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GROUP SIZE AND COLLECTIVE ACTION

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ABSTRACT

This paper examines the Olsonian thesis that group size is inversely related to successful collective action. We start with an empirical analysis based on primary data. This data gives information on a set of 21 villages in the Indian Himalayas that collectively monitor to protect and conserve community forests. This empirical analysis reveals that small and large villages fare relatively poorly, while medium size villages are much more successful, in the provision of monitoring. This finding goes against the general consensus that group size is inversely related to the likelihood of successful collective action.

We identify two features of the collective good that appear critical. Both features are standard in the literature on public goods. The first feature is that the monitoring technology displays lumpiness, and must be above a certain minimum size to be worthwhile. The second feature is that the collective good is only imperfectly excludible and that this excludibility is decreasing in the size of the group. We formulate a theoretical model which incorporates these two features and develop a set of sufficient conditions on the monitoring technology under which the sustainable levels of collective good match the empirically observed patterns.

I. Introduction

Villagers attempting to protect their common-pool resources, domestic manufacturers lobbying for higher tariffs on imported goods, trade union members organizing a strike: all are engaged in collective action. It would not be an exaggeration to say that the problem of collective action and attempts to solve it are pervasive in all walks of life. Writings on the subject have analyzed many different facets of the problem, but one of the central relationships — between group size and collective action — remains only inadequately understood. As Russell Hardin's study, *Collective Action,* notes, "The most controversial issue in the contemporary literature on collective action has probably been that of the effect of group size on the likelihood of group success" (1982: 38). In this paper we provide a systematic analysis of this issue.

Our paper has two components. The first is an empirical analysis based on primary data. In our data we discern some crucial features of collective action problems. The analysis of the data indicates a clear but unexpected relationship between group size and collective action. The second part of the paper uses insights from the empirical work to develop a generalizable theoretical model.

In the empirical work we study the efforts of different villages in *Kumaon* in the Indian Himalaya to protect their forests. Many villages have organized community-level forest councils which help residents use and protect forest resources in accordance with rules they craft. Since individuals have incentives to harvest products such as fodder and fuelwood in excess of what is permitted, monitoring is necessary to enforce rules and to restrict extraction of scarce forest products. Monitoring, a collective good, is expensive, and requires contributions from villagers if it is to be undertaken. We focus on the relationship between monitoring levels and group size.

Our main finding is that medium-size groups are more successful than both small and large groups in providing the collective good. This finding helps us bring together several key strands in the literature on the subject.[1]

To explain our finding, we examine closely the structure of the collective action problem that the forest councils face. We identify two features that appear critical. One, monitoring below a minimum level does not prevent extraction of forest products to any great degree. This suggests that the provision of a collective good such as monitoring is lumpy. Two, it is difficult to prevent even those villagers who do not contribute to the protection of the forest from entering the forest and using it. This suggests that the common-pool resource is imperfectly excludible. These two features of collective goods apply to large class of collective action situations. Using these features, we develop a game-theoretic model of voluntary contribution to provide a collective good.[2]

The analysis of this model helps us derive a general set of conditions under which group size bears a curvilinear rather than monotonic relationship with successful collective action. The first condition pertains to the lumpiness of collective goods. We show that if a collective good is lumpy, i.e., has large setup costs or a high minimum viable scale, then small groups are at a relative disadvantage in providing it. The second condition pertains to the relationship between group size and the degree of excludibility. We show that if excludibility is diminishing in the size

Recent surveys of group size and its implications can be found in Baland and Platteau (1996), Marwell and Oliver (1993), and Ostrom (1997).

[2]The assumption of imperfect excludibility distinguishes our work from models of club goods. Recall that in the case of club goods, it is assumed that the club can exclude non-members. Perfect exclusion, however, is extremely costly to achieve in practice. We believe, therefore, that our formulation may be of more general interest.

of the group, then large groups are disadvantaged. We conclude, therefore, that in all collective action situations where these two features are prominent, we should expect to see a curvilinear relationship between group size and successful provision of collective goods.

In his pioneering work, *The Logic of Collective Action*, Olson put forward the hypothesis that *"the larger the group, the farther it will fall short of providing an optimal amount of a collective good"* (1965: 35, emphasis in original). A substantial literature in economics, political science, and sociology has examined his hypothesis (Marwell and Oliver, 1993; Sandier, 1992) and many scholars have, with some qualifications, corroborated his insights. In a recent book, Sandier, for instance, argues that an updated version of Olson's proposition would read as follows, *"with identical individuals and symmetric equilibria, an increase in group size worsens suboptimality when a summation technology applies"*[3] (1992: 194, emphasis in original). Experimental and empirical writings have also arrived at similar conclusions.[4]

Equally often, however, scholars writing on the subject have remarked on the ambiguities in Olson's argument and suggested that the relationship between group size and collective action is not very straightforward. Isaac and Walker's (1988) experimental work on the voluntary provision of public goods leads them to conclude that there is no pure group-size effect. Self-governance of common-pool resources offers a particularly well-known setting in which the problem of collective action arises. Wade's (1988) research on irrigation groups in

[3] A technology is said to of the summation type if the provision of the public good depends solely on the aggregate contribution. The identity or the location of individual contributors is irrelevant.

[4]See Kim and Walker (1984) for experimental evidence. Tang's study of irrigators (1992), and Wilson and Thompson's (1993) work on grazing groups suggests that smaller groups perform better than larger ones.

South India suggests that small size is not necessary to facilitate successful collective action. Summarizing much of this literature, Ostrom (1997) says that the impact of group size on collective action is usually mediated by a variety of other variables.[5]

The precise relationship of group size with these mediating variables, however, is difficult to decipher owing to the paucity of systematic empirical work. Where comparative work has been undertaken, it usually spans diverse regions and cultures across which important contextual variables may differ.[6] As a result, theoretical developments on the subject have mostly taken place without a firm empirical foundation.

Our paper is an attempt to bridge these gaps. The empirical research we report explicitly links group size with the likelihood of collective action across 21 different cases located in the same general context. Moreover, we use our data to identify critical features of the observed collective action problem and develop a game-theoretic model using these features. Analysis of this model helps us make predictions concerning the relationship between group size and collective action for any action situation in which these features are prominent.

The analysis in this paper is directly relevant to the ongoing debates on the decentralized management of renewable resources and on the role of community in resource use and management. An important question in this debate concerns the size of the local group/community that should administer and allocate benefits from the resource. Our results

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[5]Some of these important mediating variables that the existing literature has examined are the degree of crowding and the production technology of the collective good (Hardin, 1982: 44-9; Marwell and Oliver 1993: 40-9).

[6]The only exception to this statement of which we are aware is Lam's study of irrigation systems in Nepal (1994). Lam's analysis did not discover any statistically significant relationship between performance and group size.

suggest that medium- size groups are more successful. This finding goes against conventional wisdom which would favor small groups. The precise numerical size connoted by small vs medium depends on the parameters of the two crucial variables we identify and analyze in section 2 and 3: lumpiness and the degree of excludibility of the collective good. It also depends on other contextual and institutional variables at which we hint in our concluding discussion.

The paper is organized into four sections. The introduction is followed by a description of the forest councils and the presentation and analysis of the empirical data in section 2. The findings from the analysis of the councils help us develop a formal model in section 3. We discuss some of the main assumptions underlying the model in section 4. Appendices to the paper contain important information on the rules that frame the activities and the legal position of the councils.

II. **The Forest Councils of Kumaon**

More than 3,000 village-level forest councils *(Van Panchayats)* formally control nearly 35% of the forests in *Kumaon* in the Indian Himalaya. Forests in the Indian Himalaya provide rural residents resources such as fodder, fuelwood, green manure, and construction timber. These resources are critical to the household economy. In their absence, effective household incomes would decline substantially.

The forest councils in Kumaon have the primary responsibility for the day-to-day management of forests located close to the village. They form one of the earliest examples anywhere in the world of decentralized resource management through formal state-community partnerships. Similar councils exist in other parts of India as well. Governments in African countries and in south-east Asia have also begun in the past two decades to experiment with resource management partnerships by creating village-level insitutions that have some responsibilities and powers to manage resources (Baland and Platteau, 1996).

History[1]

The forest councils of Kumaon can be traced back to the 1880s when the British colonial government attempted to transfer vast areas of the hill forests to the newly created Imperial Forest Department. By 1917, more than 60% of the total forests in the mountains had been brought under the formal control of the Forest Department. The process greatly limited the customary subsistence rights of the villagers. Elaborate rules specified new restrictions on lopping and grazing rights, prohibited the extension of cultivation, strengthened the number of official forest guards, increased the labor extracted from the villagers, and regulated the use of fire (although villagers believed fire led to higher grass production).

The new rules spurred the villagers into widespread protests. Their incessant, often violent, demonstrations led the government to appoint a committee to look into local disaffection: the Kumaon Forest Grievances Committee. On the basis of the Committee's recommendations, the government enacted the Forest Council Rules of 1931. The relatively autonomous forest management councils in Kumaon have been formed over the past 60 years under the provisions of this set of rules. Creating these councils has allowed villagers in the Hills to bring significant areas of forests back under their formal control.

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[7]The discussion of the history of the forest councils owes much to Agrawal (1996, 1997) and Ballabh and Singh (1988).

The broad parameters that define the management practices of the forest councils are laid down in the Forest Council Rules of 1931.[8] These rules delineate how new councils can be formed and existing ones dissolved, outline the duties of the councils in terms of demarcation of forests, auditing of accounts and relationship with government officials, empower the councils to manage the forests, and specify restrictions that prevent councils from destroying the forests by, for example, harvesting and selling all the trees. The existing rules grant the councils the power to harvest and allocate subsistence benefits from the forests. But they do not provide them significant formal rights to sanction rule-breakers. Enforcement of rules, therefore, depends to a great extent on the financial capacity of individual councils and the ability of their leaders to network with higher-level government officials.

