CAPRi Working Paper No. 53 • July 2006

Decentralization and Environmental Conservation: Gender Effects from Participation in Joint Forest Management

Arun Agrawal, University of Michigan
Gautam Yadama, Washington University—St. Louis
Raul Andrade, Washington University—St. Louis and
Ajoy Bhattacharya, Indian Forest Service

International Research Workshop on '*Gender and Collective Action*'
October 17-21, 2005 • Chiang Mai, Thailand

CGIAR Systemwide Program on Collective Action and Property Rights (CAPRi)
c/o INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
2033 K Street NW, Washington, DC 20006-1002 USA • T +1 202.862.5600 • F +1 202.467.4439 • **www.capri.cgiar.org**

ABSTRACT

This paper analyzes how women's participation affects institutional outcomes related to the decentralized governance of community forests in Madhya Pradesh, India. The analysis is based on data from a representative sample of 641 cases of joint forest management, India's flagship program to involve communities in forest governance. We focus on two outcomes relevant for local livelihoods: control of illicit grazing and control of illicit felling in the forest. The paper statistically estimates the effects of women's participation on outcomes, and also the source of this effect in terms of women's representation in committees and action in protecting forests. We find that women's participation has substantial positive effects on regulating illicit grazing and felling, even after controlling for the effects of a range of independent variables. We also find that the "action effect" is more important than the "representation effect," confirming some major arguments advanced by feminist environmentalists. Our statistical results are robust to different specifications and provide considerable empirical support for promoting women's participation in community-based protection of natural resources.

Keywords: Joint Forest Management, Gender equity, Decentralization, Forestry Resources

TABLE OF CONTENTS

DECENTRALIZATION AND ENVIRONMENTAL CONSERVATION: GENDER EFFECTS FROM PARTICIPATION IN JOINT FOREST MANAGEMENT

Arun Agrawal,[1] Gautam Yadama,[2] Raul Andrade,[3] and Ajoy Bhattacharya[4]

INTRODUCTION

Enabling community participation is a complex undertaking. It is complex because participation by citizens in a community unfolds in a dense context of social, economic, political, and cultural institutions and arrangements. These relationships reproduce power and resource asymmetries, privilege some citizens while disadvantaging others, and guide individual and collective behavior. Power and privilege in a community are manifest along axes of race, ethnicity, gender, and class. There is a vibrant discussion on how to overcome such power and resource asymmetries and enable participation by underprivileged citizens in social and economic development programs. The expected outcomes from such participation are greater equality in the distribution of benefits from development, especially to citizens whose preferences historically have been discounted in development. The focus of our paper is to explore if gender matters in achieving positive outcomes in community-based development programs.

---

1 Associate Professor, School of Natural Resources, University of Michigan, arunagra@umich.edu

[2] Associate Professor/Coordinator, Social and Economic Development Concentration, Washington, University—St. Louis, gautamy@gwbssw.wustl.edu

[3] Ph.D. student, Department of Economics, Washington University, St. Louis, andrade@wustl.edu

[4] Conservator of Forests, Bhopal, Madhya Pradesh, India, ajoykb@sancharnet.in

We examine if participation by women is critical to achieving better community-based natural resource management in the tribal communities of central India. Our research is especially relevant for contexts where women depend on and are extensively involved in the harvesting of non-timber forest products. In addition to examining the importance of gendered participation, we also test for competing demographic, market, and institutional factors and their influence on community-based efforts to regenerate forests in the communities of Madhya Pradesh, India. Our aim is not just to understand how communities mobilize to self-govern natural resources, but also to shine particular light on how women in these villages participate and become instrumental in positive development outcomes. To assess the performance of gender in the village level forest management committees, the study focuses on whether these committees have been able to control illegal grazing and felling in forests under their control, and how women's participation matters for this purpose. To take into account actual effects of institutional and other variables, we also use an additional dependent variable: regeneration in the forest. In essence, we are able to examine how women are privileged or precluded from participation in newly created social and political spaces arising from devolution of community forest rights to villages. Our focus on the outcomes of participation by women in community forest management is predicated on extensive discussion of the dangers of excluding underprivileged citizens from participation in decentralized natural resource management.

Governments around the world are joining the rush to decentralize environmental policy. Nearly every central government in Latin America, sub-Saharan Africa, and south and Southeast Asia claims to have decentralized governance of forests and wildlife (Agrawal 2004). International donors promote these policy reforms. Many have pumped large amounts

of money to sustain decentralized environmental policies in the belief that new strategies can successfully combine conservation objectives with poverty alleviation and development. Local decision-makers and users also often prefer decentralized arrangements, as such arrangements can increase their material benefits from forests and improve their ability to control what happens to forest resources. In this rapidly changing context of policy reform and institutional change, it is increasingly imperative to assess the outcomes of decentralization policies and the factors responsible for generating varied outcomes (Larson and Ribot 2004). Many existing studies focus on these issues (Lynch and Talbott 1995, Ribot 1999). Based typically on case studies of single or a few instances, the scholarship on decentralization examines the scope, nature, causes, and effects of decentralization policies (Gauld 2000, Goldman 2003, Gray 2002, and McCarthy 2000). This literature has enriched the understanding as to why decentralization policies have become prominent (Buckingham-Hatfield 1999), the extent to which they have been successful in specific contexts (Skonhoft 1998), and the reasons behind their successes and failures (Booth 1995). But the impressive literature on decentralization pays relatively little attention to gender and gender equity issues (cf. Agarwal 2001).

We know little about the extent to which women are relatively equal participants in, or beneficiaries of, new institutional reforms. We know even less about how their participation affects resource-related outcomes, or whether it affects institutional effectiveness. This paper focuses on outcomes associated with altered institutional arrangements in one of the best known examples of current policy shifts – the Joint Forest Management (JFM) Program in India. The objective of the paper is to identify how participation by women affects resource management. The study is based on data collected

from more than 675 village-level forest protection committees in Madhya Pradesh, the largest Indian state. In the paper, we review perspectives on gender and participation and briefly describe the JFM program and the goal of eliciting greater and wider participation by citizens. Next, we discuss the empirical methods and the data. Then the analysis of the data and the results of the analysis are presented. Our analysis addresses issues related to gender and participation by using a micro-level approach in which we examine the effects of women's participation in the control of illicit grazing and illicit felling, after taking into account the role of other factors often considered important by scholars of common property and decentralization. The paper concludes with a discussion of the scope and significance of our findings in relation to existing work on decentralized forest policies and the role of local institutions in decentralized resource management strategies.

GENDER, PARTICIPATION, AND ENVIRONMENT

The participation of women in natural resource management is justified on the following grounds. First, the importance of enabling marginal members of a community to voice preferences, make decisions and engage in local politics by which resources are allocated and distributed; in essence the stuff of citizenship. Active engagement of all citizens is essential when control of natural resources is devolved to local communities. Second, forests are a significant source of livelihood and women are the linchpin that connects the livelihood strategies of rural households with forest wealth. Therefore, successful community-based resource management is difficult without the active involvement of women in influencing and enforcing institutional arrangements governing forest resources. Likewise, women tend toward maximizing utility of natural resources for

the family in comparison to men who focus more on how resources contribute to their personal well-being.

AMPLIFYING MARGINAL VOICES THROUGH PARTICIPATION

Participation in development programs is a promise of including the less vocal and most marginal members of communities in making their preferences known, articulating the most effective mechanisms for meeting those preferences, and acting to fulfill preferred states of being. Participation in its full articulation is a way to shift the axis of power and enable new actors to gain greater influence in development outcomes. It is a shift in the participation discourse beyond beneficiary participation to citizenship, agency, governance and rights (Cornwall 2004; Gaventa 2004; Nussbaum 2001). In this framework, it is imperative to ask if the promises of equity and inclusion are being realized by women, who are traditionally marginalized in communities. Participation of women is inextricably bound up in the cultural, social, historical, and political context of communities and spaces in which development unfolds. When participatory processes tend to emphasize consensus, even well intentioned participatory institutions can exacerbate existing forms of exclusion, silencing dissidence and masking dissent. The voices of the more marginal may not be raised at all in these spaces. The project of decentralizing control of natural resource down to communities could easily strengthen the status quo and deepen gender inequity (Cornwall 2003; Meinzen-Dick and Zwarteveen 1998).

Critics of participatory development projects argue that women are one of the marginalized groups that find themselves overlooked in the apparently participatory process (Guijit and Kaul Shah, 1998; Mayoux, 1995). Women's active participation in community-based initiatives is central to their private and public bargaining power. Their participation

has salutary effects on increasing their confidence to assert their rights both within and outside the household (Agarwal 1997), whereas women's exclusion in development projects that are devolved to the community surely marginalizes them. A focus on gender and participation is important for many reasons, some of which concern representation and politics.

> Through their participation, citizens communicate information about their preferences and needs to public officials and generate pressure on them to respond. Those who are inactive risk being ignored when policies are made. Moreover, beyond the possible impact on policy outcomes, participants gain additional benefits from taking part: recognition as full members of the community; education about the social and political world; and information, skills, and contacts that are useful in other social pursuits. Thus we care about group differences in political participation…because they represent a potential compromise in the democratic norm of equal protection of interests (Burns et al. 2001).

Feminist theorists argue that women's marginalization is not one-dimensional i.e., caused only by gender. It is, instead, an outcome of the intersection of the subordination conferred by caste, class and ethnicity, as well as gender. This is especially so in Indian villages, which are highly stratified by caste, class, ethnicity and gender. In Indian rural contexts, therefore, women are likely to be disadvantaged additionally because of their caste and class locations. The higher the stratification of society, the more layers upon women, and hence the more difficult it is for them to be involved in participatory processes. Gender inequality limits actual participation even when women are not formally excluded. The means by which women are excluded may echo and reinforce hegemonic gender norms, as well as replicate patterns of gendered exclusion that have wider resonance (Cornwall 2003).

Assuming communities to be ungendered and that community participation invariably leads to equitable outcomes is to ignore gender as a constitutive element of social relationships signifying differential power among men and women and their access to private and public goods (Agarwal 1997; Agrawal and Gibson 2001; Cornwall 2003). "Framing gender as an institution is beneficial in drawing attention to its multiple features – ideology, practices, constraints, conflicts, power – and affirming its complexities and multifacetedness" (Martin 2004).

