A COLLECTIVE ACTION/CLUB GOODS MODEL FOR ANALYZING COMMON PROPERTY RESOURCES

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Introduction:

This study develops a collective action/club goods model for analyzing the private collective approach to common property resource systems (CPR). The argument is that there are contexts in which collective action is successful or has the potential for success in initiating and sustaining group organization for the joint private provision, use, and management of a common property resource. Collective action theory should be understood as addressing the issue of whether there will be group organization, group decision-making, or any other type of group initiative at all. It does not deal with what form such organization will take. In distinguishing between the conditions for initiating and sustaining collective action, I want to recognize that it is often easier to get something started than it is to keep it going. To avoid over optimism, a very brief discussion of conditions that lead to the failure of collective action is also included.

The analysis of successful provision, use, and management of common property resources is presented in two parts. The first part discusses the conditions for initiating and sustaining collective action in CPR situations. Once it is determined that the conditions for achieving collective outcomes exist, the analysis of the outcomes themselves is discussed in the second component, based on the theory of clubs.

The model can be used to determine whether a particular resource system is characterized by certain conditions that would make it amenable to collective action. The model should be able to identify whether cooperation is ongoing in a particular situation and what, if anything, should be done to strengthen it. It can further indicate whether a strategy of collective action is a viable intervention to a particular common property resource regime that appears to be characterized by open access, Prisoners' Dilemma, or other similar type problems.

Conditions for initiating collective action

PARTICIPATORY GROUP CHARACTERISTICS:

a. Identification of the Participant Group.

Identification of the relevant community is the first condition critical to the success of initiating collective action. Participants are those individuals who share in contributing to the costs and/or enjoying the benefits of the CPR. This includes those individuals who contribute to the provision of the CPR and those who use it, but these subgroups are not necessarily the same. While all providers may be users as well, not all users need be providers. I use an expansive definition of "provision" that includes: contributing to the production of the collective good, i.e. planting saplings, seeding a pasture, constructing a canal;

contributing to the maintenance and upkeep of the CPR, i.e. fertilizing, culling, reseeding, repairing; and contributing to the management of the system, i.e. coordinating, policing, punishing, etc.

Village communities are made up of a number of such collective activities and citizens of a village may be participants in a variety of subgroups that provide and use club type goods. Some may be providers and users of irrigation systems, others may just be users, and still others, neither. Other subgroups may be providers and/or users of common forests and pastures, or contribute to community education, religious and cultural activities in which the villagers benefit. This point has important implications for identifying free riders. To the outsider, it may appear that those who only use but in no way contribute to the provision (using the expanded meaning discussed above) of a particular CPR are free riding. This conventional use of the term ignores the fact that such individuals may be actively providing other club goods to the village. The elderly widow who grazes her animals on the common pasture and burns firewood from the village forest may be labeled a free rider, but her contribution to village religious and cultural activities are ignored. For these reasons, free riders are more narrowly identified as noncooperators who have a harmful effect on the CPR, i.e.

those who steal irrigation water, overcut the forest, overgraze the meadow.

Participation in the relevant group is sometimes conferred by membership in some other group whose central purpose is generally not the use or management of the resource per se. The subset of participants may be part of a larger group that has legitimate claims over the resource in question in the sense that the community holds some legally recognized property rights over the resource. The relevant group may have legally conferred rights over the resource or it may have traditionally recognized user rights, although ownership per se is not legally recognized. It is important to identify and define participants in respect to other groups with claims over the resources. In general, the relevant group should be able to claim and enforce exclusionary jurisdiction over the resource (McGrath, 1988).

To summarize, the relevant group which can be identified as participants in the CPR includes: providers and users, users only, those cooperators who neither provide nor use the resource but who have claim over it usually by virtue of their citizenship in the village, and free riders, noncooperators, who are in some way detrimental to the CPR.

b. Group Size:

It is quite apparent that "smallness" is of primary concern in determining the relevance of group size to successful collective action. Collective action typologies of group size do little to clarify the meaning of "small" and the relationship between group size and the provision of the collective good is somewhat more complex than one would expect from Olson's (1965) assertions (see Chamberlain, 1974).