To create a council, village residents need the help of government officials as well. The cost of creating a new council is relatively low. Rural inhabitants already exist as informal groups by virtue of their contiguous residence in specific villages. Government officials who supervise the functioning of the councils encourage villagers to create new councils, further lowering the costs of formation. By creating an institution oriented to use and manage critical local resources, council members bring under their control those forest areas that otherwise are under the direct control of an arm of the government—the Revenue Department. Further, those who initiate the formation of the council often emerge as its office holders, gaining prestige and status in the village. For an average village resident, the costs of establishing a council are relatively low since all s/he need do is sign a letter to that effect. Agreement by one-third of the villagers is sufficient

[8]Some of these Rules were modified in 1976. The details of the rules and the changes they have undergone are presented in appendix 1.

to initiate a council. The existing rules, thus, lead to a situation where the benefits of creating a council are relatively high for the entrepreneurs initiating formation, and the costs for an average participant low. The critical factors that determine whether a council will come into being, therefore, are connected with whether forested areas exist within the boundaries of the village, or whether land is available for setting aside so that new trees can grow on it.

The specific rules for the daily management of forests are a result of local action. In all councils, villagers elect office holders, hold meetings, and attempt to allocate benefits from the council forests among village residents. All the forest councils are not only formally empowered to initiate rules to use and protect village forests, but also to implement the rules they craft. Nonetheless, it is primarily the successful councils that elect office holders, meet frequently, discuss and create rules that will govern withdrawal of products such as fodder and fuelwood from the forests, and create monitoring, sanctioning, and arbitration devices to settle the vast majority of management questions within the village. Successful councils also select and pay guards, fine rule-breakers, raise and manage funds locally, and deploy earnings to create public goods for their villages.

Crafting institutions to manage and protect forests is critical for the conservation of resources because considerable pressures to harvest fodder and fuelwood resources exist in Kumaon.[9] In the past four decades, these pressures have grown owing to increases in population, in numbers of towns, and in the length of roads linking settlements (GOI, 1981). The success of councils in safeguarding village forests depends to a great extent on their ability to restrict the

[9] Indeed, this is a circumstance that is common to rural areas in most developing countries (Li, 1991; Low and Heinen, 1993; Raven, 1991).

offtake of forest products through protection mechanisms. Such mechanisms come in three forms as far as the councils are concerned: mutual monitoring around the year, rotational selection of village households to guard the forest, or hiring a person in a specialist position as a guard. Forest councils have experimented with each of these alternatives at different times. Our research reveals that most councils have converged toward the option of hiring a guard.[10]

The forest councils must raise sufficient resources to pay a salary to the hired guard. Illegal harvests are common during the four winter months: from mid-November to mid-March. During this period, villagers have few alternative sources of fodder and fuelwood. To monitor and protect forests successfully, the forest council must, therefore, hire a guard for at least these four months. If a guard is hired for periods less than the winter months, rule infractions increase rapidly and the ability of the council to prevent illegal harvests is vitiated. Typically, councils try to hire a guard for the entire year. The guards monitor forest use and report villagers who extract forest products illegally: those harvesting beyond specified quantitative or time limits, or those who have not paid their membership dues. The council can admonish and fine those whom the

[10]The issue of third party vs mutual monitoring and enforcement is a subject that has attracted considerable attention from other scholars as well. Singleton and Taylor (1992), for example, suggest that community enforcement of rules is more critical rather than the presence of specialized monitoring and sanctioning positions. Ostrom (1992), in contrast, argues that specialist third party monitoring and enforcement may be necessary to the maintenance of community itself. A number of empiricial studies have also described the importance of monitoring (Netting, 1981, McKean, 1992, Maass and Anderson, 1978). In this paper we do not develop a formal argument to explain why a particular protection technology--hiring of guards in specialist positions--should have emerged as the stable outcome among the Kumaon forest councils. We simply note that many forest councils deliberate over the best option to monitor and guard their forests, and after repeated experimentation, settle upon the hiring of guard(s) as the solution to problems of illegal harvesting.

guard reports as having broken rules. It can also seek the help of higher-level government officials to sanction repeat offenders.

Empirical Evidence

We selected 21 forest councils at random[11] and collected data on these councils between 1991 and 1993 using instruments developed at Indiana University. We gathered detailed information on a host of bio-physical, socio-cultural, demographic, institutional, and economic indicators to aid analysis.[12] We also collected information on the working of different councils from village-level records of meetings and accounts that the councils maintain. For successful councils, the minutes of meetings are studded with details on the type of resolutions passed, names and caste of rule breakers, fines imposed in each instance of rule-breaking, and the strategies councils follow to recover fines.

The selected councils are distributed across the three districts (administrative subdivisions) of Kumaon: Nainital, Almora, and Pithoragarh. We are interested in explaining variations in the performance of these councils with regard to collective action. Success in

[11] The forest councils were selected in the following manner. Each of the three hill districts in Kumaon contains smaller administrative divisions called "development blocks." Nainital has five blocks that occupy a hilly terrain, Almora has eleven blocks, and Pithoragarh ten. The development blocks are subdivided into 15 to 20 *"patwari circles"*. Each of the patwari circles has about 15 villages on the average, of which approximately a third have forest councils. To select the sample of forest councils on which data is presented in this paper, five blocks were selected using random number tables in the three districts: one from Nainital, and two each from Almora and Pithoragarh. Two patwari circles were then selected at random from each of the blocks. Within each patwari circle, we selected three to four councils, again at random. Data on some of the forest councils is unusable owing to missing values.

[12]See Appendix 2 for the list of data collection instruments and a representative set of indicators from each of these instruments.

achieving collective action can be measured in different ways. In our work, we look at three variables ~ number of meetings, total protection budget, and per capita contributions (see table 1 below).[13]

— Table 1 here —

It is evident that the councils differ widely on each of these three dependent variables. We start by noting that the independent variables of market pressures, ecological conditions, and administrative arrangements do not explain these variations. Table 2 presents data on two of these potential explanatory variables to show why they are not good explanations in our case.

— Table 2 here —

All the councils are close to motorable roads: only one of them is as far away as three kilometers from a road, 17 are less than 2 kilometers from roads. Thus, they face similar pressures from market forces.[14] They range in elevation from 1,100 to 2,000 meters, lying squarely in the Middle

[13]Some other variables for measuring successful collective action could be condition of forest, or income that villagers earn from forest products. Although we have collected some data on both these variables, measurement problems are acute. For the species that exist in the forests in Kumaon, there are no generally agreed methods for measuring biomass, and forest biodiversity is similarly difficult to estimate. Further, since a large proportion of benefits from the forest are not exchanged in markets, their value is also difficult to assess. As a result, we rely in our analysis on the three variables mentioned above. At least one of them, levels of monitoring, has been found to be very highly correlated with forest condition (Agrawal, 1997).

[14]The relationship between distance from roads and market pressure is well established in the literature (Southgate, Sierra, and Brown, 1991; Young, 1994).

Table 1
Performance Indicators of Collective Action

Name of Village	Number of Meetings/Year	Total Protection Budget (Rs.)	Contributions in rupees/ household (c)
l.Airadi	3	790	22.60
2.Bajgaon	12	5200	74.30
3.BatulaBanj	1	535	13.40
4.Bhagartola	10	3100	44.30
5. Gadsari	6	1425	20.40
6. Goom	6	1645	21.90
7. Gunachautra	4	150	6.82
8. Gunialekh	4	300	2.86
9. Jogabasan	7	50	3.33
lO.Kadwal	4	110	7.33
ll.Kalauta	3	N/A	N/A
12.Kana	4	410	16.40
13. Kholagaon	6	2190	23.10
14.Kotuli	8	1750	35.00
15. Ladamairoli	5	350	11.67
16.Ladfoda	3	2840	47.33
17.Lohathal	4	1850	10.57
18. Malta	2	125	8.33
19.Pokhri	2	200	20.00
20. Rauljangal	1	400	3.33
21.Tangnua	4	175	8.33

Table 2
Contextual Variables

Name of Village	Formation Year	Altitude (Meters)	Distance from Motor Road (Kms)
l.Airadi	1968	1900	2
2.Bajgaon	1959	1400	1
3.BatulaBanj	1958	1400	1
4. Bhagartola	1937	1900	1
5. Gadsari	1975	1700	1
6. Goom	1962	1750	1
7. Gunachautra	1938	1850	2
8. Gunialekh	1984	1800	3
9. Jogabasan	1962	1800	1
lO.Kadwal	1963	1700	0
ll.Kalauta	1958	1600	1
12.Kana	1991	2000	0
13.Kholagaon	1960	1500	1
14.Kotuli	1962	1700	1
15.Ladamairoli	1953	1750	1
16.Ladfoda	1970	1600	1
17.Lohathal	1945	1900	0
18. Malta	1985	1800	1
19.Pokhri	1989	1100	1
20. Rauljangal	1957	1800	2
21.Tangnua	1988	2000	0

Himalaya. The forests they possess belong to one of two major types: mixed broad-leaved trees, or needle-leaved stands of pine and cedar. In either case, the major products villagers harvest from the forest are fodder and fuelwood. Resin and timber are harvested for commercial sale in some of the councils whose forests have stands of pine and cedar. Seldom, however, are the revenues raised by selling resin or timber used to fund guards to protect the forest. In addition, since all the councils are formed under the provisions of the same set of Forest Council Rules, they also share the administrative framework. Differences in the performance of the councils, thus, cannot be explained by appealing to market pressures, ecological conditions, or administrative arrangements.

On the other hand, there are striking differences among the forest councils in their forest size and the number of households. Table 3 presents this evidence.

— Table 3 here —

Membership of councils varies between 10 and 175 households.[15] Eight councils have 30 or fewer members. We refer to these councils as "small". Three councils have more than 100 members and we classify these as "large". The rest of the councils belong to the "medium" category. The variation in size is important because the number of households a council governs has a significant impact on all the three performance indicators of forest councils that we presented in table 1.

[15]It would, perhaps, be more accurate to speak of the membership of the user-group that each forest council governs, rather than speak of the membership of the council.