Forests, Livelihoods, and Women

Beyond citizenship and inclusion, women are active in the use of forest resources.[5] In large part this has to do with social and cultural expectations which accord women primary responsibility for collecting forest products for household use. This is especially the case in the tribal belt of central India where our study is located. Women are a crucial link between livelihood strategies of tribal households and forest wealth. In the central tribal belt of India, women are responsible in a large way for collecting and processing a significant portion of forest resources, and therefore environmental policies to decentralize natural resource management have clear and significant consequences for women.

Forests and forest resources [primarily minor forest products (MFP) or non-wood forest products (NWFP)] play an important role in the viability and survival of tribal households in Madhya Pradesh and elsewhere in India. Sustainable use of forests and forest resources is a necessity for tribal households in India because of the importance of forests in

[5] This generalization may not be as relevant for timber-based economic activities in forests (Bray et al. 2003). Research on women's involvement in timber-based livelihoods around forest use is rare at best (Bray et al. 2005).

their social, cultural and economic survival (Tewari 1989). Estimates of the revenue contributions of NWFPs in India vary considerably. Some estimate that NWFPs contribute US$ 208 million to the Indian economy while another calculation places the revenues from non-wood forest products at US$ 645 million (Lele et al. 1994). Yet another estimate offered by Poffenberger (1990), estimates that the total annual value of NWFPs from the central Indian tribal belt exceeds $ 500 million. All of the estimates underscore the economic significance of collection and processing of NWFPs to forest-dependent communities.

Studies in the tribal regions of Bihar, West Bengal, and Karnataka, India offer further empirical support for the extent of dependence of tribal households on non-wood forest product collection. Data show that in two southern districts of Bihar, forty-one percent of the families collect mahuwa flowers (*madhuca indica*); thirty-one percent collect tendu leaves (*diospyros melanoxylon*) used in the making of indigenous cigarettes; twenty-three percent of the families collect mushrooms and mahuwa seeds; fifty-five percent of the families collect tamarind (*tamarindus indica*); and thirty-one percent of the families depend on the collection of wild brooms (Rao et al. 1996). In a study of Soliga tribal households, Hegde et al. (1996) find that income contribution from the collection of NWFPs is disproportionately greater than the time spent collecting the products. Their study indicates that households living in the periphery of the forest spent 39.25 percent of their time in collection and realized 47.63 percent of their income from non-wood forest products; and those tribals living closer to the forest spent 54.46 percent of their time in collection and realized 60.44 percent of their income from NWFPs. Moreover, "…variance in income from the extraction of NTFPs is much less than that of income from other vocations, indicating that the collection of NTFPs constitutes the most reliable source of income" (Hegde et al. 1996). The pivotal role that

forests play in the livelihood strategies of tribal households is evident in very favorable income returns to the time spent in collection and the stability of income from non-wood forest products. Others have noted the important role of NWFPs in meeting the subsistence needs as well as poverty alleviation of tribals (FAO 1995).

Even more significant in this relationship between forests and household subsistence is the role of women. Women and children have the primary responsibility for collecting non-wood forest products in tribal communities, and any community-based environmental strategy to manage forests must recognize this division of labor and gendered nature of forest use. The primary players in the collection, processing, and marketing of NWFPs are women. Women gather the bulk of forest produce, and this includes food and fuel related forest products. Women also gather NWFPs that are primarily for market consumption. Men are principally responsible for construction timber, poles, and some collection of medicinal plants that are also collected by women.

The importance of women in the collection of forest produce is borne by data from almost every country in Asia, Africa, and Latin America. For instance, in the North-West Frontier Province of Pakistan, women and children collect 78 percent of morels (Iqbal 1991). While women and children are the dominant players in collection and drying, men (53 percent) play a much more active role in the sale of morels. Similarly, women and children collect 90 percent of medicinal herbs and do 100 percent of the drying. Sale of medicinal herbs, disaggregated by gender, shows that 71 percent of the selling is done by women and children, and 29 percent by men (Iqbal 1991). This data from Pakistan is illustrative of the predominant role women play in the collection, processing, and marketing of non-wood forest products, without which there would be serious insufficiencies in household income

flows. Similarly, in West Bengal, India, tribal women gather *sal* leaves for six months of the year to supplement household income (Poffenberger 1990, Rajan 1995). In India, collection of *tendu* leaf (used for manufacturing *bidi*) generates part time employment for 7.5 million people and they are predominantly tribal women (Arnold 1995). Women in Uttar Pradesh, India derive a substantial proportion of their income from forests and common lands; poor women derive 45 percent of their income from forest and common land compared to 13 percent for men (FAO 1991).

The more marginal a tribal household, the greater the proportion of its income from forests. Data indicate that sub-marginal and marginal tribal households accrue 35 to 36 percent of their income from forest produce (Ramamani 1988). Dependence on forests and common property resources is highest in poor households. As household poverty increases, women become more central to ensuring the survival of households and consequently assume greater responsibility for the provision of resources from forests and common lands. The importance of forest resources for very poor tribal households is well documented in other regions of the world as well (Hegde et al. 1996). "The inextricable link between land resources and rural livelihoods, along with increasing role of women as household providers in declining rural economies, stresses the need to consider the gendered terms of access and control of the resource base, particularly in ecologically vulnerable regions" (Thomas-Slaytor 1995).[6]

Degraded forests and commons exert enormous burdens on women and children. There is a positive association between forest degradation and time and labor spent by women and children in collecting forest produce (Yadama et al. 1997). Exploratory data also

[6] On the dependence of poor on common-pool resources, see also Adhikari et al. 2004, Beck and Nesmith 2001, Bokil 1996, and Reddy and Chakravarty 1999.

indicate that women and children engage in forest product collection for a greater portion of the year. The duration of collection ranges between six to nine months a year. Pressures on forests in the central tribal belt region of India are increasing, but left with few alternatives, women and children expend ever-greater energy and resources in collecting increasingly precious non-wood forest products. Agarwal (1994a) has examined how decline in forests and village commons has eroded sources of supplementary income for women. In the face of these pressures, women warrant a greater say in the control and use of village forests and commons as women tend to fare better under common property resource regimes than in privatized property regimes where men exercise far more control (Agarwal 1994a). Village commons and forests, Agarwal notes, bolster the status of women in two ways:

> (a) the high overall dependence on them of rural households, and especially of the poor and tribal populations, for a wide variety of items essential for daily use, a dependence which becomes critical during drought and famine; (b) the fact that products from VCs and forests, which are primarily gathered by women and children, provide women with an independent source of subsistence *unmediated* by dependency relationships on men (1994a).

For these reasons, devolved forest management strategies that fail to engage women in the use, control, and management of village forests could potentially undermine women and their access to village forests. Women will continue to use forests, but without rights and responsibilities for the control and use of forests, they will be unable to take corrective action or assert their preferences over other competing demands on village forests. It is good environmental policy to recognize the considerable subsistence and economic impact of

women on tribal households and leverage the customary role of women in the protection and management of village forests.

A gender-sensitive forest management strategy accounts for gender-differentiated activities, property rights, and forest resource claims, and situates them within the context of a web of social relations. A gendered approach to community-based resource management recognizes that "questions of rights and control, above all others, implicate the social relationships within which resources are managed and used.... Furthermore, focusing exclusively on women obscures their relations with men, implying that women's and men's resource-management activities proceed along isolated, parallel tracks" (Leach 1994). Gender undifferentiated strategies assume that households constitute a set of congruent interests and preferences and that control of resources is equitable irrespective of gender (Agarwal 1994b).

When gender dimensions of forest use are overlooked, even well intentioned community management strategies may negatively affect the lives of women. For example, when a village forest committee decides to close all access to forests without any input from women, there is a real danger of transforming women into trespassers on their own commons and worse, trespassers in adjacent forests used by other communities. Women, once economically valued and productive members of a forest dependent community, are now transgressors.

Giving women a greater role in the co-management of forests increases their collective bargaining power, which is critical in order for women in rural India to assert a greater say in the way resources are managed. By giving women a greater role in joint forest management committees, we increase their bargaining power to negotiate rules and

conditions of use of community controlled forests, and more importantly, women are given more power to dictate norms of behavior vis-à-vis village forests (Agarwal 1994a). The state has a very important role to play in this regard. Simply devolving responsibility for village forests to the community will not ensure that the interests of women are protected. Someshwar (1993) highlights the importance of the State:

> In an unequal society, decentralization of decisionmaking does not necessarily result in decisionmaking by all sections of the population. More than likely, the disempowered groups would continue to be outside any such process. In such a situation, social institutions that give voice to the disempowered must be actively promoted. Although such institutions need to function independently from the state, the state has to play an active role in facilitating their formation. Contrary to current perceptions regarding the role of the state, management of natural resources cannot and should not be completely divorced from the state.

Inclusion of women in management of natural resources is compelling because such participation has the potential to lead to greater empowerment both within women's households and in the public life of their communities. Inclusion of women is also imperative given that women spend more time and labor in forest related activities, and this role is central to the livelihood strategies of their households. Community-based natural resource management strategies must include tribal women in deliberate and significant ways given their pivotal role in extraction and use of forests resources.

JOINT FOREST MANAGEMENT: ORIGINS AND INSTITUTIONAL ASPECTS

Since its beginning in the early nineteenth century and after the passage of the first Forest Act in 1878, the forest bureaucracy in India has sought to define and allocate property rights over forests even more precisely. Higher revenues and greater control over resources is the usual goal of more precise definition. JFM, with its objective of better management of forests through cooperation between the forest department and village level institutions, forms an important landmark in environmental conservation strategies in India because it undertakes to involve local populations and communities in forest protection on a country-wide basis (Kolawalli, 1995, Krishnaswamy 1995). This shift in governance strategies is at least a partial shift from the traditional goal of the forest department to maximize revenues and to do so by excluding local populations.

JFM is based on the National Forest Policy of 1988, government orders by many states, and the Government of India Policy Instructions of 1990 (Arora 1994). Its primary mechanisms of implementation are village-level organizations called forest protection committees (FPC), village forest committees (VFC) and eco development committees (EDC). It is in these forest committees, through their constitution, decisionmaking and operational and collective choices, that women are officially incorporated into, or excluded from, local level decisionmaking. Committees can either be constituted afresh, or the Forest Department can officially register and formalize local institutions that predate Joint Forest Management. Departmental officials are also empowered to dissolve committees if there are not functioning, or on evidence of corruption and illegality (Poffenberger and Singh 1996).