When we assert that large groups are more likely to fail than are small groups, it is generally not useful to assume that increasing the size of a given group automatically increases the probability of its failure. It is not logically possible to increase group size, N, ceteris paribus (Hardin, 1982). As N increases something else must also change: be it average costs (particularly for perfectly joint goods), individual valuation (particularly for goods subject to crowding,i.e. club goods); or level of supply. The issue of increasing group size does have relevance when applied to club type goods. It will be seen that increases in the number of members of a club can initially be beneficial over some range, but after a certain point is reached, the marginal costs of adding new members out weigh the marginal benefits they bring to the club. After reaching this congestion point, increases in the size of the group introduce difficulties.

One helpful way to analyze group size has been proposed by Schelling(1978) and further developed by Hardin(1982). This is called the k group, which takes into account that it is not merely the size of the group but also the ratio of benefits to costs that is important. If that ratio is large, then a relatively small fraction of the whole group would already stand to benefit from providing the good, even if this subgroup alone acted. k can designate the size of any subgroup that just barely stands to benefit from providing (in the expanded sense of the term) the group good, even without the active involvement of other members of the whole group. This recognizes that various forms of participation, including some extent of free riding, are tolerable. The entire membership of the relevant group does not need to commit itself to active cooperative participation in the proper use and management of the common property resource, for that resource to be used and managed successfully by the community.

After the initiation of collective action, as more of the good is provided the demand for the good becomes more symmetrical among all members of the relevant group. A cooperating k subgroup may need to recruit others to join it, if it is to remain in their interests to sustain the collective action by continuing to provide the good to the whole community.

c. Income Effects.

There is a divergence of views on the relationship between a propensity to become involved in collective action and the level of an individual's income. Buchanan (1968) indicates that since the main reason for the collective provision of public goods is the corresponding reduction in price, it is reasonable to assume that public goods will have greater importance in poorer communities than in wealthier ones where they can often be substituted by private goods.

R.Hardin (1982) on the other hand argues that since the wealthy have more available resources in terms of disposable income and leisure time they can contribute more toward collective action than can the less well off. Hardin recommends that groups seeking to initiate collective action should first direct their efforts toward the most well off members. If that is successful then they can expand the membership to include participation from middle income participants.

This does not sit well with the objective of harnessing collective action for the benefit of the rural poor, but on further analysis it does not present as much of a problem as it seems at first glance. First, it must be kept in mind that Hardin is writing about collective action as it pertains to the United States. Hardin, bases his analyses

entirely on the Unites Sates and makes no claims for universality of his theory, nor does he make any attempt to extend his argument to the substantially different conditions in less developed countries. Secondly, he characterizes goods suitable for collective action as both superior and nonfungible goods, types of goods that have greater appeal to the well off. The discussion on condition c., the types of goods suitable for collective action indicates that this is not relevant when considering CPR where the principle advantage of collective provision of a good over private good substitution is the price. To the extent that lowering costs is of concern to poorer individuals, the incentive to participate in collective action efforts will be positive as long as the benefits out weigh the costs.

The importance of income effects is not a trivial issue. Economic development efforts have a long history of worsening conditions for the poor. Evidence from developing countries on common property resource based collective goods indicate that while they play an important role in the economic well-being of almost all rural families, their importance in the economic well-being of poorer peasants is of even far greater importance. Evidence from India indicates that income from common property resource product collection constituted 10-12% of average per household gross income for all families in the areas surveyed. For laborers

and small farmers, this share of common property resource-based income to total income rose to a range of 30-48%; while for larger farmers the corresponding figure was 15% (see Jodha, 1983; 1985). Food products gathered from common property are a valuable source of nutrition for the poor for whom they have been found to contribute 8-9% of total direct dietary intake for laborers and small farmers (Ryan, et al, 1983).

CHARACTERISTICS RELEVANT TO COMMON PROPERTY RESOURCE SYSTEMS THEMSELVES:

There are certain characteristics of common property resources themselves that can influence the success of their provision through collective action. Note that all of the natural resource systems with which we are concerned are renewable.

d. The Scale of the Resource System:

Scale relates to the magnitude of the natural resource system. The question of the scale of provision of the collective goods produced from that system is addressed in the club goods component of the model. In discussing scale, it is useful to recall the differentiation between res nullius and res communalis types of natural resources (Ciriacy-Wantrup and Bishop,1975). This differentiation is at the core of distinguishing between an open access fishery

on the high seas contrasted to an artisanal coastal fishery, a large reserve forest covering thousands of acres contrasted with the village forest, the vast grazing lands of the Sahel, contrasted with the Alpine meadows.

