to cooperate in order to produce sufficient collective benefits, then the number of actors in the cooperative arrangement should be small; otherwise the capturability requirements will be violated. Similarly, there are cases when a large number of actors is required in order to produce community benefits. The key idea is that the optimal number of actors must be consistent with the amount of individual and community benefits expected from managing the

resource collectively and that these benefits must be fairly rapid. For instance, community rights might be less effective in managing natural forest for timber than would individual property rights. In other cases, the former might be more suitable for non-timber forest products for community benefits than individual property rights. In addition, production of collective benefits may also require participation of certain key actors. Campbell (2002) concludes that inclusion of traditional leaders in decision-making is important for successful community based NRM in Southern Africa.

The opportunity for actors to capture benefits of collective action enough to offset the cost of their production may be the key motivation for cooperating. Several factors affect individual's ability to capture benefits from collective action. Capturability of collective benefits may be hampered by institutionally created heterogeneities among users. Schelager and Blomquist (1998) categorize these into pricing, property rights, and political power heterogeneities[3]. Pricing heterogeneities may arise from pervasive government fiscal and pricing policies such as taxes and subsidies which create incentives for some resource users to act in a destructive wealth seeking manner and as a result creating general conditions of open access and subsequently weakening voluntary compliance. In the same vein, property rights and political power heterogeneity can create conditions antithetical to collective action and compliance with formal and informal rules governing resource use at the local level. Whether and how institutional heterogeneity impacts collective action and JFM programs is an empirical question.

The evidence on whether heterogeneity of resource users impedes or facilitates voluntary agreement for resolving common pool resource is mixed (Olson, 1965; Schlager and Blomquist, 1998; Carpenter, 2000; Johnson, 2000). Olson (1965) urges that heterogeneity can facilitate cooperation when some resource users in the community value the common good (i.e. soil erosion and watershed protection) enough that they are willing and able to provide it in spite the actions or inaction of the remaining group. In this case, heterogeneous users would be more successful than homogenous groups in organizing and acting cooperatively, and perhaps more effective in managing forests for local public goods. Olson however suggests that wherever heterogeneity presents insurmountable constraints to achieving cooperative action the collective approaches to resource management may be too costly and less effective in promoting voluntary enforcement.

It might be difficulty in some cases for individuals in extremely different positions (i.e. rich and poor, ethnically diverse or from different caste systems, etc) to participate in collective action let alone bargain about how benefits and cost of managing a natural resource collectively ought to be shared. Such heterogeneities can potentially impede collective action. For instance Kant and Berry (2001) argue that where such heterogeneities are pronounced and local communities are less dependant on forest resources for sustenance, such forests may be managed efficiently under State or private regimes. And also that if the forest resource is leased out to private companies but local communities are heavily dependent on those forests or some aspect of it, a joint forest management contract between the local communities and the private company may be more appropriate and effective. Which of these descriptions fits the Zambia's forests is subject of empirical investigation. Some forests will fit some organizational description while other will not and one-size fits all approach will not encourage long term community participation and sustainable management in all forest areas. In many open access forests, joint management

[3] Reader is referred to Schelager etal (1998) for details.

between government or government state agencies like the Wildlife Authority and local communities may be appropriate since most local communities are not ready at the moment to take up full responsibility over local forest management.

Paradoxically, neoclassical economic theory sometimes fails to explain what motivates individual behavior in collective action (Fehr and Gachter, 2000; Henrick etal, 2001; Carpenter, 2001) and questions the importance of economic verse vice non-economic incentive in promoting collective action and compliance. Non-economic factors including social approval, procedural and outcome fairness, and reciprocity and trust continue to be investigated in an effort to explain these paradoxes in human behavior so evident in the collective action literature. Gachter and Fehr (1999) conducted experiments to investigate whether social sanctions have important economic consequences, particularly in motivating collective action and voluntary cooperation. He found that with minimal social familiarity, approval incentives improve the level of cooperation. However, the source of social approval may be as important as familiarity in inducing voluntary compliance. Other investigators (Smith, 1998; Achelson, 1988 quoted in Sutinen etal, 1990) suggest that the same can be achieved when reciprocity consideration leads to the emergence of an elaborate rule system that encourages voluntary compliance. Fehr and Irlenbusch (2000) indicate that pure unilateral fairness considerations often over-shadow reciprocity in inducing cooperative behavior and compliance. Trust can also be a powerful means of reducing transaction cost of reaching an agreement, enforcing and monitoring formal and informal resource management rules although it does not necessarily mean that trust will reduce transaction costs and promote efficiency in all cases[4]. Williamson (2000) suggests that although everybody prefers provision of public good to lack of it, lack of trust preclude the incentives to contribute to its provision since everybody fears that others will defect and not contribute. Although the prescription would be to build trust in communities where this is lacking the transactions cost associated with this action may out weigh its benefits suggesting that other institutionalized means of ensuring compliance may be more appropriate and should be explored.

Although far from being exhaustive, this discussion suggests that formal and informal rules are important in collective action. Coarse (2000) emphasizes the point that changing formal rules alone is a very blunt instrument for trying to change the way society works, and that with appropriate enforcement mechanisms, norms of behavior that evolve overtime may be inconsistent with formal rules and may produce chaotic results. Institutional design for community based management of natural resources that have traditionally be subjected to open access or even different management regimes need to balance formal and informal rules in order to succeed. In addition, economic conditions of users and physical characteristics of the resource interact to produce different effects on incentives for compliance (or non-compliance) with internally and/or externally enforced rules (see Sutinen etal, 1999 for a discussion).

Inamdar etal (1999) indicates that local communities or user groups reject conservation programs whose transaction costs of managing and monitoring an ecologically fragile resource exceed perceived benefits. Therefore, it is insufficient to just understand the characteristics of user groups in terms of social cohesion and solidarity, trust and fairness, and other economic and institutional determinants of cooperative action but also to understand how all these factors interact with forest resource characteristics to produce environmental and welfare outcomes. In

[4]Levi (2000) provides a detailed discussion of trust, lack of trust and distrust and how this may impacts transaction costs of organizing and efficiency.

addition, the transaction cost function defined in terms of the cost of coordination and exclusion is important for analyzing and recommending from a continuum of forest regimes, ranging from open access to private property, those that are optimal for each set of specific conditions. Studies that examine and analyze exclusion and coordination costs associated with different resource regimes are particularly rear in the literature (Kant, 2002). Analysis of costs borne by local communities participating in joint forest management regimes is taken up in a separate paper. In this paper, we begin discussing theoretical foundations of community forestry management and then analyze the determinants of effective collective forest management among agrarian communities in Zambia.

3.2 Theoretical basis for local forest management

In this section we discuss some theoretical issues underlying the advocacy for community forestry using the Von-Thunen conceptual framework of rural landscape. Consider some homogenous landscape with a local community located at the center O in figure 1 below. The horizontal axis measures distance from the community center or market while the vertical axis measures the value of land employed in agriculture and forestry at any distance. The value of agricultural land (Va) is a function of farm-gate prices of agricultural products. Prices in turn depend on accessibility or transport cost to the community center or market. All households and firms face homogenous inputs with cost of access being the only factor explaining the difference in production costs. In this case, land value in agriculture (V_a) decreases with decreasing access. As the distance to the market increases, agricultural land value function eventually falls to zero at point C.

Beyond this point, no single farmer will find it profitable to invest in agriculture because the cost of secure property rights exceeds returns on any agricultural investment on the land. This description also applies to the forest value function (V_f). Households and firms will protect their ownership rights, crops and livestock at some cost. Secure property rights on agricultural land and property is feasible and enforceable for land in the region O-A_1.

Although households still take advantage of forest resources in the neighborhood of O-A, investment in them is unprofitable due to high cost of establishing and enforcing property rights on them. As a result, land in the neighborhood of OA_1 is often used as communal grazing land and for collecting of timber and non-timber forest products under open access.

At the early stages of rural development, forest products; construction timber, mushroom, firewood, edible caterpillars etc; are plentiful and commands no price (i.e. the shadow value of the resource is zero) and as a result the forest resource is subject to over-exploitation and degradation. As the neighborhood forest becomes degraded, forest products become scarce and therefore economically valuable (i.e. the shadow price exceeds zero) and the forest value gradient shifts outwards to Vf_2 from Vf_1.This shift increases land under enforceable property rights from A to A_2, and the local community can use this additional land either for plantation forestry, agro-forestry or indigenous forest management. Households will still continue to collect forest products in the region to the right of A_2 up to a point such as D where the value of forest