Members of JFM committees gain non-timber forest products from their village forests and a share of the proceeds from the sale of timber once forests have matured. Villagers do not have the right to harvest timber products by themselves, unless the wood is dry or has fallen to the ground. Their share of the proceeds from timber harvests is limited, and in some cases has been reduced further after they have successfully protected local forests. The degree to which villagers can frame their own rules of use and management is significantly shaped by forest department officials, and interventions in day-to-day management of village forests are common (Mahapatra 2000, Jeffrey and Sundar 1999). Villagers have the responsibility to protect trees and vegetation and the ability to allocate non-timber benefits within the community. Their powers are quite constrained where formation of forest committees, share in timber sales, and ability to negotiate rule changes are concerned (Kumar 2000).

According to one recent estimate, nearly 53,000 forest protection committees in India cover around 18 percent of the total forest area.[7] Other estimates list the total number of forest protection committees closer to 80,000. The work of these committees and indeed, JFM in general, has received significant attention (see Poffenberger and McGean 1996, Khare et al. 2000). Significant and well-founded criticisms of JFM point to the limited share of rural households in proceeds from sale of forest timber, and limits on women's participation in the program. But even critical evaluations of JFM concede that rural residents have gained economically from participating in JFM (Khare et al. 2000; Kumar 2000). Within communities, participation and allocation of benefits varies greatly by caste, gender, class, and occupation. For example, because of membership rules that specify a single

[7] "State Forestry Action Programme," Public speech by Inspector General of Forests, Indian Institute of Forest Management, Bhopal, Madhya Pradesh, January 21, 2000.

member from a household to the forest protection committee, women often have little say in the limited rights of management that villagers exercise (Agarwal 2001). However, the Madhya Pradesh Forest Department has made efforts toward more empowerment of committees though a series of resolutions of 1991, 1995, 2000 and 2001. Each resolution is one further step towards empowerment. For example, the latest resolution envisages all adult members (as per the *Gram Sabha* voter list) to be members of village level forest committees.

Improvements in forest condition as a result of JFM are likely the result of whether, and to what extent, new institutions are effective. Effectiveness in containing and constraining illegal actions by those subject to new institutional arrangements is a necessary condition for credible claims that improvements in forest condition are to be traced to institutional effects. To assess the performance of the village level forest management committees, therefore, the study focuses on whether these committees have been able to control illegal grazing and felling in forests under their control. The assumption is that reduction and prevention of rule-violating behavior, especially when rules are locally crafted and enforced, is essential to the effectiveness of decentralization measures. To take into account actual effects of institutional and other variables, we also use an additional dependent variable: regeneration in the forest.

DIFFERENTIATING GENDER FROM OTHER EFFECTS

When examining the role of women's participation on different measures of outcomes, it is especially important to attend to a number of other variables that the literature on common property and decentralization has identified as being important in shaping

outcomes. The importance of gender equity in community-based natural resource management is demonstrated if we are able to account for forest outcomes that are principally due to the participation of women, but only after we first consider the impact of other factors identified in previous theoretical and empirical studies. Some variables that have been given repeated attention by scholars of common property are those related to demographic pressures, market forces, socio-political forces, and institutional arrangements. Since we have collected all the data from a single political unit within India, we are especially interested in ensuring representation of variations that characterize the local demographic, economic, socio-political, and institutional contexts (see also Agrawal and Yadama 1997, Agrawal 2001).

Demography and resources

Several careful studies on resources and sustainable management identify demographic pressures as being highly relevant to effectiveness of resource management. The area of land and forests available to users affects whether consumption pressures may overwhelm institutional constraints. Similarly, the number of animals rural families possess, and changes in these numbers over time, affect the demand for fodder and thereby the pressure on grazing resources in forests. User incentives to manage forests are also affected by their assessment of whether available benefits in forests in the form of fodder or firewood are sufficient to warrant protectionist measures. Keeping these considerations in view, we focus on six demographic and resource related factors: (i) size of a village area, (ii) number of households in a village, (iii) change in number of households over the last 10 years, (iv) number of cattle in a village, (v) change in the number of cattle over the last 10 years, and (vi) whether a village forest contains fuel and fodder resources for villagers' use.

Collectively, these factors allow us to examine not only the impact of existing demographic pressures on resources, but also to assess whether the rate of demographic change has an influence on the ability of institutions to cope with harvesting pressures on a village forest.

Market pressures

The degree of articulation with markets is important to resource management because market demand for commodities such as timber, firewood and fodder can add significantly to harvesting pressures. The lure of a stream of cash revenues and incomes can lure increasing numbers of rural residents to collect forest products for sale in the market. Institutional rules to promote stinting behavior can in such situations become ineffective. One way of gauging the effect of market forces on forests is the physical proximity of a village to markets. Although prices at different locations are a more reliable window into market demand, distance from markets or roads has been used in many existing studies because of ease in collecting data, and because variations in distance from markets can reliably represent the strength of market forces (Agrawal and Yadama 1997).

Social and political conditions

Existing social and political interactions within communities are represented by such factors as: (i) conflicts among members of a forest protection committee, (ii) conflicts between a village forest committee and other adjacent forest committees, and (iii) regular interactions of a village forest committee with local forest department officials signifying the strength of coordination between the state and community. The first two factors correspond to the intuition that if there are high levels of internal or external conflicts, forest committees are likely to find it difficult to arrive at enforceable agreements to reduce harvesting

pressures, and that existing conflicts are also likely to prompt some local residents to break existing rules. Interactions with forest department officials will likely lead local residents as well as forest protection committees to reduce illegal grazing and felling in the forest, and thus result in a greater likelihood of regeneration.

Institutional arrangements

Over the past two decades, analysts attending to resource use and management have come increasingly to understand that governance of resources, much like politics, is inescapably local. Writings by scholars of common property and advocates of community-based management have had a profound effect on earlier understandings of effective ways to manage resources. Institutional arrangements have, in consequence, received immense attention by those who attempt to understand forest governance and believe local actors to be a powerful influence on whether resources can be managed sustainably. Although effective rules to monitor user actions and sanction wayward behavior are especially important features of institutions, several other aspects have also received attention. Among them are regular meetings, maintenance of records of meetings and accounts, and ability to hire and fire guards so that accountability relations can be maintained at the local level.

Some scholars of local institutions also believe that informal arrangements to govern local resources can be even more effective if they exist prior to formalization by state authorities. In light of these arguments, our attention is toward seven features of local organizational arrangements: (i) prior existence of a forest committee before being registered formally by the forest department, (ii) the extent to which a village committee holds meetings with frequency, (iii) maintenance of records of their meetings by village forest protection committees, (iv) maintenance of records by village committees of expenditures and income,

(v) the ability of a village committee to hire workers and pay them, (vi) whether the village committee patrols the forest, and finally, (vii) the ability of a village forest protection committee to sanction members who break rules.

Gender and participation

To examine the effects of women's participation in resource management outcomes, we looked at three different forms of participation. The minimal level of participation corresponds to women's membership in the forest committee. A more involved form of participation is women's presence in the meetings of the forest protection committee signifying an intermediate level of participation. If women are involved in monitoring and sanctioning by patrolling the forest, we consider this form of participation as indicating a high level of participation. Thus the three dimensions of women's participation included in our study are (i) whether women are members of the protection committee, (ii) whether women participate in meetings of forest protection committees, and (iii) whether women participate in patrolling the forest. We recognize that measures of participation focusing on women's actual involvement in decision-making and levels of benefits derived from forests would represent greater depth regarding the nature of participation, and some of its more effective forms. However, the intensity of fieldwork necessary to gather data on these variables was not possible given our resources.

DATA AND METHODS

Data

The variables in our study are drawn from the data instruments developed through the International Forestry Resources and Institutions (IFRI) Program at Indiana University. In contrast to the IFRI instruments, which require extended field stays in each research site, we used an abbreviated set of 32 questions to gather data on our variables of interest from a large number of sites. To collect data on these variables we conducted interviews with the heads of nine hundred randomly selected forest protection committees. Of these interviews, 673 produced the full complement of information on the variables in our survey (yielding a response rate of 75 percent). The basic information related to the variables on which we collected data is presented in Table 1. The upper panel provides information for the discrete variables in the dataset, while the lower panel for the continuous variables in our data. For some of the cases, we could not collect information for the full range of variables. The Table also suggests that the values of most variables are reasonably well distributed despite a few outliers, typically on the high end of the distribution in the case of the continuous variables.

The first three rows of the upper panel of the table contain information for the three dependent variables in our analysis: control of illicit grazing, control of illicit felling and the regeneration of the allotted forest.

In accordance with the conceptual framework, to examine the effects of women's participation on resource management outcomes, we looked at three different levels of participation: (i) whether women are members of the protection committee, (ii) whether women participate in meetings of forest protection committees, and (iii) whether women participate in patrolling the forest. All three variables are dichotomous, and were coded as

“1" or “0" depending on whether the response was “yes” or “no”. Descriptive statistics of these variables can be found in the upper level of Table 1.

Table 1 – Descriptive statistics of the variables in the analysis

Discrete Variables	OBS	Yes	No
Control of illicit grazing	799	347	452
Control of illicit felling	792	376	416
Regeneration of the allotted forest	767	324	443
Resources	794	747	47
Conflict among members	802	280	522
Conflict among committees	802	108	694
Interaction with forest department	801	787	14
Capacity	753	26	727
Meetrec	800	741	59
Recacct	801	722	79
Comhire	791	550	241
Orgmeet	791	656	135
Patfrec	799	614	185
Regbefr	798	189	609
Fine	809	143	666
Gender index	743	135	608
Women in the committee	783	331	452
Women in meeting	767	351	416
Women patrolling	772	342	430

Table 1 – Descriptive statistics of the variables in the analysis (continued)

Continuous Variables

	OBS	MEAN	STD. DEV	MIN	MAX
Area of Village	808	250	482.0174	0	7500
Number of families	809	159	181.3856	0	1710
Increase in families in 10 years	809	41	85.79318	-660	1010
Quantity of cattle	809	563	650.1434	0	11186
Increase in cattle in 10 years	809	66	307.5569	-3335	1600
Km. to nearest market	809	13	12.65305	0	216

We also collected data to capture variability in demography and resources, market pressures, social and political conditions and institutional arrangements. As has been mentioned, the variables related to demographic context and availability of resources are: (i) area of the village (in hectares), (ii) number of households in the village, (iii) change in number of households over the last 10 years, (iv) number of cattle in the village, (v) increase in the number of cattle over the last 10 years, and (vi) whether the forest contains fuel and fodder resources for villagers' use. Collectively, these variables allow us to include not only the effect of existing demographic pressures on resources, but also to assess whether the rate of demographic change has an important effect on the ability of institutions to cope with harvesting pressures. The first five variables in this set are continuous, but the last variable is dichotomous.

