Public Disclosure Authorized

WPS7323

Policy Research Working Paper 7323

Cooperative Behavior and Common Pool Resources

Experimental Evidence from Community Forest User Groups in Nepal

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June 2015

Abstract

This paper examines whether cooperative behavior by respondents measured as contributions in a one-shot public goods game correlates with reported pro-forest collective action behaviors. All the outcomes analyzed are costly in terms of time, land, or money. The study finds significant evidence that more cooperative individuals (or those who believe their group members will cooperate) engage in collective action behaviors that support common forests, once the analysis is adjusted for demographic factors, wealth, and location. Those who contribute more in the public goods experiment are found to be more likely to have planted trees in community forests during the previous month and to have invested in biogas. They also have planted more trees on their own farms and spent more time monitoring community forests. As cooperation appears to be highly conditional on beliefs about others' cooperation, these results suggest that policies to support cooperation and strengthen local governance could be important for collective action and economic outcomes associated with forest resources. As forest management and quality in developing countries is particularly important for climate change policy, these results suggest that international efforts such as the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation should pay particular attention to supporting governance and cooperation at the local level.

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Produced by the Research Support Team

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Keywords: Experiments, Forests, Collective Action, Public Goods Game, Nepal

JEL Codes: C93, D79, H41, Q01, Q23, Q54,

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Cooperative Behavior and Common Pool Resources: Experimental Evidence from Community Forest User Groups in Nepal[1]

1. Introduction

Social dilemmas are an obvious challenge for many groups and communities, including those focused on the use of natural resources. To sustain cooperation and improve how social dilemmas can be solved, we need a better understanding of these issues. As argued by Falk and Heckman (2009), there are three main ways to investigate people's behavior: (i) using surveys, (ii) observing actual behavior and (iii) conducting experiments. Each of the methods has its pros and they complement each other. Naturally occurring data has its obvious benefit of being based on real behavior, but it is difficult to interpret, because causality is hard to identify. On the other hand, laboratory experiments can easily control for causality but external validity can be questioned.

Some research has thus tried to meet on middle ground and focused on the important question of correlation between real life cooperative behavior and cooperative behavior in experimental settings. These studies compare, for example, real life cooperative decisions of users of a common resource with the same people's decisions in an experimental game.

Public goods experiments have been used to experimentally measure cooperative preferences (for overview see e.g., Chaudhuri, 2011; Ledyard, 1995; Zelmer, 2003). The advantage with an experimental approach, where subjects are anonymous to each other and decisions are made in privacy, is that cooperative behavior is not affected by factors such as reputation or self-image that are potentially context-specific. Such an approach potentially allows us to control for confounding concerns. However, only a few studies have investigated the

[1] Financial support from the World Bank Knowledge for Change Program is gratefully acknowledged. Responsibility for the content of the paper is the authors' alone and should not be attributed to their institutions, the World Bank, or its member countries.

external validity of public goods experiments in general and very few have been conducted in low-income countries among a non-student subject pool (e.g. Cardenas and Carpenter, 2008; Rustagi et al., 2010; Voors et al., 2013).

For resources held in common, the academic and policy literatures view better cooperation as an important step toward improved natural resource management (Ostrom, 2010). In the case of common forests, this collective action takes the form of access controls, rules, monitoring, enforcement, and governance contributions. These collective action steps are believed to result in better forest management, which is expected to increase forest quality, generating higher rents (resulting from marketed and non-marketed ecosystem services) and greater social welfare (Bluffstone et al., 2014; Beyene et al., 2014; Chhatre and Agrawal, 2009; Bottazoi et al., 2014; Rustagi et al., 2010). Higher quality collective action may be made up of individuals who, inherently and/or because of the institutions in which they live, are more able or willing to cooperate.

It is of interest to know more about the determinants of cooperation and evaluate whether cooperation is context-specific or if cooperation is more general. If the latter, we would expect to see cooperation exhibited in lab experiments mirrored in field contexts, such as cooperation-intensive real world contexts like community forestry. Community forests are a particularly useful context in which to examine the linkage between experimental cooperation and real world cooperation, because they are especially important in developing countries like Nepal. Indeed, in most low-income developing countries forests provide products that are essential to the daily lives of people, including fuelwood, forest fruits and vegetables, building materials and animal fodder (Cooke et al., 2008). They also, of course, provide local indirect use values like watershed protection and global indirect use values like carbon sequestration.

Recently, the carbon sequestration benefits of developing country forests have been especially highlighted. Virtually all net deforestation, which releases carbon into the atmosphere, occurs in the developing world and the UN Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+) attempts to reduce deforestation and forest degradation in developing countries (Bluffstone et al., 2013). Collective action and cooperation may therefore be relevant for climate change policies.

To summarize, when forests are community controlled, rents from forest ecosystem services are expected to be greater when communities engage in effective collective action behaviors. Collective action is expected to be driven by cooperative individuals. This paper tests this hypothesis and in the process sheds light on the external validity of experimental cooperation in rural areas of low-income countries.

Using a one-shot experimental public goods game with real and meaningful payoffs, we examine the cooperative behavior of Nepali forest user group members and evaluate the relationship between such experimental behavior and their personal characteristics, their trust in neighbors, and the nature of the institutions in which they interact. After evaluating the determinants of experimental cooperation, we connect the experimentally measured cooperation with reported, costly real-world activities that either directly support community forest collective action or indicate that respondents are taking steps to substitute out of fuelwood collected from community forests. These causal links are made using econometric techniques appropriate to the dependent variables analyzed.

2. Literature

Cooperation among people is to a large extent based on conditional cooperation, i.e., people cooperate if they believe that others also do so (e.g., Axelrod and Hamilton, 1981; Rabin, 1993). Public goods experiments have shown that although there is a large heterogeneity in cooperative behavior, populations are typically characterized by two main types: free-riders and conditional co-operators (e.g., Fischbacher et al., 2001; Fischbacher et al., 2012).[2,3] There is by now a small but growing literature investigating the correlation between cooperative behavior in public goods experiments and cooperative behavior in real life. The overall results are mixed, but there seems to be a tendency to find a positive correlation between behaviors in the lab and in the field.

Carpenter and Seki (2006) correlate results from a public goods experiment among Japanese fisherman. They find that people in more competitive environments, such as fishers and fish traders, are less cooperative than staff at the local fishing cooperative. Among artisanal fishers in Brazil, Fehr and Leibbrandt (2011) find that fishers who are more cooperative in a public goods experiment and less impatient in a time preference experiment less intensively exploit their fishery.

Voors et al. (2013) conduct a public goods experiment with farmers in Sierra Leone and they find no correlation between experimental behavior and real life cooperative behavior, such as community work. Bouma et al. (2008) combine experimental evidence from a trust game in India with information on households' participation in community management. They find that players that are more cooperative also engage in more pro-social community-based natural resource management activities.

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[2] These results have been found to be robust across subject pools and locations (e.g. Fischbacher et al., 2001, on Swiss students; Herrmann and Thöni, 2009, on non-student population in Russia; Kocher *et al*., 2008, on students in USA, Austria and Japan; Martinsson *et al*., 2013, on students in Vietnam and Colombia).

[3] Gächter (2007) argues that it is important for policy design to know if people are conditional co-operators, and cooperation is fragile if conditional cooperation is not perfect.

Rustagi et al (2010) is an especially relevant paper, because they also link public good experimental results with reported pro-social forest behaviors that include costly community forest monitoring. They find in southern Ethiopia that the extent of such monitoring is an important determinant of forest management outcomes. They also find that groups with a higher fraction of conditional co-operators spend more time in costly monitoring. Costly forest monitoring is one of the six forest collective action behaviors we examine in this paper.

Community forestry is just one type of collective action around common pool resources, but it is an especially important one in low-income countries. Because forests are critical to local livelihoods and must somehow be shared, their sustainable management is essential for the welfare of the community. Though multiple disciplines have examined cooperative preferences and behaviors, an increasingly well-developed economics literature suggests that successful collective action is very important for economic outcomes and development (Bouma et al., 2008). Knack and Keefer (1997) and Zak and Knack (2001) both find trust yields macroeconomic payoffs like higher incomes and investment. In developing country settings using survey data, Bluffstone et al (2008), Mekonnen and Bluffstone (2008a) and Bluffstone et al (2012) find that better forest sector coordination spurs private investments in trees and livestock. These findings are similar to others in the literature that link a variety of investments with more effective collective action (Glaeser et al., 2002; Nyangena, 2011).

As Ostrom (2010) has emphasized, common resource management is not a panacea and the interdependencies created between community members may result in open access or worse. Community member interdependencies are complex; both good and bad outcomes are possible depending on the process of coordination and multiple equilibria are possible (Bowles and Gintis, 2002). Glaeser et al (2002) discuss this issue in terms of social capital, pointing out that collective action may be unstable and can be disrupted by outside shocks. They note, for example (p. 442):

> "These [interpersonal] complementarities raise the possibility that there exist multiple equilibria in the levels of social capital investment. In some communities the level of investment is high and the return to investment is consequently high. In other communities no one invests and the return to investment is low … Multiple equilibria models explain how small differences in initial conditions can generate large divergence in long-run levels of social capital."

We conduct our study in Nepal and experimental subjects are members of communities that share forests and so it is important to understand and examine the effects of the ecosystems that make up and the management institutions that control those forests. With regard to ecosystems, there are many sub-ecosystems, but the main division is based on location in the hills or the *Terai*, which is the plains area that adjoins India. These ecosystems are very different, with *Terai* ecosystems generally being more productive and having more biomass. Bluffstone et al. (2014), for example, find that *Terai* forests on average have about 43% more biomass per hectare than hill forests. They also have more valuable timber species like Sal.[4]

Communities may also have very different forest management institutional structures depending on whether they have applied and been approved to be part of the Nepal Community Forestry Programme. Forests that are part of the Community Forestry Programme are controlled and managed by communities and have effectively been handed over to them. Forests not under the Community Forestry Programme remain national forests ostensibly owned and controlled by the Government of Nepal (GON). In practice, most national forests are controlled and managed on a day-to-day basis by communities, but are believed to be less well managed and often open access.