Figure1: Rural agricultural and forest land and property rights

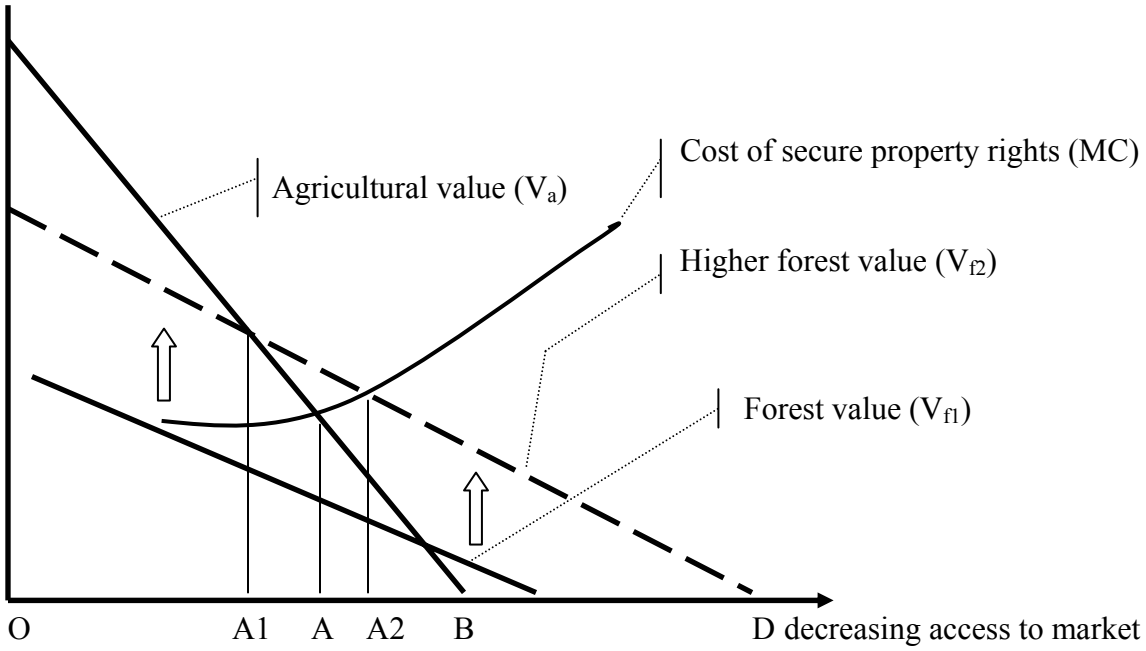
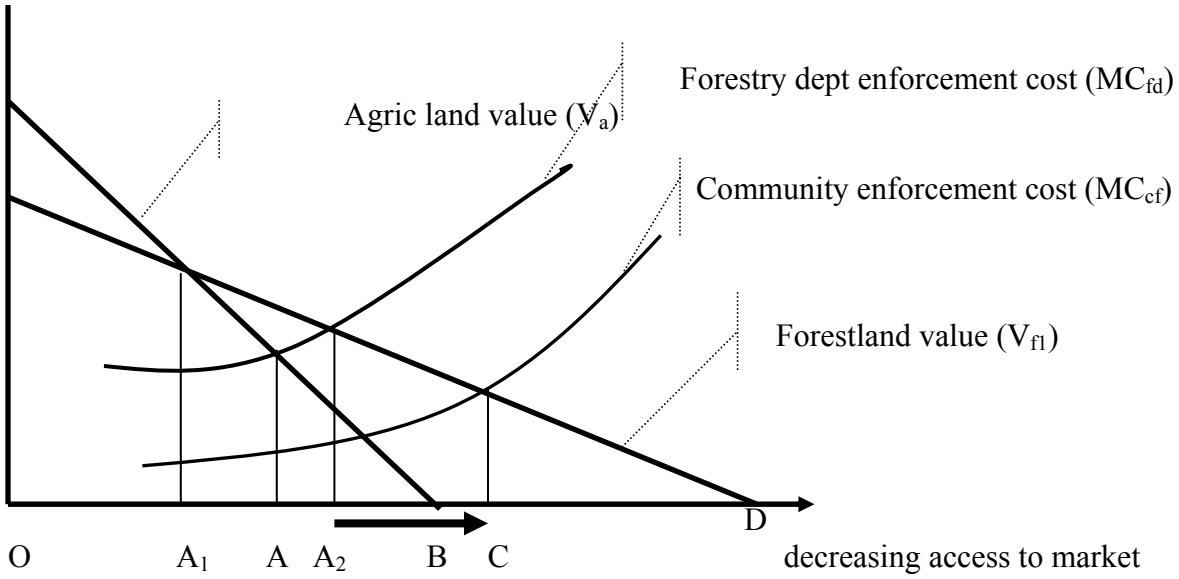


Figure 2: Advantages of community forestry

Land value



a product collected is just equal to the cost of its collection. This general description illustrates a key point that while some private forest management is possible; households still rely on open forests for additional forest products for own consumption and for sale. It is at this point that we begin to examine community or Joint Forest management and discuss its advantages basically for any community that fits this theoretical description.

Most natural forests are located on customary lands sounding local communities and far from government local and central offices, a feature that makes government an 'absentee landlord'. Moreover, government officers including forest officers at district level will not have the same knowledge about the resource and local community that the local landowner has. This means that local forest management will be less expensive if managed by the local community than by any government ministry—the Forest Department in our case. Figure 2 reproduces figure 1 with two cost functions of indigenous forest management, one for the Forest Department and the other for local community management (JFM). Apart from its potential to reduce the costs of management, local community management also brings more forestland under sustainable management depicted by distance, A_2-C.

It is however important to recognize that not all forestland can be managed sustainably, even under effective community based management. Some forests will still continue to be under open access. In addition, community forestry regardless of its effectiveness cannot manage and protect global and aesthetic forest values all by itself. Protecting these forest values might require putting in place effective management initiatives and programs at national, regional and global level. In addition, local communities are neither capable of protecting community rights nor to effectively sanction norm violators all by themselves. On this basis, government should play an important role in ensuring that community rights are assigned and protected, conflicts are minimized, community awareness and technology is improved and a fair distribution of benefits among community members is effected. In this respect, a more embracing concept of Joint forest management or co-management defined as a variety of institutional arrangements in which the forest resource users and the Government share the management responsibilities is perhaps a more pragmatic approach towards complete devolution of rights to forest dependent communities and user groups.

4.3 The empirical model of collective action in joint forest management

Our empirical strategy is derived from the discussion of the theoretical basis of community forestry and managing some forests at the local level may be more effective than any centralized management. This might only be true when local communities have the right incentives and are interested in managing the forest resource collectively. Local communities are certainly interested in the long term viability of village forest commons on which they are heavily dependent and as such efforts to resolve collective action dilemmas must be mutually rational for the group as whole although individual cooperation is unlikely to be consistent with group rationality. Designing a system of rewards and punishment that encourages individual optimal behavior continue to attract policy and scholarly interest. Based on Wade (1988), Ostrom (1990) and other studies, Baland and Platteau (1996) summarize factors that facilitate successful management of local commons into four categories:

i) Resource systems characteristic including riskiness and predictability of the resources, its physical attributes and resource boundaries;
ii) Group or community characteristics such as groups size, wealth and socio-cultural and economic heterogeneity, and organizational experience, interdependence and social networks;
iii) Institutional factors relating to management rules, norms and sanctioning systems and;
iv) External factor such as technology and markets and external sanctioning systems like governments administrative and judicial system.

The preceding discussion suggests that factors that affect collective action will certainly affect the position of the community enforcement curve and the forest value curve. How much forestland can effectively be managed at the local level depends, to a large extent, on the strength of collective action, which in turn depends on factors that influence the marginal cost and benefits of collective management[5]. We denote all these factors by $X= (x_1, x_2,\ldots x_n)$. Following Gebremedhin et al (2003) we denote collective management by M and specify the forest value and community enforcement cost by B (M) and C (M) respectively. B (M) is continues, twice differentiable and decreasing in M such that $B'(M) <0$; $B'(M) \leq 0$, $B(0) = 0$ and $C(0) = 0$. C(M) is continues and twice differentiable and increasing in M such that $C'(M) > 0$, $C''(M) \geq 0$. The benefits and cost functions are specified in equation (1) and (2)

$$B(M) = aM - bM^2 \qquad (1)$$

$$C(M) = cM + dM^2 \qquad (2)$$

Our interest is to identify factors that shift the forest value and community enforcement costs curves and to use this information to recommend forest characteristics, community attributes and resource characteristics that best satisfy the criteria for sustainable local forest management in a rural setting. Since changes in the X variables shift the intercept of the forest value and community enforcement cost curve, we substitute **a** and **c** by (X+e) and (X+u) respectively, where e and u captures random errors including measurement errors, to obtain equation (4) and (5)

$$B(M) = (X+e)M - bM^2 \qquad (3)$$

$$C(M) = (X+u)M + dM^2 \qquad (4)$$

Differentiating (3) and (4) with respect to M yields the marginal benefits and cost of collective management given by (5) and (6).

$$\frac{\partial B(M)}{\partial M} = \alpha X - 2bM \qquad (5)$$

$$\frac{\partial B(M)}{\partial M} = \delta X + 2dM \qquad (6)$$

[5] For a review of determinants of collective action see Wade (1988), Baland and Platteau (1996) Ostrom (1990) and more recently Agrawal (2002) and Bardham and Johnston (2002); Johnston (2002); Johnston and Bardham (2002); Heltberger, (2002) among others for empirical case studies and walker et al, (2000), Chermak and Krause (2002); Cardenas (2002) and others for experimental evidence.

Equating 5 and 6 and solving for M yields optimal collective management as a function of a vector of exogenous variables X: **b, d, α,** and **δ** are parameters to be estimated.

$$M^* = \frac{(\alpha - \delta)X}{2(b+d)} \qquad (7)$$

In order to determine the impact on M* of x_i ($x_i \in X$) we examine comparative statics of equation 7. Differentiating (7) with respect to xi yields (8).

$$\frac{\partial M^*}{\partial x_i} = \frac{\alpha_i - \delta_i}{2(b+d)} \cdots\cdots \begin{matrix} < 0 \text{ if } (\alpha_i - \delta_i) < 0 \\ > 0 \text{ if } (\alpha_i - \delta_i) > 0 \end{matrix} \qquad (8)$$

where i=1, 2…. n and indexes x_i in X. In the section below, we specify an econometric model of collective action and discuss the choice and expected signs of explanatory variables.

As noted in the literature not all relevant factors can be fitted in a single model without encountering estimation problems (Ostrom et al, 2002). As such, only key variables enter the final estimable model. We have attempt to chose variables that are specifically relevant to this case study, choosing at east on variable from each of the five categories presented above. Questions relating to the impact of local forest management on forest conditions are presented in the subsequent paper. We estimate the following econometric model of collective action.

$$M_i = \alpha_{i1} + \sum_{j=2}^{n} \beta_{ij} \ln X_{ij} + \varepsilon_i \qquad (9)$$

Where member, α_{i1} denote community dummies, X_{ij} is set of explanatory variables including the index of organizational intensity, individual organizational experience, hectares planted, livelihoods activities, socio-cultural heterogeneity (ethnicity, religion,) age, Gender, household size, wealth inequality, forest condition, and ε is the error term. M is the dependant variable defined as the amount of labor household contributes to monitoring and enforcement and *i* and *j* indexes communities and individual variables respectively. Three measures of collective action: (i) the amount of labor households pledge to contribute to enforcement and monitoring activities in the forest reserve in the village; (ii) stated household monetary contribution to village resource management committee (VRMC) for forest management; and (iii) active membership and participation in VRMC and/or other community based projects are alternative measures of collective action. In this draft report collective action is defined in terms of household labor contribution to local forest management.