Table 3
Village Size and Forest Area

Name of Village	Number of Households (n)	Forest Area (Hectares)	Forest Area in hectares/ household (f)
1.Airadi	35	24	.66
2. Bajgaon	70	40	.57
3.BatulaBanj	40	8	.20
4. Bhagartola	70	63	.90
5. Gadsari	70	56	.80
6. Goom	75	80	1.06
7. Gunachautra	22	27	1.23
8. Gunialekh	105	346	3.30
9. Jogabasan	15	74	4.93
10.Kadwal	15	21	1.40
11.Kalauta	30	45	1.50
12.Kana	25	38	1.52
13. Kholagaon	95	85	.90
14.Kotuli	50	35	.70
15. Ladamairoli	30	33	1.10
16.Ladfoda	60	50	.83
17.Lohathal	175	90	.51
18. Malta	15	31	2.07
19.Pokhri	10	20	2.00
20. Rauljangal	120	70	.58
21.Tangnua	21	11	.52

Small councils typically hold four or less meetings a year. The same is true of the large councils. The fact that many of the small and large councils hold as many as four meetings a year may be explained by the requirement in the Forest Council Rules of 1976 that all councils should meet regularly, preferably every quarter. We should infer, therefore, that fewer than four meetings indicates poor performance on this indicator. An examination of the minutes maintained by the small and large councils reveals that they meet infrequently, that their records are sketchy, that they have been relatively lax in creating management rules, and that they are rather ineffective in enforcing the few rules they have created.

The meeting records of the medium-size councils contain lists of rule breakers, the dates when guards detected rule infractions, the nature of infractions and the fines imposed. In contrast, the minutes maintained in the small and the large councils are bereft of such details. Simply looking at the records, one might conclude that few rules were ever broken in councils like Gunialekh, Kana, Ladamairoli, Malta, Pokhri, Raukjangal, or Tangnua. It would be a wrong conclusion. In multiple conversations, the office holders in the small and large councils invariably complained more vociferously than those in the medium-size councils about their limited resources, the apathy of their villagers toward maintaining the councils, and the problems they faced in containing rule-breaking behavior. The absence of evidence indicates the absence of efforts to collect it, not the absence of wrong doing.

Data Analysis

To tease out the relationship between group size and the number of meetings held annually, we present two figures. Figure la presents information on all the councils in which the per household forest area is less than one hectare (f<l). Figure lb shows the councils that possess more than one hectare of forest per household (f>l). By separating the data into two categories of forest availability, we reduce the effects on performance of changes in forest area per household. That allows us to observe more clearly the impact of changes in group size on the performance of the council.

— Figure la and lb here —

Figure la and lb plot the number of meetings/year against group size for the two sets of councils. One fact is immediately obvious from the two figures: the relationship between group size and the number of meetings held by the councils is not monotonic. A closer scrutiny of figure la will reveal that the average number of meetings in small and large councils is 4 and for medium-size councils it is 6.13. In figure lb, a similar curvilinear relationship is observable. The average number of meetings for small, medium and large councils is respectively 3.84, 5.5, and 4.

Small and large forest councils are also different from the medium-size ones in the contributions made by households to monitor and protect the forest. We first consider total contributions (C) from members toward protection. Councils typically pay a guard Rs. 200 a month for performing monitoring duties. Four months of protection during the winter months is the critical level of monitoring and protection to prevent excessive rule-breaking and illegal extraction. We notice from table 1 and 2 that only eight councils are able to raise more than this critical amount, and of these eight, seven are in the medium-size category. Lohathal, which also

Figure 1a: Group Size and Number of Meetings (f<1 Ha.)

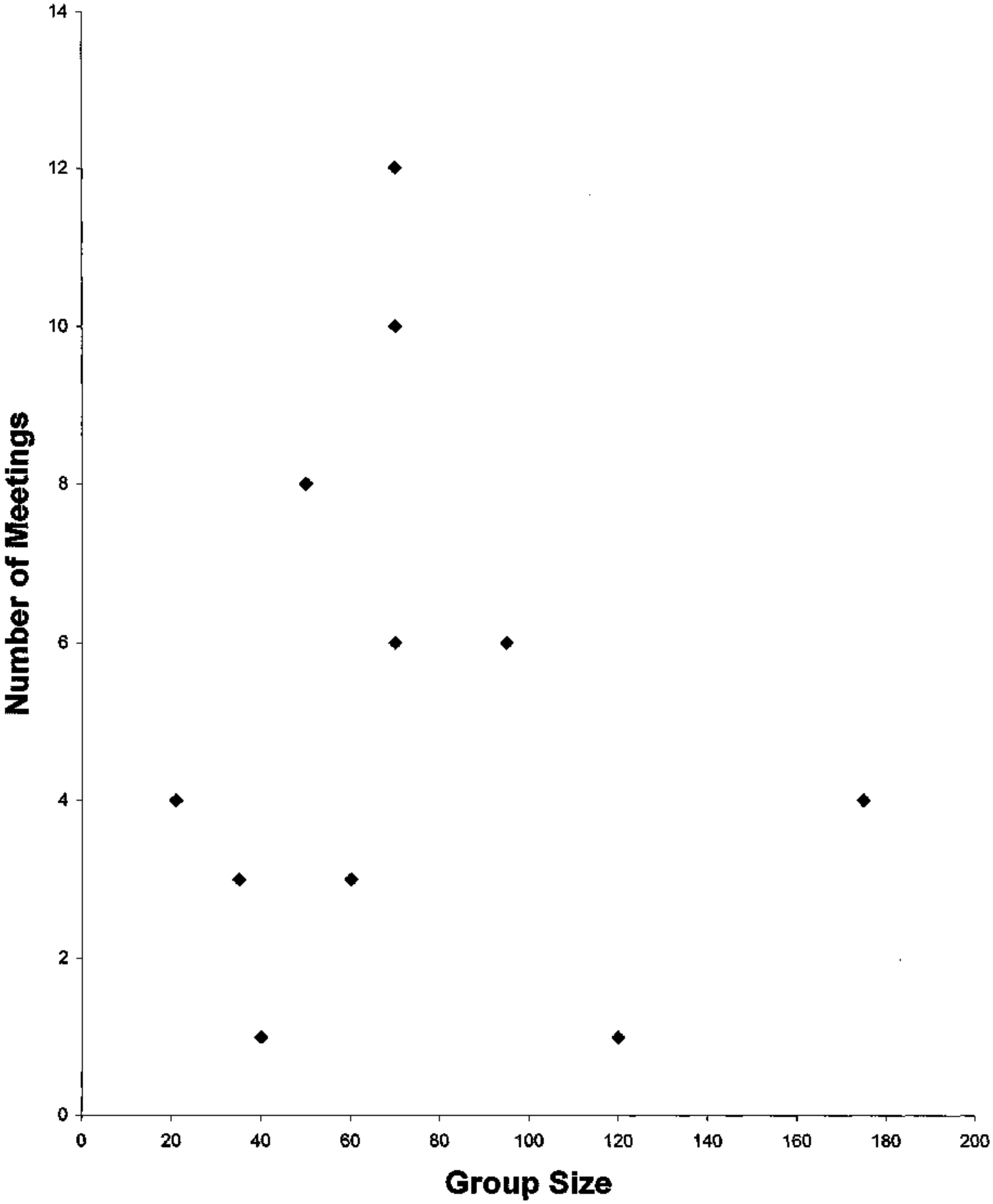
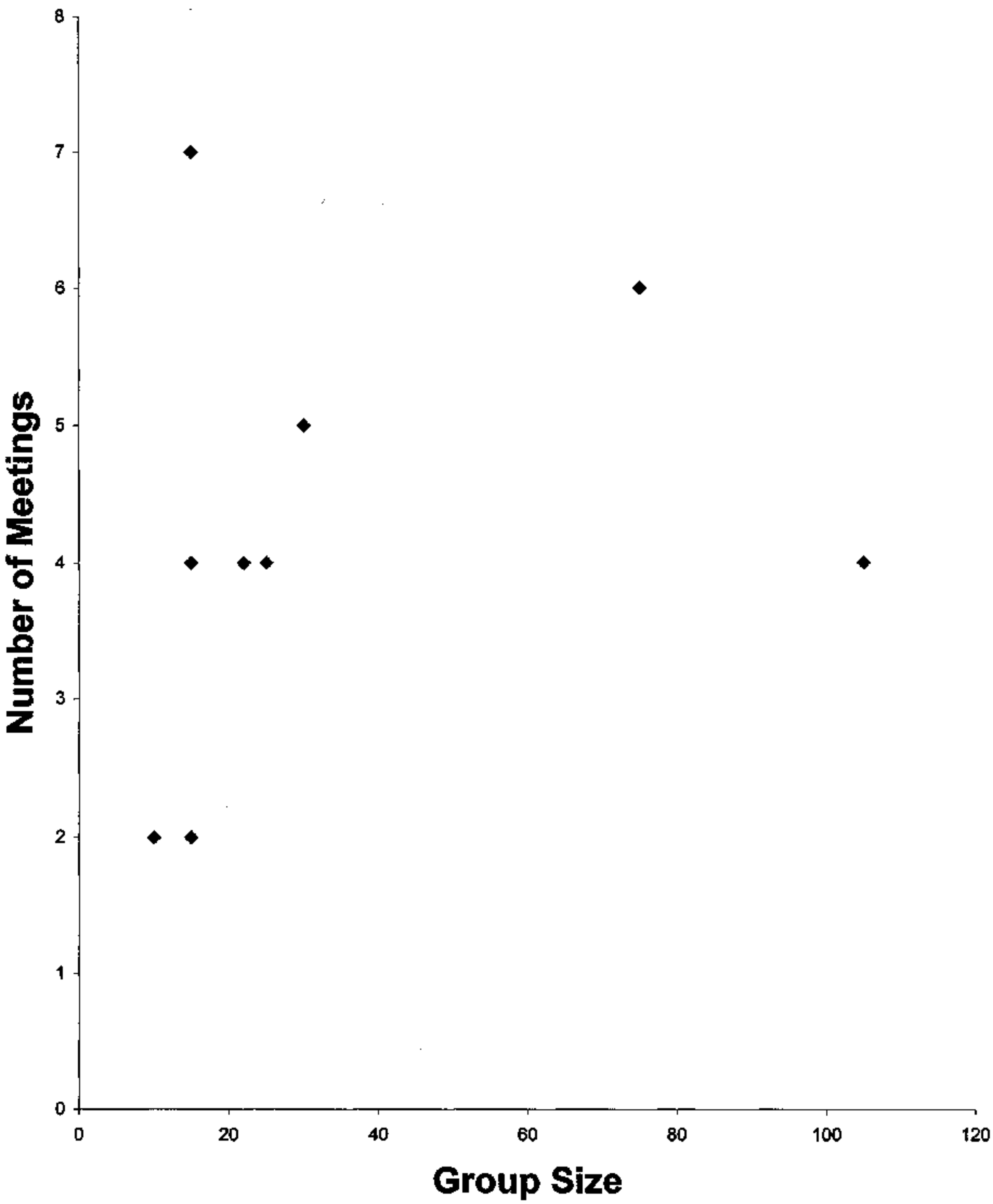


