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Joint Forest Management, Role of Communication, and Harvesting Behaviour: Evidence from Field Experiments in India

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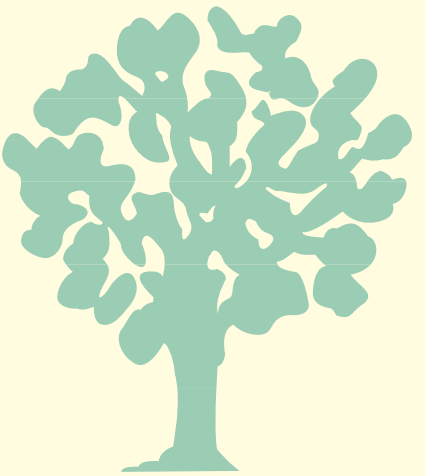

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Joint Forest Management, Role of Communication, and Harvesting Behavior: Evidence from Field Experiments in India

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Abstract

There has been much interest recently in promoting decentralization in the forestry sector in the belief that it would bring in downward accountability, which in turn would ensure economic efficiency, sustainability of the resource, and social and economic equity. Since local users are likely to have better knowledge of their needs and aspirations, decentralization could provide incentives for local communities to make locally informed decisions about resource use. In India, both Joint Forest Management and successive legislations since the Forest Policy of 1988 have indicated the Government's resolve to promote the role of local communities in the management of forests. This paper addresses the issue of whether the relationship between forest and forest-dwelling communities continues to be symbiotic, or whether it has changed due to globalization and commercialization. The findings indicate that in the case of indigenous communities, their relationship with the forest continues to be non-exploitative and non-commercial. Using field experiments as a method of investigation, the paper shows how the introduction of communication within a group of harvesters moderates and homogenizes their behavior regarding forest use. The results of the study underscore the need for and importance of programs like JFM which provide opportunities for communities to make collective decisions through enhanced communication so that they can use their resources not only sustainably but with a view to benefit sharing.

Key words: Joint Forest Management, Forest Dwelling Communities, Decentralization, Communication, Community Attitudes, India.

Joint Forest Management, Role of Communication, and Harvesting Behavior: Evidence from Field Experiments in India

Rucha Ghate and Suresh Ghate

1. Introduction

Decentralization is today a strategy of governance to facilitate the transfer of power closer to those who are affected by the exercise of power (Agrawal and Ostrom, 2001). It has also become a tool for achieving development goals in ways that respond to the needs of local communities (World Bank, 2000). The underlying argument for promoting the devolution of authority, accompanied by 'downward accountability', is that it would ensure economic efficiency and sustainability of the resource while improving social and economic equity. Since local users are likely to have better knowledge of their needs and aspirations, decentralization could provide incentives for local communities to make locally informed decisions regarding resource use (Agrawal and Ostrom, 1999; Fisher, 1999; Ribot, 2002, 2003; Ribot *et al.*, 2005). In recent times, an increasing number of developing countries across the world have responded positively to 'sharing authority' (Meinzen-Dick and Knox, 1999; Edmund and Wollenburge, 2001). In the context of India, with regard to forests, both legislations and programs since the Forest Policy of 1988 have clearly indicated the Government of India's resolve to promote the role of local communities in the management of forests.

Starting with the Joint Forest Management (JFM) program in the early 1990s to the recently passed Forest Rights Act (FRA)[1] that has extended rights over forestland to local communities, the devolution of authority in the case of India has only been increasing. For instance, the *Panchayat* Extension to Scheduled Areas Act (PESA) of 1996 gave power over minor forest products to *gram sabha* (village assemblies) in scheduled areas, thus taking 'decentralization' beyond Forest-Department-managed territory. It made *gram sabha "competent to safeguard and preserve the traditions and customs of the people, their cultural identity, community resources, and the customary mode of dispute resolution"* (section 4 (d)). Similarly, the Biodiversity Conservation Act (2002), while taking within its purview all forms of local governance like *gram panchayat* (village level), *panchayat samiti* (sub-district level), *zilla parishad* (district level), and even municipal corporations in urban areas, authorized local level institutions to grant or refuse permission to outsiders to use products of biotic resources, and to charge fees for their use. Although the implications of PESA are not evident at the ground level, and rules of the Biodiversity Conservation Act are yet to be finalized by the National Biodiversity Authority (Gadgil, 2008), the two Acts reflect the Government's commitment to decentralization.

One of the objectives of JFM is to tackle the problem of deforestation through participatory means. In this paper we investigate the role of communication, which is the basis of participation, within a community in relation to forest exploitation in the state of Maharashtra. We use field experiments to find out if the forest dependent indigenous communities continue to view forest as a subsistence resource or whether globalization and commercialization have had a negative impact

[1] Complete title of the act is 'The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

on their outlook. We also try to find out if the platform for communication made available to communities through JFM enhances non-exploitative behavior.

2. The Critique of JFM

The process of decentralization has not been bereft of criticism over the years, interestingly, from opposing points of view. While one group argues that the Government has not devolved enough authority to local communities, the other group takes up the position that the Government has placed too much confidence in traditional sustainable practices as well as in the capacity of communities to manage the precious resource. Even in the case of the FRA, both the Ministry of Environment and Forest (MoEF) and wildlife conservationists vehemently opposed it on grounds that it was an 'ideal recipe' to ensure the destruction of India's forests and wildlife via "*legalizing encroachments*" (Krishnan, 2007), believing that improved accessibility to otherwise remote forest villages, improved educational facilities, and access to markets could result in unsustainable commercial use of forest products, encroachments, and overexploitation of common lands (Jodha, 1992). On the other hand, another group has argued that the Act has failed to create a watertight case for securing land rights to forest dwellers, and that it has not devolved sufficient power to the communities (Hebbar, 2006).