5 EMPIRICAL RESULTS AND DISCUSSION

5.1 Descriptive statistics and household socio economic characteristics

Table 1a and 2a in the appendix summarizes socio-economic characteristics of households by forest area. Almost all communities surveyed have stable populations with low inward and outward migration. Over 70% of the people interviewed have stayed in the same village for more than 10 years and only 5% migrated from other regions/provinces to settle in the area in the last five years. A stable population provides grounds for developing durable institutions for

managing common pool resources, makes the identification beneficiaries and design of incentives slightly less complicated.

Millions of poor people in Saharan Africa are dependent on forests and woodlands as sources of subsistent food and household energy, but the degree of dependence is greatest among women and children (Kaimowitz, 2003)[6]. Our sample comprises 54.5% and 45.5% female and male respondents respectively. Of these, 77% are married and 23% are single, separated or widowed. Although no significant differences in age distribution and household size were observed across study sites, the average land cultivated and planted, systems of cultivation and household assets remarkably different across settlements. No significant variations in household ranking of different forest products and forest utilization across settlements and by gender were observed, except that male respondents ranked timber and construction poles highest followed by fuelwood and wildfood. Those forest dwellers engaged in charcoal production for sale ranked fuelwood highest on the list of forest products they considered important to their livelihoods. As expected, poorer communities (Mwewa and Myafi) appeared to be relatively more dependent on forests as sources of safety-nets than as a source of household income although this is expected to change as local village groups embark on bee-keeping projects to generate additional forest income.

Chibwe has another interesting contrast. First, its residents derived substantial forest income from charcoal and timber and collection of wild honey. Second, even though this community had the largest number of NGOs operating within the community, was ranked second highest in terms of organizational intensity and was the wealthiest of all forest community surveyed, it had the lowest labor contribution and the least interest in local forest management. This is however not surprising because wealthier households tend to have higher implicit wage rates (i.e. high opportunity cost of labor) than poorer ones. The decision by a donor agency which supported the forest management program to pull-out of the area in preference to new pilot programs in Southern Province dampened local interest in joint forest management in the area[7]. It was apparently clear from group discussions (and information from key informants) that illegal and unsustainable harvesting of wood for timber and charcoal production from the forest reserve have since increased. These new forms of failures, which we refer to as "Donor Failure" must be minimized as much as possible by ensuring that donor funded projects in natural resource management are sustainable and receive popular support from local communities and user groups.

Subsistence agriculture is a major source of employment for over 90% of the households interviewed in Lukangaba and Mwewa forest reserves. These households practice slush and burn cultivation (referred to as chitemene system) and grow some of their crops on village gardens or small farms. Chitemene system is highly dependent on availability of trees and contributes to forest degradation in communities or forest areas where the population density is high. However, chitemene system of cultivation continues to be an important substitute to modern fertilizer-based agriculture among poor households who cannot afford chemical fertilizer.

[6] Dependency on forest products for subsistence and as a source of household income will be estimated for each community once data analysis is completed.

[7] This is perhaps the second most visible case of donor failure in community natural resource management in Zambia after Luangwa integrated resource management project (See Wainwright and Wehrmeyer, 1998; and Bwalya, 2003; for details).

Dependence on open forests and woodlands for wild food (i.e. honey, mushrooms, tubers, berries, etc) and for fuelwood and construction poles is quite visible in all community members. Approximately 16% of the household interviewed are highly dependant on charcoal and firewood production for sale (mainly residents of Chibwe and Lukangaba forest reserves) and another 11% harvest forest products (thatching grass, mushroom, berries and wild honey) for sale in nearby rural markets. Semi-formal employment in agriculture and forestry sectors and other forms of non-farm employment is estimated at 13 % and 4.3% respectively. The average household income derived from forest products (mainly hardwood timber) is highest among residents of Nyampande (approx. US$900 per household per year) followed by Chibwe residents (US$ 450) who derived forest income from fuelwood, timber, wild honey and thatching grass which they sell to nearby tourist operators/lodges. Mansa, Myafi, Chaba and Mwewa received the least income from forest products in that order. Among the forest areas surveyed, Open Nyampande forest had more valuable stocks of timber trees in open access forests. Because of proximity to urban and peri-urban markets, charcoal production for sale was an important source of forest income only in Chibwe and Lukangaba. Unfortunately, over 80% of the charcoal produced for sale was unlicensed and hence illegal[8].

Land allocation systems are quite elaborate in all the study areas and land disputes are rare. Over 90% of those interviewed acquired land from traditional rulers or through inheritance and only 5% acquired land through other means. Customary courts settle intra-household land disputes while the local government intervenes in land disputes between traditional leaders and communities.

5.2 Rural livelihoods and rural household income

In this section, we discuss community livelihood strategies and household sources of income and in particular the contribution of forest income to total household income. We present indicative estimates of household income by source and how these vary within and across forest communities. Subsistence agriculture appears to be the major source of employment and livelihood for many households. Over 95% of the residents interviewed in Lukangaba forest area practice slush and burn cultivation (hereafter Chitemene System) and cultivate village fields, where cassava is grown together with groundnuts and other relish crops. Households who can afford chemical fertilizers grow maize on relatively larger scale producing enough for own consumption and a surplus for sale. The prominence of chitemene system of cultivation and cassava cultivation contrasts communities in Luapula Province from those in Central and Eastern Provinces. In fact, the Ministry of Agriculture and Cooperatives encourages cassava cultivation, a drought resistant crop, in all those areas experiencing persistent droughts. Any surplus maize, cassava, beans and groundnuts is sold for cash or exchanged for consumer goods.

Chitemene system has a long standing socio-political history of Luapula and Northern Provinces of Zambia. The purpose of this brief discussion is not to provide a full account of the chitemene system and the environmental issues associated with it, a topic well covered by Moore and Vaughan (1994), but to emphasize the intricate relationships that exist between forests and woodlands and chitemene cultivation. Perhaps even more important is the land tenure system that accompanies chitemene cultivation and specifically how chitemene fields are allocated

[8] A lot of grey areas exist in charcoal licensing policy and these policy inadequacies encourage illegality and non-compliance.

across households and generations. The governance structures for allocating chitemene field in Lukangaba and Mwewa forest communities provide useful insights for understanding local land tenure systems and its implications for sustainable local forest resources by different income groups and by gender.

The important lessons learned from informal discussions with villagers in Lukangaba and Mwewa forest communities in Luapula Province suggest that allocation of chitemene fields, which are located in open forests, follow some form of ancestral rights which are transferred from one generation to another within a family or clan. In contrast, people in other study sites (communities in Myafi, Chaba and Chibwe, and Petauke in Central and Eastern Provinces) do not practice chitemene cultivation. Households in Chibwe local forest area grow maize and sweet potatoes and few other stable crops. Charcoal production is the major source of household income contributing over 70% of the income villagers earning. However, subsistence agriculture still remains the major source of rural livelihoods and employment for many households in these community forests.

Most residents in Open Nyampande forest reserve in Petauke district (Open Nyampande forest reserve) grow maize and few cash crops such as cotton and sorghum. Cotton production is supported by cotton merchants through cotton out-grower schemes. A cotton out-grower scheme is an arrangement between cotton merchants (firms) and local farmers whereby the former deliver inputs to local small scale farmers to grow cotton which upon harvest is purchased by the same merchants who supplied them with inputs. This arrangement enables cotton merchants to recover their input loans from cotton farmers while at the same time establishing trust and creditworthiness on both parties. These out-grower schemes help farmers to diversify agricultural production and farm income. In fact, evidence from this study indicates that over 20% of agricultural households in the area earn more income from cotton and sorghum production than from any other crop. We find that over 60% of households in Nyampande open forest receive over 80% of their income from agricultural production averaging K1, 600,000 per household per year. Although income from forests, mainly hardwood timber, is on average twice more than agricultural income, forest income supports only a meager 10% of the local population in the area.

The relationship between wealth accumulation and forest income is one of the most debated topics in the forest income accounting literature. It is often urged that the pattern of forest utilization and forest values targeted depend on household ability to harvest, add value and market forest products. What this means is that those households with larger endowments of wealth are more likely to acquire materials and tools for harvesting and processing timber and non-timber products than poor households. Whereas the latter depend on forests and woodlands as a source of commercial income poor households exhibit a different kind of dependency—they look at forests as important sources of safety-nets in hard times and subsistent foods, medicine and materials (construction poles and fuelwood) and other environmental services such as protection of soil erosion and watershed protection. Because of these differences in perceptions and forest use patterns the kind of forest livelihood activities undertaken by different income groups will tend to vary and so will be the impacts on forest conditions of their harvesting decision.