In general, it can be stated that the smaller the resource system and the more recognizable its boundaries, the more amenable it will be to collective action efforts to manage its use (Coward, 1977). It will be helpful to relate resource scale to the user group as well, since a resource that is too small in the sense that it does not provide sufficient benefits to the whole group, is unlikely to be able to cover the costs of collective action to manage the provision of those benefits. The interrelationship between the scale of resource provision and the size of the relevant group is one of the major contributions of the club model.

e. Recognition of Resource Scarcity:

Scarcity appears to have an inverted "U" shape relationship with the probability of successful common property resource management (Hoben, 1979). At low levels it may be difficult to recognize the need for formal management tools to control use, while at severe levels, the costs of introducing and maintaining management may be too high. At low intensities of use more would be lost than gained, in an economic sense, by restricting use of the commons. Whereas at high levels of intensity, the point has been reached not only where the

value of the commons has been exhausted by overuse, but restricting current users would be of little value, since others would take their place at the first indication of positive value. It is at intermediate levels of resource scarcity that the probability of successfully initiating collective action for a common property resource is greater. Every user still benefits, but total benefits are being reduced by overuse. It is at this point that "users could gain from a fair system of restriction and anybody who increases his use inflicts losses on others that exceed his own gain" (Schelling, 1978:114; also see McGrath, 1989). Identifying this point is one of the contributions that the club goods model can bring to the analysis of CPR.

Actual resource scarcity and recognition of such are not the same thing. Resource scarcity can occur because there are too many individuals using the resource, because individuals are using it too fast, or a combination of both. The amount of time between the onset of overconsumption and exhaustion varies with the type of resource, its accessibility, and the rate of regeneration (Edney, 1980).

In analyzing renewable natural resources as sustainable club goods, we simply mean that the average rate of withdrawal of the good in question does not exceed its average rate of replenishment. For the continuance of successful collective action, resource systems must meet the criteria for

sustainability. More sophisticated tools of resource economics can be employed here to determine the carrying capacity and sustainability of a CPR. This is one area in which government involvement could be beneficial.

f. Type of Goods Suitable for Collective Action.

Economists typify goods as being inferior, normal, and superior. These are then related to elasticities of incomes. In defining the types of goods suitable for collective action, Hardin (1982) identifies them as having two characteristics: superior and nonfungible. Nonfungible goods are those that are not monetary or are not readily exchangeable for money. Examples are clean air, education, conservation, and health care. Superior goods are those for which the well off would be willing to spend a larger proportion of their income to secure than would the less well off. Hardin argues that many nonfungible goods collectively sought are superior goods.

On the other hand, the types of goods that I am concerned with are the outputs or products of renewable common property resource systems and they do not fit well with either of the above characteristics. Most renewable collective goods from common property resources, i.e. fuelwood, fodder, fish, irrigation water, etc., can be classified as normal goods meaning if they were marketable private goods, consumers would purchase more of them as

their incomes increased. This holds even more so for poor consumers who have higher elasticities of demand for such products (see Jodha, 1983;1985; Ryan, et al,1983).

Elinor Ostrom (forthcoming) makes a useful distinction between resource systems and resource units. Resource systems are thought of as the stock that is capable of producing a maximum quantity of a flow variable without harming the system. Resource units are what individuals use from resource systems. For example, a brackish water lagoon can be thought of as a resource system; and the crabs, shrimp, and fish that are captured from the lagoon are various types of units.

Conditions for sustaining collective action;

Just as important as getting collective action started is the issue of its sustainability. The conditions for initiating collective action I have just presented remain necessary for the sustainability of that collective action as well. There are additional conditions that are needed for collective action to continue once it has begun, a dynamic analysis of collective action. Some of these can be considered as carrot and stick conditions that help to sustain mutual cooperation. Such strategies are those that are provokable. They are spread by reciprocity and are enforced by retaliation.

g. Repetitive Encounters:

One criticism of Olson's analysis of collective action is its static nature (Hardin, 1982; Axelrod, 1984). In static analysis of choice the costs and benefits of alternative actions are checked and then a determination of the best alternative is made. In groups which are anomic and noniterative, members tend to be narrowly self-interested, since they have no need of knowledge of what other players are going to do. Contingent choosing and sanctioning are impossible, and individuals will never cooperate. In dynamic analysis, interactions are either ongoing or recurrent, meaning there is no single choice, but rather a sequence of choices to be made. Each person's future choice may be contingent on other's current choices. Players who rationally defect in noniterative Prisoners Dilemma games can rationally cooperate in iterative play (Taylor, 1976; Axelrod, 1984). Most interesting group choices are made by groups that are ongoing; often, choices are provoked by ongoing or repeated choice problems. It is such dynamic situations **that** characterize important CPR interactions.