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[4] Sal (*Shorea robusta)* is a member of the Dipterocarpaceae family. It is a particularly valuable timber species found in Nepal at lower elevations. Other species include broadleaf, pine, *bel* and *chilaune*.

Nepal introduced the decentralized Community Forestry Programme (CFP) in the late 1980s in the context of serious deforestation and forest degradation, as a centralized approach was not working (Guthman, 1997; Ojha et al., 2007; Hobley, 1996, Springate-Bejinski and Blaikie, 2007; Carter and Gronow, 2005) and a number of scholars have claimed that the Community Forestry Programme forests have in many areas stemmed and reversed deforestation and forest degradation (e.g., Pokharel and Mahat 2007; Yadav et al., 2003; Gautam et al., 2003).

Since 1993 when the first CFP groups were registered, the CFP has expanded to include 18,133 forest user groups, with the involvement of over 2.2 million households (almost 35% of the total) managing 1.7 million hectares of forest. Almost 65% of all forests are in the hills are CFP forests, but only 18% of *Terai* forests are Programme forests (MOFSC, 2013). This difference reflects a variety of circumstances, including that the hills are historically the more populated areas of Nepal and government officials have been less willing to devolve *Terai* forests. In its short history of 30 years, the Nepal Community Forestry Programme is believed to have improved forest quality (Branney and Yadav 1998; DoF, 2005; Shrestha and McManus, 2008), expanded community infrastructure, increased incomes (Kanel and Niraula, 2004; Hobley and Jha 2012), and supported conflict resilient and democratic community institutions (Hobley and Jha, 2012)

The CFP is a form of local collective action that is formalized by government, but is driven primarily by communities. Joining the CFP requires paperwork, time and negotiation outside the community that is generally costly; communities therefore have skin in the game when they apply for CFP status. For example, using a survey of 309 households belonging to eight different forest user groups in the middle hills of Nepal, Adhikari and Lovett (2006) find that transaction costs for Community Forestry Programme forest management as a percentage of resource appropriation costs are as high as 26%.

3. Experimental design

3.1. Location

The experiments were conducted in 20 villages in Nepal. Prior to the experiments, subjects also participated in focus group discussions related to REDD+ and were recruited by local and professional enumerators with significant experience in rural data gathering. As discussed in the directions given to experimentalists included in the Appendix, anyone who attended the focus group discussion could in principle participate in the experiments. Subjects only needed to be adults and have the numeracy skills needed to understand the experiment.[5] Because any qualified adult who attended the focus group could participate in the experiment, the sample is not completely random, but is believed to be reasonably representative of populations in the hill and *Terai* regions of Nepal. A total of 327 subjects participated in the public goods experiments, typically in a public building such as a school or agricultural cooperative building.

All experimental subjects are forest user group members and 89% of respondents participating in the experiment were part of formal Community Forestry Programme groups. The average CFP forest was officially registered 10 years before the data were collected, with a maximum of 19 years and all but one CFP forest had been in existence at least 5 years. Approximately 20% of CFP member experimental subjects serve on their CFP management

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[5] Approximately 5% of potential candidates in each site were rejected because the experimentalists concluded they could not sufficiently understand the game and make the needed calculations. For example, potential respondents were rejected if they were unable to calculate the average payoff from the public good game. Details are discussed in the Appendix.

committees, which indicates that they have leadership roles in their forest user groups, and this percentage is virtually identical for men and women.

3.2. Public Goods Experimental Design

We now turn our attention to explaining the public goods experiment we use to understand respondents' cooperative inclinations. This analysis is followed by a presentation of descriptive statistics and an examination of those findings and development of regression models explaining the experimental outcomes. After investigating the experimental outcomes, we analyze the reported community forest management behaviors and relate them to the individual contributions in the public goods game.

The subjects participated in a one-shot three-person standard public goods experiment.[6] Each subject was endowed with Rs. 100. The initial endowment of R. 100 was approximately one half of the daily laborer wage and therefore gave sufficient incentives to carefully evaluate the choices in the experiment. Since the experiments were conducted with subjects that often have little or no education, to facilitate understanding we directly used the local currency rather than an experimental currency combined with an exchange rate.

The subject was then asked how much of her endowment of Rs. 100 she would like to contribute to a public good, while the remainder was kept as her private income. The contributions could be made in increments of Rs. 5.0. Thus, this is similar in terms of numbers of strategies to choose from to have an experiment with 20 tokens where it is possible to contribute integer tokens as is the normal practice. The total amount given to the public good by all three group members was multiplied by 1.5 and then shared equally among all three group members.

[6] At the beginning of the experiment, we explained that there were two experiments. First, we conducted the experiment as discussed in this paper. In the second experiment, we tested different institutional settings and subjects were randomized into different treatments. We used stranger matching and there was no feed-back during the experiment.

This explanation was provided to the subjects to make it easy for them to understand the set-up of the public goods experiment.

It should be noted that the return to each subject for a contribution of Rs. 5.0 is Rs 2.5, which is an easy and intuitive number. To let the total amount given to the public good by all three group members be multiplied by 1.5 and then shared equally among all group members is equivalent to having the marginal per capita return (*MPCR*) from investing in the public good set to 0.5, i.e., for each unit invested in the public goods all members of the group earns 0.5 units. This MPCR creates the conflict between the privately optimal strategy to contribute nothing to the public good (since *MPCR* < 1) and what is best from a social perspective, which is to contribute the whole endowment because MPCR•*n* > 1.

Our chosen *MPCR* of 0.5 creates the conflict between the private optimum to free-ride and the social optimal contribution to fully contribute to the public good. Thus, we can summarize subject *i*'s payoff in Rs. in the standard public goods experiment as

$$\pi_i = 100 - c_i + 0.5\sum_{j=1}^{3} c_j \,, \tag{1}$$

where c is the amount invested in the public good.

In the public goods experiment, each subject belonged to a group of 3 anonymous players, including themselves. The players were assigned randomly from 15-20 villagers known to each other and in general members of the same community forest user group. Experimental subjects were therefore well acquainted with one another, though they did not know the identities of the other players in their specific three-person group. Neither during nor after the experiment were the identities of group members revealed. This was clearly stated in the instructions.

After contributions to the public good were chosen, the subjects were asked about their beliefs regarding the total contributions of the other two anonymous members of the group. Following Gächter and Renner (2010), the guessed beliefs were monetarily incentivized. If subjects predicted correctly, they received an additional Rs. 50 as a prize. We chose this simple and high prize reward, because having a reward function that depends on how far from the correct answer is complicated to explain. The elicitation of beliefs allows us to test if subjects are conditional cooperators, i.e., if own contributions are related to how much they believe others would contribute. As shown in e.g., Fischbacher et al. (2001), this seems to be the dominating contributor type in public goods experiments, often accounting for half of subjects. Because significant proportions of subjects had little formal education or were illiterate, the experimentalists read instructions aloud and subjects reported their answers back to them as in Henrich et al., (2001).

3.3. Model Approach

The goals of the regression models are a) to understand the determinants of contributions to the public good and beliefs, and b) to estimate the effect of contributions to the public good on the reported collective action behaviors so we can better understand the relationship between cooperation and collective action that supports community forests in Nepal.

We first estimate three OLS models of respondent public good contributions (CONTRIBUTION1). The first only includes respondent characteristics and the second adds household characteristics and wealth. Because the literature suggests that conditionality is likely to be particularly important for cooperation, we also include a third model with respondent beliefs (BELIEF1) about the total contributions of the two anonymous group members. We then estimate two models of BELIEF1 (respondent characteristics and respondent characteristics plus household characteristics) and find that many variables affecting CONTRIBUTION1 are also important for BELIEF1.

After analyzing the determinants of CONTRIBUTION1, we test is whether those who contribute more to the public good in the experiment (i.e. cooperative individuals, conditional or otherwise) are more likely to participate or more extensively engage in costly collective action activities that benefit community forests. We analyze the six behaviors and associated variables described below, all of which are costly to respondents, either in terms of time, land, or money. The first three variables are binomial, variables 4 and 5 are count data and variable six is an interval variable.

- (ANYTREE_CF) Whether the subject planted any trees in the community forest during the previous month;[7]
- (MEETING_DUM) Whether the subject attended a community forest user group meeting during the previous month;
- (BIOGAS_DUM) Whether the subject had adopted biogas;
- (MONITORING) Number of hours the subject spent monitoring and guarding the community forest during the previous month;
- (NUMTREES_FARM) Number of trees planted by the subject and his or her family on their private land during the last five years;
- (NUMTREES_CF) Number of trees planted by the subject in the community forest during the previous month by category (0, 1-3, 4-6, 7-10, >10);

All these behaviors have important common benefits, but we anticipate that respondents incur the costs associated with the behaviors at least partly because they are in their own interests in light of their personal characteristics and the institutional environments in which they live. For example, attending user group governance meetings, while costly, also offers private benefits, such as the opportunity to see friends and take a break from agricultural work. Biogas adoption and planting trees on household farms have particularly strong private aspects, but also

[7] This variable relies on the same information as NUMTREES_CF, but is included because only 38 respondents had planted any trees during the previous month.

important public benefits. For example, adopting biogas, while reducing fuelwood collections and therefore benefiting community forests (Somanathan et al., 2014), also offers cooking convenience and reduced labor costs.

We include as covariates in our models all the respondent and household characteristics listed in the first part of Table 1 discussed in the next sub-section. These covariates include respondent and household characteristics like caste, gender, age, education, and family size. Economic factors and assets, which affect respondent budget constraints, may also be important in determining respondent cooperative behaviors. For example, wealthier households may be able to afford being more generous.