Figure 3: Household wealth as percentage of wealth held by the richest household

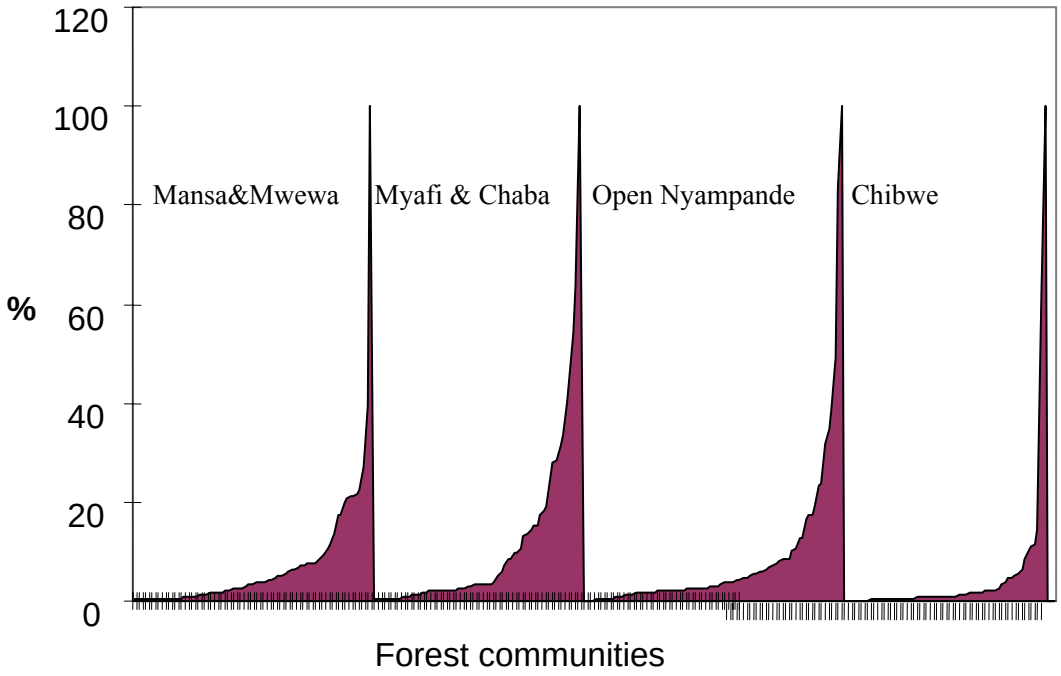


Figure 3 shows household wealth as a share of wealth held by the richest household in the area. Significant differences in wealth accumulation across households and forest communities exist and that wealth inequality[9] also varies by gender of household head.

For instance, the percentage of people with assets 10 times that of the richest household range from 72% in Myafi and Chaba to 80% in Open Nyampande (Petauke), Lukangaba and Mwewa forest reserves and further to 92% in Chibwe forest reserves. Although these differences are not dramatic, wealth appears to be more concentrated among fewer households in Chibwe than in Myafi and Chaba forest communities. However, this comparison holds only in relative rather than absolute terms.

Table 2 below illustrates the distribution of household wealth within and across forest communities. Ostensibly, households in Mwewa forest reserve had the least accumulated wealth and the largest proportion of the poor (80.8%). In contrast, Chibwe forest community had the second largest proportion of the households falling in the middle income category (41.9%) after Lukangaba (34.5) but had the highest proportion of people falling in the high income category (27.4%). On aggregate, 51%, 31.5% and 17.2% of the sample are in low, medium and high income categories respectively. What is evident from this analysis is that while Chibwe forest communities had the highest stock of household asset, these assets were distributed quite equitably across households. We also found statistically significant regional differences in household accumulated wealth [$\chi_{(10)}$=24.36, p-value =.007)]. There are a lot of factors which

[9] One measure of wealth inequality, the Gini-coefficient, was calculated at .30 using data on household assets. This figure is much than 1996 national average of .514.

explain these disparities; the obvious ones being proximity to urban markets and differences in the quality of roads. Wealth accumulation may be related to the type of people who have over the years settled in these forest areas. For instance, there are relatively more retired (miner) workers who have settled around Chibwe forest reserve with high endowment of physical assets acquired while in formal employment or open retirement. These households also reside in better houses than a typical villager.

Table 1: Distribution of household wealth by forest communities

area or forest reserve	Income group			Total
	low	middle	high	
Lukangaba (Mansa)	53.2%	34.0%	12.8%	100.0%
Mwewa (Samfya)	80.8%	15.4%	3.8%	100.0%
Myafi (Mkushi)	64.9%	21.6%	13.5%	100.0%
Chaba (Mkushi)	55.6%	25.9%	18.5%	100.0%
Open Nyampande (Petauke)	48.8%	33.8%	17.5%	100.0%
Chibwe (Kapiri-Mposhi)	30.6%	41.9%	27.4%	100.0%
Total	51.3%	31.5%	17.2%	100.0%

Source: Authors own calculation based on survey data

Notes: (1) $\chi_{(10)}$=24.36(.007). (2) Income groups are defined by household accumulated wealth. The low income group had wealth less than ZK1500, 000; the middle income group between ZK1500, 000 and ZK2, 500,000 and high income group ZK2, 500,000.

5.3 Contribution of forest products to household income

Forests and woodlands are important source of wild foods, fuelwood, fodder and forbs for livestock, medicines and other materials. While sustainability of most rural livelihood activities depends on the availability of forest products and services, the degree of dependency of forests is hard to estimate partly because of the diverse nature of forest products and services and the difficulty of quantifying non-market forest values. However, attempts are increasingly being made to estimate the contribution of dry forests and woodlands to local livelihoods and income in Southern Africa and in other forest resource rich developing countries. These estimates of dependency by income group have produced mixed results, some indicating that poorest households are more dependent on forests than the moderately poor and the rich (Cavendish, 1999; Gunatilake etal, 1993). On the other hand Adhikari (2003) found richer households to be more dependent on the forests than the poor. In addition, the contribution forest income to household income also varies. For instance, while Cavendish (1998) estimated a 35% contribution of environmental goods and services (from forest commons) to household income in rural Zimbabwe, Levang et al (2003) estimated 30.4% contribution to the income of 72% of the households in rural Nepali. These estimates need to be replicated in a variety of contexts in order to create a better understanding of the importance of forest resources and income to the livelihoods of those households living at the forest frontier.

Limiting environmental income accounting to rural households can potentially underestimate incomes and level of dependence on forests and woodlands since most forest income is captured by non-rural and non-poor households at different points along the distribution chain. It is

evident in this study and in the literature that rural households are somehow more dependants on forests and woodlands than urban households, and that wealth endowment influence economic choices and income generating activities people engage in as well as the amount of income they can possibly derive from forests (Barham, etal, 1999). Although the sale of forest products contributes less than 30% to household income forest contribution to local livelihood is still substantial for many rural dwellers.

In Zambia, for example, over 90% of household energy which is 74% of total national energy consumed is fuelwood (Bwalya, 2002; GRZ, 1996). Thus for Zambia's forests and woodlands, the question is not whether rural and urban households are dependent on forest resources, they certainly are! However, the biggest challenge confronting policy makers is how to promote cost effective and sustainable management of these forests and woodlands in ways that maximize rural incomes and contribute to poverty reduction.

Attempts to estimate forest contribution at household income in developing countries include Cavendish (1998), Levang et al (2003), Barham etal (1999), Adhikari (2003) and many others. These estimates vary across case studies and forest resource types. For instance, Cavendish (1998) estimates a 35% contribution of forest income to total income in rural Zimbabwe, Levang et al (2003) 30.4% in Indonesia and Adhikari (2003) estimates forests to contribute 20-14% to total income of mountain dwellers in rural Nepal. Differences in resource values targeted, local market conditions, transaction costs, and availability of alternative household income generating activities are some of the factors that influence what forest activities forest dwellers undertake and how much forest income they can possibly earn.

Knowledge of forest contribution to local livelihoods and to rural income is critical to the analyses of cooperative action and incentives for successful local forest management. We estimate income derived from forest products, ignoring whatever is harvested and consumed within the household. No attempt was made to incorporate harvesting costs such as labor costs since these costs are not only difficulty to estimate but also vary quite remarkably from one individual to another. No cost data was collected and incorporated in measuring forest incomes: what we have estimated are gross incomes derived from different household income generating activities, forest products, agriculture and livestock and income from trading and off-farm income.

Table 2 below shows major household income generating activities. The unweighted percentage contribution is calculated as total income in each category divided by total income from all seven income categories and is recorded in column (d). It is clear from column (d) that agriculture is the main source of household income accounting for 50% (including income from livestock) of total household cash income followed by income from forest products contributing 29.4 % and then income from trading 11%. Income from informal and formal employment accounts for 3.3% and 2.1 % respectively and income from others sources (remittances, gifts, etc) accounting for 3.9%. Notice that although average income from forest products and trading is greater than income from agriculture, the former involves 17% and 8% of the total local population respectively. In contrast, despite that average income from agriculture is relatively smaller than income derived from forest products there are more people (44.4%) earning income from the former source compared to the latter.

Table 2: The analysis of household income by income generating activities

Income sources	Proportion of the sample (a)	Mean income (ZK) (b)	Percent contribution (c)	Percent contribution Unweighted (d)
Sale of agric products	44.4%	832,305	72.8%	47.1%
Sale of livestock	17.2%	137,282	1.8%	3.0%
Sale of forest products	19.4%	1,194,426	19.8%	29.4%
Income from trading	8.2%	1,057,870	3.2%	11.1%
Income from informal employment	13.3%	195,432	1.5%	3.3%
Income from formal employment	2.5%	657,714	0.2%	2.1%
Income from other sources	5.4%	572,133	0.7%	3.9%
Total	100%	n/a	100%	100%

Source: Author's own calculation based on survey data.