Yet, in the midst of such arguments for and against decentralization, the JFM program has continued to grow in terms of the number of JFM committees, as well as in terms of its spread to all parts of India. JFM is the most common operational form of the devolution policy for 'inclusive' decentralized management of forests in India. It envisages the involvement of local communities in the management of state-owned forests under partnership arrangements with the state Forest Department (FD)[2]. Some of the broad incentives offered under the program are: (i) usufruct rights on forest products for subsistence; (ii) the restoration of degraded forests as well as the preservation of well-stocked forest lands; (iii) the sharing of benefits that accrue among members of the community in the long term; and (iv) making available other development funds for poverty alleviation by establishing Forest Development Agencies (FDA) at the forest division level (since the year 2000), and thus federating the JFM committees (under FDA). There are operational variations between states, with alterations/modifications over time, but on the whole conservationists and scholars look upon the JFM program as an attempt to reverse the process of forest degradation on the one hand, and to meet people's needs on the other. In the past 20 years, the Program has been successful in establishing JFM committees in 106,482 villages in India. The target in the tenth Five Year Plan was in fact to bring the entire 170,000 forest-fringe villages under the JFM umbrella (Pai and Dutta, 2006). In the case of Maharashtra state, by March 2006, there were JFM committees in 11,799 of the approximately 15,000 forest-fringe villages**.**

JFM is a program that has given rise to extensive studies. Among the various aspects of the Program studied are its structure, provisions, working, and impacts. Poffenberger *et al.* declared enthusiastically in 1998 that JFM would bring in a *"reversal of the alienation of forest people's rights, of institutional conflict, and of ecological patterns of forest degradation"* (xi). But in many subsequent studies the program came under criticism for its typically top-down approach;

[2] No.6.2/89-Forest Policy, June 1, 1990; No.22-8/2000-JFM(FPD), February 21, 2000; Strengthening of JFM Program, Guidelines, by MoEF, on December 24, 2002; NAEB 25-1-1/99-B-2 dated 4-01-2000 issued by the Central Government to all States; Government Regulation No. MSC/2000/143/F-2, 25.4.2003 issued by the Government of Maharashtra.

asymmetric power relationships between the state functionaries and the people; power imbalances within communities; inadequate benefit-sharing provisions (Sundar, 2001; Conroy *et al.*, 2000); and its weak legal footing (Upadhyay, 2003). At the ground level, JFM continues to suffer because in many instances both the partners, i.e., the Forest Department and the communities are not ready for the new institutional arrangement (Parul, 2006). Several studies have demonstrated how, in most places, the protection committees set up under the JFM do not last long, or end up being unequal partners (Matta and Kerr, 2004; Ghate and Nagendra, 2005). They become dysfunctional either after the initial enthusiasm dies down or after the incentive money is exhausted (Kumar, 2002). Some scholars have noted that communities by and large remain unconvinced about the benefits to be gained from accepting state-designed arrangements which entail considerable loss of autonomy (Sarin *et al.*, 2003), and leave little room for equal participation by the people (Ballabh *et al.*, 2002).

Yet, the fact remains that the JFM program is the first-ever such explorative initiative to bring the Forest Department (FD) and resource users together, thus providing them with a platform for devising a common strategy to manage forests. It blends both scientific management techniques and age-old indigenous usufruct practices to conserve forests on a sustainable basis (Mukhopadhyay *et al.*, 2007). Forest committees, in several instances, are working not merely as a *"sounding board for schemes that the department would wish to undertake in villages"*, but are successfully using the forum, both formally and informally, to secure forest usufruct (Tiwary, 2005). The JFM has helped address several issues concerning the livelihood security of the local people (Shylendra, 2002). Moreover, the higher biomass growth rate in JFM forests (Murali *et al*., 2002) is not only meeting the substantial biomass needs of the community by reducing the distance traveled and time spent for fuel wood and fodder collection, but also contributing towards achieving sustainable forestry (Patel *et al*., 2006; Aggarwal *et al.*, 2006; Srivastava *et al*., 2004). According to studies, some officials have reported more satisfaction in investing their time in participatory management because it results in a less stressful relationship with forest dwellers (Prasad *et al*., 2001). It is against this background that we have selected JFM as a representative program of decentralization.

3. The Changing Attitude of Communities toward Forests

In the centralized forest management regime of both pre- and post-independence India, the collection of minor forest products for sustenance and sale were the major benefits to the communities from forests (Kannan, 1983). The lack of ownership over forests as well as the centralization of authority in the hands of the state acted as a perverse incentive for the communities leading to encroachments, mistrust, and poaching (Fernandes and Kulkarni, 1983; Gadgil *et al.*, 1982; Gadgil, 1983). Although religious dictates, eclectic belief systems and social norms based on prior experience did seem to orient communities towards forest protection (Gadgil and Guha, 1992), there were also increasing instances of commercial use, encroachments and over-exploitation (Jodha, 1992). Even after the Government implemented JFM as a program, skepticism regarding the motives behind the participatory approach prevailed initially in many communities (Sarin, 1998). Factors like global market dynamics, the ongoing process of transformations in community characteristics, values, and traditions, as well as diversifications in livelihoods due to economic growth, led to a perception among the communities that immediate benefits under the JFM were small compared to the cost of collective action (Jodha, 1998; Baland and Platteau, 1996; Sundar, 2000; Matta, 2006).