Figure 1b: Group Size and Number of Meetings (f>1)



raises more than Rs. 1,000 every year, can do so only because it is the largest village in the sample with 175 households. But its forest is so large that the council members must hire more than one guard every year, and they constantly complain about the scarcity of funds and their limited ability to pay a guard. Councils that are able to raise only small amounts to pay guards have sometimes tried to adopt other means to monitor rule infringements and to impose sanctions. Their efforts have sometimes been rewarded with success. For the most part, however, these other monitoring technologies have not proved sustainable.

Figure 2a and 2b plot group size against aggregate contributions for the two sets of councils corresponding to forest area per household, $f<l$ and $f>l$, respectively.

— Figure 2a and 2b here —

In each of these two figures, we observe that small and large councils have considerably smaller budgets in comparison to the medium size councils.

When we move to discussing per household contributions (c), the limited capacity of the councils in the large and the small villages becomes clear. In figures 3a and 3b, almost all the small and the large councils raise very low per household contributions from village residents. It is obvious from both these figures that contributions from members of medium-size councils are far higher than those from members of small and large councils.

— Figures 3a and 3b here —

Figure 2a: Group size and Protection Budget (f<1)

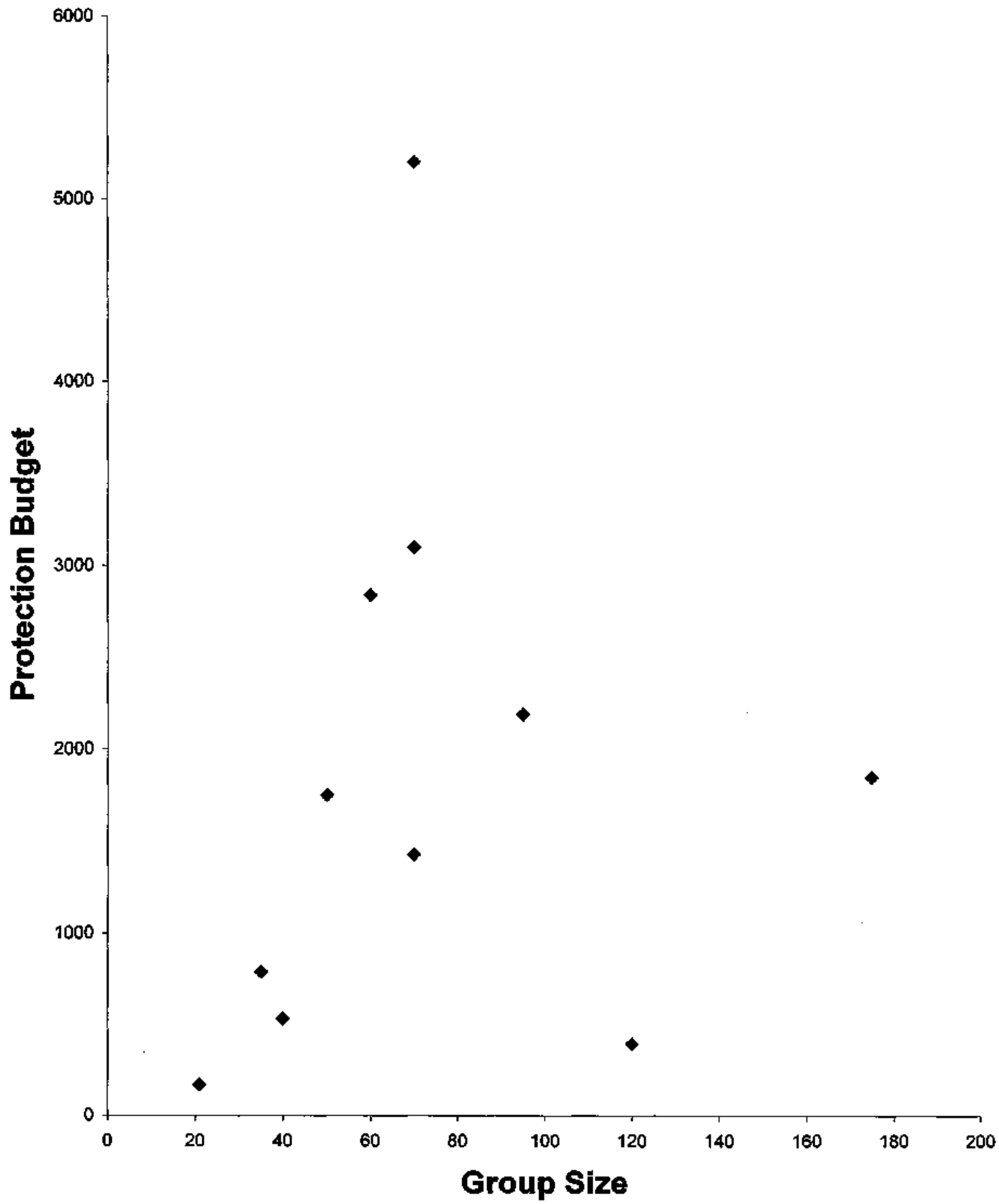


Figure 2b: Group Size and Protection Budget (f>1)

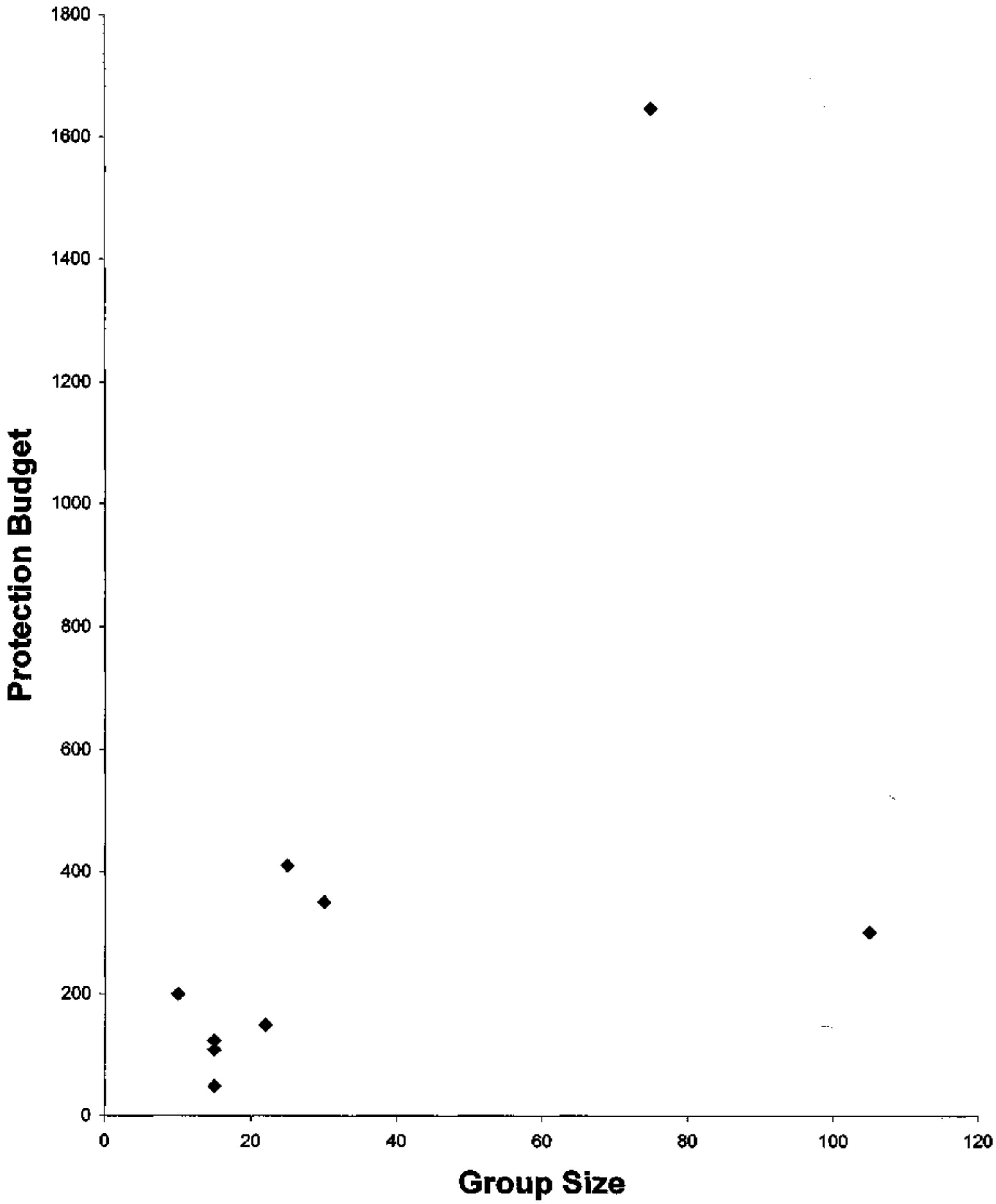


Figure 3a: Group Size and Household Contribution (f<1)