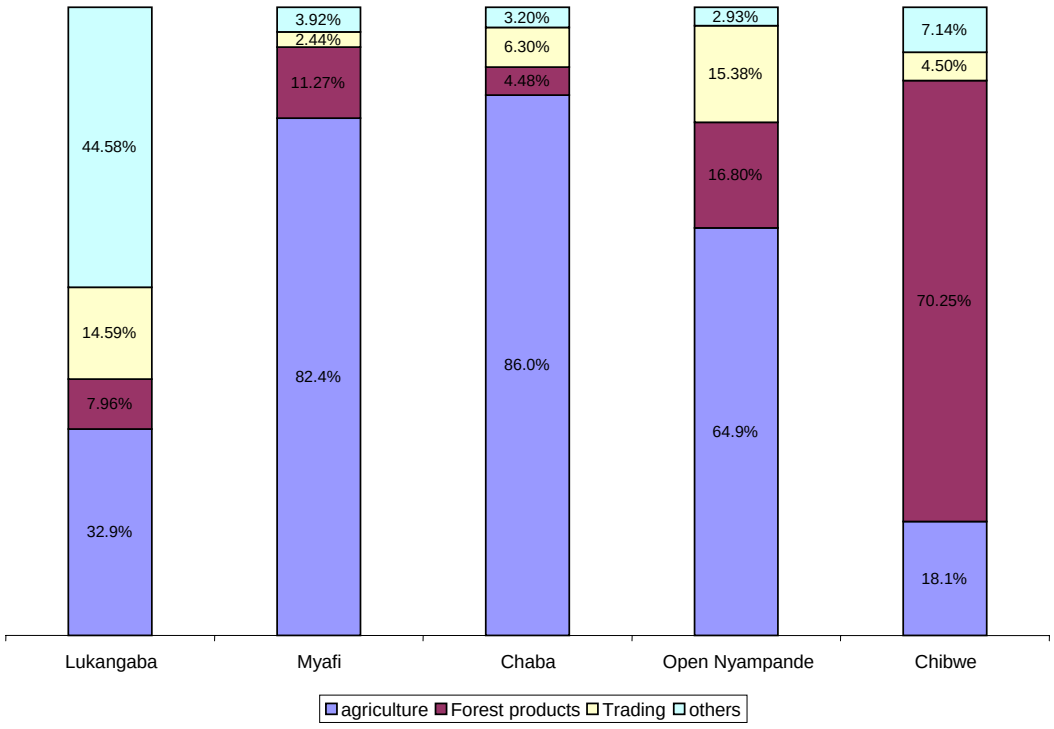
Using the distribution of sample population across income categories, we compute weighted percentage contribution of different income generating activities to total household income. Population weighted measures are summarized in column (c). The importance of the agricultural (including livestock) sector to the rural economy is even more visible contributing 74.6% of rural income and forest income contributing 19.8%. Income from other sources account for only 5.6%. Our estimates of income from forest products is consistent with those obtained by Adhikari (2003) but somewhat lower than those obtained by Cavendish (1998) and Levang *et al* (2002). If the objective is to raise income from forest products partly as a means to promote prudent forest uses and management practices local programs to improve product innovation and development is required. Improving production, processing and marketing of non-timber products like organic honey and bee-wax is capable of raising rural income several-folds and thereby raising incentives for sustainable local forest management.

At present much of the forest income comes from charcoal production, wild honey and timber, but this income is not evenly distributed by different social economic groups and across study sites. Communities closer to urban markets and with good road network are more able to harvest and sale forest products at good profit margins than those households farther away from urban markets.

Figure 2 below and table 3a in the appendix show household income by study site and income generating activity. Clearly, Myafi, Chaba, and Open Nyampande communities derive a greater part of household income from agriculture, Chibwe from forest products and Mansa from both agriculture, trading and informal employment. It is evident from this analysis that the Chibwe forest community is more reliant on forests and as such derives more income from forests and woodland resources than from any other income generating activities. Income from forest products and agriculture contribute 70% and 18% to household income and involves more than

30% and 28% of the local population respectively. Ready demand and proximity to urban markets makes charcoal production and sale of thatching grass profitable activities for residents of Chibwe.

Figure 5: Percentage contribution to household income by different income generation activities weighted by number of households engaged in the activity



In contrast, although residents of Nyampande open forest in Petauke district derived on average more income from forest products (mostly from hardwood timber) accounting for 16% of household income, this income accrues only to 10% of the local population. Contribution of forest income to total household income in other study sites range from 11% in Chaba local forest reserve to 4.5% in Myafi local forest reserve and involve less than 15% of the local population. Being the remotest of all the six forest communities surveyed, Mwewa (local forest reserve) residents derived the least income from forests and woodlands with only 2% of the local population harvesting forest products for sale. Most of this income came from such activities as basket-making, timber and canoe construction. These products once harvested and processed are sold to fishermen and fish traders in local markets located more 40 kilometers from the local forest reserve. Because of long distances and poor roads both agriculture and forest activities generate very little cash income for these residents.

5.4 Distribution of forest income by gender, household wealth and forest area

Households were classified in three income groups; low income group (51.3%), middle income group (31.5%), and high income (17.2%) categories based on accumulated household wealth. This classification is significantly correlated with income group classification which uses the number of hectares cultivated [χ = 10.84, P-value = 0.028]. This suggests a close relationship between agricultural production and accumulated household wealth, other things equal. Those in the low income category have assets less than ZK1500, 000; the middle income group is between ZK1500,000 and ZK2,500,000; and high income groups with accumulated assets over ZK2,500,000. Household income earned from agriculture , forest products, trade in agricultural and forest products, and from other income sources was also classified into small (less than ZK200,000), medium (ZK200,000 and ZK500,000) and high income (over ZK500,000) per year. Despite the significant seasonal variations of household income by sources, we chose to record income as yearly earnings to facilitate comparisons. The data also indicates significant difference household assets and area cultivated and planted across forest communities.

One of the important questions in household forest income accounting related to whether poorer households derive more income from forest products and hence are more reliant on the forests than richer households, and the dependency is highest among women and children. Of the 121 households who reported income from sale of agricultural produce, 52% were male and 48% female respondents and no significant difference in amounts of income was observed across income groups, χ (4) = 3.98, P-value .409]. However, when we look at household income derived from sale of forest products, we find more women (68%) earning less than ZK100, 000 per year and only 12.5% earning more than ZK500,000. In comparison, 39% of male respondents earn more than ZK500,000 from forest products. These differences are however expected because a greater portion of forest income comes from charcoal and timber production and these activities are largely undertaken men. The third most important source of forest income was wild honey mainly collection by men. Women collect wild fruits, tubers, edible caterpillars and mushroom but these No-wood forest products are of low value and highly perishable but labor intensive. In contrast, timber and charcoal are non-perishable and relatively highly prices. It is thus not surprising that men derived more income from forests and woodlands than women.

Table3: Distribution of forest income by gender

	Forest income categories			Total
Gender	<K100,000	K100,000 and K500,000	>K500,000	
male	38.9%	22.2%	38.9%	100.0%
female	68.8%	18.8%	12.5%	100.0%
total	49.1%	20.8%	30.2%	100.0%

Source: Author's own calculation based on survey data.

Some interesting contrasts in terms of household income sources across forest communities. For instance, while communities living around Nyampande open forest (56%) derive more than

ZK500,000, 70% of villagers living around in Lukangaba, Chaba and Chibwe forest reserves earn less than ZK100,000 per year. Over 71% of the residents in Chibwe derived less than ZK100,000 from agriculture. Generally, although women and poorer households are more reliant on forest products for subsistence they get the lowest income from forest products. Most forest based income generating activities seem to be pro-male and most women are discouraged from engaging in high value male dominated forest income generating activities.

This analysis suggests that harvesting of forest products and the amount of cash earned from the forest products depend on demand and proximity to urban markets and on forest products being harvested and traded. Forest livelihoods are also differentiated by gender, with women collecting non-wood products (except honey which is mostly collected men) mainly for subsistence and men harvesting timber, wood for charcoal, wild honey and other non-wood forest products for sale. Forest products and charcoal production in particular are the important sources of forest income for households living near urban and peri-urban centers. This suggests that increasing investment in transport infrastructure development will accelerate market integration and consequently raise forest values and forest income. In the long-term, market integration will raise pressure on open access forests and weaken collective forest management. The full effect of (rapid) market integration, locational heterogeneities and forest conditions on collective action and sustainable local forest management is empirically examined below.

6 EMPIRICAL ANALYSIS OF COLLECTIVE ACTION IN JFM

6.1 Testable hypotheses and variables specification

The status of forest resource and the predictability of forest benefits determine local incentive for collective management. Local communities will be less motivated to cooperate and to expend their scarce resources to manage a highly degraded resource or a fragile forest ecosystem whose returns are highly uncertain. We asked respondents to rank forest reserves and open access forests on a scale 1-5, where 1 and 5 denotes “very good” and well stock forest and “degraded” forests respectively. We define forest condition or scarcity (ROPENFR) as a ratio of rank of forest reserves to open forest. Although the relationship between collective action and forest conditions runs in both directions, we hypotheses that collective action will be effective in communities where forest values and forest ecosystem is perceived to be valuable and worthwhile managing.

With substantial amounts of forest resources and moderately low population implies that the per-capita cost of collective management will also be low. But as population density increases people begin to scramble for the resource, discount rates increase and collective incentives to cooperate to manage village forest common decreases. This suggests that the relationship between population density and collective action is U shaped facilitating collective action at lower to moderate population levels and raising the cost of organizing and collective action when population and population density is substantially high. This relationship implies also that high rates of population growth increases the scarcity of forest resources and shifts the marginal benefits of collective management outwards, as shown the figure 1. We hypothesize scarcity of forest resources, captured by ROPENFR, to have a positive impact on collective action.

Olson (1965) and Taylor (1987) urge that heterogeneity facilitates cooperation when some resource users within the community value the common good (i.e. soil erosion and watershed protection) enough that they are willing and able to provide it in spite of the actions or inaction of the remaining group. Heterogeneity can arise from different sources and at different organizational levels. Economic (income or wealth inequality) and non-economic (cultural, ethnic, political, institutional) heterogeneity impact incentives of resource users to organize themselves to resolve common pool dilemmas (Agrawal, 2002, Chermak and Krause, 2002).

The empirical literature on the effect of socio-cultural differentiation on collective action is mixed and varies from one case study to another. Whereas the effects of such variables as gender may be small and context specific group diversity is likely to have a sizeable impact on collective action. We compute an index of group diversity or social heterogeneity (SH) based on ethnicity and religious affiliation of respondents. We use this measure to examine the effect of cultural differentiation on trust and social cohesion and consequently on collective action. The sign on SH cannot be ascertained a priori. It appears that ethnic diversity and diversity religious affiliations across communities and households can have different effects on collective management and as such should be analyzed separately. We examine the effect on collective action of wealth (WEALTH) and income (LnHA) and wealth inequality (UNEQUAL) across communities. Bardham and Dayton-Johnson (2002), Dayton-Johnson (2000) and Cardenas (2003) argue that [high] income and wealth inequality inhibits cooperation. The sign on wealth, income (LnHA) and wealth inequality cannot be ascertained a priori.