The main assets in rural Nepal are land and farm animals; we therefore include total agricultural land size, private forest area, the number of oxen, and the number of buffalo held by the household. Though not of primary focus for this paper, all these variables may affect public good contributions/beliefs and reported pro-forest behaviors and may be correlated with independent variables of interest.

In the models of community forest-supporting behaviors we include three additional variables that are unlikely to be related to contributions or beliefs. We know, for example, from Voors et al. (2013) that the institutional environment can have a strong influence on individuals' cooperative behavior. We therefore include as an explanatory variable a dummy variable that indicates whether or not the respondent is a member of an official government registered community forest user group (CF_MEM). This is done because there may be systematic differences in observed pro-forest behaviors between CFP forests and non-CFP forests due to different rules, norms or habits created by Community Forestry Programme forest participation.[8]

The dependent variables that directly affect community forests (ANYTREE_CF, MEETING_DUM, MONITORING, NUMTREES_CF) have timeframes during the previous month and NUMTREES_FARM focuses on the previous 5 years. As all Community Forestry Programme groups were formed well before one month ago, even going back to 1995, but in only one case less than 5 years ago, it is impossible to have reverse causality with respect to the first 4 variables and very unlikely with regard to NUMTREES_FARM. That BIOGAS_DUM has very important private good elements makes such endogeneity or other confounding factors highly unlikely. Omitted independent variables are, of course, always possible.

In our models of the six forestry behaviors we also include a dummy variable for whether the respondent is a CFP management committee member (CF_OFFICER), because officers who are in effect group leaders are likely to work harder at and adjust more quickly to forest collective action than other members. The second variable included in the forest behavior models, but not in the contribution and belief models, is MONITOR_PAY, which is a dummy variable for whether the respondent received pay from the forest user group for monitoring and patrolling in the forest. This variable indicates whether the respondent is essentially a part-time forest user group employee, which could affect participation in community forest activities. For example, those receiving pay for monitoring may spend more time monitoring than those who are not paid forest guards. All those receiving pay are CFP members.

In terms of econometric methods, we estimate OLS models of CONTRIBUTION1 and BELIEF1 that first include only participant characteristics and then add household characteristics

[8] We tested whether Community Forestry Programme experience might influence experimental cooperative behavior or beliefs, but in no models was CF_MEM significantly correlated with CONTRIBUTION1 or BELIEF1. Including CF_MEM in models did not substantively change coefficient estimates of other variables.

and wealth. For the variable CONTRIBUTION1 we add a third model that includes BELIEF1 as an independent variable, because individual cooperation possibly is conditional on the expected contributions of others in the group.

Turning our attention to models of collective action behaviors that support community forestry, the first three dependent variables are dummy variables. We therefore estimate probit models, which assume a normal distribution.[9] MONITORING and NUMTREES_FARM are count data variables. We therefore estimate the model using Poisson regression, but based on goodness-of-fit X^2 tests we reject the use of Poisson models[10] in favor of negative binomial count data models. NUMTREES_CF is an interval variable.[11] We therefore estimate the model using interval regression as was done in Bouma et al. (2008).

Unobservable community factors, including the degree of social cohesion, are potential determinants of public good contributions, as well as individuals' participation in pro-forest collective action. Such unobservable factors are very difficult to measure, but we take account of unobserved linkages between subjects that are part of the same user group by clustering all robust standard errors at the forest user group level.

4. Results

4.1 Descriptive Statistics

Table 1 below presents the key descriptive statistics associated with our sample. These variables are also, as discussed above, used as controls in our regression models. Sixty-three percent of participants were men and the mean age was 39 years. Average family size is 5.5, with

[9] Logit regression results are similar and are available from the authors.
[10] X^2=3686 (prob > X^2 (312)=0.000) and X^2=19,932 (prob > X^2 (312)<0.001).
[11] Categories are 0 trees; 1 to 3 trees; 4 to 6 trees; 7 to 10 trees; and more than 10 trees planted during the previous month.

1.6 children and 80% live in the middle hills rather than the *Terai*, which is the plains area adjoining India. Almost 80% identify farming as their main occupation. Caste discrimination is illegal in Nepal, but caste can still be an important determinant of success. In the sample 11% were from lowest caste (Dalit) groups, half were from indigenous (Janajati) and 39% were from Brahmin and Chetri castes.

>>> TABLE 1 ABOUT HERE

Experimental subjects are members not only of forest user groups, but also households, which is the level at which private assets are held in Nepal. Land and animals are the main physical assets of households and the primary indicators of wealth. Agricultural land holding on average was 0.58 hectares and 63 respondents (19.3%) reported having private forestland, with a mean of 3.76 *ropanis* (1912 m^2) [12] among households having private forests. A total of 149 households have no oxen of their own, which can be a disadvantage. Not having oxen when needed can delay timely plowing and affect agricultural yields, but 126 households have two oxen. On average respondents' households have 0.52 cows, but 214 have no cattle at all. Buffalo are more common, with a mean of 1.21 and 202 households having at least one buffalo.

The average maximum household education is 9.0 years, with a sample maximum of 17 years, and average respondent education is 6 years. Ninety percent of households identify fuelwood as their main cooking fuel, but 14% also have biogas and 67% have electricity, which is mainly used for lights. Table 2 presents the frequencies of cooking fuels used by respondents.

>>> TABLE 2 ABOUT HERE

Respondents report that they engage in a variety of activities that directly and indirectly contribute to community forest quality. In this paper we attempt to explain the outcomes in Table 3, which includes costly monitoring as in Rustagi et al. (2010). Community forests are subject to

[12] 1 *ropani*=509m^2.

encroachment by outsiders and potentially also over-use by group members. Monitoring is therefore of critical importance, but also costly for members. Respondents spent an average of 2.14 hours guarding their forests during the previous month and among those who had monitored, 15% received some pay for those efforts. On average, these paid guards are less wealthy than others, with less buffalo and land than mean subjects. Forest guard positions therefore tend to assist less wealthy group members.

>>> TABLE 3 ABOUT HERE

In addition to monitoring community forests, respondents report participating in forest governance. Governance is an important aspect of collective management, because it assures that necessary tasks are completed, members are involved in collective action, and a diversity of views are considered (Ostrom, 1990), but governance can be very costly for members. For example, attending user group meetings can have high opportunity costs (Adhikari and Lovett, 2006). In our sample 46% of respondents attended a forest user group meeting during the previous month.

Households report planting trees on their own farms, which provide products that substitute for those from community forests and are part of household adaptation to forest collective action (Bluffstone et al. 2008), and have adopted biogas, which is also a potential response to controls associated with community forest collective action. Respondents had on average planted in the range of 1 to 3 trees in their community forests during the previous month and on average had planted 14 trees on their own land during the last five years. Forty-one out of 327 (12.5%) households had planted more than 20 trees on their own property during the past five years and 14% had biogas plants that may help reduce the need for fuelwood from forests.

4.2 Experimental Contributions and Beliefs about Others' Contributions

To facilitate comparisons to previously conducted experiments, we describe contributions and beliefs as a fraction of total endowment. The average public goods contribution (CONTRIBUTION1) is 62.65%, which implies a relatively high level of cooperation compared to other experiments with a similar design. As shown in Figure 1, although there is a wide variety of contributions, there is a modest tendency for subjects to contribute half of the endowment. Subjects' beliefs about the average contributions of the other two group members (BELIEF1) of 60.21% were close to the actual average contribution, suggesting respondents know the habits of their neighbors. The histogram of beliefs in Figure 2 shows that the distribution of beliefs maps well to the contributions in Figure 1.

>>> FIGURE 1 ABOUT HERE

>>> FIGURE 2 ABOUT HERE

Beliefs about others' contributions - essentially how collaborative villagers believe their fellow group members are – may affect individuals' contributions. For example, if respondents believe that on average the other two members of their three-person group will contribute heavily to the public good, because of the interdependence built into the experiment, they may also heavily contribute.[13]

>>> TABLE 4 ABOUT HERE

As shown in Model 1 in Table 4, a number of personal characteristics, including if the respondent lives in the *Terai*, if the respondent is a woman, if the family is larger, and if the most educated family member has a *lower* level of education increase public good contributions. We estimate that those who live in the hills contribute about Rs. 14 less (about 22%) than those who

[13] The Spearman correlation between contribution and belief is 0.53 ($p<0.001$).

live in the *Terai*. Women on average contribute Rs. 9.23 more to the public good (15% more) than men. An additional family member is associated with an additional contribution of Rs. 2.0. Subjects in large families therefore contribute more to the public good. We do not find any effects of age, respondent education or Dalit caste membership. Model 2 adds in wealth measures, but no variables significantly affect contributions. Wealth does not appear to affect public good contributions.

In Model 3 we add in BELIEF1, which is the respondent's subjectively assessed belief about the contributions of his/her two fellow group members. We see that including this variable makes an enormous difference and causes two of four variables significant in Models 1 and 2 to become insignificant. Whereas Models 1 and 2 explain 7% - 8% of the variation in the data, adding the variable belief yields a model that explains over 33% of the variation; clearly, belief belongs in the model.

If the respondent believes his/her group members will contribute one additional rupee, the own contribution is estimated to increase by Rs. 0.25. The coefficient estimate is significant at the 1% level, which appears to provide strong evidence of conditional cooperation. When BELIEF1 is added to the model, among the variables that are significant in Model 2, only the effects of living in the hills and maximum household education remain significant in Model 3.

>>> TABLE 5 ABOUT HERE

That so many variables significant in Models 1 and 2 become insignificant in Model 3 suggests that demographic and wealth variables may be important for beliefs about the contributions of the fellow experimental group members. We find that many of the same variables that affect contributions also affect beliefs with the same signs. The only variables significant in Table 5 that are not important in Table 4 are LAND_HA and FOREST_ROP. As shown in Table 5, an increase in private forest land of 1 *ropani* is estimated to reduce the believed contribution by Rs. 2.11, which is a very small effect. An additional hectare of agricultural land (about twice the mean) increases estimated belief by Rs. 9.23, which is also a very small effect.