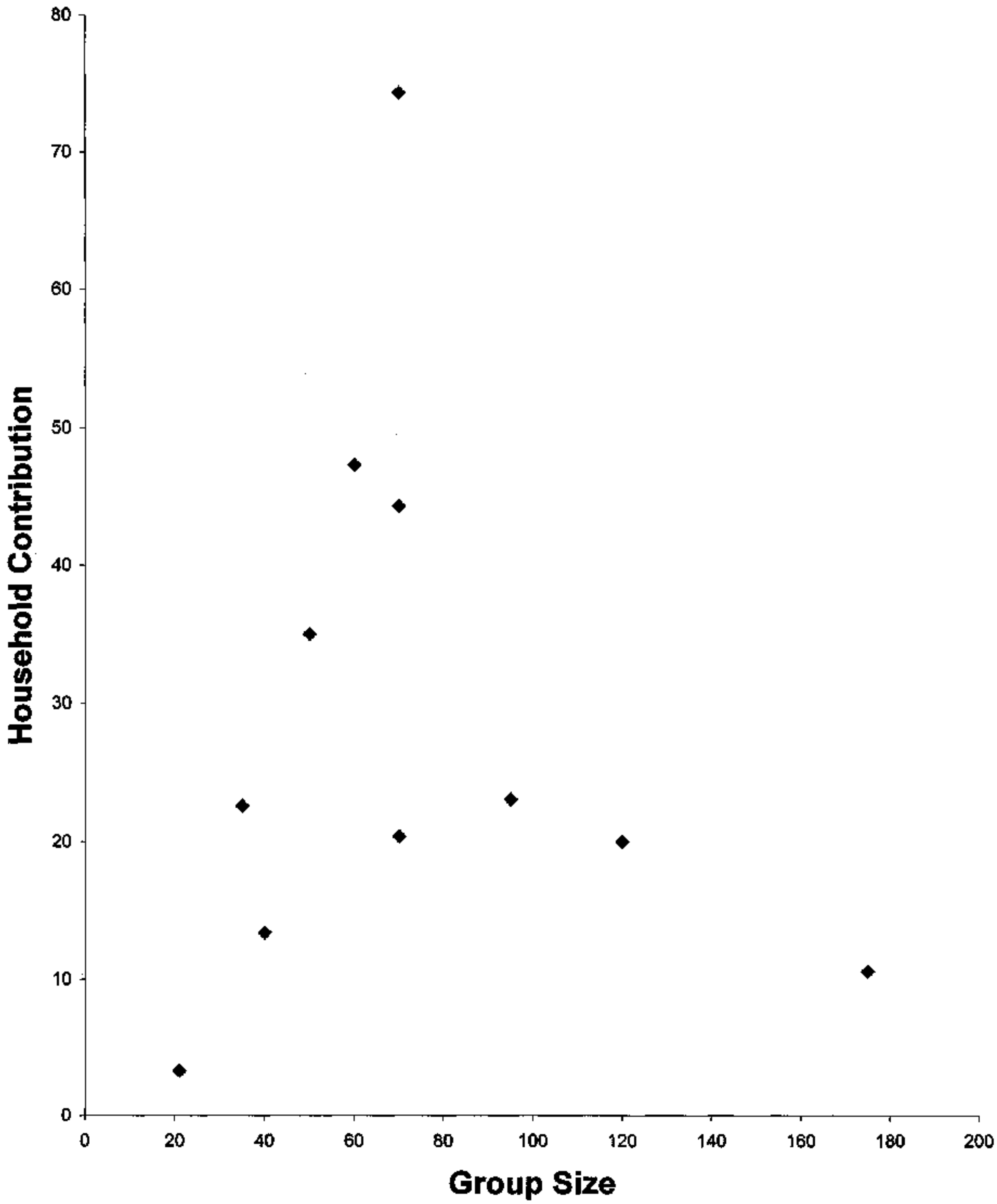
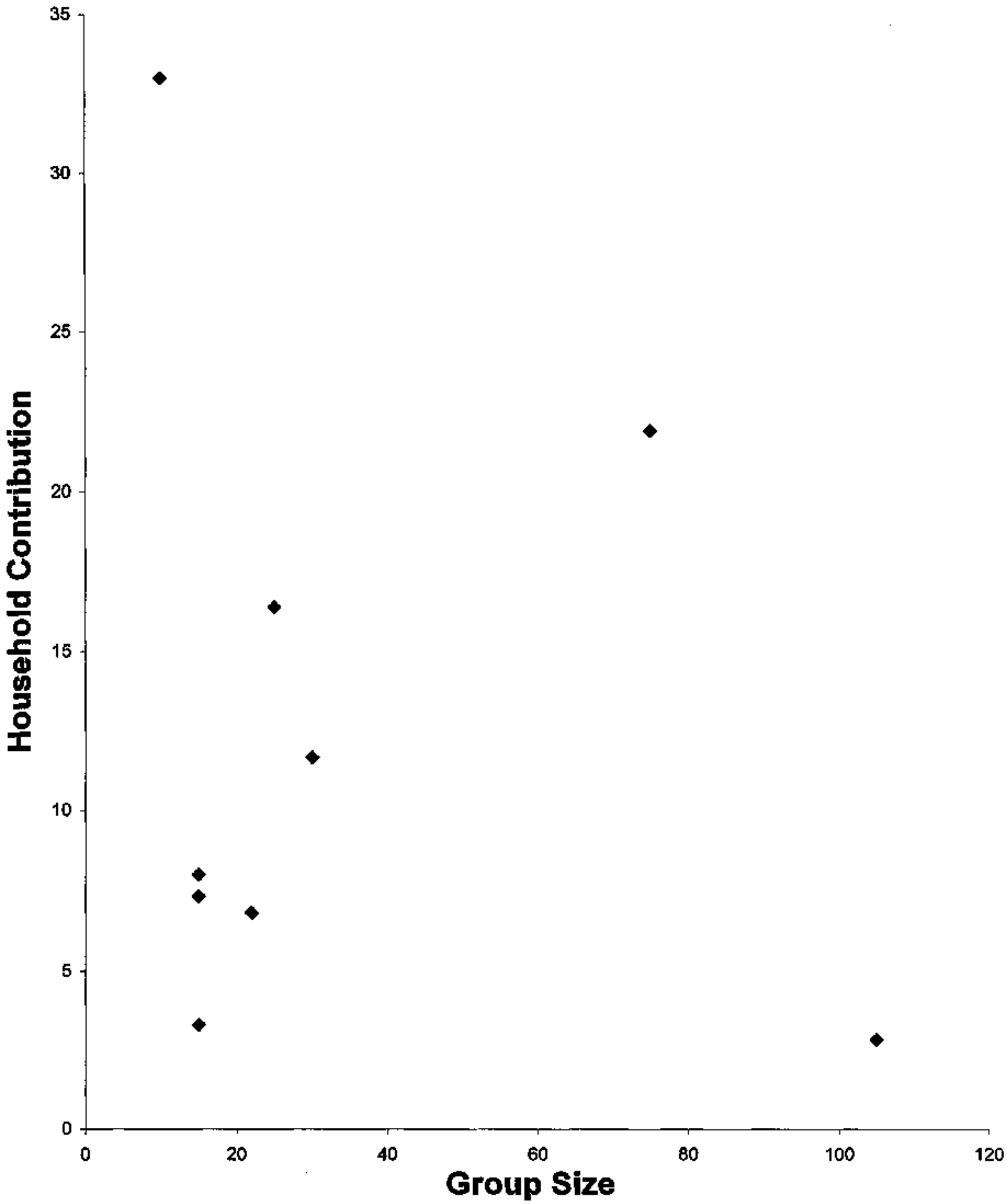


Figure 3b: Group Size and Household Contribution (f>1)



To explain these variations in per household contributions for protection consider, first, the small groups. Recall that effective monitoring requires hiring a guard for at least four months and an expenditure of around Rs. 800. The villagers in small groups, it seems, recognize the fact that when they are a part of a small group the ability of the group to protect its forests is limited unless all of them contribute funds toward monitoring at a substantially higher level than their capacity. Not only must all groups protect their forests from intra-group cheating, but also from possible depredations by members of other villagers. Many of the members of the small villages realize that the best strategy for them is not to contribute.

The story is somewhat different for the large villages. Resident members of these groups realize that given the larger size of their groups, monitoring is likely to become less effective, especially if the group hires only one guard. Further, as group size increases, the ability of the council to sanction an increasing number of rule breakers also diminishes. The incentives of village households not to pay, therefore, become high. In contrast, we find the highest levels of contributions in the medium-size groups. They are able to commit a sufficiently high surplus to the hiring of a guard, and to the organization of protection, for much of the year.

The above discussion reveals a striking and unexpected relationship between group size and collective action. We find that medium-size councils are the most succssful along all the three performance indicators we have used, in each of the two forest-availability classes. Two aspects of the collective action situation emerge as crucial: One, the lumpiness in the level of monitoring, i.e., there is a minimum level of monitoring below which it becomes ineffective. Two, the collective good is only partially excludible and the degree of excludibility declines as the size of the group increases. In the next section we develop a theoretical model that incorporates these two features of the collective choice problem and analyzes the conditions under which the above relationship between group size and collective action obtains more generally.

m. **The Model**

We consider a group of agents who own a common-pool resource.[16] Free access to the resource would lead to excessive exploitation owing to the externalities generated by individual resource extraction. This excessive extraction motivates the regulation of resource use. Members of the group set up an organization, henceforth referred to as a council, to devise rules for resource use. The council creates mechanisms to monitor individual actions and to ensure that rules are followed. The council also determines the appropriate level of monitoring and decides on how to finance monitoring. The main source of funding is contributions from individual members.

This is the setting of the voluntary contribution game played between the council and the individual members of the group. Individuals choose whether or not to contribute, based on a comparison of the relative payoffs. The council, thus, has to determine a monitoring level that is optimal subject to the constraint that individual agents have an incentive to cover the corresponding cost. To focus on this optimization problem we take as given the formation of the

[16]We use the term "agent" in this section for convenience. It refers to a "household" in the empirical context of section 2. The common-pool resource may be any renewable common pool resource such as a forest, fishery, ground-water basin, or pasture.

council.[17] Of particular interest to us is the relationship between the optimal level of sustainable monitoring and the size of the group.