The rapid pace of changes in attitude to forest ownership and user rights reported above make it all the more imperative to understand the nature of the existing relationship between forests and the indigenous rural communities in India: that is, whether it has continued to remain as symbiotic as it was decades ago, especially in the case of indigenous communities that have limited interaction with the 'outside' world; or whether factors like globalization, economic growth, and spread of education have impacted negatively on the relationship. If it is the latter scenario, the question for those interested in forest conservation is whether communities would now treat forests only as a source of revenue and would not be unwilling therefore to exploit it commercially. If that is the case, the result of decentralization policy is not likely to be very different from the revenue-oriented policies of colonial times. But if it is the former scenario, one may ask whether programs like JFM, which provide opportunities for forest dwelling communities to take operative decisions vis- -vis forests after discussion amongst themselves, have a qualitative impact on the exploitation of forests. If the answer to this question is 'yes', then decentralization needs indeed to be given a further impetus. Our study addresses the questions raised above based on field experiments conducted in six villages, across the state of Maharashtra, inhabited mainly by indigenous communities. These villages are covered under the JFM program which began almost 20 years ago in the state. The villages, however, did not come into the fold of JFM all at the same time. The results of the study indicate that, in the case of indigenous communities, their relationship with the forest continues to be non-exploitative and non-commercial. The study further enforces the need for programs like JFM that provide opportunities for communities to make collective decisions through enhanced communication, which allow them to address not only the issue of sustainable use of their resources but also the issue of equitable benefit sharing. Our study is in conformity with findings that behavior in public good and common-pool resource experiments deviates substantially from the Nash equilibrium strategies when subjects are merely allowed to communicate with one another (Ostrom and Walker, 1991).

4. Methodology

4.1 Study Area

Maharashtra is one of the largest states of India, of which almost 20 percent (approximately 60,955 sq km) is classified as forest. Five districts of the state, namely, Thane, Dhule, Nandurbar, Amravati and Gadchiroli, have a relatively higher proportion categorized under 'forest', indicating that sometimes ago, there was sufficient forest cover prompting the Forest Department to take these areas under its jurisdiction. However, presently, only Amravati and Gadchiroli districts can boast of a good cover of 'mixed' forest. The five districts are also populated with indigenous/ tribal people, belonging mainly to Gond, Warli, Bhil, Madia, Korku, Padavi, and Katkari tribes. Six villages, namely, Aire (Thane district), Bijrigavan (Nandurbar district), Gadhaddeo (Dhule district), Talwada and Zhimela (of the Gadchiroli district that has the maximum forest cover in the state), and Khongda (Amravati district) are the research sites of the study.

The forest area of these villages varies from 1781.6 ha in the case of Gadhaddeo to 154.63 ha in the case of Bijrigavhan. Agriculture is the dominant occupation of all the villages, with average land holding varying from 0.8 ha in Talwada to 2 ha in Aire. The size of the village varies from 66 households (246 individuals) in Talwada to 522 households (with 2160 individuals) in Gadhaddeo (see Table-2). Four out of the six villages report seasonal migration in the non-agriculture months for employment to nearby villages. The study villages are located between 3 and 18 kms from

the closest towns and are connected by all-weather roads. The villages have primary schools and facilities for potable water. Except Zhimela, the other villages have a fair price shop and an *anganwadi* (pre-school) facility. Only Talwada has a Primary Health Care Center. None of the villages has a post office, a Range Forest Office, a bank or an agriculture extension center. We give the location of the study villages in Figure 1, while we present other details in Table-3.

4.2 Data Collection

Since the main aim of this study was to ascertain the attitude of the indigenous communities towards forests and how it is reflected in the quality of the resource, observations on the behavior of participants in the experiments constitute the core data. However, we collected supporting data at multiple levels, using different methods. At the village level, we held at least one focused group discussion while, at the institutional level, we held 3-4 key informants' interviews to collect information using the 'Association Protocol' of IFRI[3]. We used the data thus collected to develop a measure for the functioning of JFM committees. The indicators developed were (i) maintenance and improvement activities; (ii) conservation measures undertaken by JFM committees; (iii) awareness of the committees regarding provisions under the JFM, existence of micro plan, and plan for forest protection. We obtained a score for each indicator, which we report in Table 4. At the household level, we collected information from 60 household heads, using a structured questionnaire. We collected forest level information using IFRI protocols[4], which helped in determining the quality of forests in the sample villages[5]. The six villages forming the sample are geographically fairly well distributed and capture the different forest conditions as well as the status of the JFM program.

We conducted field experiments in each of the six villages. Each experiment consisted of two games played by a team of five villagers. We designed the games to capture (i) the attitudinal aspects underpinning individual behavior expressed through privately taken decisions regarding forests use such as harvesting trees, and (ii) the individual decisions regarding forest use arrived at after communication amongst participants. While the first game tried to replicate the open-access harvest situation, the second tried to mimic the JFM situation partially[6] by allowing the participants to discuss and decide forest use/harvest strategy. Both the games had incentives in the form of pay-offs for each tree harvested. In this paper, we refer to the two games as the non-communication (or open access) game, and communication (JFM) game respectively. At the time of conducting the household survey, we made an attempt to identify willing participants for the experiment, and to make the team representative of different age groups, educational levels, and land ownership in order to capture economic variations; and to make it representative in terms of socio-political classes by including a *sarpanch* (the head of the *gram panchayat*), a police *patil* (the village-level employee of the Police Department), or president of the JFM committee. Due to obvious constraints with regard to the involvement of women in such experiments in rural indigenous Indian communities, only men participated in the experiment.

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[3] IFRI refers to a protocol developed by the International Forestry Resources and Institutions, Indiana University, and University of Michigan, USA.

[4] These refer to 'forest' and 'plot' protocols developed by IFRI.

[5] We determine the state of the forest through a composite index of basal area, stem count, and height of trees in the forest of the respective villages.

[6] We are aware that JFM does much more than merely providing a platform for communication through Forest Protection Committees. But in this paper, our objective is to assess through field experiments the impact of communication on harvesting behavior.

4.3 Case for Field Experiments

Field experiments increasingly play an important role in studies relating to the behavioral aspects of subjects by simulating real life situations. They allow for the re-creation of an environment where *"economic phenomena present themselves"* (Reiley and List, 2007, p.9) in a form that captures the typical characteristics of a real world scenario as a means of understanding implicit interrelationships. *"Distinct from traditional empirical economics, field experiments provide an advantage by permitting the researcher to create exogenous variation in the variables of interest allowing one to establish causality rather than mere correlation"* (Reiley and List, 2007, p.2). In a field experiment, the researcher considers the actual preferences and institutions of the real world, jointly testing both the structural assumptions (such as the nature of the values of a good) and behavioral assumptions (such as the Nash equilibrium) (Reiley and List, 2007).