Market integration can impact collective action and forest conditions either positively or negatively. While policies that reduce transaction costs promote market integration and are important for raising rural income and forest values, rapid market integration is often associated with higher rates of forest clearance (Pendleton and Howe; 2002)[10]. In addition, market integration brings about ways new ways of resolving risk and uncertainty that replaces and undermines the traditional role of common property institutions as sources of risk assurance[11]. Distance (ACCESS) to urban markets is used to capture market integration, it also appropriately accounts for regional heterogeneity differences across communities and forest areas covered in the study. We hypothesize market integration to have a negative impact on cooperation.

Evidence on the role of organizational experience on collective action is mixed most empirical studies. For instance, Baland and Platteau, 1996; Minenzen-Dick, 2002; Gebremedihin et al, 2003 argue that prior experience with institutional cooperation improves cooperation and facilitates collective action. This prediction is consistent with evidence from common pool experiments, which suggests that repeated interactions promote cooperative behavior (Mason and Phillips, 1997). On the contrary, Heltberg (2001) found communities with prior experience with institutional management less able to operate management rules. We use the number of local organization (NORGNS), level of individual participation in VRMC (MEMBER), and years of membership (LEXP) in community organizations to measure the effect of prior organizational experience and social capital on collective forest management. We compute an

[10] However, the effects of market integration seem to depend on the property rights system and management regime. For instance, we might observe a negative impact of market integration for open access resources than those under community rights or individual rights. Thus, the effects of market integration may depend on property rights and on effective management.

[11] For a through discussion on this Fafchamps (1992).

index of organizational diversity (IDEXOGN) to measures differences in organizational capital across communities and how it impacts collective action for natural resource management.

Table 4: Description and measurement of variables and their expected signs

Variables **Socio-economic variables**	**Variable**	**Expected sign**
Log of Age of respondent	LNAGE	--/+
Gender: 1 if male and 0 otherwise.	GENDUM	--/+
Marital status:1 if married and 0 otherwise	MARIDUM	--/+
Education: 1 if household schooling is greater than primary and 0 otherwise.	EDUDUM	+
Log of household size	LNHSZE	+
Residence: 1 if household stayed in the same areas for 10 or more years 0 otherwise.	RESIDE	+
Wealth is the inventory of total household assets	WEALTH	--/+
Social heterogeneity is the share of households of minority tribes and religion to native and major religion respectively	SH	--/+
Wealth Inequality is the gini-coefficient of wealth for each of the six community surveyed	UNEQUAL	--/+
Proximity to urban centre (1 if community is along major road and rail grid, 0 otherwise)	ACCESS	--
PFAP is 1 if the forest area is a donor funded pilot area, 0 otherwise.	PFAP	--
Employment and forest utilization		
Agricultural employment:1 if agric is major employment for household and 0 otherwise	AGRIC	+
Forest:1 if forest activity is the major source of employment and 0 otherwise	FOREST	--/+
Number of hectares planted (proxy for income)	LnHA	--/+
Forest conditions		+
Condition of forest reserve ranked on scale 1 to 5 with 1=very good, 5=degraded	RESERVE	
Condition of open forests ranked on scale 1 to 5 with 1=very good, 5=degraded	OPENFOR	--
Ratio of rank of open forest to open forest [OPENFOR/RESERVE]	ROPENFR	--
organizational capital and participation		+
Membership of VRMC: 1 if respondent is a member and zero otherwise	MEMBER	+
Ratio of non-natives to natives in the area	TRIBE	--
Number of households of minority religion(s) to dominant religion	RELIGION	--
Years of active membership in local organization(s)	NORGNS	+
Number of organization in the area/community	IDEXOGN	+

Local communities can organize and enforce management rules fairly well, but they are often incapable of sanctioning highly connected and sophisticated norm violators who come from outside the community. Therefore, community management efforts must be accompanied by government law enforcement and sanctioning systems if community rights and property are to be safeguard. The role of government joint forest management is even more pronounced and broader. It includes government active participation in designing and overseeing the implementation of management plans, regulating access and resource utilization, timber certification and licensing, and collection of fees and distribution of forest benefits. In many such cases, government structures and intervention impact local incentives for long-term local forest management.

In developing countries, community natural resource management has a substantial development component and the role of local and international organizations is highly visible. These organizations shape the nature and outcome in common pool resource management programs they support—notable ones being in wildlife (Wainright and Wehrmeyer, 1998), forestry (GRZ, 1998) and agriculture. Just as government failures have adversely affected sustainability of natural resources, development agencies and other non-state actors can potentially produce similar failures. Half of the local communities surveyed have an active presence of a development agency. We use this information to examine the effect of external organization (PFAP) on collective action and institutional durability. We hypothesis that if external organizational norms and programs act as substitutes to goods provided by the forest commons, erode community values on which collective action is based and are not demand driven but rather imposed on local communities, such external interventions will adversely impact collective action. However, if external organizational norms and programs complement those of local communities then a positive impact results.

6.2 Determinants of collective action: estimation and results

There are econometric issues that need to be addressed and considered in our choice of empirical strategy. First, the dependant variable is number of man-days per year a household devotes to monitoring, enforcement and silvicutural activities in the forest reserve. During data collection or interviews households were reminded that labor (man-days per year) devoted to forest management will not be simultaneously available for other household activities. Each household thus faces a fixed number of man-days per day, such that any man-days devoted to forest management reduces labor allocated to other livelihood activities (agriculture, household work, etc) and leisure. About 10% of the total respondents allocated zero man-days to forest management, censoring the data at zero. Since the dependent variable is censored from below, we face three estimation problems: From the theoretical standpoint, since $m_{ij} \geq 0$, its expected value, $E(m_{ij} \setminus X)$, is non-linear in X, except of course when the range of X is limited. Censoring also implies constant partial derivatives and the expected value of the dependent variable for most combinations of parameter estimates and explanatory variable may be negative. Moreover, while discarding zero observations leads to sample selection biases, presences of zero responses also imply that we cannot take logarithms of the dependent variable. But, even if this was possible, estimating a non-linear model is unlikely to yield consistent and efficient estimates in the presence of heteroskesticity. To counteract these estimation problems, we apply maximum likelihood estimation to estimate a censored Tobit model. Using Green's (2003, p.764) index function formulation, the following standard Tobit model with heteroskedasticity corrected standard errors is estimated using the Limdep 7.0 Econometric Software (Green, 1998).

$$
\begin{aligned}
& m_i^* = x_i \beta + \varepsilon_i \\
& m_i = 0 \quad \text{if } m_i \leq 0 \qquad (10) \\
& m_i = m_i^* \quad \text{if } m_i > 0 \\
& \text{var}(\varepsilon_i) = \exp(\gamma' v_i)
\end{aligned}
$$

We will strengthen our variable choice and econometric estimations and testing before we are confident that our estimate are consistent and pass theoretical validity tests. For instance, a probit model will be estimated and signs on explanatory variables compared with those from the Tobit

model. Theoretical validity requires that the signs on all coefficients are the same in both models. Below we present and discuss some tentative results of the collective action. Empirical estimation of model specified in equation (9) are reported in table 5 and table 3a in the appendix. The model performance statistics indicates a good fit with observed chi-square value for the two Tobit regression (38.48 and 34.44) in Table 5 and 3a exceeding the chi-square critical values (30.14 and 26.3) at 95% confidence level.

The level of cooperation at the household level depends on a number of household characteristics. Results show that gender, household size and the amount of land cultivated or planted (which is a proxy for household)[12] have a positive effect on cooperation. In particular, increasing land cultivated or household income is positive and significant at 1% level, suggesting that raising farm income increases cooperation and collective action. The coefficient on age of respondent is negative and statistically significant as expected. Old people cannot effectively police a local forest all by themselves; monitoring and enforcement, silvicultural activities and fire prevention are tasks which must be performed by middle-aged and energetic members of the community. Old people provide advice and institutional memory. Household size is positive and significant at 11%, suggesting that households with surplus labor should allocate more labor to local forest management since the opportunity cost of doing so is much lower than for labor deficit households.

Household's major sources of employment and livelihoods were included to capture the opportunity cost of labor or availability of exit options for households participating in local forest management. Availability of exit options depends on the kinds of livelihoods strategies people are involved in and how vibrate these activities are. The major livelihood and income generating activities in the study sites included farming, harvesting of forest products for own consumption and for sale and informal trading in forest and agricultural products. We examine whether forest, trading, informal and formal employment and agricultural activities or employment are important exit options from the commons for most households. All employment variables were negative and insignificant except FOREST and AGRIC which were significant at 10%. This means that as non-traditional sources of livelihoods improve and begin to provide important exit options from the forest commons, say by reducing dependency on the common or as individual needs change and outweigh collective benefits, people will abandon the common as they wobble to maximize individual benefits at the expense of societal collective benefits. In this case, collective action will fall and other adaptive management systems should be devised to ensure sustainability of forest commons. Thus the collective institutional set-up needs to be flexible to allow for incremental changes to its institutional and management design.

While household level heterogeneities are important, cooperative behavior and strength of collective action may well be determined by community variables which shape individual and group decisions and incentives. Organizational skills are captured by individual membership (MEMBER) to VRMC and by the number of community organizations (NORGNS) in which a particular individual is an active member. Both variables have positive coefficients indicating that prior experience and participation in collective projects improves individual cooperation[13].

[12] See Hyde et al ( ) for similar application.

[13] The number of community organization one can belong depends also on whether these organizations are present in the community and accessibility. However, membership by itself does not entail active participation.