Regarding market pressures we collected information about distance to the closest market (in kilometers). Variation in distance from markets can represent to some extent market pressures because the incentive for extraction of resources is greater when markets

are closer. Although prices at different locations may be more reliable proxies of the market pressure, the distance from markets or roads has been used in many existing studies because of ease in collecting data (see Agrawal and Yadama, 1997).

The data to control for social and political conditions in which the committees work are: (i) whether members of a forest protection committee have conflicts among themselves, (ii) whether a forest protection committee reports conflicts with other committees, and (iii) whether a committee has regular interactions with forest department officials.

Lastly, variables representing institutional arrangements under which each committee works are: (i) whether the forest protection committee existed before being registered formally, (ii) whether the committee holds meetings at least once a month, (iii) whether the committee maintains records of its meetings, (iv) whether the committee maintains records of its expenditures and income, (v) whether the committee can hire workers and pay them, (vi) whether the committee patrols the forest, and (vii) whether the committee has imposed fines on members who break rules. Each of these seven variables is a dichotomous variable, where we coded a “yes” response as “1" and a “no” response as “0".

It is also worth noting that nearly 93 percent of the forest protection committees indicated that their forests contained products upon which the villagers depended to a significant degree (Resource dependence variable in Table 1). The number of cases in which respondents indicated that interactions with forest department officials were regular is also very high – above 95 percent. This is not surprising given that our sample is drawn from Madhya Pradesh and Chattisgarh with a higher proportion of forest dependent tribal populations.

Three institutional variables exhibit widespread adoption by the forest protection committees. These concern regular meetings, maintenance of records of meetings and maintenance of records of income and expenses. Such extensive adoption is partly the result of formal requirements in the Joint Forest Management rules. The more interesting point when considering the extent to which these requirements have been adopted is not that so many of the committees follow them, but why a significant number of committees do not follow them. Anywhere between 15 to 30 percent of the committees do not follow these rules. It is also interesting to note that the incidence of record keeping is higher than that of regular meetings. This suggests that forest protection committees find it harder to elicit sufficiently high levels of participation from their members in comparison to their ability to keep formal records. Although we consider the three forms of women's involvement in forest protection committees to constitute increasing levels of participation by women, the data indicate that the three variables do not comprise an ordered set. That is, there are many cases where women participate in meetings but are not members in the forest protection committee, and others where women are involved in patrolling but not present at meetings. Existing formal rules requiring women's membership in forest protection committees are thus not entirely effective, and women's involvement in committee meetings and patrolling seems to be taking place both formally and informally.

Methods

In our analysis, we examine how independent variables affect each of the three outcome variables. In each case, we use a probit model since our three dependent variables are all dichotomous. The statistical relationship between our independent variables and the dependent variables can be summarized in the following equation.

$$\Pr(\boldsymbol{outcome}_i=1|\boldsymbol{x}) = \boldsymbol{\Phi}(\alpha + \beta dem_i + \varphi soc_i + \delta inst_i + \sigma gend_i + \varepsilon_i) \quad (1)$$

Where the dependent variable is the probability that an outcome variable takes value of 1, *dem* is the vector of demographic variables described before, *soc* is the vector of political interaction and social variables, *inst* is the vector of variables representing the institutional arrangements and *gend* is the vector composed by the variables related to the participation of women in committee's activities. The subscript *i* denotes the committee, and ε is the error term. The function $\boldsymbol{\Phi}(x)$ denotes the standard normal cumulative distribution function.

We examined the effects of the variables related to local institutional arrangements and gender and participation individually, as well as by two indexes of institutional capacity and gender participation. To construct the institutional capacity index, we created a dummy variable that takes value of 1 in committee *i* if all the discrete variables related to institutional arrangements have value 1 in that committee, 0 otherwise. Thus, if the responses to all seven institutional variables for a given committee were "1", the value of the institutional capacity index would be 1 for that observation. If one of the component variables were coded as "0", the value of the index would be 0. The gender participation index was created following the same methodology, although in this case the three independent variables related to participation of women were used.

If the controls included in the analysis are precise, then we should be able to obtain reliable estimates of the effect of participation of women at different levels in the probability of, say, controlling illicit grazing. However, there are two concerns to take into account. The first concern is that there may be some variables at the local level that may affect the outcome variables that may also affect the women's participation variables. Think for

example, that some political units in a district may be more concerned about forest resources. If this concern translates into interventions that facilitate the desired outcome, its effect will not be adequately captured by our controls. This unobserved variable will bias the estimates of the gender effects if it is correlated with the participation of women in the activities of the committee. Another example may be that committees located in different communities have different codes of conduct related to the gender division of labor. This will affect the different levels of participation of women. If it also affects the probability of controlling illicit grazing (maybe through the number of people considered capable of patrolling the forest, or the intensity of this control), then the estimate of the effect of women's participation will be biased. To deal with these problems we created *districts dummies*, a variable representing the district to which the community belongs (the number of districts as well as the number of communities belonging to those districts are listed in Table 2). By including the district fixed effects we control for any unobserved factors at the district level that may affect dependent and independent variables.

Table 2 – Number of committees by district

District	Frequency	District	Frequency
Bhind	14	Raisen	20
Panna	15	Narsinghpur	63
Sagar	41	Chhindwada	15
Shahdol	79	Seoni	44
Mandsaur	6	Balaghat	38
Ujjain	14	Surguja CH	14
Dewas	21	Bilaspur CH	54
Jhabua	20	Raigar CH	18
Dhar	40	Rajnandgaon CH	1
Indore	21	Raipur CH	31
Khargone	65	Sheopur	19
Khandwa	17	Neemuch	5
Rajgarh	1	Barwani	38
Vidisha	16	Kawardha CH	1
Bhopal	20	Mahasamund CH	16
Sehore	21	Dhamtari	21
Total		**809**	

The second concern is that it may be the case that the control of illicit grazing is jointly determined with the control of illicit felling. If this is the case the error terms in the equation regarding control of illicit grazing and control of illicit felling (equations of type (1)) are correlated. Thus, a system of binary equations would seem to be a more appropriate way to estimate the parameters of interest. To account for this possibility we estimate an alternative specification, where the probability of controlling illicit grazing and illicit felling

are jointly determined, by using a bivariate probit specification and present the results of this alternative specification below as well.

RESULTS

The results of our analysis are presented in Tables 3, 4 and 5. Table 3 presents the marginal effects of the independent variables on the probability of controlling illicit grazing; Table 4 presents the results on the probability of controlling illicit felling; and Table 5 on the probability of regeneration in the allotted forest. As was mentioned in the previous section, two main specifications were used: one in which we included aggregate indicators of the institutional capabilities of the committees (Capacity Index, in the Tables) and of the degree of women's participation in the activities of the committee (Women's participation Index); and another where we included the disaggregated variables used to build the two indices. Results of these estimations are presented in columns (a) and (b) of each of the tables. In addition, to control for factors at the geographic or political level that our control variables may not capture, the same models were estimated including regional effects at the district level.[8] Results of the estimations including these regional dummies are presented in columns (c) and (d) of each table. In column (c) the results are based on the capacity and women's participation index, while in column (d) we present results from using the individual variables that comprise the two indices. These tables are extracts of tables with full specifications including estimates in addition to marginal effects. These complete tables are available upon request.

[8] Different specifications using regional dummies at the Block level were also estimated. The results are very similar to the ones presented here using district dummies.

Since our main interest in this paper is to identify the effects of women's participation, we will focus the ensuing discussion mainly on gender related issues. Nonetheless, it is useful first to indicate some of the more important results concerning the control variables.

Control variables

The analysis reveals some interesting patterns concerning the role of the demographic, social, political and institutional variables we used. From columns (a) and (b) of tables 3, 4 and 5, we can see that some of the effects of these variables on the actions of those dependent on forests and regeneration-related outcomes are as we expected. Others need further examination.

The area of the village is not statistically significant in any of the models. The results suggest that there is no clear effect of village area on the likelihood of greater control over rule-violating behavior or regeneration in the forest. This result is in line with a significant literature that suggests that natural resource governance outcomes are not merely dependent on population and demographic pressures but are a function of local institutional arrangements that enable communities to manage community forests successfully (Agrawal and Yadama 1997; Baland and Platteau 1996; Gibson et al. 2000). Other demographic variables, like number of families and cattle, and the percentage increase in both, have statistically significant effects in most of our models, although there appears to be no clear pattern. For example, in the case of control of illicit grazing, what matters is the percentage increase in both, families and cattle, while in the case of control of illicit felling it is the increase in families and the quantity of cattle that matters. In the case of the regeneration of allotted forest it is the quantity of cattle that is important. Overall the analysis suggests that

the effects of variations in levels of population have statistically smaller and less significant effects than the effects of changes in population in the past decade. Forest protection institutions likely require time to adjust to change, and rapid changes are more likely to introduce negative effects on resource-related actions and forests themselves.

The variable distance from markets has a statistically significant effect in most of our models, except on illegal felling. Distance from markets is important for the control of illegal grazing and regeneration of allotted forest. Interestingly, distance from markets has a negative effect on control over grazing and regeneration, suggesting that as distance to market declines, control of illegal grazing and regeneration is more likely. This is likely given that distance from markets is also indicative of the ease with which government officials may be able to visit the villages to monitor forest protection committees. If this were the case, then the variable distance to roads should present the same pattern. However, distance to the nearest road is statistically significant only in the case of regeneration of the allotted forest and positively affects regeneration of the forest. Thus, the negative relationship between distance and control of illegal grazing and regeneration may be a window into the consciousness of the members of the village to be more responsible in managing the resources induced by outside exposure. Another explanation for an inverse effect between distance and control of illegal grazing and regeneration perhaps resides in the relationship between proximity to markets and higher wealth. It is plausible that the negative pressures on forests is lower in communities that are closer to markets and which are also economically better off due to this proximity to markets. Indeed, when district dummies are included (columns (c) and (d) of each table), the effect of this variable vanishes for the case of illicit grazing and decreases for the case of illicit felling. This result suggests that the

significance of the variable was due to some confounding factor adequately captured by the regional dummies.