It is **generally** agreed that cooperation may emerge as a rational strategy in open ended iterated Prisoners' Dilemma when there are even tacit opportunities for making one's choices contingent on those of one's partner, that is, threatening the partner with defection in return for defection, adopting a "Tit-for-Tat" strategy (Axelrod, 1984).

In this way rationality can become strategic. Cooperation is not assured, but neither is noncooperation imperative. This result weakens as the size of the group increases. The condition of repetitive interaction is made more compelling by considering it along with the importance of the future on present behavior.

h. The Shadow of the Future.

We have just seen that one condition that makes it possible for cooperation to emerge is the fact that participants might meet again. This possibility means that the choices made today not only determine the outcome of this move, but can also determine the later choice. The future can cast a shadow back upon the present and thereby affect the current strategic situation.

The future is generally less important than the present for two reasons. The first is that individuals tend to value payoffs less as the time of their obtainment recedes into the future. Secondly, there is always some chance that the individuals will not meet again.

In theoretical terms, the discount rate must be sufficiently small to make the future loom large in the calculation of the total payoffs. The very possibility of sustaining cooperation in collective action depends on there being a good chance of continuing interaction. As long as the

discount rate is small enough cooperation will be the appropriate strategy. If it rises above the threshold for stability, it will no longer pay to reciprocate the other's cooperation. If the other player is not likely to be seen again, it generally pays to defect rather than to cooperate.

In the situations that concern us in this study, there is no question but that individuals participating in the CPR will meet again and frequently. Repetitive interaction among the participants is a given. This leaves the question of determining the discount rates participants face in deciding on how important the future is vis a vis the present. It is generally held that poor people have high discount rates, meaning that present concerns with survival greatly out weigh consideration of future benefits. Determining discount rates is more complex than this simple assertion would indicate.

In CPR situations, discount rates depend on a number of factors, including: i) assurance that present participants and their heirs' will be able to reap the benefits of investments in the CPR both in the short and long term, ii) comparison of opportunities for more rapid return on investments in other settings, iii) discount rates may vary by types of participants: provider/users may have very low discount rates; users alone, somewhat higher; cooperators who neither provide nor use, even higher; and noncooperative

free riders, very high, iv) discount rates are affected by the general level of physical and economic security of the participants, and v) societies have general norms over the relative importance of the future to the present (see Ostrom,forthcoming).

An important way to promote cooperation is to arrange that the same individuals will meet each other again, be able to recognize each other from the past, and recall how each other behaved until now. This continuing interaction is what makes it possible for cooperation based on reciprocity to become stable. Cooperation can be promoted by enlarging the shadow of the future by making the interactions more durable and by making them more frequent. Prolonged interactions allow patterns of cooperation which are based on reciprocity to be worth trying and allows them to become established. Repetitive interaction will have an influence on the discount rate. This is one reason why cooperation emerges in villages more than it does in cities. The principle is: frequent interactions help promote stable cooperation. Thís is largely due to the lower transaction costs in making joint decisions in small communities and, as will be seen presently, to the greater social stigma for violating the common good. While it will not be addressed in any detail, it should be noted that the club model has the capacity to address time issues through the analysis of intergenerational variables.

i. Provocability:

In game theoretic terms, a provokable strategy is one that gives rise to responses to others behavior. Provocability means that the players will discriminate between those who respond to cooperation and those who do not. A cooperative move by one player provokes a cooperative response from the other player; and a noncooperative move, a noncooperative response. By retaliating with defection when met with defection, players discourage one another from persisting whenever defection is tried.