Table 5: Determinants of collective action: dependant variable is labor contribution to monitoring & enforcement and management of local forest reserve

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
EAST	161.2925270	66.534829	2.424	.0153	.28673835
LUAP	214.6659208	71.794011	2.990	.0028	.26164875
CHIBWE	199.0307289	80.679899	2.467	.0136	.22222222
MKUSHI	203.9498626	72.573585	2.810	.0050	.22939068
MEMBER	17.15564998	9.1918753	1.866	.0620	.35125448
IDEXOGN	.6646972572	.41362405	1.607	.1081	77.720129
LNHA	12.23189391	3.8631913	3.166	.0015	.98424749
CHARC	-22.13009641	13.853129	-1.597	.1102	.10752688
TRIBE	-188.2153318	130.61588	-1.441	.1496	.40792548
LNAGE	-83.21526809	28.528234	-2.917	.0035	1.5789964
GENDUM	12.20390026	8.4995678	1.436	.1511	.54838710
LNHSZE	27.03592565	18.209696	1.485	.1376	.76215054
NORGNS	11.34143491	4.8325840	2.347	.0189	1.7562724
ROPENFR	-14.03830600	6.7975933	-2.065	.0389	1.5480884
Sigma	67.19641874	3.0097117	22.327	.0000	
		Marginal effects			
EAST	141.5163707	58.517229	2.418	.0156	.28673835
LUAP	188.3456263	63.178621	2.981	.0029	.26164875
CHIBWE	174.6274730	70.932222	2.462	.0138	.22222222
MKUSHI	178.9434693	63.851684	2.802	.0051	.22939068
MEMBER	15.05218727	8.0648727	1.866	.0620	.35125448
IDEXOGN	.5831983985	.36313694	1.606	.1083	77.720129
LNHA	10.73213536	3.3896501	3.166	.0015	.98424749
CHARC	-19.41671437	12.162589	-1.596	.1104	.10752688
TRIBE	-165.1381571	114.62852	-1.441	.1497	.40792548
LNAGE	-73.01220301	25.023703	-2.918	.0035	1.5789964
GENDUM	10.70757403	7.4573460	1.436	.1510	.54838710
LNHSZE	23.72103747	15.972123	1.485	.1375	.76215054
NORGNS	9.950855981	4.2429720	2.345	.0190	1.7562724
ROPENFR	-12.31706237	5.9672216	-2.064	.0390	1.5480884
Sigma	9.419014364	.....(Fixed Parameter).....			

Number of observations : 279
Log likelihood function : -1468.086
LM test [df] for tobit : 34.484[14]
ANOVA based fit measure : .096128
DECOMP based fit measure : .105121

In addition, NORGNS is statistically significant at 1% suggesting that organizational skill and experience in implementing community-based projects is an important determinant of collective action. IDEXOGN measures organizational intensity at community level. This variable was positive and statistically significant at 10%. This result suggests that cooperation and collective action will be easy to sustain in communities with a good history of successful community institutions and participation[14]. This is a fundamental result which suggests that the relationship between organizational embeddedness and socio-cultural factors can help determine why some regions or communities flourish whereas others remain underdeveloped, and why community forestry succeeds in some communities and forest areas and not in others. It appears that community projects should target those communities that have a successful record with collective management and those with little or no formal experience and to limit collaborative

[14] This result is consistent with Baland and Platteau, 1996; Minenzen-Dick, 2002 and Gebremedihin et al (2003) among others, but contradicts that of Heltbeger (2001).

projects in those communities where failure rates are high. Similarly, government and external organizations should desist from initiating community projects which they are incapable of sustaining. It is these "donor and government failures" which erode community solidarity, trust and cooperative behavior among otherwise cooperative households, user groups and communities.

The Gini-coefficient (UNEQUAL) was computed for each community to investigate how differences in wealth inequality across communities impact collective action. This variable was positive but consistently insignificant in all the estimations suggesting that wealth heterogeneity across communities had no significant effect on collective action, meaning that differences in labor contribution to local forest management is not explained but relatives in accumulated wealth across study sites. However, we find income differences across households to have a positive effect on collective action. Household income (LnHA) was positive and significant at 1%.

Access to markets (ACCESS) a proxy for market integration was negative and significant at 1%. This result suggests that collective forest management would be difficulty to achieve in those communities and forests near urban markets where land and forest values and implicit wage rates are high. While market integration increases forest values, it transforms production technologies and cost-benefit ratios of private harvesting versus communal forest uses in way that might undermine the very essence and effectiveness of collective forest management. Market integration also makes it easier for people outside the collective arrangement to exert pressure on the resource and for political influence and economic hegemony of urban interests to permeate local institutional rules governing resource utilization and management. We argue that the greatest potential for successful local forest management is in those forests located in relatively remote areas that are important safety nets to local communities and user groups. Despite social-cultural heterogeneity being negative both TRIBE and RELIGION) were statistically significantly.

Several hypotheses have been advanced regarding the effect of forest conditions, resource scarcity and availability of substitute on collective action. Resource scarcity signals the need to put in place institutional restraints on utilization to ensure a sustained flow of forest products and services to the community. Forest condition (ROPENFR) measured as ratio of perceived status of the forest reserve to open access forests (a substitute source) is negative and significant at 5% and 10% in tables 3 and 4, and 6 respectively. This result is consistent with our graphical analyses of community forestry where we demonstrated that as harvests from open access forests become more difficulty and costly and hence the resource more valuable local communities devise rules to manage some forestland (or engage in agro-forestry) to ensure a stead flow of forest products. Similarly the coefficient of size of the forest reserve is negative and statistically insignificant.

7 CONCLUSIONS, DISCUSSIONS AND RECOMMENDATIONS

For contemporary commons the scholarly and policy question is not whether decentralized natural resource management is appropriate and effective, but one of whether we can identify circumstances and conditions under which state, markets and local organizations can efficiently

contribute to long-term forest management (Runge, 1986; Uphoff, 1993). Institutional choice is one of the most influential theoretical tools for addressing this question. It identifies design principles of successful management and conditions that facilitate collective resolve of common dilemmas. This paper in addressing the latter assumes that rational individuals appropriating village forest commons make cost-benefit calculations of whether or not to invest in management of those forests or in the processes of institutional change that galvanizes the way by which the commons are utilized and managed (Wade, 1988; Ostrom, 1990, 1992). We empirically examined the livelihood portfolio of rural communities in six local forest communities spread across three provinces in Zambia. Then we examine the key determinants of collective action.

In terms of livelihood strategies, evidence suggests agriculture and forest resources are important contributors to rural livelihoods and household income, with agricultural income accounting for 50% of household income, followed by forest income (29.4%) and income from trading 11%. Income from informal and formal employment accounts for 3.3% and 2.1 % respectively and income from others sources (remittances, gifts, etc) accounting for 3.9%. Notice that although average income from forest products and trading is greater than income from agriculture, the former involves 17% and 8% of the total local population respectively. In contrast, despite that average income from agriculture is relatively smaller than income derived from forest products there are more people (44.4%) earning income from it than form forest (17%) products and trading (8%). The amount of income obtained from forest products depends on demand and availability of valuable forest products and on proximity to urban markets. Types of forest activities and income derived from forests also varied by gender. While over 68% of the women getting less than ZK100, 000 per annum, 39% of the men obtain over K500, 000 per annum.

The importance of charcoal production is a major source of forest income especially for those living around Chibwe and Lukangaba forest reserves. Those in Open Nyampande local forest cut timber which they transport to Lusaka for sale. The greatest promise for raising forest income and promoting sustainable local management will eventually involve two major forest products; bee-keeping (honey and bee-wax) and managed charcoal production since most of these forests have characteristically low value timber species. These features underscore the important role of external support to these local forest conservation and rural development especially agriculture. This is because local forests alone cannot generate sufficient economic benefits to induce local communities to take full interest in the sustainability of local forests. Local incentives can be farther improved by channeling resources to support programs in agriculture aimed at increasing productivity and income and consequently long-term forest conservation.

The second objective of this study was to identify the major determinants of collective action in local forest management in the study area. We examined how socio-cultural, community attributes and economic factors and forest conditions affect collective action in six JFM project areas. Evidence suggests that the level of income and income inequalities across households, forest scarcity, organizational experience and social capital, and individual prior experience with collective action programs have a positive impact on collective action.

We also find that market integration and proximity to urban markets (which some form of regional heterogeneity) weakens cooperation. There is inadequate evidence to suggest that socio-cultural heterogeneity hinders cooperation in the study area. However, study shows that investment in human capital will be required to improve skills and cognitive abilities of rural

households participating in JFM programs in the study area. This is important because skills development enhances organizational, managerial and entrepreneurial talents of the rural people and promotes stability of social capital and thereby strengthening collective action within the community. In order to improve the implementation of JFM programs and to enable local communities to derive substantial benefits from forest management investments in human capital through training and rural extension services should be provided in all the communities covered in this study.

However, human capital alone is insufficient to explain why some institutional arrangements are more durable and likely to succeed than others. Social capital improves the social structures of the community to organize, sanction and enforce social norms which do not only benefit a person or persons whose efforts is necessary to bring them about but all those who are part of the structure. Our results suggest that organizational skills and experience in implementing community-based projects is an important determinant of collective action. This result also suggests that we can possibly understand and offer substantive explanation of why community forestry succeeds in some communities and not in others by examining how organizational capital and socio-cultural factors impact community solidarity and individual cooperation. One might thus be tempted to recommend that JFM projects should target those communities that have a successful record or with no such formal organizational experience at all and to limit community-based approaches in those communities that have a poor record of local cooperation. In the same vein, government and external organizations should desist from initiating community based natural resource projects for which they are incapable of sustaining since such projects erode community solidarity, trust and reduce possibilities for future cooperation in other social spheres.

Evidence from focus group discussions suggests that local people anticipate JFM to emphasize both forest conservation and rural development. They urge that in order to reduce pressure on local forests, especially from slash and burn agriculture and other unsustainable forest uses, provision of agricultural credit and extension services to peasant farmers will strengthen local participation and compliance with the JFM regime. This argument is consistent with the notion that the degree to which a diversity of association and population segments may participate in long-term conservation tends to be associated with higher income and low rates of poverty and income inequality. This is consistent with observations by others scholars like Rainey et al (2003) that structural pluralism influences the kind of economic organizations that locate and stay in a community, the diversified employment structure that it encourages and the types of poverty-oriented programs that the community adopts.