We now set up the contribution game. Consider a group of agents, n, where the typical agent i = 1, 2, ..., n. This group of agents owns a common-pool resource of size F. Let the per capita resource be denoted by f = F/n. In what follows, we shall use the expressions nf and F interchangeably. Let $m \in \mathbb{R}_+$ denote the level of monitoring. We denote by C(m) the total costs of monitoring and by R(m, nf) the aggregate reward from monitoring. In what follows, it will be assumed that both C(m) and R(m, nf) are continuous and (weakly) increasing functions of m. We will use small case letters to denote per capita values. Thus c(m, n) = C(m)/n is the per capita cost when a group of size n monitors at a level m, and r(m, nf) = R(m, nf)/n is the corresponding reward per capita.[18]

The council announces a level of contribution for each agent, c(m, n), and a corresponding reward r(m, nf). An individual has the choice of contributing c(m, n) or of abstaining from contribution. Thus, the strategy of agent i is denoted by $s_i \in S_i$ where $S_i = \{0, 1\}$. We use 0 to denote no-contribution, and 1 to denote contribution.[19]

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[17]While the formation of the organization is itself a collective action problem, in this paper we restrict our focus on the provision of monitoring. Our choice is motivated by the empirical work presented in section 2. Our data suggest that the costs of forming the councils are low, and the non-monetary benefits are significant for organizers.

[18]This formulation of per capita costs and returns implicitly assumes that all agents choose to contribute funds for the monitoring.In our analysis, we will consider symmetric outcomes only. We adopt this formulation for notational convenience.

[19]This binary choice formulation is standard in the literature on collective action. We note, however, that it represents a simplification of the decision problem individuals face. In our context, for example, individuals might choose to contribute and also decide on extracting benefits over and above their entitlement. In what follows, we simplify the decision problem and

Let $s = (s_1, ..., s_n)$ be the strategy profile of the n agents. Thus $s \in S$ where $S = \prod_{i=1 \text{ to } n} S_i$. Also let s_{-i} denote the strategies of all agents other than i. The payoff to agent i from contribution is then expressed as

$$\prod_i(s_i = 1, s_{-i}, m, n) = r(m, nf) - c(m, n) \qquad (1)$$

If, on the other hand, she chooses not to contribute, then she is not entitled to extract resources. This prohibition, however, does not imply that the individual cannot derive any benefits fromt he common pool resource. The extent of benefits she derives depends on the degree of excludibility of the resource. We shall assume that the resource is only imperfectly excludible. This assumption is consistent with what we observed in our empirical work:[20] the council attempts to exclude villagers who have not paid their contributions, and such villagers often try, with varying degrees of success, to harvest benefits to which they are not entitled.

Let $q_i = \sum_{j \neq i} s_j/(n-1)$ represent the proportion of agents other than agent i who contribute. Also let $p(q_i, m, n)$ denote the probability of exclusion of agent i, in a group of size n, with monitoring level m and a proportion q_i of contributors. Given the monitoring level m, and a profile of contribution strategies of other agents, s_{-i}, the payoff from non-contribution to agent i is given by

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assume that agents who contribute abide by the rules devised by the council while the agents who choose not to contribute try and extract resources illegally.

[20]The assumption is also in accordance with the large literature on common pool resources. For a discussion, see Ostrom (1990), and Ostrom Gardner and Walker (1994).

$$\prod_i(s_i = 0, s_{-i}, m, n) = p(q_i, m, n)\cdot 0 + [1-p(q_i, m, n)]\cdot r(m, nf).^{21} \quad (2)$$

This payoff reflects the idea that if an agent is excluded her benefits are zero, while if she is not excluded then she can access the resource like other agents, without incurring any costs. It is worth emphasizing that if the good is perfectly excludible, then the probability of exclusion is 1 and p(qi, m, n) = 1 for all values of qi, m, and n. The behavior of the p(.,.,.) function plays an important role in the analysis. Thus imperfect excludibility of the common-pool resource is a crucial element of our model.

A strategy profile $s = (s_1, s_2, ..., s_n)$ is said to be a Nash equilibrium if for every agent i,

$$\prod_i(s_i, s_{-i}, m, n) \geq \prod_i(s_i', s_{-i}, m, n), \text{ for all } s_i' \in S_i. \quad (3)$$

We restrict attention to symmetric Nash equilibria of the contribution game. The focus on symmetric equilibria is, in part, motivated by our empirical work. We observed that village populations are relatively homogeneous. We also observed that villagers are expected to contribute equal amounts toward funding monitoring activities.[22] We analyze the incentives of individual agents to contribute given that every other agent does so, i.e., $q_i = 1$.

From expressions (1) and (2), we can infer that an agent i will choose to contribute only if

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[21] When the collective good is excludible, $p(q_i, m, n) = 1$. In what follows, the negative effects of large size stem from the impact of n on the function $p(q_i, m, n) = 1$ (see proposition 2). If the good is excludible, these effects will vanish.

[22] Also see Guha (1989) for a discussion on intra-village homogeneity in the Indian Middle Himalaya.

$$r(m, nf) - c(m, n) \geq [1 - p(1, m, n)]r(m, nf) \quad (4)$$

Rearranging terms gives us the inequality,

$$p(1, m, n)r(m, nf) \geq c(m, n) \quad (5)$$

The council will choose a level of monitoring that maximizes the returns to the group members, subject to the constraint that thecosts of monitoring are recovered via contributions. The councils constrained optimization problem can be written as follows:

$$\begin{aligned} &\mathrm{Max}_m\ r(m, nf) - c(m, n) \\ \text{s. t.}\quad &p(1, m, n)\, r(m, nf) \geq c(m, n). \end{aligned} \quad (6)$$

This completes the description of the contribution game. We examine the optimal levels of monitoring that can be supported in a symmetric Nash equilibrium of the contribution game. The analysis makes some simplifying assumptions. The first assumption concerns the existence of a solution to the optimization problem.

(A.1). *For any n and f, the optimization problem of the council has a unique solution.*

Let m(n, f) denote this unique optimal level of monitoring. We note that existence and uniqueness of m(n, f) obtain whenever the objective function r(m, nf) - c(m, n) is strictly concave and the feasible set is convex. This suggests that our first assumption is relatively mild.

In this general setting, a wide range of monitoring patterns are possible. To analyze these possibilities, and the diverse relationships between levels of monitoring, and the costs and rewards associated with monitoring, we restrict the class of functions c(.,), r(.,.), and p(.,., .). Our assumptions are, again, in part motivated by the empirical work reported in section 2. During empirical research we observed that monitoring activity has to be above a certain level to yield positive returns. This "lumpiness" of monitoring arises in the following way: if a council chooses to hire a guard for very short periods of time, individual agents can easily circumvent detection by simply extracting needed forest products at other times and during other seasons. Monitoring activity below a certain level, thus, provides negligible protection. More generally, we note that lumpiness in monitoring can arise owing to a variety of factors, such as technological constraints or fixed costs of hiring personnel. Most collective goods have this property of lumpiness. These considerations motivate our next assumption.

(A.2). *There is a minimum effective level of monitoring, m_l, where $m_l > 0$. Given any n and f, $r(m, nf) = 0$, for every $m < m_l$.*

Our next assumption simply says that for every f, there is an upper bound on per capita returns.

(A.3). *Fix any f. There exists a number $r(f) < \infty$, such that $r(m, nf) \leq r(f)$, for every n and m.*

The above assumptions have the following direct implication.

Proposition 1: *Suppose that (A.1) - (A.3) hold and $C(m_l) > 0$. Given any f, there exists a minimum group size $n_l(f)$ such that for all $n \leq n_l(f)$, the optimal level of monitoring $m(n, f) = 0$.*

Define $n_l(f)$ to be such that $n_l(f) \cdot r(f) = C(m_l)$. Since $C(m_l) > 0$, and r(f) is bounded above, this implies that $n_l(f) > 0$. The proof of the proposition is completed by noting that for groups of size $n \leq n_l(f)$, the maximum aggregate returns from monitoring, $n \cdot r(f)$, are lower than the costs of the minimum effective level of monitoring, $C(m_l)$.

This proposition says that if group size is small then the council may not find it worthwhile to organize monitoring of the common-pool resource. We now consider the nature of monitoring in large groups.

The constraint in the optimization problem in (6) suggests that, in general, the levels of sustainable monitoring depends on the effectiveness of exclusion. We now state our assumptions concerning the function p(., ., .). The first assumption is that the function is increasing in m. We also assume that for a group of size n, and a given level of monitoring, m, the probability of exclusion is increasing in the proportion of contributors, q_i. The intuition behind this assumption is that an increase in the proportion of contributors reduces the size of the pool of agents who have to be monitored and this makes it easier to exclude any individual agent from using the resource. We also note that for a given proportion of contributors, q_i, the number of agents to be monitored increases with group size. This suggests that for a fixed level of monitoring, the likelihood of successful exclusion of any particular non-contributor should be decreasing. This motivates the third part of the following assumption.

(A.4). *(i). $p(q_i, m', n) > p(q_i, m, n)$, for $m' > m$;* *(ii). $p(q_i', m, n) > p(q_i, m, n)$, for $q_i' > q_i$;* *(iii). $p(q_i, m, n') < p(q_i, m, n)$ if $n' > n$.*

To develop some intuition, we first examine the relationship between group size and collective action with the help of an example with specific functional forms. We later use the intuition derived through this example to model a set of sufficient conditions. Given the lumpiness of monitoring (and of collective goods in general) to which we alluded above, we should expect that returns to monitoring would increase rather rapidly initially and then this rate of increase would decline. In other words, we expect that the rewards function would display an s-shape. This motivates the use of a logistic function.

$$r(m, nf) = r(f) / 1 + e^{-(a+b(n)m)}, \text{ where } a < 0,\ b(n) > 0,\ b'(n) < 0. \quad (7)$$

In this function, r(f) is the maximum return from protection and b measures the effect of increasing monitoring. In our case, b is a function of the group size, n, with larger n leading to smaller values of b. The derivative of r(m, nf) with respect to m is given by dr/dm = b(r(f) - r(m, nf)/ r(f)). Thus, lower values of b imply lower (higher) marginal returns to monitoring at low (high) levels of monitoring. In our context, this seems reasonable since, for fixed f, a larger n (and a correspondingly smaller b) implies larger overall resource size.