Other estimates are notable primarily because the estimated coefficients are roughly twice the magnitudes of and therefore proportionate to those in Table 4 (i.e., there are two fellow group members). For example, female respondents expect 20% more contributions from their experimental group members than men. Though living in the hills strongly affects actual contributions, it has no effect on beliefs about others' contributions.

4.3 Cooperation and Reported Community Forest Collective Action Activities

>>> TABLE 6 ABOUT HERE

We now turn our attention to models of reported collective action behaviors that are important for forests. Spearman correlations between experimental variables and outcome variables are presented in Table 6. We see that all statistically significant correlations are positive. CONTRIBUTION1 is positively and correlated with BELIEF1 and all tree planting variables at less than the 10% significance level. We also see that respondents that had planted more trees on their own farms during the previous 5 years tended to have higher levels of all other variables.

>>> TABLE 7 ABOUT HERE

The models without demographic and wealth controls are presented in Table 7. We find that in this parsimonious model without respondent characteristics, respondent contributions to the public good in the experiment have no effect on forest-related behaviors. Members and officers in registered Community Forestry Programme user groups, though, have different reported behaviors than non-CFP respondents. Both normal members and officers are more likely to have participated in forest governance by attending a user group meeting during the past month. CFP members are also *less* likely to have biogas and also engage in *less* forest monitoring. CFP officers are *more* likely, though, to have biogas and also put in more reported hours of community forest monitoring than those who are not CFP management committee members.

>>> TABLE 8 ABOUT HERE

We see in Table 8 that adding household controls to the probit models makes a difference for biogas adoption and planting of trees in community forests. CONTRIBUTION1 positively affects both adoption of biogas and planting any trees in common forests. More (conditionally) cooperative individuals are therefore estimated to be more likely to make these important and costly investments.

Though more cooperative respondents do not participate more actively in governance, those who are CFP members or management committee members are more likely to have attended forest user group meetings during the previous month than non-CFP respondents. Collaborative governance therefore appears to be an important feature of the Nepal Community Forestry Programme.

Among the added household controls, we find that female respondents are more active in forest user group governance and are therefore more likely than men to have attended a forest user group meeting during the previous month. Households with higher levels of maximum household education are more likely to have adopted biogas and planted any trees during the previous month in the community forest. Perhaps not surprisingly, because animal dung is an important input, households with more water buffalo are more likely to have adopted biogas.

>>> TABLE 9 ABOUT HERE

Table 9 presents the results of the count data and interval regression models with household controls. We see once again that experimental cooperation can make a difference for reported forest-related behaviors. CONTRIBUTION1 is positively correlated with all three dependent variables, but only the estimated effect on numbers of trees planted on respondents' own land during the previous five years is statistically significant at least at the 10% level. We note, though, that the estimated effects of CONTRIBUTION1 on MONITORING and NUMTREES_CF are very close to 10% significance levels.

CFP members are estimated to monitor common forests less than others, which is not wholly unexpected because in our study area the Nepal Community Forestry Programme is not a unique path to forest collective action and non-Community Forestry Programme forests are known to engage in significant collective action (Bluffstone et al., 2014). We do find, though, that CFP officers spent more hours in monitoring forests during the previous month than those who are not officers. Low caste Dalit respondents report planting fewer trees, whether on their own land or in common forests. In our communities there is little evidence that low caste user group members do more work (e.g. monitoring or tree planting) than higher caste groups, which has been an issue noted by others (e.g. Adhikari 2005). Respondents with more education plant more trees on their own land and those in larger families do more monitoring.

5. Conclusions

This paper examines whether cooperative behavior of respondents as measured by contributions in a one-shot public goods game correlates with reported pro-forest behaviors which are highlighted in the literature as contributing to forest quality, including reduced forest degradation and carbon sequestration. This linkage is important, because it can help policy makers understand the importance of conditional cooperation to collective action and contributes to the literature on the external validity of lab experiments.

The context is important, because experimental subjects are all members of the same forest user groups and collective action is known to be critical to successful community forestry. Our results therefore help us understand under what circumstances those who are more cooperative actually contribute more to collective action. All the outcomes analyzed are costly in terms of time, land, or money.

We find significant evidence that more cooperative individuals (or those who believe their group members will cooperate) engage in collective action behaviors that support community forests, once we adjust for demographic factors, wealth and location (hills versus *Terai*). Those who contribute more in the public goods experiment are found to be more likely to have planted trees in community forests during the previous month and to have invested in biogas. They also plant more trees on their own farms and, though not significant at the 10% level, seem to have spent more time monitoring and planted more trees in community forests during the previous month. These findings suggest that generic lab experiments can be externally valid in community forestry field contexts.

They also indicate that a potential input into community forest collective action is cooperation, which in most contexts, including ours, is conditional on beliefs about the cooperative behaviors of others. We indeed find significant evidence that experimental cooperators behave as conditional cooperators, because experimental subjects contribute more to the public good when they believe the other two anonymous group members also contribute more to the public good. The nature of the cooperation in the forest user groups is therefore complex, with linkages between behaviors and beliefs about fellow group members. We also find that cooperative behavior differs between those who live in the hills and *Terai*, with hill residents contributing significantly less to the public good. We do not know the reason for this result, but probably is related to the lower levels of market activity and cash-earning possibilities in the hills. Compared with the *Terai*, hill areas are more remote and less integrated with markets.

These results are highly relevant to the literature on the external validity of experiments and also for policy makers attempting to promote outcomes linked to collective action. Indeed, as has been indicated throughout the non-experimental literature, positive real-world collective action outcomes appear to be related to group member cooperation. As cooperation is found to be highly conditional, our results suggest that policies to support local cooperation and strengthen local governance could be important for collective action and economic outcomes associated with forest resources. As forest management in developing countries is particularly important for climate change policy, these results suggest that international efforts such as REDD+ should pay careful attention to supporting local governance and cooperation.

References

Adhikari, B. (2005) 'Poverty, property rights and collective action: Understanding the distributive aspects of common property resource management', Environment and Development Economics, 10: 7-31.

Adhikari, B. and Lovett, J. 2006.Transaction costs and community-based natural resource management in Nepal. *Journal of Environmental Management* 78 (2006) 5–15.

Axelrod R., W.D. Hamilton, 1981. The evolution of cooperation. *Science* 211, 1390-1396.

Beyene AD, Bluffstone R and Mekonnen A. 2013. Community Controlled Forests, Carbon Sequestration and REDD+: Some Evidence from Ethiopia. Discussion paper Series. Environment for Development.

Bluffstone, R. E. Robinson and P. Guthiga. 2013. "REDD+ and Community Controlled Forests in Low-Income Countries: Any Hope for a Linkage?" *Ecological Economics*, Vol. 87: 43-52.

Bluffstone, R., M. Boscolo and R. Molina. 2008. “Does Better Common Property Forest Management Promote Behavioral Change? On-Farm Tree Planting in the Bolivian Andes,” *Environment and Development Economics* 13: 137–70.

Bluffstone, R, E. Somanathan, P. Jha, H. Luintel, R. Bista, M. Toman, N. Paudel, B. Adhikari. 2014.”Does Collective Action Sequester Carbon? The Case of the Nepal Community Forestry Program.” Paper Prepared Under the World Bank Project “Community Forestry as Pro-Poor Carbon Sequestration Policy

Bluffstone, R, M. Yesuf, B. Bushie, D. Damite. 2012. “Household Rural Livelihoods and Private Natural Capital Investments. Does Social Coordination Play a Role? Evidence from Ethiopia.” Environment for Development Working Paper.

Bottazoi P, Crespo D, Soria H, Dao H, Serrudo M, Benavides JP, Schwarzer S and Rist S. 2014. Carbon Sequestration in Community Forests: Trade-offs, Multiple Outcomes and Institutional Diversity in the Bolivian Amazon. *Development and Change*. Vol. **45** (1): 105-131.

Bouma, J, E. Bulte and D. van Soest. 2008. “Trust and Cooperation: Social Capital and Community Resource Management, *Journal of Environmental Economics and Management*, 56: 155-166.

Bowles, S. and H. Gintis. 2002. “Social Capital and Community Governance,” *The Economic Journal*, Vol. 112 (483): F419-F436.

Branney P. and Yadav KP. 1998. Changes in Community Forest Condition and Management 1994-1998. Analysis of Information from the Forest resource assessment Study and Socio-economic Study in the Koshi Hills, Nepal. Project Report No. G/NUCommunity Forestry Programme/32. Kathmandu: UK Community Forestry Project.

Cardenas, J.C. and Carpenter, J., 2008. Behavioral development economics: lessons from field labs in the developing world. Journal of Development Studies 44, 337–64.

Carpenter, J. and E. Seki 2005. Competitive Work Environments and Social Preferences: Field experimental evidence from a Japanese fishing community. *The B.E. Journal of Economic Analysis & Policy*, 1-25.

Carter J, and Gronow J. 2005. Recent Experience in Collaborative Forest Management: A Review Paper. *Occasional Paper* No. 43. Indonesia: Centre for International Forestry Research.

Chaudhuri, A., 2011. Sustaining cooperation in laboratory public goods experiments: a selective survey of the literature. *Experimental Economics* 14, 47-83.

Chhatre A and Agrawal A. 2009. Trade-offs and synergies between carbon storage and livelihood benefits from forest commons. *PNAS*, **106**(42):17667-17670.

Cooke, P, G. Köhlin and W. F Hyde. 2008. “Fuelwood, Forests and Community Management – Evidence from Household Studies,” *Environment and Development Economics*, 13: 103-135.

Falk, A. and J.J. Heckman. 2009. "Lab Experiments Are a Major Source of Knowledge in the Social Sciences." *Science* 326, 535-538.

Fehr, E. and A. Leibbrandt. 2011. A study on cooperativeness an impatience in the tragedy of the commons, *Journal of Public Economics* 95, 1144-1155.