Conflicts among forest protection committees seem not to produce statistically significant effects on outcomes. We had expected to find a negative relationship between inter-committee conflict and forest governance outcomes. The absence of a clear relationship suggests that in Madhya Pradesh, such conflicts are relatively less important in affecting outcomes. One reason that might partially explain this result is the extensive involvement of forest department officials in committees. Their presence may mute the negative effects of inter-community conflicts. In fact, the variable interactions with the forest department has a positive and statistically significant effect on the control of illicit grazing, felling and the regeneration of allotted forest, although the effect in the case of illicit grazing disappears when individual institutional variables are introduced into the analysis. These results suggest that the active involvement of forest department officials in Madhya Pradesh has a salutary effect on forest outcomes.

On the other hand, conflicts among members within a committee produce negative effects on the control of illicit grazing and illicit felling, and the relationship is statistically significant in nearly all our models. The marginal effects of intra-community conflicts are especially important for control over grazing and regeneration. Absence of conflicts improves the likelihood of control over illegal grazing and felling in the forest. This variable is not significant in the case of regeneration of allotted forest, as expected.

Institutional capacity index has a statistically significant effect on the control of illicit felling. The statistical insignificance of the institutional capacity index for the other two outcome variables can be taken to mean that the component variables in the index –

committees' existence prior to formal recognition, regular meetings, maintaining of records, hiring of workers, patrolling of forest, and use of fines and other sanctions on rule breakers – have competing and conflicting effects on the dependent variables. This intuition is confirmed when we examine columns (b) and (d), where the index is disaggregated and the different variables are used individually in the analysis. Several of the individual variables are statistically significant by themselves on the three outcomes, although their relative importance varies for the three different outcome variables. Regular meetings and capacity to hire guards seem to be more important overall than existence before formal registration or formal patrolling. It is highly plausible that the effects of patrolling are captured more by the variable – hiring of guards.

Finally, it is worth noting that when regional fixed effects are included in the model, some of the control variables become insignificant while the impact of other control variables diminishes. In including regional effects in the estimations, we are capturing additional elements to those captured solely by including our control variables. Thus, the inclusion of these regional dummy variables is important to control for unobserved factors that may confound the estimates of our variables of interest. Moreover, the likelihood ratio test of the joint significance of these regional effects variables (included in columns (c) and (d) of each table) confirms that they are statistically important.

Women's participation

The gender index is statistically significant and positive in all the specifications for the three outcomes. In the case of the control of illicit grazing, women's participation index is associated with an increase of 24 percent in the probability of controlling illicit grazing (Table 3 column (a)) and with an increase of 28 percent in the control of illicit felling ((Table

4 column (a)). In the case of regeneration of the allotted forest, the effect of women's participation index is to increase regeneration by approximately 28 percent (Table 5, column a). Moreover, these effects are robust to the specifications where the dummy variables related to the district to which the committee belongs were included. In the case of illicit grazing, for example, these results indicate that when women belong to a forest protection committee, participate in the meetings of that committee and patrol the forest then the probability of controlling illicit grazing is 25 percent higher than in communities where women do not participate in these three activities (Table 3 column (c)).

To examine the effect of each of the different forms of women's participation on the outcomes, women's participation index was decomposed into its three individual variables. Results in the columns (b) of each table, indicate that women's participation in patrolling has very important effects on all three forest outcomes. In the same column, we can observe that women's participation in meetings has statistically significant and positive effects in the control of illicit grazing and the regeneration of the allotted forest, and the presence of women on a committee has a statistically significant effect in the control of illicit felling. Having women participate in patrolling the forest increases the likelihood of controlling illicit grazing by 27 percent, illicit felling by 29 percent and regeneration of allotted forest by 14 percent. Participation of women in meetings increases the likelihood of controlling illicit grazing also by 14 percent and the likelihood of the regeneration of forests by 11 percent. The effect is not significant in the case of illicit felling. Finally, there is an 11 percent increase in the probability of controlling illicit feeling when women have membership on forest protection committees.

The results suggest that more direct participation by women in decision-making and implementation of forest protection has a stronger and more statistically significant effect on control of illegal grazing, illegal felling, and regeneration. The only exception to the general pattern that higher levels of women's participation have a more statistically significant effect on resource-related outcomes is in the case of women's presence in meetings and the control of illegal felling. One possible explanation of the result may be that women are not as important in decision-making in the committees where felling of timber is concerned, but are quite important in ensuring that villagers abide by the decisions made by the committee. However, we are not entirely satisfied with this explanation.

The role of the regional dummies is important in this case. When these regional effects are included, the importance of having women patrol forests decreases relative to their participation in meetings, although, in absolute terms, it is still more important. Also, the effect from women's participation in patrolling is much lower on the regeneration of forest than the effect of other resource-related outcomes. This result is intuitive since it is likely that the control of illicit felling and grazing is more dependent on patrolling than the immediate regeneration of allotted forest.

Overall, we find that higher levels of women's participation in forestry related village meetings and patrolling of forests has important and positive effects on outcomes even when we take into account a host of other factors considered important in the literature. Indeed, women's participation has marginal effects on outcomes that are as or more important than the seven institutional variables we included in our analysis.

Joint estimation of control of illicit grazing and illicit felling

It is possible that control of illicit grazing and control of illicit felling are jointly determined. We tested whether this might be the case statistically, and the results are presented in Table 6. In Table 6, columns (a) and (c), presents the estimates for the case in which the capacity and the gender index are included. The difference between these columns is that column (c) includes regional effects. Similarly, columns (b) and (d) of Table 6 present the results of the estimation when both indexes are decomposed into their individual components. Column (b) does not include regional effects. Regional effects were incorporated in the estimation that yields the results presented in column (d) for purpose of comparison.

Results indicate that control variables related to demographic and market pressures maintain the same behavior as in previous regressions. Variables related to social and political factors (conflict among members, conflict between committees, interaction with the forest department) also maintain their effect on each of the outcome variables.

Recall that Table 6 presents the marginal effects of each variable on the probability of controlling illicit grazing and illicit felling simultaneously. In column (a) the composite index of institutional capabilities has no effect in this joint outcome. In column (c) we can observe the same result when regional effects are included. When the capacity index is decomposed into its respective variables, we see that the capacity of the committee to hire and to impose fines significantly increase the likelihood of positive forest outcomes. The same happens when the committee maintains meetings once a month. These results are independent of the inclusion of regional effects. An interesting result is that existing before registration apparently affects the probability of controlling illicit grazing and illicit felling negatively.

This result appeared before only in the case of illicit felling when regional dummies were included (column (d) in Table 4). It may be driven by misguided activities that are still present after the registration of the committee, in other words, after the implementation of the committee's activities under the regulations of the forest department.

The gender participation index is again statistically significant for achieving positive joint outcomes of controlling illegal grazing and felling. In Table 6, the estimates are positive and statistically significant, with a marginal effect of around .25 when regional effects are not included, and of 0.24 when regional dummies are included. Both these results indicate significant increase in the likelihood of positive forest outcomes and are close to the effect estimated in previous regressions. When the disaggregated variables of women's participation were included, we find that participating in meetings and patrolling is important for the joint control of illicit grazing and illicit felling, while being a member of the committee does not appear to have a statistically significant effect.

Table 3–Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Control of illicit grazing [Marginal Effects])

	(a)	(b)	(c)	(d)
Area of Village (xe-04)	-0.138	-0.680	-0.115	-0.806
	(0.31)	(1.51)	(0.24)	(1.63)
Number of families (xe-04)	-0.579	-0.103	0.583	0.526
	(0.43)	(0.07)	(0.36)	(0.33)
Increase in families (10 years)	-0.001	-0.001	-0.001	-0.001
	(2.10)*	(2.78)**	(1.30)	(2.37)*
Quantity of cattle (xe-03)	-0.068	-0.056	-0.035	-0.058
	(1.51)	(1.22)	(0.78)	(1.22)
Increase in cattle (10 years) (xe-03)	0.439	0.310	0.462	0.413
	(1.97)*	(1.45)	(1.80)	(1.68)
Distance to nearest market	-0.007	-0.007	-0.003	-0.003
	(3.18)**	(2.79)**	(1.12)	(1.13)
Distance to nearest road	0.002	0.002	0.002	0.003
	(1.14)	(0.83)	(0.99)	(0.90)
Time of operation (until survey) (xe-03)	0.285	0.183	0.202	0.138
	(1.11)	(0.66)	(0.64)	(0.41)
Availability of fuelwood	-0.057	-0.138	-0.252	-0.341
	(0.52)	(1.07)	(1.68)	(2.05)*
Availability of fodder	0.264	0.276	0.315	0.341
	(1.95)	(1.96)	(2.22)*	(2.29)*
Conflict among members	-0.176	-0.250	-0.181	-0.244
	(3.68)**	(4.73)**	(3.22)**	(4.04)**
Conflict among committees	0.054	0.076	0.019	0.039
	(0.81)	(1.02)	(0.24)	(0.46)
Interacts with forest dept.	0.143	0.093	0.133	0.087
	(3.05)**	(1.78)	(2.53)*	(1.49)
Capacity index	0.106	--	0.091	--
	(0.93)		(0.74)	
Maintains records of meetings	--	0.183	--	0.240
		(1.24)		(1.40)
Maintains accounting records	--	-0.297	--	-0.413
		(2.25)*		(2.54)*
Capacity to hire	--	0.268	--	0.289
		(5.22)**		(4.51)**
Meetings once a month	--	0.175	--	0.167
		(2.53)*		(2.16)*
Patrols everyday	--	0.074	--	0.085
		(1.40)		(1.39)
Existed before registration	--	-0.176	--	-0.259
		(3.44)**		(4.41)**
Impose fines	--	0.160	--	0.174
		(2.75)**		(2.59)**

Table 3–Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Control of illicit grazing [Marginal Effects]) (Continued)

Women participation index	0.241	--	0.249	--
	(4.35)**		(3.92)**	
Women in the committee	--	-0.048	--	-0.044
		(0.98)		(0.73)
Women in meeting	--	0.149	--	0.188
		(2.98)**		(3.40)**
Women patrolling	--	0.271	--	0.265
		(5.43)**		(4.68)**
Includes regional dummies	NO	NO	YES	YES
	--	--	(0.000)	(0.000)
Observations	623	623	621	621

Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%

Table 4--Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Control of illicit felling [Marginal Effects])