In behavioral economics, which is inclusive of normative behavior, economists are widely resorting to field experiments as a means of supplementing data from surveys. Carpenter (2002) offers three reasons to do so. The first reason is that surveys often suffer from what is called hypothetical bias, which means that people respond to situations differently when the situation is hypothetical than when the situation is real. The second reason is the idealized 'persona bias' and the 'surveyor effect'. The idealized persona bias occurs when people respond to questions as the person that they wish they were rather than the person that they really are, while the surveyor effect refers to the phenomenon where survey-takers often try to figure out what the researcher would like to hear and then give either that response or its opposite. The third reason refers to the notion of incentive compatibility, where the experiment participants often have an incentive to truthfully reveal private information (Cardenas and Carpenter, 2005).

Field experiments also come in handy for all three purposes for which researchers normally collect data: that is, to construct a theory; to test a theory, and to make measurements of key parameters (Ostrom, 1998; Reiley and List, 2007). Barr (as quoted in Cardenas and Carpenter, 2005) believes that the data generated through experiment is cleaner as (i) there is more control on the data generation process, (ii) it generates data on revealed preference directly, and (iii) it is analyzed directly. Comparability and replication are additional incentives for conducting field experiments. They allow researchers not only to compare experiments across cultures but also to replicate them within cultures to check the robustness of the results (Cardenas and Carpenter, 2005).

Although there is greater recognition of field experiments as a more faithful way to gather data in instances where there are incentives for truthful revelation of behavior/information, they are not without lacunae. For example, control, which is one of the most striking features of experiments, may not be perfect. Further, due to logistical/practical constraints, the number of participants in an experiment is likely to be small, hence raising questions regarding the significance and relevance of the inferences made from the observations which are small in number. Another issue pertains to the representativeness of the participants. In the case of the experiments conducted in this study, all six communities that we selected were predominantly indigenous (which is the control for cultural and social factors) and poor[7] (which is the control for economic factors). As mentioned

[7] According to the poverty line defined by the Government of India, the communities we studied were poor.

earlier, we made an attempt to ensure that the group of participants in each village was representative of the community although, due to social inhibitions, women did not volunteer to participate in the experiments. This imposes a limitation on the universality of representation. A major advantage in our study, however, was that the participants in the experiments were actual harvesters of the forest resource. Therefore, the experiment was not about an artificial situation, but very much about a situation that they were familiar with. However, since the participants were playing a game, there could not be any assured guarantee that their observed behavior would any way replicate their actual behavior in the real-world economic settings that the experiment was supposed to represent.

4.4 Structure of the Field Experiment[8]

Each experiment consisted of two games, a non-communication and a communication game, and had a 'within subjects' design. Thus, the five persons chosen from each village participated in both the games. The games started with a given forest comprising a hundred trees, which was the maximum possible size, displayed on a board. The participants played each game for up to 10 rounds although we did not disclose this number to the participants. The game could, however, end before ten rounds if less than five trees remained in the forest. Thus the participants would play each game in effect for, at the most, 10 rounds. We give the maximum number of trees that an individual participant could harvest in any given round below (Table-1).

At the end of every round, we added 10% of the remaining number of trees to the pool of trees to be considered for the next round in order to capture the effect of regeneration in any natural forest. While doing this, we took care to ensure that the resource size did not exceed 100 (which was the capacity of the forest) at any stage. For each tree harvested, the harvester was entitled to a payoff of INR 10[9]. We made payments at the end of the game. The participants made the harvesting decisions individually, and in private. At the end of each round, we informed the participants only about the total harvest for the group. We did not inform them of the harvest of individual participants. Thus, at the beginning of each round, the participants were aware of resource size. The only difference between the two games was that while in the first game there was no communication between the participants, which meant that the individual took the harvesting decision privately, in the second game, we allowed the participants to communicate throughout the game in order to make collective decisions, to formulate strategies and rules for harvesting, and to try to identify the rule-breakers if any, etc. (as the JFM program expects them to). However, even in the communication game, every individual made the actual harvesting decision privately, which was not disclosed to the group until the end of the game.

Before the participants actually played the game, there were three practice rounds to make sure that all the participants understood the game well. We made the participants calculate the resource size at the beginning of each round as well as their pay-offs in order to make sure that they made informed decisions.

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[8] We take the idea of this field experiment from an experiment designed by Cardenas, Janssen, and Bousquet. http://www.umass.edu/resec/seminars/docs/Cardenas%20Janssen%20Bousquet%20EnvExpEconHandbook.pdf

[9] USD 1= INR 45 approximately.

5. Results and Discussion

This section first discusses some summary statistics on development, institutional and resource indicators in the six study villages and then analyses data obtained from the field experiments, which comprised five participants from each of the six villages, with each experiment made up of two games, and each game played for a maximum of ten rounds. Thus, we collected in all six hundred observations for this analysis[10].

5.1 Village differences in civic amenities, institutional and resource characteristics

We now discuss the characteristics of the six villages. Aire, Gadhaddeo, and Bijrigavhan are bigger villages with over a 1000 population while Talwada, Zhimela, and Khongda are approximately a third the size of these villages. Land holding varies marginally across the villages (see Table-2). However, forest cover in the six villages varies and the ratio of forest cover to population is less than one for the first three villages, with Bijrigavhan having the least. It is greater than one for the remaining three. Thus, in terms of resource availability, the bigger villages are resource poor on a per capita basis.

It is useful to examine the six villages along three discerning attributes: civic amenities representing the level of exposure of the community to the outside world, the status of Joint Forest Management, and the quality of forests. With regard to presence or absence of civic amenities Table–3 indicates that all six villages are at a low level of development. There is not much difference on this count among the villages. They all have schools, potable water and an approach road, and none has a bank or post office. Aire, Gadhaddeo and Khongda have a gram Panchayat.