Fischbacher, U., S. Gächter and E. Fehr, 2001. Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters* 71, 397-404.

Fischbacher, U., S. Gächter and S. Quercia, 2012. On the Behavioral Validity of the Strategy Method in Public Good Experiments. *Journal of Economic Psychology* 33, 897-913.

Gautam AP, Webb EL, Shivakoti GP and Zoebisch MA. 2003. Land use dynamics and landscape change pattern in a mountain watershed in Nepal. *Agriculture, Ecosystems and Environment* 99 (1–3): 83.

Glaeser, E. D. Laibson and B. Sacerdote. 2002. "An Economic Approach to Social Capital," *The Economic Journal*, 112 (483):F437-F458.

Guthman, J. 1997. Representing Crisis: The Theory of Himalayan Environmental Degradation and the Project of Development in Post-Rana Nepal. *Development and Change*, 28:45-69.

Gächter, S., 2007. Conditional cooperation: Behavioral regularities from the lab and the field and their policy implications. In Frey, B. and A. Stutzer (eds): Economics and Psychology. A Promising New Cross-Disciplinary Field. The MIT Press 2007, pp.19-50.

Gächter, S. and E. Renner, E., 2010. The effects of (incentivized) belief elicitation in public good experiments. *Experimental Economics* 13, 364-377.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, H Gintis, and R. McElreath, 2001, In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies, American Economic Review, 91(2), 73-78.

Herrmann, B. and C. Thöni, 2009. Measuring conditional cooperation: A replication study in Russia. *Experimental Economics* 12, 87-92.

HMG/DoF. 2005. Forest Cover Change Analysis of the Terai districts, 1990/91 – 2000/01. Kathmandu: Department of Forest, Ministry of Forest and Soil Conservation.

Hobley, M. 1996. Participatory forestry: The process of change in India and Nepal. *Rural Development Forestry Network*, Overseas Development Institute, London.

Hobley, M. and C. Jha. 2012. "Community Forestry Program Impact Study Persistence and Change: Review of 30 Years of Community Forestry in Nepal," for Nepal Ministry of Forests and Soil Conservation.

Kanel KR and Niraula DR. 2004. Can Rural Livelihood be Improved in Nepal through Community Forestry? *Banko Jankari* 14(1): 19-26.

Knack, S. and P. Keefer. 1997. "Does Social Capital have an Economic Payoff? A Cross-Country Investigation," *The Quarterly Journal of Economics*, Vol. 112 (4): 1251-1288.

Kocher, M., T. Cherry, S. Kroll, R. Netzer, and M. Sutter, 2008. Conditional cooperation on three continents. *Economic Letters* 101, 175-178.

Ledyard, J., 1995. Public goods: A survey of experimental research in Kagel, J. and A. Toth (eds.), *Handbook of Experimental Economics*, Princeton University Press, Princeton.

Martinsson, P., N. Pham-Khanh, C. Villegas-Palacio, 2013, Conditional cooperation and disclosure in developing countries, *Journal of Economic Psychology* 34, 148-155.

Mekonnen, A. and R. Bluffstone (2008) "Does Common Property Forest Management Change On-Farm Behavior? Evidence on Tree Planting in Highland Ethiopia," EfD and Resources for the Future Discussion Paper Efd DP 08-*29*.

MOFSC. 2013. Persistence and Change: Review of 30 Years of Community Forestry in Nepal. Ministry of Forest and Soil Conservation.

Nyangena, W. 2011. "The Role of Social Capital in Sustainable Development: An Analysis of Soil Conservation in Rural Kenya," in *Agricultural Productivity in East Africa: Investment, Sustainability and Poverty Reduction*. R. Bluffstone and G. Köhlin eds. Resources for the Future Press, forthcoming 2011.

Ojha HR, Timsina NP, Kumar C, Banjade MR, and Belcher B. (Eds.) 2007. Communities, Forests and Governance: Policy and Institutional Innovations from Nepal. Delhi, Adroit.

Ostrom, E. 2010. *Presentation to the Tenth Annual Meeting of the South Asian Network of Development and Environmental Economists*, 12/6/2010, Godavari, Nepal.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for CollectivAction*. New York: Cambridge University Press.

Pokharel BK and Mahat A. 2009. Kathmandu to Jiri: A Photo Journey (1968 – 2005). Nepal Swiss Community Forestry Project, SDC, Intercooperation, Nepal.

Rustagi, D, S. Engel, M. Kosfeld. 2010 "Conditional Cooperation and Costly Monitoring Explain Success in Forest Commons Management *Science* 330, 961 (2010);

Shrestha KK & McManus P. 2008. The politics of community participation in natural resource management: lessons from community forestry in Nepal. *Australian Forestry* 71: 135-146.

Somanathan, E, R. Bluffstone, and M. Toman. 2014. "Biogas Replacement of Fuelwood: Clean Energy Access with Low-Cost Mitigation of Climate Change" Paper Prepared Under the World Bank Project "Community Forestry as Pro-Poor Carbon Sequestration Policy

Springate-Baginski O and Blaikie P. 2007. (Eds.) Forests, People and Power: The Political Ecology of Reform in South Asia. EarthScan Forestry Library. London and Sterling, Earthscan.

Voors, M., Turley, T., Kontoleon, A., Bulte, E., List, J.A. 2012. Exploring whether behavior in context-free experiments is predictive of behavior in the field: Evidence from lab and field experiments in rural Sierra Leone. *Economics Letters* 114, 308–311.

Yadav NP, Dev OP, Springate-Baginski O and Susan J. 2003. Forest Management and Utilization under Community Forestry. *Journal of Forest and Livelihood*. 3(1):37-50.

Zak, P. and S. Knack. 2001. "Trust and Growth," *The Economic Journal*, 111: 295-321.

Zelmer, J., 2003. Linear public goods experiments: A meta-analysis. *Experimental Economics,* 6, 299-310.

Table 1. Respondent and Household Characteristics

Variable	Mean	Std. Dev.	Min	Max
Included in Both Sets of Models				
Community Forestry Programme member dummy (CF_MEM)	0.89	0.31	0	1
Resident of hill area dummy (HILL)	0.89	0.31	0	1
Respondent age (AGE)	38.84	13.68	16	73
Female dummy (FEMALE)	0.38	0.49	0	1
Dalit dummy (DALIT)	0.10	0.30	0	1
Family size (FAMILY)	5.61	2.17	2	16
Maximum education in family in years (MAXEDUC)	9.07	4.29	0	17
Education of respondent in years (EDUC_RESP)	6.01	4.60	0	15
Total agricultural land in hectares (LAND_HA)	0.50	0.69	0	9.6
Total private forest land in ropanis (FOREST_ROP)	0.72	2.24	0	20
Total oxen (OXEN)	1.12	1.18	0	6
Total buffalo (BUFFALO)	1.21	1.53	0	12
Included only in Models of Community Forest Behaviors				
Community Forestry Programme officer dummy CF_OFFICER	0.19	0.39	0	1
Whether respondent received pay for monitoring during previous month dummy (MONITOR_PAY)	0.14	0.35	0	1

n = 327

Table 2. Main Fuel Used by Respondents

Dung	1.53%
Electricity	1.83%
Fuelwood	88.38%
Crop Residues	0.31%
Other	7.95%

n = 327

Table 3. Reported Collective Action Behaviors Benefitting Community Forests**.** n= 327

Variable	**Mean**	**Std. Dev.**	**Min**	**Max**
Number of Trees Planted in Community Forests in Previous Month (MEETING_DUM)	0.455	0.499	0	1
Biogas Use Dummy (BIOGAS_DUM)	0.141	0.348	0	1
Planted Any Trees in Community Forest Dummy (ANYTREE_CF)	0.116	0.321	0	1
Number of Trees Planted on Own Land during Previous 5 Years (NUMTREES_FARM)	13.77	43.292	0	500
Number of Hours Spent During Previous Month Monitoring Community Forests (MONITORING)	2.413	6.640	0	60
Number of Trees Planted in Community Forests during Previous Month (NUMTREES_CF)	1.269	0.841	1	5

Table 4. OLS Model of Experimental Public Good Contributions (CONTRIBUTION1)

	Model 1	Model 2	Model 3
HILL	-13.606	-13.673	-9.921
	(2.38)**	(2.45)**	(2.80)***
AGE	0.093	0.083	0.011
	(0.71)	(0.65)	(0.09)
FEMALE	8.002	8.245	3.538
	(1.94)*	(1.97)*	(1.15)
DALIT	8.805	9.725	7.344
	(1.65)	(1.76)*	(1.99)*
FAMILY	1.481	1.278	0.218
	(2.18)**	(1.93)*	(0.33)
MAXEDUC	-1.734	-1.832	-1.128
	(2.74)**	(2.86)***	(2.22)**
EDUC_RESP	0.598	0.627	0.254
	(1.13)	(1.19)	(0.57)
LAND_HA		2.710	0.413
		(1.62)	(0.26)
FOREST_ROP		-0.391	0.133
		(0.61)	(0.26)
OXEN		0.408	0.282
		(0.19)	(0.21)
BUFFALO		0.592	0.993
		(0.63)	(0.91)
BELIEF1			0.249
			(7.11)***
CONSTANT	60.308	59.919	39.032
	(4.75)***	(4.89)***	(3.45)***
R^2	0.12	0.12	0.33

N=327 in all models; * p<0.1; ** p<0.05; *** p<0.01; robust t-statistics and errors clustered at the forest user group level

Table 5. OLS Model of Beliefs (BELIEF1) about Experimental Group Members' Contributions.