	(a)	(b)	(c)	(d)
Area of Village (xe-04)	0.467	-0.024	-0.277	-0.338
	(1.12)	(0.06)	(0.60)	(0.68)
Number of families (xe-04)	0.193	0.632	0.815	0.820
	(0.14)	(0.46)	(0.50)	(0.50)
Increase in families (10 years)	-0.001	-0.002	-0.001	-0.001
	(2.70)**	(3.00)**	(1.72)	(2.60)*
Quantity of cattle (xe-03)	-0.140	-0.135	-0.061	-0.091
	(2.85)**	(2.61)**	(1.21)	(1.65)
Increase in cattle (10 years) (xe-03)	-0.068	-0.262	0.059	0.016
	(0.02)	(0.85)	(0.21)	(0.05)
Distance to nearest market	0.002	0.003	-0.004	0.004
	(0.96)	(1.40)	(1.44)	(1.60)
Distance to nearest road	-0.001	-0.002	-0.002	-0.003
	(0.43)	(1.13)	(1.18)	(1.75)
Time of operation (until survey) (xe-03)	0.554	0.317	0.035	0.088
	(2.11)*	(1.11)	(0.11)	(0.25)
Availability of fuelwood	-0.080	-0.157	-0.231	-0.265
	(0.73)	(1.27)	(1.63)	(1.72)
Availability of fodder	0.206	0.203	0.267	0.221
	(1.50)	(1.45)	(1.78)*	(1.40)
Conflict among members	-0.214	-0.281	-0.189	-0.251
	(4.39)**	(5.27)**	(3.26)**	(4.10)**
Conflict among committees	0.068	0.093	0.046	0.067
	(1.00)	(1.26)	(0.57)	(0.78)
Interacts with forest dept.	0.102	0.040	0.112	0.055
	(2.15)*	(0.77)	(2.10)*	(0.93)
Capacity index	0.247	--	0.091	--
	(2.15)*		(2.18)*	
Maintains records of meetings	--	0.257	--	0.378
		(1.68)		(2.20)
Maintains accounting records	--	-0.230	--	-0.404
		(1.72)		(2.55)*
Capacity to hire	--	0.180	--	0.244
		(3.41)**		(3.64)**
Meetings once a month	--	0.188	--	0.197
		(2.70)**		(2.50)*
Patrols everyday	--	0.047	--	0.040
		(0.88)		(0.65)
Existed before registration	--	-0.066	--	-0.169
		(1.26)		(2.74)**

Table 4--Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Control of illicit felling [Marginal Effects])

	(a)	(b)	(c)	(d)
Impose fines	--	0.139	--	0.160
		(2.37)*		(2.41)**
Women participation index	0.275	--	0.264	--
	(4.95)**		(4.14)**	
Women in the committee	--	0.116	--	0.109
		(2.36)*		(1.84)
Women in meeting	--	0.036	--	0.040
		(0.71)		(0.70)
Women patrolling	--	0.290	--	0.268
		(5.79)**		(4.73)**
Includes regional dummies	NO	NO	YES	YES
	--	--	(0.000)	(0.000)
Observations	621	621	608	608

Absolute value of z statistics in parentheses. * significant at 5%, ** significant at 1%

Table 5 – Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Regeneration of allotted forest [Marginal Effects])

	(a)	(b)	(c)	(d)
Area of Village (xe-04)	-0.139	-0.547	0.001	-0.349
	(0.30)	(1.14)	(0.00)	(0.66)
Number of families (xe-03)	0.191	0.296	0.336	0.430
	(1.43)	(2.06)*	(2.05)*	(2.50)*
Increase in families (10 years)	-0.0002	-0.0004	-0.0001	-0.0003
	(0.53)	(0.85)	(0.12)	(0.52)
Quantity of cattle (xe-03)	-0.112	-0.124	-0.071	-0.103
	(2.38)*	(2.50)*	(1.30)	(1.84)
Increase in cattle (10 years) (xe-	0.053	-0.081	-0.059	-0.145
	(0.24)	(0.34)	(0.24)	(0.55)
Distance to nearest market	-0.009	-0.009	-0.007	-0.006
	(3.53)**	(3.35)**	(2.40)*	(2.02)*
Distance to nearest road	0.009	0.007	0.010	0.007
	(2.31)*	(1.85)	(2.12)*	(1.41)
Time of operation (until survey)	0.158	0.015	0.114	0.139
	(0.61)	(0.06)	(0.34)	(0.41)
Availability of fuelwood	0.243	0.134	0.052	0.024
	(2.22)*	(1.04)	(0.32)	(0.14)
Availability of fodder	0.053	0.092	0.158	0.145
	(0.40)	(0.71)	(1.11)	(1.01)
Conflict among members	0.028	-0.045	0.017	-0.023
	(0.56)	(0.86)	(0.27)	(0.37)
Conflict among committees	0.082	0.170	0.117	0.172
	(1.17)	(2.24)*	(1.34)	(1.90)
Interacts with forest dept.	0.194	0.126	0.236	0.167
	(4.13)**	(2.46)*	(4.33)*	(2.81)**
Capacity index	-0.031	--	0.025	--
	(0.28)		(0.19)	
Maintains records of meetings	--	0.119	--	0.105
		(0.70)		(0.53)
Maintains accounting records	--	0.150	--	0.105
		(1.04)		(0.59)
Capacity to hire	--	0.057	--	0.065
		(1.09)		(0.93)
Meetings once a month	--	0.233	--	0.260
		(3.34)**		(3.28)**
Patrols everyday	--	-0.125	--	-0.117
		(2.38)*		(1.90)
Existed before registration	--	-0.051	--	0.024
		(1.00)		(0.38)

Table 5 – Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Regeneration of allotted forest [Marginal Effects]) (continued)

	(a)	(b)	(c)	(d)
Impose fines	--	0.124	--	0.102
		(2.15)*		(1.49)
Women participation index	0.285	--	0.331	--
	(5.11)**		(4.68)*	
Women in the committee	--	0.061	--	0.101
		(1.26)		(1.63)
Women in meeting	--	0.113	--	0.128
		(2.26)*		(2.23)*
Women patrolling	--	0.145	--	0.110
		(2.94)**		(1.91)
Includes regional dummies	NO	NO	YES	YES
	--	--	(0.00)	(0.00)
Observations	609	609	587	587

Table 6 – Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Joint estimation of control of illicit grazing and illicit felling [Marginal Effects])

	(a)	(b)	(c)	(d)
Area of Village (xe-04)	0.018	0.39	0.256	-0.388
	(0.04)	(0.95)	(0.01)	(0.002)
Number of families (xe-03)	-0.043	0.006	-0.038	-0.066
	(0.35)	(0.05)	(0.00)	(0.925)
Increase in families (10 years)	-0.001	0.001	-0.001	-0.001
	(2.54)*	(3.15)**	(0.03)	(2.64)*
Quantity of cattle (xe-03)	-0.101	0.095	-0.061	-0.067
	(2.43)**	(2.23)*	(2.03)*	(1.02)
Increase in cattle (10 years) (xe-03)	0.271	0.146	0.303	0.228
	(1.44)	(0.76)	(1.41)	(1.53)
Distance to nearest market	-0.003	-0.001	-0.002	-0.001
	(1.39)	(0.67)	(0.56)	(0.26)
Distance to nearest road	0.001	-0.001	0.001	0.001
	(0.56)	(0.09)	(1.81)	(0.99)
Time of operation (until survey) (xe-03)	0.428	0.238	0.040	-0.022
	(1.86)	(0.97)	(0.90)	(0.007)
Availability of fuelwood	-0.064	-0.150	-0.048	-0.156
	(0.63)	(1.30)	(6.01)	(4.57)**
Availability of fodder	0.201	0.199	0.206	0.206
	(2.20)**	(2.20)*	(9.03)**	
Conflict among members	-0.184	-0.251	-0.191	-0.254
	(4.63)**	(6.08)**	(6.82)**	(5.24)**
Conflict among committees	0.065	0.102	0.062	0.089
	(1.06)	(1.54)	(2.57)*	(1.34)
Interacts with forest dept.	0.122	0.068	0.117	0.074
	(3.09)**	(1.54)	(4.12)**	(2.73)*

Table 6 – Effects of demography, committee capacity, socio-political, and gender equity (Dependent variable: Joint estimation of control of illicit grazing and illicit felling [Marginal Effects]) (continued)

	(a)	(b)	(c)	(d)
Capacity index	0.162	--	0.128	
	(1.48)		(1.75)	
Maintains records of meetings	--	0.181	--	0.197
		(1.75)		(1.74)
Maintains accounting records	--	0.275	--	-0.268
		(2.35)*		(1.88)
Capacity to hire	--	0.225	--	0.211
		(5.57)**		(3.67)**
Meetings once a month	--	0.166	--	0.149
		(3.21)**		(2.51)*
Patrols everyday	--	0.062	--	0.083
		(1.40)		(0.87)
Existed before registration	--	-0.131	--	-0.191
		(3.10)*		(2.16)**
Impose fines	--	0.149	--	0.175
		(2.82)*		(3.18)**
Women participation index	0.254	--	0.238	
	(4.96)**		(6.09)**	
Women in the committee	--	0.25		0.015
		(0.58)		(0.37)
Women in meeting	--	0.094		0.072
		(2.13)*		(3.77)**
Women patrolling	--	0.280		0.265
		(6.52)*		(5.89)**
Includes regional dummies	NO	NO	YES	YES
	--	--	(0.00)	(0.00)
Observations	620	620	620	620

Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%

CONCLUSIONS

This paper has investigated the effects of women's participation in JFM forest protection committees in Madhya Pradesh. It has done so by statistically examining how different forms of participation that require increasing commitment from women may simultaneously have greater positive effects on resource governance outcomes. It fills a gap

in the decentralization literature that has been relatively inattentive to questions of women's participation in community-level functioning of forestry organizations, and especially inattentive to effects of variations in participation in contexts where non-timber forest products contribute significantly to rural livelihoods. Nor are there many analyses of environmental policy decentralization that take into account a large number of cases. The result of the existing focus on specific cases is that studies of decentralization find it difficult to examine the joint effects of multiple variables at the same time. Therefore, the paper makes an important contribution to the literature on gender and decentralization – both because of its substantive focus and its approach.

Our data suggest that women's participation has substantial statistically significant effects on resource-related outcomes. The marginal effects of higher levels of women's participation turn out to be highly important for our dataset, more so than many of the institutional, economic, demographic, and other sociopolitical variables we included in our analysis. The effects of women's participation need more attention in other contexts. But an important policy implication of the reported research is that local institutional design should be more attentive to mechanisms through which women can find involvement in forest governance and protection to be closely tied to their interests.