To quantify the effectiveness of the JFM as an institution, each village was assigned a score on the basis of the community's involvement in maintenance and improvement, conservation measures, awareness towards JFM, existence of micro plan, and participation in forest protection, which are then added together. As Table – 4 shows, all the villages had some sort of forest management micro-plan in place, though the quality of implementation differed. The years of establishment of JFM committees in the sample villages varied from 1999 (in Zhimela) to 2006 (in Bijrigavhan). The big villages of Aire, Bijrigavan, and Gadhaddeo had some forest protection mechanism in place, while the three smaller villages did not have any specific strategy to protect the forests, mainly because of the abundance of good quality forest[11]. Khongda, interestingly, had some conservation measures in place. This came about primarily because it is located on the periphery of the Melghat Tiger Project, and forest officials are vigilant regarding forest use by the villagers.

Village Bijrigavhan which is the most resource poor on the per capita basis[12] has a relatively high institutional score. Although JFM was formed in this village in the year 2006, the Forest Department did not start the process of preparing a micro plan for the village. In 2008, to take advantage of an afforestation program that would bring in funds for plantation work but required a micro plan to be in place, some villagers and officials associated with Bijrigavhan prepared a micro plan.

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[10] It would have been a better option to include a higher number of participants, in proportion with the household size of each village, but financial and practical constraints prevented this.

[11] One of the villagers in Talwada when asked about protections measures, countered us by asking "protection from whom?"

[12] The forest was completely poached after the forest was handed over to the Revenue Department from the ownership of Private forest Chieftains in 1975 (Ghate, 1992).

However, as reflected in the 'awareness in JFMC' scores in Table-4, most of the members of this community were not fully aware of this. In the case of Gadhaddeo, the leader in the village, who was *sarpanch* as well as the president of Forest Protection Committee in 2009, was politically active. This village was also the recipient of a State level award for the best JFM committee in 2008. However, with regards to forest, it has maximum area under encroachment, with no effort made to vacate the encroachments. During our field survey, there was an incidence of forest fire, which we reported to the committee members. But their response was casual. Thus, the institutional scores reflect measures being taken but not the internalization of JFM.

Forest quality in this study was captured through enumeration of stand basal area (per hectare), stems per plot, and mean height (see Table-5). In our sample, there were three villages with good quality forests (Khongda, Talwada, and Zhimela). While Khongda is located close to a tiger reserve, both Talwada and Zhimela are in Gadchiroli district, which has a large proportion of forests with low population density. In case of Aire, although the final score is higher than that of Zhimela, it has fewer stems per plot indicating that it has fewer trees, but the standing trees are big and old. Aire is only 110 kilometers away from Thane (a big cosmopolitan city adjoining Mumbai), and has been under pressure from high timber demand. The two most degraded forests (Bijrigavhan and Gadhaddeo) are more or less at par, and reasons for degradation are large scale encroachments and poaching during the change of ownership from private forest chieftains to the Revenue Department in the mid 1970s.

5.2 Harvesting Behavior

Given the structure of the game, the players could have maximized their gains/harvest in two ways. In the absence of information regarding how many rounds the game would last, the exploitative (Nash) strategy would have led to just one tree remaining at the end of the fifth round, with the total harvest of the group at 115 trees (individual harvest of 23 trees). On the other hand, with additional information that the game would last for at most 10 rounds, the participants might have planned to harvest even more in the communication game. The group could adopt a strategy (Nash) wherein it would harvest 9 trees in each of the first 5 rounds, and then 20 in the 6^{th} round, followed by 25 trees in each of the remaining 4 rounds. In this way there would be no trees left in the forest after the tenth round. In this situation the group harvest would be 165 trees (average individual harvest of 33 trees).

In our experiments, however, none of the above mentioned exploitative or maximizing strategies was adopted. At no stage either of the communication or non-communication games, in any village, did the participants enquire about the number of rounds the game would last. Both the communication and non-communication games lasted the full 10 rounds. Out of 600 (10 rounds x 5 players x 6 villages x 2 games), there were just 25 (i.e., 4.1%) instances of individuals harvesting five trees in a round. Of these, 12 were in the non-communication game (for instance, a participant in Talwada harvested 5 trees in each of the ten rounds), and 13 in the communication game (see Table-6). From the total individual harvest of the game, it is clear that the harvesting pattern was not exploitative. For example out of 60 (5 players x 6 villages x 2 types of games) instances of net individual harvests, there were just 5 (8.33%) instances of harvest of 23 or more trees, all in the non-communication game (see Table-7).

In the case of the non-communication game, the village-level average harvest was 68 trees (ranging from 29 to 125), with an individual average harvest of 13.6 trees (i.e., INR 136). In the case of

the communication games, the village-level harvest varied from 34 to 70 with an average of 59 trees. The average individual harvest was 11.8 (i.e., INR 118). At the individual level, the standard deviation reduced from 10.7 in the case of non-communication to 4.9 in the case of communication (see Table-8). In general, based on the overall harvesting behavior, it is clear that villagers harvested less than the optimal number of trees. Is this because a game was being played and villagers were being watched? Or is it because they continue to adhere to norms that are non-exploitative and have a conservationist attitude towards the forests? While we cannot deny that the villagers may have been influenced by our presence as observers, the rules of the game were made clear to the villagers and they knew that increasing harvest was 'allowed'. But because they chose to harvest at lower levels, we conclude that there is an element of non-commercial attitude toward forests.

The next issue is to examine whether the harvesting behavior was affected by communication. To make this assessment, we applied two types of mean difference tests on harvests. Table-8 presents the average harvest for each of the six villages (columns B and C), and the standard deviation or spread in the harvest (columns D and E) for the non-communication and communication games. The t-test statistics on the mean comparisons (column F) suggests that the difference in harvest between the two games is statistically significant for three villages. In case of two villages Talwada, and Zhimela, there is a significant (at 10%, and 5% levels respectively) decline in harvest with communication. The Wilcoxon signed rank test[13] indicates that harvest declines significantly (at 10%) in village Aire as well. Thus, the most common response to increased communication appears to be a decline in village level harvest.