We next specify a cost function that is linear in the level of monitoring. In this function, w can be interpreted as the wage rate of guards.

$$c(m, n) = mw/n, \text{ where } w > 0 \quad (8)$$

Finally, we specify a probability function:

$$p(q_i, m, n) = q_i \cdot m \,/\, (1+m)\,(1+n^{\alpha}), \text{ where } \alpha > 2. \quad (9)$$

It can be checked that the p(., ., .) specified above satisfies (A.4). It is also worth noting that in this specification the likelihood of exclusion decreases very rapidly with the size of the group since $\alpha > 2$. Set $q_i = 1$ in the above specification of p(., ., .). The council's optimization problem can be rewritten as follows:

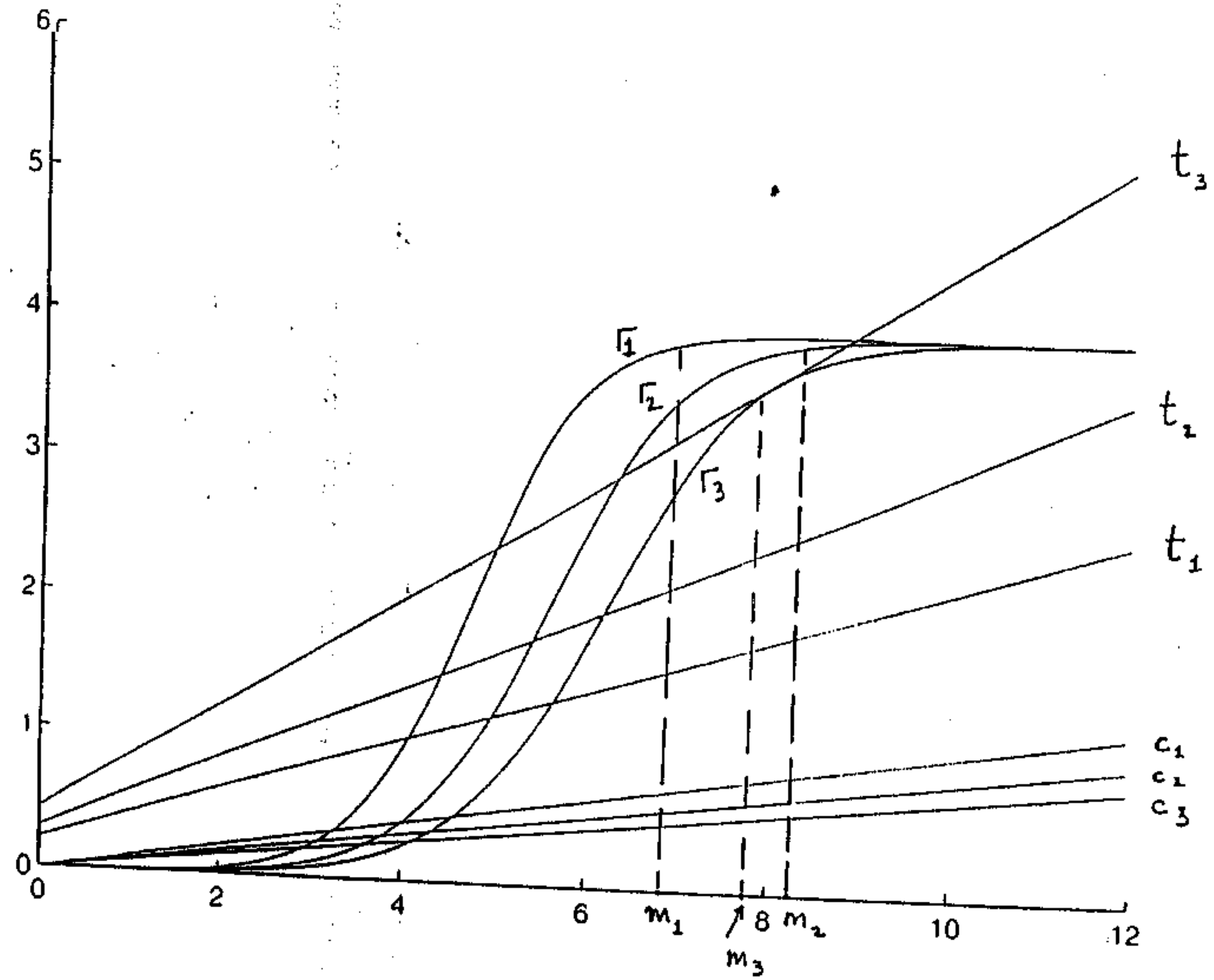
$$\max_m r(f)/(1 + e^{-(a+b(n)m)}) - mw/n$$

$$\text{s.t. } r(m, nf) \geq w(1+m)(1/n+n^{\alpha-1}) \quad (10)$$

We consider three group sizes n_1, n_2, and n_3, where $n_1 < n_2 < n_3$. We define $t(m, n_k) = c(m, n_k)/p(1, m, n_k)$, for k = 1, 2, 3. We use c_k to denote $c(m, n_k)$, and r_k to refer to $r(m, n_k f)$, for k = 1, 2, 3. The optimal sustainable levels of monitoring are illustrated in figure 4 below.[23]

— Figure 4 here —

[23]In plotting the figure we use the following parameter values: r(f) = 4; a = -7.80; w = .10; $\alpha = 4.0$. We consider three values of n, $n_1 = 1$, $n_2 = 1.25$, and $n_3 = 1.5$. Corresponding to these values of n, we have three values of b, $b_1 = 1.65$; $b_2 = 1.40$; and $b_3 = 1.26$.



6
5
4
3
2
1
0
0
2
4
6
8
10
12
m_1
m_2
m_3
Γ_1
Γ_2
Γ_3
t_1
t_2
t_3
c_1
c_2
c_3

FIGURE 4

In this figure we observe that the monitoring level is low for the small and the large groups, n_1 and n_3, and it is relatively high for the medium sized group n_2. In the case of n_3, the level of monitoring falls because the constraint which reflects individual incentives to contribute becomes more stringent. In particular, in the picture this constraint defines a unique feasible monitoring level, m_3[24]

At this stage it is instructive to compare the patterns of monitoring derived from our theoretical analysis in figure 4, with the empirical data presented in figures 2a and 2b. We note a close resemblance between the two sets of figures. The level of monitoring is initially very low for small groups, it increases rapidly among medium-size groups, and then falls sharply for large groups. The protection budget for most small and large councils is well below the threshold required to hire a guard for an entire year. Indeed, except in one case, it is also below the amount necessary to hire a guard for the four winter months. This suggests that the model we have constructed generates outcomes that are in accordance with the level of monitoring actually chosen by the councils.

In Figure 4, the level of monitoring falls as group size becomes large. It is useful to see how this happens. First note that an increase in n lowers the marginal cost of monitoring. This suggests that an increase in group size makes monitoring more attractive. On the other hand, as group size increases, the likelihood of exclusion declines. In our example, this fall in probability

[24]We note that the logistic function does not satisfy (A.2), since returns are positive even for very low levels of monitoring. It can, however, be checked that proposition 1 still obtains for the functions specified above. This suggests that (A.2) is sufficient but not necessary for zero monitoring in small groups. Thus, we expect the Proposition 1 will obtain so long as returns are very low, until some level of monitoring.

of exclusion outweighs the effect of the falling marginal cost of monitoring. The net effect is to make the individual incentive constraint for contribution more stringent as group size increases.

We now state some general conditions under which monitoring is not incentive compatible in large groups. For our purposes, the incentive constraint is better expressed as a ration of the cost function and the probability of exclusion. Recall that t(m, n) = c(m, n)/p(l, m, n). Our discussion motivates the following restrictions on the function t(m, n).

(A.5). *(i) $t(m', n) > t(m, n)$, if $m' > m$; ii) There exists a $n'' > 0$ such that $t(m, n') > t(m, n)$, for $n' > n \geq n''$; (iii) $\lim_{n \to \infty} t(m, n) = \infty$, for all $m \geq 0$.*

We can now state the following result concerning monitoring in large groups.

Proposition 2: *Suppose (A.1) - (A.3) and (A.5) hold. Then for every f, there exists a critical group size $n_u(f) < \infty$ such that positive levels of monitoring are not sustainable for group sizes $n \geq n_u(f)$.*

Proof: Fix some f. We can rewrite the constraint in the maximization problem given in (6) as follows:

$$r(m, nf) \geq c(m, n)/p(1, m, n). \qquad (11)$$

We next note than under (A.2) positive monitoring levels less than m_l are never optimal. Thus we can restrict attention to monitoring levels $m = 0$ and $m \geq m_l$. Under (A.5) (iii), there exists some n' such that

$$t(m_l, n') \geq r(f) + \epsilon, \text{ for some } \epsilon > 0. \tag{12}$$

Given (A.5) (i), the above inequality implies that for all $m > m_l$,

$$t(m, n') \geq r(f) + \epsilon \tag{13}$$

Under (A.3), it follows that for all $m \geq m_l$,

$$r(m, nf) \leq r(f) < r(f) + \epsilon \tag{14}$$

From (A.5) (ii) we know that there exists an n" such that $t(m, n)$ is increasing in n for all $n \geq n"$. We can, without loss of generality, take n' to be larger than this n". Hence, for all $n > n'$, and for all $m \geq m_l$, we have

$$r(m, nf) < r(f) + \epsilon \leq t(m, n). \tag{15}$$

Thus no individual has an incentive to contribute to monitoring in groups of size $n \geq n'$. Therefore, the council will be obliged to set a monitoring level of zero for these group sizes. Let $n' = n_u(f)$. Since f was arbitrary, this completes the proof.■

Proposition 2 establishes that a council in a large group will be constrained to optimally choose a level of monitoring equal to zero. This is owing to a collapse in individual incentives to contribute in large groups. This fall in incentives, in turn, is due to a sharp fall in the degree of excludibility of the common-pool resource as the group size gets large. We have, thus, shown that for every f, there exist critical numbers $n_l(f)$ and $n_u(f)$ such that for group sizes $n \leq n_l(f)$ and $n \geq n_u(f)$, the optimal level of monitoring that can be sustained is zero. Our example, depicted in Figure 4, illustrates why levels of monitoring are likely to be highest for medium-sized groups.