Higher levels of involvement of women in the activities of the committee increase the likelihood of positive forest outcomes. The positive outcomes we highlight in the paper occur both at the level of institutional effectiveness, and outcomes in the forest. Institutionally, greater involvement in women leads to control of illegal activities in local forests. Within the forest, greater involvement of women improves regeneration in the forest.

The positive relationship between women's participation and positive outcomes may be the result of two different mechanisms. First, women are typically responsible in rural areas for collecting fodder and firewood from forests. When they participate in patrolling the forest, it is likely that they are able to impose some restraint on illegally harvesting products in the forest. Second, women may be more effective in apprehending women rule-violators. Men, when appointed as guards or monitors, may find it more difficult to directly apprehend women. Our results also suggest that government and local community officials can do a lot more to involve women in decision-making related to forest governance and protection. Indeed, proactive actions in this regard will likely make decentralized community based forest conservation far more effective. Our results are in accord with the large literature on gender and environment that calls for greater attention to women's practices in forests and tying their practices to the goals of resource governance. The results are especially encouraging because they suggest that efforts to address gender equity in participation considerably increase the likelihood of sustainable governance of forest resources.

Before concluding, we need to consider the possibility that the causal arrow between women's participation and our outcome variables runs in the opposite direction than the one we hypothesize. Thus, women may be less inclined to participate in patrolling when illegal felling, or grazing, or regeneration is occurring in the forest for fear of being intimidated by those breaking rules. But it is unclear why they would be intimidated by regeneration in the forest. If anything, regeneration should prompt them to be less interested in patrolling or even participating in forest protection committee activities. Similarly, illegal grazing or small scale rule violations by users with respect to subsistence timber extraction are unlikely to deter determined women. Further, the effects of greater availability of firewood and fodder are taken into account in our analysis through the explicit inclusion of these factors as independent variables. These considerations lead us to place higher confidence in our

reported findings than would be the case otherwise, and to call for more insistent policy efforts to promote women's involvement in local-level decision making to govern forests.

REFERENCES

Adhikari B, S. Di Falco, and J. C. Lovett. 2004. Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecological Economics* 48(2): 245-57.

Agrawal, A. 2001. Common Property Institutions and Sustainable Governance of Resources. *World Development* 29(10): 1649-72.

Agrawal, A. 2004. Environmental politics and institutional choices: Forestry and wildlife policies in the developing world, 1980-2005. Book manuscript presented at the CHAOS seminar, University of Washington, June 8-9, 2004 in Seattle.

Agrawal, A. and C. Gibson. 2001. Introduction: The role of community in natural resource conservation. In *Communities and the environment,* ed. Agrawal, A. and C. C. Gibson. New Brunswick, N.J.: Rutgers University Press.

Agrawal, A. and G.. Yadama. 1997. How do local institutions mediate the impact of market and population pressures on resource use. *Development and Change* 28(3): 435-65.

Agarwal, B. 1994a. A field of one's own: Gender and land rights in South Asia. Cambridge: Cambridge University Press.

Agarwal, B. 1994b. Gender and command over property: A critical gap in economic analysis and policy in South Asia. *World Development* 22 (10): 1455-1478.

Agarwal, B. 1997. Re-sounding the alert – gender, resources and community action. *World Development* 25:1373-1380.

Agarwal, B. 2001. Participatory exclusions, community forestry, and gender: An analysis of South Asia and a conceptual framework. *World Development* 29(10): 1623-1648.

Arnold, J.E.M. 1995. Socio-economic benefits and issues in non-wood forest product use. In *Report of the international expert consultation of non-wood forest products.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Arora, D. 1994. From state regulation to people's participation: Case of forest management in India," *Economic and Political Weekl*y 29: 691-98.

Baland, J. M. & Platteau, J. P. 1996. *Halting degradation of natural resources: Is there a role for rural communities?* Oxford: Clarendon Press.

Beck, T. and C. Nesmith. 2001. Building on poor people's capacities: The case of common property resources in India and West Africa. *World Development* 29(1): 119-33.

Bokil, M.S. 1996. Privatisation of commons for the poor: Emergence of new agrarian issues. *Economic and Political Weekly* 31(33): 2254-61.

Booth, Philip. 1995. Decentralization and land-use planning in France: A fifteen year review. *Policy and Politics* 26(1): 89-105.

Bray DB, Merino-Perez L, Negreros-Castillo P, Segura-Warnholtz G, Torres-Rojo JM, Vester HFM. 2003. Mexico's community-managed forests as a global model for sustainable landscapes. *Conservation Biology* 17 (3): 672-677

Bray, D. B., L. Merino-Perez, and D. Barry. 2005. *The community forests of Mexico: Managing for sustainable landscapes*. Austin: University of Texas Press.

Buckingham-Hatfield, S. and S. Percy. 1999. *Constructing local environmental agendas: People, places and participatio*n. New York: Routledge.

Burns, N., K. L. Schlozman, and S. Verba. 2001. *Private roots of public action: Gender, equality, and political participation.* Cambridge: Harvard University Press.

Cornwall, Andrea. 2003. Whose voices? Whose choices? Reflections on gender and participatory development. *World Development* 31(8):1325-1342.

Cornwall, Andrea. 2004. Spaces for transformation? Reflections on issues of power and difference in participation in development. In *Participation: From tyranny to transformation? Exploring new approaches to participation in development,* ed. Hickey, S. and G. Mohan London: Zed Books.

FAO. 1991. *Restoring the balance: Women and forest resources*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO. 1995. *Report of the international expert consultation on non-wood forest products.* Rome, Italy: Food and Agriculture Organization of the United Nations.

Gauld, R. 2000. Maintaining centralized control in community-based forestry: Policy construction in the Philippines. *Development and Change* 31: 229-54.

Gaventa, J. 2004. Toward participatory governance: assessing the transformative possibilities. In *Participation: From tyranny to transformation? Exploring new approaches to participation in development,* ed. Hickey, S. and G. Mohan London: Zed Books.

Gibson, C., McKean, M., and Ostrom, E. ed. 2000. *People and forests: Communities, institutions, and governance*. Cambridge: MIT Press.

Goldman, M. 2003. Partitioned nature, privileged knowledge: Community-based conservation in Tanzania. *Development and Change* 34(5): 833-62.

Gray, L. 2002. Environmental conflicts and land rights: Rethinking community natural resource management programs in Burkina Faso. *Environment and Planning D: Society and Space* 20: 167-82.

Gujit, I and Kaul Shah. 1998. *The Myth of community: Gender issues in participatory development*. London: Intermediate Technology Publications.

Hegde, R., S. Suryaprakash, L. Achoth, and K. S. Bawa. 1996. Extraction of non-timber forest products in the forests of Biligiri Rangan Hills, India: Contribution to rural income. *Economic Botany* 50(3): 243-251.

Iqbal, M. 1991. *Non-timber forest products: A study of their income generation potential for rural women in North West Frontier Province (Pakistan)*. Peshawar: Planning and Development Department & International Labour Organization.

Jeffrey, R. and N. Sundar. 1999. *A new moral economy for India's forests? Discourses of community and participation.* New Delhi: Sage Publications. (Sage: New Delhi, 1999).

Khare, A., M. Sarin, N.C. Saxena, S. Palit, S. Bathla, F. Vania, M. Satyanarayana. 2000. *Joint forest management: Policy, practice and prospects.* London: International Institute for Environment and Development.

Kolavalli, S., Joint forest management: superior property rights? *Economic and Political Weekl*y, 30: 1933-38.

Krishnaswamy, A. 1995. Sustainable development and community forest management in Bihar,India. *Society and Natural Resource*s 8: 339-50.

Kumar, N., 2000. All is not green with JFM in India. *Forests, trees, and people newslette*r, 42: 46-50.

Larson, A.M. and J. Ribot. 2004. Democratic decentralization through a natural resource lens: An introduction. *The European Journal of Development Research* 16(1): 1-25.

Leach, M. 1994. *Rainforest relations: Gender and resource use among the Mende of Gola, Sierra Leone*. Edinburgh: Edinburgh University Press.

Lele, U., K. Mitra and O. N. Kaul. 1994. *Environment, development, and poverty: A report of the international workshop on India's forest management and ecological revival.* CIFOR Occasional Paper No. 3. Bogor, Indonesia: Center for International Forestry Research.

Lynch, O. and K. Talbott. 1995. *Balancing acts: Community based forest management and national law in Asia and the Pacifi*c. Washington DC: World Resources Institute.

Martin, P. Y. 2004. *Gender as social institution*. Social Forces 82(4):1249-1273.

McCarthy, J. 2000. The changing regime: Forest property and *reformasi* in Indonesia. *Development and Change* 31(1): 91-129.

Mahapatra, R. 2000. Community forest management: The Nepalese experience. *Down to Eart*h, 8(9): 1-10.

Mayoux, L. 1995. Beyond naiveté: Women, gender inequality and participatory development. *Development and Change* 26: 235-258.

Meinzen-Dick, R. and M. Zwarteveen. 1998. Gendered participation in water management: Issues and illustrations from water user's associations in South Asia. *Agriculture and Human Values* 15: 337-345.

Nussbaum, M. 2001. Women's capabilities and social justice. In *Gender justice, development, and rights.* New York: Oxford University Press.

Poffenberger, M. 1990. Joint management for public forests: Experiences from South Asia." In *Research policy for community forestry, Asia Pacific region*, 158-182. Bangkok, Thailand: Regional Community Forestry Training Center.

Poffenberger, M. and C. Singh. 1996. Communities and the state: Reestablishing the balance in Indian forest policy. In V*illage voices, forest choices,* ed. Poffenberger, M. and B. McGean. Delhi: Oxford University Press.

Poffenberger, M. and B. McGean, eds. 1996. V*illage voices, forest choices,* ed. Poffenberger, M. and B. McGean. Delhi: Oxford University Press.

Rajan, R.P. 1995. Sal leaf plate processing and marketing in West Bengal. In *society and non-timber forest products in tropical Asia,* ed. Fox. J. Occasional Paper No. 19, Environment Series, 27-36. Honolulu, Hawaii: East-West Center.

Ramamani, V. S. 1988. Tribal economy: Problems and prospects. Allahabad, India: Chugh Publications.

Rao, A. Ratna, and B. P. Singh. 1996. Non-wood forest products contribution in tribal economy, *Indian Forester* 122 (4): 337-341.