Interestingly, in the case of Bijrigavhan, there is a statistically significant (at 1%) increase in harvest. Gadhaddeo and Bijrighavan rank at the top for institutional protection measures being undertaken and at the bottom for resource availability. It is hard to explain the harvesting pattern in Bijrigavhan (and Gaddadheo) – while it could just reveal erratic response, it may also have something to do with low forest quality and the institutional measures undertaken in response to it.

Examining the standard deviation values in Table-8, it suggests that there is a homogenization of harvesting patterns as a result of communication. This is validated by the Variance Difference Test which shows that for all the villages together, dispersion declined significantly (at 1%) in the communication game relative to the non-communication situation. For three villages, namely Aire, Talwada and Zhimela, dispersion declined significantly. These results suggest that once villagers start talking to each other, harvest across individuals moves closer to the average level. Communication results in peer-influence and harmonizes individual actions.

The village Bijrigavhan continues to be an outlier with dispersion significantly increasing (column I, Table-8). We note that throughout the game, harvesting behavior in Bijrigavhan was erratic. While in the non-communication game, the individual scores as well as variations in harvest size in Bijrigavan were low, in the communication game the group harvest scores varied significantly especially in the last five rounds (group harvest was 14, 1, 15, 0, 20). Such deviation is not uncommon, as has been reported in other studies (Cardenas et al, 2004).

5.3 Resource Size

The second most important result pertains to non-diminishing resource size. In four of the six villages, when the non-communication game was played, the resource size remained 100

[13] This test, unlike the t-test, does not assume that the sample is normally distributed.

throughout. In one village it went down to 88, while in another it went down to 40 by the end of the 10th round. The average resource size for all the six villages together over all the rounds was 94 trees, with a standard deviation of 13.2.

In the case of the communication games, four communities maintained the resource size at 100 throughout. In two villages, the resource size reduced to 96 and 93 in the intermediate rounds but it rose to 100 in the subsequent rounds. These two villages were different from the two villages mentioned in the non-communication case. In the communication games, the average resource size was 99.6 with a standard deviation of 1.28. It was expected that when communication was allowed, the "rationally" behaving participants with an interest in continuously maintaining the maximum possible resource size of 100 trees would have planned to harvest (as a group) nine trees in each round. Their average individual harvest, as a result of this action, would have totaled 18 trees at the end of 10 rounds, higher than the experimental average individual harvest for both types of games. Our results however show that out of a total of 60 rounds of non-communication games, in 38 rounds (63.3%), 92 or more trees were left at the end of the round. In the case of the communication games, there were 49 such rounds (81.6%). As has been mentioned earlier, this is not an economically 'rational' behavior – farmers are harvesting less than the optimal given the maximum size of the forest (100 tress) and 10% regeneration.

It is pertinent to mention here that the pay-off for participants in the experiment was substantially higher than what an individual would have actually earned in the village after a full day's labor[14]. On average, each player earned a total of INR 254 in the two games together. Thus, they neither showed any desire for over kill (i.e., exploitative behavior) nor any strategic planning of resource use (i.e., commercial or even economically rational behavior). As a matter of fact, they were overwhelmingly concerned about the resource size, and it often (63% of times in the non-communication and 82% of times in the communication situation) resulted in a sub-optimal harvest. This concern was reflected in their discussions during the communication game. Again, the results suggest that communication made the villagers even more conservative in their use of forests.

5.4 Inter-community Parity in Harvesting as a Result of Communication

As mentioned above, the six communities were located far from each other. They were therefore independent in terms of their behavior with no ability to influence each other's harvesting patterns. This was well supported by the fact that their harvesting patterns were significantly different from each other in the non-communication games. However, their harvesting patterns did not remain statistically different with the introduction of communication. The Kruskal-Wallis test gave the p-values of 0.029 and 0.180 respectively (Table-9), indicating that communication tended to bring about homogeneity in the harvesting behavior of communities irrespective of their geographic location, forest condition, and institutional functioning. This result can possibly be explained by the fact that all these communities are predominantly indigenous, with high level of dependence but similar needs and shared norms. In the experiments, during the communication rounds, it was observed that a decision once taken was adhered to by all, and there was not one instance of infraction. It is possible that once communication occurs, the shared norms and similarity of needs across villages become more influential resulting in homogenization of harvests across communities. This result should, of course, be further examined through deeper analyses.

[14] Average wages per day in the study villages was Rs. 40 in agriculture, Rs. 70 in forestry work, and Rs. 62 for other manual labor.

5.5 Low level of strategizing

As has been mentioned in sections 5.2 and 5.3, the communities end up with sub-optimal harvests. This could be because they do not indulge in strategizing harvesting behavior to maximize the gains. In the communication game, we found that the participants were active in deciding the strategies in a few rounds (mainly in the first 2-3) only. The harvesting pattern across villages reflected this observation as the individual harvest of all players in the first three rounds of the communication game was significantly (statistically) different from the corresponding harvest in the non-communication game (p value = 0.031). However, towards the end of the game, the difference in individual harvest between the two games did not remain statistically significant (p value = 0.869) (see Table-10). Generally, one would expect resource size to diminish as the game progresses, limiting choices for the harvesters – but this did not happen. The striking feature of this result is that in these experiments the resource size remained high throughout the games, offering varying choices to players in the case of both the communication and non-communication games. These results hint at low interest in strategizing among villagers. Communication results in some changes in harvesting patterns, but villagers do not seem inclined to participate in continuous and intense negotiations amongst themselves.