	Model 1	Model 2
HILL	-16.904	-15.078
	(1.17)	(1.08)
AGE	0.300	0.288
	(1.02)	(1.04)
FEMALE	19.256	18.913
	(2.12)**	(2.04)*
DALIT	8.404	9.565
	(0.81)	(0.90)
FAMILY	4.293	4.259
	(2.70)**	(2.75)**
MAXEDUC	-2.838	-2.829
	(2.40)**	(2.30)**
EDUC_RESP	1.262	1.502
	(1.18)	(1.40)
LAND_HA		9.227
		(2.29)**
FOREST_ROP		-2.107
		(1.94)*
OXEN		0.507
		(0.10)
BUFFALO		-1.609
		(0.44)
CONSTANT	87.352	83.928
	(3.23)***	(3.17)***
R^2	0.09	0.10

N=327 in all models; * $p<0.1$; ** $p<0.05$; *** $p<0.01$; robust t-statistics and errors clustered at the forest user group level

Table 6. Spearman Correlation Matrix (p values in parentheses)

	CONTRI-BUTION1	BELIEF1	MEETING _DUM	BIOGAS _DUM	ANYTREE _CF	NUMTREES _FARM	MONITOR _ING	NUMTREES _CF
CONTRI-BUTION1	1.00							
BELIEF1	0.54	1.00						
	(0.00)***							
MEETING _DUM	0.01	-0.03	1.00					
	(0.92)	(0.64)						
BIOGAS _DUM	0.01	0.02	0.00	1.00				
	(0.79)	(0.76)	(0.99)					
ANYTREE _CF	0.09	0.07	0.07	-0.01	1.00			
	(0.10)*	(0.23)	(0.20)	(0.86)				
NUMTREES _FARM	0.09	0.21	0.18	0.20	0.26	1.00		
	(0.09) *	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***			
MONITOR-ING	0.01	0.01	0.14	0.08	0.42	0.28	1.00	
	(0.90)	(0.91)	(0.01) ***	(0.13)	(0.00) ***	(0.00) ***		
NUMTREES _CF	0.09	0.07	0.07	0.00	1.00	0.26	0.42	1.00
	(0.10) *	(0.23)	(0.24)	(0.93)	(0.00) ***	(0.00) ***	(0.00) ***	

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

Table 7. Models of Reported Forest Collective Action Behaviors by Analytical Method (no Household Controls).

	Probit			Negative Binomial Regression		Interval Regression
	MEETING _DUM	BIOGAS_DUM	ANYTREE _CF	NUMTREES _FARM	MONITOR ING	NUMTREES _CF
CONTRIBU TION1	-0.000	0.002	0.007	0.005	0.002	0.006
	(0.02)	(0.54)	(1.09)	(0.70)	(0.40)	(0.80)
CF_ MEM	1.063	-0.621	-0.321	-0.794	-1.624	-0.731
	(2.16)**	(1.84)*	(0.90)	(1.35)	(2.52)**	(1.25)
CF__ OFFICER	0.648	0.460	0.431	0.442	1.130	0.625
	(2.15)**	(2.12)**	(1.21)	(1.03)	(2.54)**	(0.89)
CONSTANT	-1.200	-0.748	-1.447	2.886	1.769	0.818
	(2.38)**	(2.18)**	(3.20)***	(4.72)***	(2.80)***	(1.22)
LN_ALPHA				1.580	1.977	
				(6.86)***	(7.17)***	
_LN_SIGMA						0.807
						(3.54)***
Wald X^2	10.40	6.71	10.79	8.32	11.23	7.89
Prob > X^2	0.015	0.082	0.013	0.04	0.011	0.048
Pseudo R^2	0.074	0.032	0.032	-	-	-
Log pseudo likelihood	-208.60	-128.57	-113.76	-963.66	-496.17	-707.93

N=327 in all models; * $p<0.1$; ** $p<0.05$; *** $p<0.01$; robust t-statistics and errors clustered at the forest user group level

Table 8. Probit Models of Reported Forest-Related Collective Action Behaviors with Household Controls.

	MEETING_DUM	BIOGAS_DUM	ANYTREE_CF
CONTRIBUTION1	-0.002	0.006	0.010
	(0.72)	(1.85)*	(2.02)**
CF_MEM	0.838	-0.379	-0.106
	(1.75)*	(1.08)	(0.27)
CF__OFFICER	0.823	0.194	0.350
	(2.78)***	(0.82)	(1.18)
MONITOR_PAY	0.345	0.270	-[14]
	(1.29)	(0.56)	-
HILL	-0.266	0.314	0.296
	(0.84)	(0.91)	(0.62)
AGE	0.001	-0.004	-0.007
	(0.16)	(0.35)	(0.42)
FEMALE	0.331	-0.139	0.021
	(1.95)*	(0.58)	(0.09)
DALIT	-0.259	-0.129	-0.324
	(0.88)	(0.40)	(0.88)
FAMILY	0.050	0.058	0.052
	(1.36)	(1.32)	(1.63)
MAXEDUC	-0.044	0.117	0.092
	(1.40)	(2.42)**	(2.31)**
EDUC_RESP	0.018	0.007	0.019
	(0.55)	(0.20)	(0.61)
LAND_HA	-0.159	0.118	-0.188
	(1.39)	(0.79)	(0.75)
FOREST_ROP	-0.009	0.007	-0.006
	(0.17)	(0.19)	(0.11)
OXEN	0.025	-0.070	-0.105
	(0.27)	(0.90)	(0.88)
BUFFALO	-0.047	0.137	-0.015
	(0.72)	(2.01)**	(0.17)
CONSTANT	-1.108	-2.851	-2.905
	(1.30)	(3.43)***	(3.39)***
Wald X^2	68.56	124.62	52.47
Prob > X^2	0.000	0.000	0.000
Pseudo R^2	0.126	0.187	0.121

N=327 in all models; * *p*<0.1; ** *p*<0.05; *** *p*<0.01; robust t-statistics and errors clustered at the forest user group level

[14] Due to perfect collinearity with ANYTREE_CF the variable MONITOR_PAY was dropped.

Table 9. Count Data and Interval Regression Models of Reported Forest-Related Collective Action Behaviors with Household Controls.

	Negative Binomial Regression		Interval Regression
	NUMTREES_FARM	MONITORING	NUMTREES_ CF
CONTRIBUTION1	0.009	0.008	0.009
	(2.50)**	(1.51)	(1.37)
CF_MEM	-0.749	-1.942	-0.255
	(1.20)	(2.41)**	(0.35)
CF__OFFICER	-0.191	1.007	0.608
	(0.66)	(2.31)**	(0.95)
MONITOR_PAY	0.180	0.887	-0.562
	(0.23)	(1.30)	(1.71)*
HILL	1.071	0.207	-0.133
	(2.87)***	(0.31)	(0.23)
AGE	0.015	0.012	-0.014
	(1.24)	(1.21)	(0.95)
FEMALE	-0.301	-0.159	0.068
	(1.02)	(0.50)	(0.30)
DALIT	-1.643	-0.192	-0.831
	(3.23)***	(0.34)	(1.99)**
FAMILY	0.118	0.153	0.047
	(1.61)	(3.03)***	(0.83)
MAXEDUC	-0.001	0.033	0.078
	(0.02)	(0.50)	(1.60)
EDUC_RESP	0.080	0.061	0.025
	(2.41)**	(1.20)	(0.66)
LAND_HA	-0.015	-0.482	-0.143
	(0.17)	(1.62)	(0.85)
FOREST_ROP	0.085	-0.001	0.088
	(1.28)	(0.02)	(1.09)
OXEN	0.070	0.165	-0.243
	(0.70)	(1.19)	(1.19)
BUFFALO	-0.131	-0.066	-0.138
	(1.50)	(0.86)	(1.89)*
CONSTANT	0.544	-0.315	0.295
	(0.47)	(0.22)	(0.32)
lnalpha	1.392	1.866	
	(6.14)***	(6.78)***	
lnsigma			0.761
			(3.80)***
Wald X^2	136.92	48.74	18.13
Prob > X^2	0.000	0.000	0.26
Log pseudo likelihood	-939.75	-489.19	-692.82

N=327 in all models; * p<0.1; ** p<0.05; *** p<0.01; robust t-statistics and errors clustered at the forest user group level

Figure 1. Contributions to the Public Good by Respondent

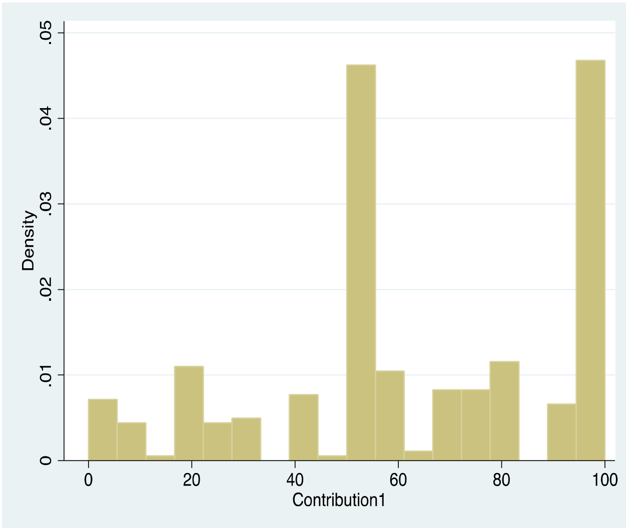
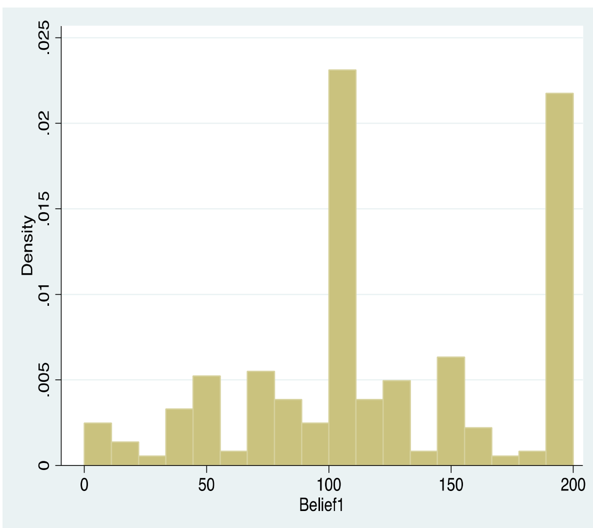


Figure 2. Beliefs about Other Two Group Members' Total Contributions to the Public Good



Appendix 1

Experimental instructions for Respondents

Introduction

Greetings and welcome to all of you. My name is … and I am ….
I am here for a research project concerning livelihood improvement through forest conservation. For this research project, we would like to play a few games with you. Depending on the decisions made by you and other players in these games, you can earn money. The payment that you receive from these games is not from my own pocket, but sponsored by the World Bank. Before we proceed with the games, I would like to tell you some important things.