Reddy, S. R. C. and S. P. Chakravarty. 1999. Forest dependence and income distribution in a subsistence economy: Evidence from India. *World Development* 27(7): 1141-49.

Ribot, J. 1999. Decentralisation, participation, and accountability in Sahelian forestry: Legal instruments of political-administrative control. *Africa* 69(1): 23-65.

Skonhoft A. 1998. Resource utilization, property rights and welfare: Wildlife and the local people. *Ecological Economics* 26(1): 67-80.

Someshwar, S. 1993. People versus the State? Social Forestry in Kolar, India. In *Defense of livelihood: Comparative studies on environmental action*, ed. by Friedmann, J. and H. Rangan. West Hartford: Kumarian Press.

Tewari, D. N. 1989. *Dependence of tribals on forests.* Ahmedabad: Gujarat Vidyapith.

Thomas-Slayter, B. and Rocheleau, D. 1995. *Gender, environment, and development in Kenya: A grassroots perspective*. London: Lynne Rienner Publishers.

Yadama, G.N., B. Pragada, & R.R. Pragada. 1997. *Forest dependent survival strategies of tribal women: Implications for joint forest management in Andhra Pradesh, India.* Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok, Thailand: FAO.

List of CAPRi Working Papers

01 Property Rights, Collective Action and Technologies for Natural Resource Management: A Conceptual Framework, by Anna Knox, Ruth Meinzen-Dick, and Peter Hazell, October 1998.

02 Assessing the Relationships between Property Rights and Technology Adoption in Smallholder Agriculture: A Review of Issues and Empirical Methods, by Frank Place and Brent Swallow, April 2000.

03 Impact of Land Tenure and Socioeconomic Factors on Mountain Terrace Maintenance in Yemen, by A. Aw-Hassan, M. Alsanabani and A. Bamatraf, July 2000.

04 Land Tenurial Systems and the Adoption of a Mucuna Planted Fallow in the Derived Savannas of West Africa, by Victor M. Manyong and Victorin A. Houndékon, July 2000.

05 Collective Action in Space: Assessing How Collective Action Varies Across an African Landscape, by Brent M. Swallow, Justine Wangila, Woudyalew Mulatu, Onyango Okello, and Nancy McCarthy, July 2000.

06 Land Tenure and the Adoption of Agricultural Technology in Haiti, by Glenn R. Smucker, T. Anderson White, and Michael Bannister, October 2000.

07 Collective Action in Ant Control, by Helle Munk Ravnborg, Ana Milena de la Cruz, María Del Pilar Guerrero, and Olaf Westermann, October 2000.

08 CAPRi Technical Workshop on Watershed Management Institutions: A Summary Paper, by Anna Knox and Subodh Gupta, October 2000.

09 The Role of Tenure in the Management of Trees at the Community Level: Theoretical and Empirical Analyses from Uganda and Malawi, by Frank Place and Keijiro Otsuka November 2000.

10 Collective Action and the Intensification of Cattle-Feeding Techniques a Village Case Study in Kenya's Coast Province, by Kimberly Swallow, November 2000.

11 Collective Action, Property Rights, and Devolution of Natural Resource Management: Exchange of Knowledge and Implications for Policy, by Anna Knox and Ruth Meinzen-Dick, January 2001.

12 Land Dispute Resolution in Mozambique: Evidence and Institutions of Agroforestry Technology Adoption, by John Unruh, January 2001.

13 Between Market Failure, Policy Failure, and "Community Failure": Property Rights, Crop-Livestock Conflicts and the Adoption of Sustainable Land Use Practices in the Dry Area of Sri Lanka, by Regina Birner and Hasantha Gunaweera, March 2001.

14 Land Inheritance and Schooling in Matrilineal Societies: Evidence from Sumatra, by Agnes Quisumbing and Keijuro Otsuka, May 2001.

15 Tribes, State, and Technology Adoption in Arid Land Management, Syria, by Rae, J, Arab, G., Nordblom, T., Jani, K., and Gintzburger, G., June 2001.

16 The Effects of Scales, Flows, and Filters on Property Rights and Collective Action in Watershed Management, by Brent M. Swallow, Dennis P. Garrity, and Meine van Noordwijk, July 2001.

17 Evaluating Watershed Management Projects, by John Kerr and Kimberly Chung, August 2001.

18 Rethinking Rehabilitation: Socio-Ecology of Tanks and Water Harvesting in Rajasthan, North-West India, by Tushaar Shah and K.V.Raju, September 2001.

19 User Participation in Watershed Management and Research, by Nancy Johnson, Helle Munk Ravnborg, Olaf Westermann, and Kirsten Probst, September 2001.

20 Collective Action for Water Harvesting Irrigation in the Lerman-Chapala Basin, Mexico, by Christopher A. Scott and Paul Silva-Ochoa, October 2001.

21 Land Redistribution, Tenure Insecurity, and Intensity of Production: A Study of Farm Households in Southern Ethiopia, by Stein Holden and Hailu Yohannes, October 2001.

22 Legal Pluralism and Dynamic Property Rights, by Ruth Meinzen-Dick and Rajendra Pradhan, January 2002.

23 International Conference on Policy and Institutional Options for the Management of Rangelands in Dry Areas, by Tidiane Ngaido, Nancy McCarthy, and Monica Di Gregorio, January 2002.

24 Climatic Variablity and Cooperation in Rangeland Management: A Case Study From Niger, by Nancy McCarthy and Jean-Paul Vanderlinden, September 2002.

25 Assessing the Factors Underlying the Differences in Group Performance: Methodological Issues and Empirical Findings from the Highlands of Central Kenya, by Frank Place, Gatarwa Kariuki, Justine Wangila, Patti Kristjanson, Adolf Makauki, and Jessica Ndubi, November 2002.

26 The Importance of Social Capital in Colombian Rural Agro-Enterprises, by Nancy Johnson, Ruth Suarez, and Mark Lundy, November 2002.

27 Cooperation, Collective Action and Natural Resources Management in Burkina Faso: A Methodological Note, by Nancy McCarthy, Céline Dutilly-Diané, and Boureima Drabo, December 2002.

28 Understanding, Measuring and Utilizing Social Capital: Clarifying Concepts and Presenting a Field Application from India, by Anirudh Krishna, January 2003.

29 In Pursuit Of Comparable Concepts and Data, about Collective Action, by Amy Poteete And Elinor Ostrom, March 2003.

30 Methods of Consensus Building for Community Based Fisheries Management in Bangladesh and the Mekong Delta, by Parvin Sultana and Paul Thompson, May 2003.

31 Formal and Informal Systems in Support of Farmer Management of Agrobiodiversity: Some Policy Challenges to Consolidate Lessons Learned, by Marie Byström, March 2004.

32 What Do People Bring Into the Game: Experiments in the Field About Cooperation in the Commons, by Juan-Camilo Cárdenas and Elinor Ostrom, June 2004.

33 Methods for Studying Collective Action in Rural Development, by Ruth Meinzen-Dick, Monica Di Gregorio, and Nancy McCarthy, July 2004.

34 The Relationship between Collective Action and Intensification of Livestock Production: The Case of Northeastern Burkina Faso, by Nancy McCarthy, August 2004.

35 The Transformation of Property Rights in Kenya's Maasailand: Triggers and Motivations by Esther Mwangi, January 2005.

36 Farmers' Rights and Protection of Traditional Agricultural Knowledge, by Stephen B. Brush, January 2005.

37 Between Conservationism, Eco-Populism and Developmentalism – Discourses in Biodiversity Policy in Thailand and Indonesia, by Heidi Wittmer and Regina Birner, January 2005.

38 Collective Action for the Conservation of On-Farm Genetic Diversity in a Center of Crop Diversity: An Assessment of the Role of Traditional Farmers' Networks, by Lone B. Badstue, Mauricio R. Bellon, Julien Berthaud, Alejandro Ramírez, Dagoberto Flores, Xóchitl Juárez, and Fabiola Ramírez, May 2005.

39 Institutional Innovations Towards Gender Equity in Agrobiodiversity Management: Collective Action in Kerala, South India,, by Martina Aruna Padmanabhan, June 2005.

40 The Voracious Appetites of Public versus Private Property: A View of Intellectual Property and Biodiversity from Legal Pluralism, by Melanie G. Wiber, July 2005.

41 Who Knows, Who Cares? Determinants of Enactment, Awareness and Compliance with Community Natural Resource Management Bylaws in Uganda, by Ephraim Nkonya, John Pender, Edward Kato, Samuel Mugarura, and James Muwonge, August 2005.

42 Localizing Demand and Supply of Environmental Services: Interactions with Property Rights, Collective Action and the Welfare of the Poor, by Brent Swallow, Ruth Meinzen-Dick, and Meine von Noordjwik, September 2005.

43 Initiatives for Rural Development through Collective Action: The Case of Household Participation in Group Activities in the Highlands of Central Kenya, By Gatarwa Kariuki and Frank Place, September 2005.

44 Are There Customary Rights to Plants? An Inquiry among the Baganda (Uganda), with Special Attention to Gender, by Patricia L. Howard and Gorettie Nabanoga, October 2005.

45 On Protecting Farmers' New Varieties: New Approaches to Rights on Collective Innovations in Plant Genetic Resources by Rene Salazar, Niels P. Louwaars, and Bert Visser, January 2006.

46 Subdividing the Commons: The Politics of Property Rights Transformation in Kenya's Maasailand, by Esther Mwangi, January 2006.

47 Biting the Bullet: How to Secure Access to Drylands Resources for Multiple Users, by Esther Mwangi and Stephan Dohrn, January 2006.

48 Property Rights and the Management of Animal Genetic Resources, by Simon Anderson and Roberta Centonze, February 2006.

49 From the Conservation of Genetic Diversity to the Promotion of Quality Foodstuff: Can the French Model of 'Appellation d'Origine Contrôlée' be Exported? by Valérie Boisvert, April 2006.

50 Facilitating Collective Action and Enhancing Local Knowledge: A Herbal Medicine Case Study in Talaandig Communities, Philippines, by Herlina Hartanto and Cecil Valmores, April 2006.

51 Water, Women and Local Social Organization in the Western Kenya Highlands, by Elizabeth Were, Brent Swallow, and Jessica Roy, July 2006.

52 The Many Meanings of Collective Action: Lessons on Enhancing Gender Inclusion and Equity in Watershed Management, by Laura German, Hailemichael Taye, Sarah Charamila, Tesema Tolera, and Joseph Tanui, July 2006.