6. Conclusions and Policy Implications

Contrary to the rational choice theory, scholars have found that behavioral decisions are not always affected by short-term gains, but also by variables like acquaintance, communication, culture, etc (Ostrom, 1998 & 2006). Our study too indicates that irrespective of the presence of formal institutions and the quality of the forest in which the indigenous communities live, their attitude seems to be non-exploitative and non-commercial. For communities that are located in well-stocked forests, it is easier to harvest sustainably than for those who dwell in degraded forests. However, sustainability of the forest seems to be priority for most of the forest dwelling communities. Yet, from the point of view of economic rationality, this harvesting behavior seems irrational, as they do not optimize their pay-off, which indicates that their attitude towards the forests is not predominantly 'economic'.

The behavior described above is what Cosmides and Tooby (1994, quoted in Ostrom, 1998, p.2) would call *"better than rational"* because in addition to ensuring the sustainability of the natural resource, it leads towards equality (of resource use) through communication. While, theoretically, communication alone should not make any difference to the private decisions of individuals trying to optimize pay-offs, especially when benefits go to individuals, there are findings consistently indicating an increase in the level of cooperation when individuals are allowed to communicate face to face (Sally, 1995; Cardenas *et al.*, 2004; Ostrom *et al.*, 1994). As seen in the present study, communication not only furthers sustainable behavior among the communities but also leads to equality of harvesting and, thereby, equality of pay-offs to all involved (as seen in the reduction in standard deviation and dispersion). Communication also moderates the harvesting pattern. Where harvesting is high in the non-communication situation, communication leads to a reduction in harvesting. In situations where harvesting is low, it leads to an increase, without compromising on sustainability[15]. Communication brings parity in pay-offs across inter- and intra-community levels.

[15] Similar results were found by Cardenas et al., 2004

One major policy-relevant inference to be drawn from this study is that JFM is a step in the right direction when it comes to decentralization of forest management. JFM expects communities to formulate their own operational level rules for regulating the use, monitoring, guarding, and protection of the resource. It provides a platform for communities to take decisions via communication with each other regularly at both general body and executive body meetings. Therefore, the government needs to identify the factors that hamper effective implementation of the program and adopt corrective measures that take better advantage of the pro-conservation attitude of indigenous communities.

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LIST OF TABLES

Table 1: Maximum Allowed Individual Harvest in a Round

Resource Level	100-25	24-20	19-15	14-10	9-5	4-0
Harvest	5	4	3	2	1	0

Table 2: Sample Village Profile

Village	Aire	Gadhaddeo	Bijrigavhan	Talwada	Zhimela	Khongda
Population	1429	2160	1040	246	392	469
No. of HHs	243	522	189	66	78	82
Distance from Nearest Town(km)	9	3	5	10	18	9
Average Land Holding (ha)	2	1.2	1.2	0.8	1	1
Migration (does it take place?)	Yes	Yes	Yes	No	No	Yes
Forest Area (ha)	634.41	1781.6	154.63	522.05	575.26	871.52
Year of JFM	2003	2005	2006	2004	1999	2000

Table 3: Civic Amenities in Sample Villages

Amenities	Aire	Gadhaddeo	Bijrigavhan	Talwada	Zhimela	Khongda
Approach Road	√	√	√	√	√	√
Potable Water	√	√	√	√	√	√
School	√	√	√	√	√	√
Fair Price Shop	√	√	√	√	√	√
Primary Health Center	-	-	-	√	-	-
Bank	-	-	-	-	-	-
Post Office	-	-	-	-	-	-
Independent Gram Panchayat	√	√	-	-	-	√
Anganwadi	√	√	√	√	-	√
Range Forest Office	-	-	-	-	-	-
Agricultural Extension	-	-	-	-	-	-

Table 4: Indicators of Institutional Functioning

Indicators	Aire	Gaddhadeo	Bijrigavhan	Talwada	Zhimela	Khongda
Maintenance and Improvement (min. score - 0, max score - 1)	0	0	0	0	0	1
Conservation Measures (min. score - 0, max score - 3)	0	0	0	0	0	2
Awareness of JFMC (min. score - 0, max score - 3)	0	2	1	1	1	2
Micro-plan (min. score - 0, max score - 4)	1	4	3	3	2	3
Forest Protection (min. score - 0, max score - 3)	2	1	2	0	0	0
Institutional score	3	7	6	4	3	8

Table 5: Indicators of Forest Quality

Village Name	Stand Basal area (ha)	Stems per plot	Mean Height	**Forest Score**
Aire	16.65	4.97	10.12	31.74
Gadhaddeo	2.82	2.27	5.22	10.31
Bijrigavhan	3.08	2.57	8.93	14.58
Talwada	19.74	9.63	13.8	43.17
Zhimela	8.74	8.14	12	28.88
Khongda	15.00	7.12	13.7	35.82

Table 6: Frequencies for Number of Trees Harvested in a Round

	Village Name	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	158	26.0	26.3	26.3
	1	251	41.3	41.8	68.2
	2	122	20.1	20.3	88.5
	3	35	5.8	5.8	94.3
	4	9	1.5	1.5	95.8
	5	25	4.1	4.2	100.0
	Total	600	98.7	100.0	
Missing	System	8	1.3		
Total		608	100.0		

Table 7: Frequencies for Total Harvest of the Player

	Village Name	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	3.3	3.3	3.3
	1.00	2	3.3	3.3	6.7
	2.00	3	5.0	5.0	11.7
	4.00	1	1.7	1.7	13.3
	6.00	1	1.7	1.7	15.0
	7.00	6	10.0	10.0	25.0
	8.00	1	1.7	1.7	26.7
	9.00	4	6.7	6.7	33.3
	10.00	7	11.7	11.7	45.0
	11.00	2	3.3	3.3	48.3
	12.00	3	5.0	5.0	53.3
	13.00	3	5.0	5.0	58.3
	14.00	5	8.3	8.3	66.7
	15.00	4	6.7	6.7	73.3
	16.00	2	3.3	3.3	76.7
	17.00	1	1.7	1.7	78.3
	18.00	2	3.3	3.3	81.7
	19.00	2	3.3	3.3	85.0
	20.00	3	5.0	5.0	90.0
	21.00	1	1.7	1.7	91.7
	23.00	1	1.7	1.7	93.3
	25.00	2	3.3	3.3	96.7
	33.00	1	1.7	1.7	98.3
	50.00	1	1.7	1.7	100.0
	Total	60	100.0	100.0	