There are certainly a number of other factors that underlie successful management of forests, and this paper does not in anyway provide an exhaustive discussion of all these factors. The paper however identifies some key factors that appear to be consistent with the general theory of collective action and Zambia's practical experiences with collective natural resources management in general and JFM in particular. We extent our conclusions by emphasizing that no single organizational and management design will effectively promote collective action and long-term local forest management in all forest areas and communities. Great flexibility in institutional and management design should be exercised in order to allow for incremental and adaptive changes to be made to the JFM design along the implementation path.

Our future research efforts will target analyses of organizational features, enforcement and sanctioning structures and systems and contractual arrangements that best suite the criteria for sustainable management and local benefits from these forests. Economic valuation of forest resources in local forest reserves by local communities and forest income accounting is examined in our separate paper/report.

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8. APPENDICES

Table 1a: Descriptive Statistics by forest area and communities

Age/forest area	LUFR	MWRF	MYFR	CFR	ONFR	CBFR
Wealth inequality (Gini-coefficient)	59.4	69.5	82.0	65.1	67.5	80.2
Age of respondent	37.9	35.58	46.46	33.48	38.12	46.58
Household size	6.55	7.73	6.38	6.04	5.95	7.11
Labor contribution to VRMC	103.67	96.16	82.57	64.52	84.53	72.18
Number of hectares planted	2.66	3.14	6.84	4.90	6.40	4.40
availability of firewood (1=most abundant, 5=depleted)	2.64	2.42	2.70	2.56	2.74	2.94
Scarcity of mushrooms (‘’)	2.20	2	2.26	2.33	3.24	2.19
Scarcity of construction poles (“)	2.89	2.50	2.87	2.91	2.50	2.63
Status of forest reserve (1=best, 5= degraded)	1.52	1.52	1.92	1.84		2.35
Status of open forest (1=best; 5 = degraded)	2.65	2.69	2.67	3.00	2.64	3.46
Firewood collection reserve (hrs/head load)	2.40	0.90	1.24	1.18		1.21
Firewood collection Open forest (hrs/head load)	0.86	0.63	1.70	1.80	0.86	0.86
Ratio of stocking of forest reserve to open forest	0.58	0.58	1.37	0.63		0.69
Index of ethnic diversity	49.0	38.48	49.35	37.03	34.20	47.40
Index of diversity of religious affiliations	42.8	61.6	63.33	57.8	42.5	68.38
Overall index of social-cultural diversity	20.97	23.68	34.22	21.41	14.34	32.40
Overall Index of organizational intensity	91.65	53.72	58.76	41.96	87.2	91.88
Index of membership to agricultural groupings	12.97	2.92	13.98	10.99	6.16	18.97
Index of membership to producer associations	13.91	9.96	5.99	3.00	7.12	11.04
Index of local NGO concentration	2.96	0	5.00	0	9.2	3.97
Household wealth (assets)	2,855,426	832,442.5	2,480,911	3,602,759	4,655,513	14,339,537
Distance to forest reserve	3.77	1.77	3.02	3.38		1.76
Distance to open forest	0.44	0.58	0.42	0.55		0.51
Importance of forests for wild food gathering	2.38	1.44	1.79	1.96	2.69	2.28
Importance of forests for medicinal products	3.95	3.72	4.31	3.78	3.44	3.66
Importance of forests for wood products	2.52	2.58	2.22	2.37	2.67	2.82
Importance of forests for fuelwood	1.31	2.04	2.12	1.81	1.55	1.28

Notes: LU = Lukangaba forest reserve; MWFR= Mwewa forest reserve; MYFR= myafi forest reserve; ONFR=Open Nyampande forest reserve; CBFR= Chibwe forest reserve.

Table 2a: comparative analysis of household incomes from different sources across communities

Forest areas/income categories	N	Mean	Minimum	Maximum	Sum	*% of total*
Lukangaba Forest Reserve (Mansa District)						
sales of agric products	12	427833.3	36000	2500000	5134000	*28.43*
sale of livestock	9	89111.11	10000	240000	802000	*4.44*
sale of forest products	7	205285.7	12000	600000	1437000	7.96
income from trading	6	439166.7	20000	1200000	2635000	*14.59*
income from informal employment	8	456250	20000	1440000	3650000	*20.21*
income from formal employment	3	904666.7	14000	2100000	2714000	*15.03*
income from other sources	4	422250	20000	1000000	1689000	*9.35*
	49				**18061000**	***100.00***
Myafi Forest Reserve (Mkushi district)						
sales of agric products	22	362636.4	20000	1750000	7978000	*77.96*
sale of livestock	9	50168.44	16	160000	451516	*4.41*
sale of forest products	4	288375	10000	900000	1153500	11.27
income from trading	1	250000	250000	250000	250000	*2.44*
income from formal employment	1	400000	400000	400000	400000	*3.91*
Total	**37**				**10233016**	*100.00*
Chaba forest reserve (Mkushi District)						
sales of agric products	13	413923.1	12000	1500000	5381000	*67.76*
sale of livestock	4	362500	26000	1300000	1450000	*18.26*
sale of forest products	4	88875	10500	225000	355500	*4.48*
income from trading	1	500000	500000	500000	500000	*6.30*
income from other sources	2	127500	55000	200000	255000	*3.21*
Total	**24**				**7941500**	*100.00*
Open Nyampande forest reserve (petauke district)						
sales of agric products	48	1582138	15000	16000000	75942600	*63.23*
sale of livestock	13	153153.8	16000	700000	1991000	*1.66*
sale of forest products	9	2241667	30000	9960000	20175000	*16.80*
income from trading	5	3694000	80000	8000000	18470000	*15.38*
income from formal informal employment	14	66642.86	5000	190000	933000	*0.78*
income from formal employment	1	50000	50000	50000	50000	*0.04*
income from other sources	3	850000	50000	1500000	2550000	*2.12*
Total	**93**				**120111600**	*100.00*
Chibwe Forest Reserve (Kapiri-Mposhi district)						
sales of agric products	29	302420.7	0	2400000	8770200	*14.89*
sale of livestock	13	145769.2	0	800000	1895000	*3.22*
sale of forest products	30	1379267	6000	12000000	41378000	*70.25*
income from trading	10	247600	0	820000	2476000	*4.20*
income from formal informal employment	15	176533.3	0	600000	2648000	*4.50*
income from formal employment	2	720000	0	1440000	1440000	*2.44*
income from other sources	4	72500	0	150000	290000	*0.49*
Total	**103**				**58897200**	*100.00*

Table 3a: Determinants of collective action: dependent variable is labor contribution

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Primary Index Equation for Model					
EAST	306.0580146	196.13001	1.560	.1186	.28673835
LUAP	376.4894957	203.63815	1.849	.0645	.26164875
CHIBWE	378.1543289	219.59093	1.722	.0851	.22222222
MKUSHI	333.5481643	212.68200	1.568	.1168	.22939068
LNFHA	-10.26236524	13.845511	-.741	.4586	8.3730810
MEMBER	14.61325863	9.5952513	1.523	.1278	.35125448
ACCESS	-39.06275985	12.520356	-3.120	.0018	.45161290
LNHA	12.51736024	4.1053608	3.049	.0023	.98424749
CHARC	-24.12680417	13.730077	-1.757	.0789	.10752688
AGRIC	-19.39391257	11.743191	-1.652	.0986	.84587814
INFTFOR	-13.23471416	12.327377	-1.074	.2830	.13978495
TRIBE	-150.4496810	168.57125	-.892	.3721	.40792548
RELIGION	-36.55499329	51.677609	-.707	.4793	.52955344
LNAGE	-90.34206962	28.825696	-3.134	.0017	1.5789964
GENDUM	11.24698977	8.4488942	1.331	.1831	.54838710
LNHSZE	28.17886827	18.097678	1.557	.1195	.76215054
UNEQUAL	47.12642473	99.660658	.473	.6363	.70834767
NORGNS	11.36568228	4.9018464	2.319	.0204	1.7562724
ROPENFR	-12.55124082	6.7937771	-1.847	.0647	1.5480884
Sigma	66.07010374	2.9567248	22.346	.0000	
Marginal effects					
EAST	269.6952221	172.93204	1.560	.1189	.28673835
LUAP	331.7587297	179.57450	1.847	.0647	.26164875
CHIBWE	333.2257639	193.62010	1.721	.0852	.22222222
MKUSHI	293.9192635	187.51742	1.567	.1170	.22939068
LNFHA	-9.043092286	12.200743	-.741	.4586	8.3730810
MEMBER	12.87705547	8.4557412	1.523	.1278	.35125448
ACCESS	-34.42170827	11.038241	-3.118	.0018	.45161290
LNHA	11.03017104	3.6181364	3.049	.0023	.98424749
CHARC	-21.26029542	12.107415	-1.756	.0791	.10752688
AGRIC	-17.08971929	10.350446	-1.651	.0987	.84587814
INFTFOR	-11.66229605	10.866750	-1.073	.2832	.13978495
TRIBE	-132.5747348	148.53737	-.893	.3721	.40792548
RELIGION	-32.21188978	45.545227	-.707	.4794	.52955344
LNAGE	-79.60851657	25.392627	-3.135	.0017	1.5789964
GENDUM	9.910733454	7.4444603	1.331	.1831	.54838710
LNHSZE	24.83093327	15.941777	1.558	.1193	.76215054
UNEQUAL	41.52732808	87.820918	.473	.6363	.70834767
NORGNS	10.01532409	4.3217183	2.317	.0205	1.7562724
ROPENFR	-11.06002626	5.9895788	-1.847	.0648	1.5480884
Sigma	.0000000000	.....(Fixed Parameter).....			

Number of observations	: 279
Log likelihood function	:-1463.060
LM test [df] for tobit	: 38.439[19]
ANOVA based fit measure	: .112660
DECOMP based fit measure	: .123610