General rules

1. In all games, your identity will be kept anonymous. This means that except for me and my assistants no one will come to know of your identity. We are interested only in the decisions made by you in these games and not your identity. This is the reason that we will not ask your name in any of the games. We will identify your decision in the game with an identity card like this (*show ID card*). Please do not lose this card.

2. We will play two games with you. You will earn money in both games but you will receive your money only in the end. We will keep a record of your earnings in both games on a sheet like this (*show payoff sheets for clarity*) to make sure that you receive the correct amount.

3. Both games will be played for one round only. This means that after you have played the first game, we will begin with the second game. After a game is over, there is no subsequent interaction. You will play with different people in the two games.

4. We will give you separate instructions and examples on how to play each of these games. The instructions for each game will be given before we play the game. For instance, before we play the first game, we will give you the instructions on how to play the first game. Likewise, when we play the second game, we will give you the instructions for the second game. It is very important that you listen to these instructions carefully. In case you do not understand the game, please stop us and ask us. We will then come to you and discuss your questions in private.

5. Before we play the actual game, we will check if you have understood the game or not. In case you do not understand the game, we will give the instructions again. However, if you are still not able to understand the game, we will have no choice but to request you to leave the venue. In this case, you will receive 25 Rupees from us. Therefore, it is important that you listen to the instructions carefully.

6. We would like to keep the game anonymous, therefore, please do not discuss the game with each other, as this would spoil the study. You may discuss about, rainfall, market, cattle, sports, and other such things. In case we find that you are discussing the game with other players, we will exclude you immediately from the game. In this case, you will not receive any money.

7. I repeat again, please do not hesitate to ask any questions. We encourage you to ask as many questions concerning the games, as you would like to ask. In case you have any questions at this

stage, you may ask them now. Otherwise, we will begin with the instructions for the first game. If you have any questions let us know and we will come to you and discuss your questions in private. We do this since our discussion could otherwise influence the others.

Instructions

We will now give you instructions and examples for the first game. This is followed by a test in which we will check if you have understood the game or not. Once we are sure that you have understood the game, we will begin playing the game.

We will divide you into groups of three players. You will not come to know to which group you belong. Likewise, you will not come to know the identity of the other players in your group. Similarly, the other players will not come to know your identity.

At the beginning of the game, each player will receive 100 Rupees from us. Now you have to decide how many from the 100 Rupees to put into your pocket and how many into a project. You may put any amount between 0 and 100 Rupees into the project. Now we will show you how this is done. Please note that since this is an example, we will tell the player how many Rupees to put into the project. But when we play the actual game, you will have to decide this on your own, without any help from us. (*Randomly select a player and give him 100 bills of 10 Rupees each. Please make sure that each time YOU tell the person on how much he should put into the project. Do not allow the player to take a decision because this may influence the decision of other potential players*).

Suppose you are a player in this game. As mentioned before, you receive an endowment of 100 Rupees from us. Now let us assume that out of 100 Rupees, you put zero Rupees into the project. Please put zero Rupees into the project. *Ask the group*: Can you tell me how many Rupees there are in the project? How many Rupees does the player have in his pocket? Have you understood this?

Now, let us assume that out of 100, you put 5 Rupees into the project. Please put 5 Rupees. How many Rupees are in the project? How many Rupees does the player have in his pocket? I will now give you another example. Now, let us assume that out of 100, you put X Rupees into the project. Please put X Rupees. How many Rupees are in the project? How many Rupees does the player have in his pocket? (*Carry on this procedure for X= 10, 20, 28 and 50 Rupees*).

Have you understood this part? Do you need additional examples? (*If yes, select another person and repeat the examples in the same order*).

Any amount in the project will be increased by 0.5 Rupees for each Rupee in the project. For example, if you put 0 Rupees into the project, the project amount will be increased by 0 Rupees. Now, the final amount of money in the project is 0 Rupees. If you put 1 Rupee into the project, the project amount will be increased by 0.5 Rupees. Now, the final amount of money in the project is 1.5 Rupees (*Carry on until 100 Rupees using 5, 10, 40 and 100 Rupees*). I repeat, the project amount will be increased by 0.5 Rupees for each Rupees in the project. Have you understood this? Do you need additional examples? (*If yes, select another person and repeat the examples in the same order*).

After the project money has increased, it will be divided equally between you and your two partner players, irrespective of how much you have put into the project (*Please repeat this again*). For example, if the project contains 0 Rupees, it will be increased by 0 Rupees and then divided equally between you and your partner player. However, since zero does not increase, both you and your partners will get zero Rupees from the project. For example, if the project contains 1 Rupee, it will be increased by 0.5 Rupees. Now the total value of the project is 1.5 Rupees, and the three of you get 0.5 Rupees each from the project (*Carry on until 100 Rupees using 15, 30, 50 and 100 Rupees*). Have you understood this part? Do you need additional examples? (*If yes, select another person and repeat the examples in the same order*).

Please remember that any money that you put into the project is first increased and then divided equally among the players in your group. Any amount that you put in your pocket remains the same. If you put 1 Rupee in your pocket, it remains 1 Rupee. It neither increases nor is it divided.

Your final earning from the game is the sum of the amount you have in your pocket and the amount you receive from the project.

We will now give you three examples. Please note that since now we are learning how to play this game, you can see the identity of each player as well as the decisions made by them. When we play the actual game, you will not come to know of this. Do you understand this? We will now select three people and tell them to take the following decisions in the game. You are player I and you are player II and you are player III (*look for participants with weak comprehension and always give them a chance to act as player I and player II and player III*). We give you 100 Rupees each at the start of the game. Those who play together in this practice round will not play together in the game.

Example 1: Now we will see what happens if all three players put zero Rupees into the project.

Player I and II and III: Please put zero Rupees into the project. Now, can you tell me how many Rupees did player I put into the project? How many Rupees does he have in his pocket? How many Rupees did player II put into the project? How many Rupees does he have in his pocket? How many Rupees did player III put into the project? How many Rupees does he have in his pocket? How many Rupees are in the project? We have zero Rupees in the project. Since zero Rupees does not increase and cannot be divided, each player gets zero Rupees back from the project.

Player I has put zero Rupees into the project, so he has 100 Rupees in his pocket. He gets zero rupees from the project. Can you tell me, what is his income? Since player I has 100 Rupees in his pocket and he gets zero Rupees from the project, his final income is 100 Rupees.
(*Please repeat the procedure to calculate the income of the second player and the third player.*)

Example 2: Now we will show you the second example. You are player I, you are player II and you are player III *(select three other participants)*. You get 100 Rupees from us at the beginning of the game. Now we will see what happens if all three players put 100 Rupees each into the project. Player I and II and III please put 100 Rupees into the project. Now, can you tell me how many Rupees did player I put into the project? How many Rupees does he have in his pocket? How many Rupees did player II put into the project? How many Rupees does he have in his pocket? How many Rupees did player III put into the project? How many Rupees does he have in his pocket? How many Rupees are in the project?

We have 300 Rupees in the project. The project amount will now be increased by 150 Rupees since 0.5 Rupees is added for each Rupee we have in the project. In the project we have 300 rupees and if we give 0.5 Rupees for each Rupees there is additional 150 Rupees. The final amount in the project is 300 Rupees + 150 Rupees = 450 Rupees. Now 450 Rupees is divided equally among the three players. So, each player gets 150 Rupees. Now, can you tell me, how many Rupees does player I have in his pocket? How many Rupees does he get from the project? What is his final income? We repeat, since player I has zero Rupees in his pocket and he gets 150 Rupees from the project, his final income is 150 Rupees. (*Please repeat the procedure to calculate the income of the second player and the third player*.)

Example 3: Now we will show you the third example. You are player I, you are player II and you are player III *(select three other participants)*. We will see what happens if player I puts zero Rupees into the project and Player II puts 20 Rupees into the project and Player III puts 40 Rupees into the project. Player I, please put zero Rupees into the project. Player II, please put 20 Rupees into the project. Player III please put 40 Rupees into the project.

Now can you tell me how many Rupees did player I put into the project? How many Rupees does he have in his pocket? How many Rupees did player II put into the project? How many Rupees does he have in his pocket? How many Rupees did player III put into the project? How many Rupees does he have in his pocket? How many Rupees are in the project?

We have 60 Rupees in the project. The project amount will be increased by 30 Rupees.
So the final amount in the project is 60 Rupees + 30 Rupees = 90 Rupees. Now 90 Rupees is divided equally among the three players. So, each player gets 30 Rupees. Now, how many Rupees does player I have in his pocket? How many Rupees does he get from the project? So, what is his final income? We repeat, since player I has 100 Rupees in his pocket and he gets 30 Rupees from the project, his final income is 130 Rupees.

How many Rupees did player II put into the project? How many Rupees does he get from the project? So, what is his final income? I repeat, since player II has 80 Rupees in his pocket and he gets 30 Rupees from the project, his final income is 110 Rupees. How many Rupees did player III put into the project? How many Rupees does he get from the project? So, what is his final income? I repeat, since player III has 60 Rupees in his pocket and he gets 30 Rupees from the project, his final income is 90 Rupees.