Table 8: Statistics of harvest

	Mean of individual harvest		Standard Deviation		Mean Diff Test		Variance Diff Test	
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
Village	Before communication	After communication	Before communication	After communication	t-test	signed rank test	F>1	F<1
1. Aire	11.4	6.8	13.65	4.32	-0.833 (0.225)	0.674* (0.050)	9.96** (0.023)	
2. Gadhaddeo	9	11	6.04	3.16	0.964 (0.1940)	-0.677 (0.4982)	3.65 (0.119)	
3. Bijrigavhan	5.8	14	2.17	4.64	4.358*** (0.006)	-2.023** (0.043)		0.22* (0.085)
4. Talwada	25	12.6	14.73	3.43	-2.053* (0.054)	2.032** (0.042)	18.39*** (0.008)	
5. Zhimela	18.2	13.2	6.22	2.39	-2.599** (0.030)	1.914* (0.055)	6.79** (0.045)	
6.Khongda	12	13.2	6.44	7.79	0.534 (0.310)	-0.577 (0.5637)		0.68 (0.361)
All	13.6	11.8	10.7	4.9	-0.607 (0.285)	0.525 (0.599)	4.79*** (0.00)	

Note: P- value within parentheses. Wilcoxon sign rank test does not assume normality. *, **, and *** indicate significant at 10%, 5% and 1% respectively. For t-test, degrees of freedom is 29, and for F-test, degrees of freedom is (4, 4).

Table 9: Kruskal Wallis Test

Village	N	Mean Rank (non-comm)	Mean Rank (comm)
1. Aire	5	12.70	6.50
2. Gadhaddeo	5	11.80	13.60
3. Bijrigavhan	5	7.50	18.80
4. Talwada	5	23.90	17.00
5. Zhimela	5	21.50	19.00
6. Khongda	5	15.60	18.10

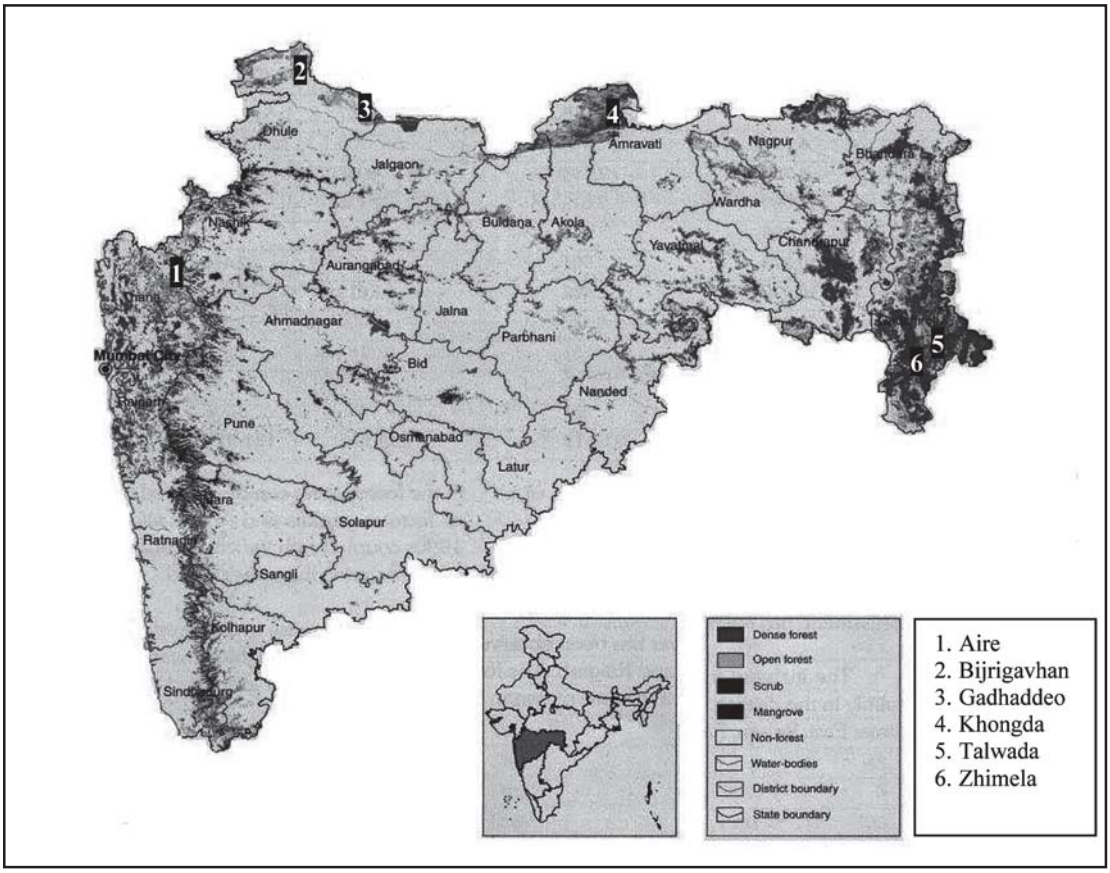
Non-comm: Chi-Square – 12.477; df – 5; Asymp.Sig. – 0.029
Comm: Chi-Square – 7.589; df – 5; Asymp.Sig. – 0.180

Table 10: T- Test (Paired Samples)

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	individual harvest first three rounds no com - individual harvest first three rounds with com	.355	1.538	.162	.033	.677	2.193	89	.031
Pair 2	individual harvest last three rounds no com - individual harvest last three rounds with com	-.033	1.910	.201	-.433	.366	-.166	89	.869

LIST of FIGURES

Figure 1: Location of Study Villages



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