Our examination of the relationship between group size and collective action in the form of successful provisioning of monitoring can be summarized in the following manner:

> Suppose that monitoring displays lumpiness and that the common-pool resource becomes progressively less excludible as group size increases. Then, medium size groups are relatively more likely to sustain levels of monitoring in comparison to small and large groups. This suggests that success in collective action bears a curvilinear relationship with group size.[25]

IV. Discussion

In this section, we examine some of the assumptions that underlie the model and the effects of relaxing and varying them. This discussion suggests the robustness of the basic insight in this paper about the relative superiority of medium-size groups in organizing collective action.

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[25]We are currently working on developing a general set of conditions on the rewards, costs, and probability functions under which the optimal level of monitoring is zero until $n_l(f)$, increases from $n_l(f)$ until some group size n^*, decreases from n^* until $n_u(f)$, and is zero for all group sizes larger than $n_u(f)$.

The Formation of Institutions

In our analysis above we conceptualize the management of a common pool resource as a two-stage process. In the first stage, individual set up a council, and in the second stage this council chooses levels of protection and determines individual contributions that cover the cost of protection, subject to the constraint that these contributions be individually incentive compatible. In the formal analysis, however, we take the existence of the institution as given and focus on the second stage of the process.

We expect that in other settings, eg., the formation of a labor union, a peasant cooperative, or a lobbying group, the institution-formation process will not be so straightforward. We briefly discuss how the incentives to form institutions might relate to our results above. To restate the obvious, individuals choose whether to participate in creating an institution after assessing the rewards and the costs of doing so. The benefits from participation are reflected in an increase in the likelihood of the formation of the institution. Once the institution is formed, it makes decisions concerning the provision of some collective good that can be sustained via individual contributions. Consequently, in deciding whether or not to participate in the process of institution formation, an individual takes into account both the marginal increase in the likelihood of institution formation (as a result of her efforts), and the payoffs from the subsequent activities of the institution.

Our arguments in sections 2 and 3 suggest that the payoffs from the activities of the institution will initially display increasing returns but that these returns eventually will be constant or decreasing, with respect to the size of the groups. Standard considerations suggest that the marginal impact of an individual's efforts will be inversely related to the size of the group engaged in institution formation.[26] Thus, in environments where the collective good provided by the institution has significant setup costs or displays lumpiness, we believe the curvilinear relationship we have identified between group size and collective action should still be observed.

It is worth noting that this conclusion does not rely upon the assumption of imperfect excludibility which is crucial for the derivation of our results in section 3. In this analysis, increasing group size has a negative effect because it lowers the excludibility of the collectively provided good. Our discussion about the incentives of institution formation, thus suggests, that group-size effects in the first stage of collective action will, if anything, reinforce the group-size effects identified in the analysis in section 3.

The group size effects we have identified are especially relevant in relation to decentralized resource management. In recent years, scholars and policy-makers alike have become less preoccupied with centralized solutions to market failures. Concurrently, advocacy on behalf of community-level institutions and their role in management of resources has gained ground.[27] But small is not necessarily beautiful, nor big necessarily better. The findings discussed in this paper about group size and its relationship to provision of collective goods suggest that care must be exercised in decentralizing resource management. Small and large groups may not be able effectively to protect their resources owing to the inability to raise sufficiently high

[26]David Hume was, perhaps, the first to explore this inverse relationship. More recently, Buchanan and Tullock (1962) and Olson (1965) have posited a similar connection.

[27]Bates (1981) and Repetto and Gillis (1988) are two hard-hitting classics that identify the failures of state involvement in development and conservation, respectively. Ostrom (1990) provides a measured defence of decentralized community involvement in resource use.

amounts to undertake monitoring. In our example, we identify specific cut-off points for group-size categories. In other contexts the critical size below and above which groups may not be able to provide monitoring will depend the precise relationship of group size with such variables as the lumpiness of the good, degree of excludibility (both discussed in this paper), production technology of the good, and jointness in supply.

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Appendix 1
Changes in Forest Panchayat Rules between 1931 and 1976.

Subject	1931	1976
Formation/ Dissolution	1. Two or more residents could propose the formation of the Forest Panchayat for a village. 2. The Deputy Commissioner could dissolve a panchayat in case of repeated mismanagement or rule infractions.	Rule 2 remains the same Modifications: 1. One third of the villagers must propose the formation of the forest panchayat.
Membership	1. At least three and at most nine members elected to the Forest panchayat council by villagers. 2. Panches select their leader as Sarpanch 3. Panches could force resignation of individual members by a majority — the empty position could be filled from among right-holders by a majority decision of the panches. 4. All village residents, and others who possessed rights in the forest, could be rightholders in the panchayat forest.	Rule 2,3,4 remain the same. Modifications: 1. Five to nine mebers to be elected to the forest panchayat council 2. The Deputy Commissioner could nominate one member to the council. 3. The Sarpanch could be removed from office by one third of the members, provided this step is approved by two thirds of the members in a subsequent meeting.

Rules laid down by Govt	1. Panchayat Forest land could not be sold, mortgaged or subdivided. 2. The products and proceeds from the sale of products of the panchayat forest to be used for the benefit of the community. 3. Panchayat to protect the forest and its trees. (But no explicit restriction on commercial sale of trees or timber). 4. Panchayat to prevent villagers from cultivating the panchayat forest land 5. Panchayat will demarcate the forest area. 6. The panchayat will maintain minutes of meetings, records of accounts, and make decisions in regular meetings. 7. Panchayat to follow the instructions of higher revenue officials. 8.Quorum required two thirds of the members of the committee to be present. 9. All decisions to be made by simple majority.	Rule 1, 2, 4, 5, 6, 7 amd 8 remain the same. Further Restrictions: a. All decisions of the panchayat to be made by two third vote. b. Panchayat should meet at least once every three months; proceedings of the meeting to be recorded and copy submitted to the deputy commissioner. c. All extraction of timber beyond one tree requires permission from the Deputy Commissioner, Divisional Forest Officer (DFO) and the Conservator of Forests (CF). Any sales of forest produce must be in accordance to the Working Plans prepared for the Forest Panchayat by the Forest Department. d. For commercial sale or auction of forest products (fodder, grass, minor forest products, firewood, timber), the permission of the DFO must be obtained. If the value of the auctioned products exceeds Rs. 5,000, the DFO must be present. All auctions above Rs. 5000 must be approved by the Conservator of forests. e. The panchayat must prepare annual budgets and submit an annual report to the DFO each year. f. Special officers appointed to supervise forest panchayats must oversee at least a third of panchayats each year. g. Forest panchayat accounts could be audited.
Elections	Panchayal officials elected for three years. New elections to be held every three years.	Panchayat elected for five years. New elections to be held every five years.

Rights and Powers of Panchayats	In general similar to forest officials: 1. Fine rule-breakers up to Rupees five. 2. For offences where the fine should be higher, the panchayat could file court cases against rule-breakers. 3. Levy fees from users for fodder, grazing, fuelwood, or construction stones. 4. Regulate grazing in the Panchayat Forest and impound animals who are in the forest against rules. 5. Confiscate cutting implements used in contravention of panchayat rules. 6. Restrict/ suspend rights of users who break rules regularly. 7. Appoint guards to monitor and enforce rules.	In general similar to forest officials: Rule nos. 3, 4, 5, and 6 remain the same. Further Restrictions: a. All appointments by the forest panchayat require approval of the Deputy Commissioner b. At least 20% of the area of the forest panchayat to be set aside from grazing; Could lease land for commercial use. c. Could compund fines on individual rule-breakers up to a limit of Rs. 50 with their permission, and up to Rs. 500 with the permission of the Deputy Commissioner; and to file court cases against rule-breakers. d. Could grant no more than one tree to a right holder--written consent of more than half the panches, and stamp of Sarpanch necessary
Rules regarding Resin Extraction	1. The forest department responsible for harvesting resin from Chir Pine trees 2. Profits to be shared between FD and the Panchayat in proportions to be determined by the Forest Conservator. 3. Panchayat could harvest resin as long as it is in accordance with rules laid down by the Forest Department; and the resin sold to either the forest department or registered buyers. 4. Panchayat members could harvest resin for domestic use.	Rule 1,3, and 4 remain the same. Further Restrictions: a. See modification b, c, and d under the subject "Allocation of Income".
Rule Enforce-ment	All fines imposed by the panchayat were treated as government dues and recoverable using similar procedures	Same as before.

Allocation of Income	1. All income from sale of forest products to rightholders as assigned to the forest panchayat 2. All income from sale of resin to be allocated in accordance with proportions determined by the Conservator of forests (in practice it went to forest panchayat). 3. Income from sale of forest products (such as timber, resin, minor forest produce) to non-right-holders was assigned to the forest panchayat.	Rule 1 remains the same. Modifications: a. Forest department to deduct 10% from all gross revenues of the forest panchayat as its share to meet administrative expenses. b. Net income from commercial sale and auctions to be deposited in a Panchayat Forest Fund, managed by the Deputy Commissioner. b. 20% of the net income allocated to District Council to meet development costs. c. 40% of the net income allocated to the Forest Department to maintain and develop panchayat forests d. Remaining 40% of net income allocated to panchayat~to be spent on works of public utility as approved by the deputy commissioner