We will now summarize the key results from these examples:
a) If all three players put zero Rupees into the project, they earn 100 Rupees each.
b) If all three players put 100 Rupees into the project, they earn 150 Rupees.
c) If the first player puts zero and the second player puts 20 Rupees and the third player puts 40 Rupees into the project, the first player who puts zero Rupees earns 130 Rupees, the second

player who puts 20 Rupees earns 110 Rupees, and the third player who puts 40 Rupees earns 90 Rupees.
d) If all players put the same amount into the project, they all earn the same income.
e) If you put less than what your partner players put into the project, you earn a higher income than they do.
f) If you put more into the project than your partner players, you earn a lower income.

If you have any questions, you may ask them now. Otherwise, we will call you one by one and ask six questions to check if you have understood the game or not. Please note that if you answer these questions wrong, we will give you 25 Rupees and request you to leave the game venue. Therefore, please tell us if we need to repeat the examples or not

(*If yes, repeat the examples in the same order*).

Control questions
1. How much money do you get at the start of the game? / What decision do you have to take in the game?
2. Suppose, you decide to put X Rupees into the project, how much is left in your pocket?
3. What happens to the money in the project?
4. If you put X Rupees into the project, by how much will this increase? What happens after the money is increased?
5. If you put X Rupees into the project and both your partner players also put X Rupees into the project, who earns more?
6. If you put Y Rupees into the project and both your partner players put Z Rupees into the project, who earns more?

(Vary X, Y, Z between players. For those who answer 5-6 questions correctly, ask them to sit back in the room. Pay the remaining players 5 Rupees and request them to leave. After this, repeat the control questions and let the selected players answer in a chorus. Ask again, if everyone understands. If yes, give them the identity cards).

We will now call you one by one to enter this room and play the game. Please remember that you will not come to know the identity of your partner players or the amount they put in the project.

While you wait for your turn, two assistants will conduct interviews with some of you. They will also check if you discuss the game with each other or not. If they find you discussing the game, we will have to expel you from the game. So, please do not discuss the game with other people.

When entering the room, please keep your identity card ready.

First decision
Hello! Have a seat please. I hope you have understood the game. Your identity card, please? Here are your 50 Rupees. Now you have to decide out of 50 Rupees how much you would like to put into the project. Please put the amount here on the table. The money that you would like to put in your pocket here. *When participant has put their money then ask*: So you would like to give X rupees to project and keep Y rupees for yourself? *(Important: Do* ***not*** *allow the*

participants to take the money they put in their pocket with them when they leave the room. All the money remains in the room. Participants get their money only at the end of the experiment.)

How many Rupees do you believe your two partner players in total will put into the project? (*Important: the participants should guess the* ***sum*** *of the other players' contributions.*) Please think before you answer the question. If you guess correct you will receive additional 25 Rupees. Please say a number between 0 Rupees and 100 Rupees. Thank you. Please do not discuss this with the other players.

Appendix 2
Instructions for facilitators

We will give you instructions how to conduct the experiment with the participants. The experimental venue must comprise three separated rooms or areas:

(a) A room or area where you explain the games to the participants and check their game comprehension,

(b) A room or area where the participants make their decisions in the games (important: they must make these decisions in private so they have to enter this room or area one by one), and

(c) A room or area where the participants wait after they have made their decisions in the games. There must be at least one facilitator in each room or area to make sure that the participants do not discuss the game.

What do you do when participants arrive at the experimental venue?
Tell the people that participation in the experiment is voluntary and take informed consent from all participants before the experiment begins. In case members of user groups cannot show up and send representatives from their households, allow the representatives above 16 years old to take part in the experiment. Do not allow younger representatives to take part.

Invite the participants to a room or area and request them to sit. Request the local leaders or vice leaders to check if: (a) all participants are from the same invited group, (b) do not belong to the same household, and (c) are at least 16 years old.

Send back all participants who do not meet these criteria with a show up fee of 25 Rupees. People who lack the functional capacity to participate should also be sent back with a show up fee of 25 Rupees.

Introduce yourselves and explain that the experiment is part of a research project. Read out the written instructions to the entire group. The instructions include the following key points: (a) all game decisions are anonymous, except to you (the facilitators), (b) all games will be played only once, (c) separate instructions will be given for separate games, (d) control questions will be used to test game comprehension and only those who answer these questions correctly will be allowed to participate, (e) once the actual game has begun, game discussion is not allowed and will lead to expulsion from the game, and (f) questions concerning games are encouraged.

The experimental instructions are designed in a didactical style. During the instructions, the participants should be given lots of opportunities to ask questions. This approach will help in developing a wider understanding among participants. Do not allow players to speak about their strategies aloud. Answer all questions by repeating the relevant information and examples given in the experimental instructions. Do not help the participants to reach a decision in the game. Answer all questions in private.

Before the actual game, test the participants one by one for their game comprehension using the 6 control questions given in the experimental instructions. Those who cannot answer at least 5 of the 6 control questions correctly should be given a show up fee of 25 Rupees and sent back. Make sure that the rejected participants and uninvited persons leave the experimental venue.

Use identity (ID) cards to distinguish between participants. Each participant gets his own ID. Use a unique ID for each participant. Do not use the same ID for two or more participants. Each participant is given a card with his ID at the beginning of the experiment. Participants have to show their ID card whenever they make their decisions in the games and answer the survey questions.

How do you explain the game to the participants?
You should explain the game and check the participants' understanding in the waiting area. You explain the game to the participants by reading the experimental instructions aloud. You show the examples as described in the instructions. You check the participants' understanding by asking each of them the six control questions. For those participants who answer 5-6 questions correctly, ask them to sit back in the room. Pay the remaining players 25 Rupees and request them to leave.

<u>Important</u>: after the game has been explained, make sure that people do not discuss the game with each other.

How do the participants play the game?
After the people who couldn't answer the control questions correctly have left, divide the remaining participants in groups of three players. Remember that new groups are created for the second experiment. Call them one by one to a separate room, ask for their ID card and ask them to make their decisions.

<u>Important</u>: do not show any emotion (approval or disproval) when the participants make their decisions. They must feel completely free to do whatever they want. If the participants ask you what they should do, say that you will not help them to reach a decision. Just repeat the information and examples given in the experimental instructions.

After each decision, the players leave the room and sit outside. They should be separate from those who are waiting to play the game.

How do you form the groups?
In the game groups of three people are formed. You should write down all ID numbers of those participants who were finally selected to play the game on a piece of paper. From that list you randomly create groups of three. On the paper and in the EXCEL sheet (baseline-announcement or baseline-punishment depending on treatment) you enter the ID numbers in clusters of three.

For the second experiment the mentioned procedure is conducted again but the same people cannot be in the same group. On the paper and in the EXCEL sheet (announcement or punishment depending on treatment) you enter the ID numbers in clusters of three. If the number of people are not possible to divide by three send the spare people home and pay them 75 Rupees (e.g., if 16 people show up then form 5 groups with 3 people and the send 1 person home after paying 75 Rupees).

<u>Important</u>: the group in second game cannot consist of people who have been in the same group in the first game. Make sure the IDs do not correspond to the order in which the participants play the game. So, the participants should not be able to infer from the order of play with whom they play the game.

How do the participants answer the survey questions?
The interviews should be conducted while the participants wait before or after they play the games. As in the experiments, anonymity should be ensured during the interviews.

<u>Important</u>: ask first for the participant's ID in order to match the answers to the survey questions to the behavior in the games later. While conducting the interviews in the waiting areas you should make sure that no one discusses the game.

How do you save the data?
Use the Excel spreadsheet we have prepared for you. Fill in all the required information. Enter the results directly in to the Excel spreadsheet when game participants make their decisions. Always make a backup copy of data on a flash drive. Make sure you have a fully charged laptop as most sites will not have electricity. Fill in the participants' ID and their decisions in the games and their answers to the survey questions. Always use participants' ID cards to match their decisions in the games and answers to the survey questions. The Excel file is also used to calculate the participants' final payoffs.

<u>As a backup, write down the same information as typed into EXCEL on a sheet of paper with the same layout as the provided EXCEL sheet.</u>

<u>Important</u>: We show examples in the Excel sheets for how to fill in the data. These are hypothetical examples just for you. You should be able to understand the examples and calculate the payoffs on your own! You should also practice the calculation of payoffs with more examples. Make sure that the hypothetical examples can be distinguished later from the real data.

When do you inform the participants about the games' outcome?
The participants will be informed about what happened in their group, that is, how all three players have decided in the different games, only at the end of the experiment. The only

exception is the announcement. The participants get to know all announcements in their group before they decide how much they want to put into the project.

How do you pay the participants?
The participants come to the room one by one in order to get paid in private. First, ask for their ID cards. Second, tell them the outcome of the games, that is, how the participant himself and his two partner players have decided in the games.

The final income consists of the participants' earning from the first part (baseline) and the earnings from the second part (agreement or punishment treatment). The participants also get paid if they correctly guessed the behavior of their partner players in the beliefs questions. There are two questions about beliefs; one in the baseline game and one in the agreement game.

Use the Excel file where you have written down all the players' decisions to calculate the earnings. Sum up the earnings from the first part and the second part and from the beliefs questions to calculate the final income. If it sums to an uneven denomination of coins or notes, round upwards.

After participants get paid they leave the experimental venue.

Important: before they leave make sure that they have answered all survey questions.

Which treatment do you use for a certain village?
We expect 300 participants in total. We have two different experimental treatments. That is, there are two different experimental games. The two different treatments are called *agreement treatment* and *punishment treatment*.

The baseline game is played in both treatments, i.e. by all participants.

We prepared experimental instructions for both treatments. The participants from one village all do the same treatment. They participate in one treatment only. We would like to have an equal number of participants for each treatment (roughly 150 participants per treatment). The participants play the game in groups of 3 players.

Make sure that the villages that play the agreement treatment and the villages that play the punishment treatment do not vary in another systematic way. More precisely, if there are two similar villages, one of them should play the agreement treatment and the other one should play the punishment treatment. If there are four similar villages, two of them should play the agreement treatment and the other two should play the punishment treatment. And so forth.