For collective action to get started, mutual cooperation among at least the k subgroup is needed. Once the collective good is being provided and its demand is being met, the k subgroup may need to recruit nonactive participants into its subgroup if the collective good is to continue to be provided. A provokable strategy is one that rewards cooperation with cooperation (as in the Assurance Game;see Sen,1967) and retaliates defection with defection. Assurance cuts both ways. Over time, cooperation can expect cooperation and' noncooperation can expect noncooperation, leading to reciprocal behavior.

j. **Reciprocity:**

The principle of reciprocity holds that people behave well because they see the advantages to be gained through cooperation with their fellows and recognize that they can

extract their due only if they fulfill their obligations as well(Colson, 1974). In the small-scale societies, under a minimal or diffuse government, the organization of public affairs is left to the community. In such societies, reciprocity is an important organizing force. People, and especially groups, confront one another not merely as distinct interests but also holding the possible inclination and certain rights to prosecute those interests. Unconditional cooperation, like unconditional defection, cannot only hurt the individual but it can hurt others as well.

Reciprocity, that is, making a conditional response to a provocation, is a better foundation for sustainability than is unconditional cooperation. Especially when there is no central authority to do the enforcement, the participants must rely on themselves to give each other the necessary incentives to elicit cooperation rather than defection. The relative importance of conditions g. and h., repetitive interaction and importance of the future, is reinforced by reciprocity. When the importance of the future is lessened, it may no longer pay to reciprocate the other's cooperation. On the other hand, cooperative exchanges over time can actually change the nature of the interaction. In terms of the Prisoners' Dilemma, this can be interpreted to mean that sustained mutual cooperation can alter the payoffs of the

players, making mutual cooperation even more valuable than it was before (Axelrod,1984).

A community using reciprocity can actually police itself, thereby reducing transaction costs associated with collective action. The question remains as to what form the enticement should take, but by guaranteeing punishment of any individual who tries to be less cooperative, the deviant strategy can be made unprofitable (see Sugden, 1985). This is an important finding, since internal monitoring is seen as a key to the successful management of many long existing CPRs (see E.Ostrom forthcoming).

k. Retaliation: Threats and Sanctions:

It was stated in Condition i that a noncooperative move will provoke a noncooperative response. What that response will be depends on the situation and on the rules that the group has established to deal with noncooperators. The chief means of enforcing cooperation is by retaliation through mutually deterring threats and sanctions. By threatening each other, agents can stabilize a realizable outcome. Thus, we can interpret threats as a mechanism for promoting cooperation. To enforce the stability of an agreed upon outcome, the provokable agents can announce specific reactions to potential noncooperative moves. If the potentially noncooperative agent will be worse off after the announced threat has been carried out, he should be deterred from

reneging on the agreement. In this way even non-binding agreements can be achieve stability(Moulin, 1982). By this definition a successful threat is one that is not carried out (Schelling, 1978). To sustain realizable outcomes through deterring threats, reneging strategies must be observable.

The ultimate threat is for the cooperators to withdraw their contribution to the collective action, but this would result in reverting to a classic Prisoners' Dilemma situation with noncooperation the dominant strategy for all. This is in fact what some analysts believe happens in many natural resource systems that are characterized by open access and free riding strategies(see McGrath, 1989). One characteristic of many people in small communities is that they cannot easily terminate a relationship if the return is unsatisfactory, because others may insist that the relationship still exists or because they are afraid to anger others by removing all checks on behavior. Mutual fear plays a significant role in keeping situations in small scale communities under some type of control (Colson, 1974). There is an awareness that everyone is vulnerable if there are no checks on behavior.

Before reaching this last resort, there may be other options that a group can use to enforce cooperative behavior among the users of a common property resource system. If the size

of the group is small in the sense that its members are recognizable and if the resource system is small with clearly defined boundaries, there can exist a high degree of noticeability of rule-breaking free riders. Punishment of cheaters can take any number of forms, but generally, the more the relevant group already has joint rules for purposes other than common property resource use, and the more bite behind those rules, the greater the chance are that rules governing the common property resource system will be enforced (Wade, 1986). Small-scale communities generally operate under a set of rules that define suitable social behavior. These rules operate to eliminate conflict of interests by defining what it is that people can expect from others in the community. In other words they reduce ambiguity that leads to conflict and increase assurance that leads to cooperation. Rules do not solve all problems, but they simplify interactions by presenting a framework for organizing activities.

Small groups are able to institutionalize ways of warning rule-breakers. Threats can be made through gossip, jokes, songs that contain messages of ridicule or condemnation (Colson, 1974). These are common devices used by people in small-scale communities, either because they have no institutionalized forms of authority or they prefer to deal with such situations through informal means. The importance of reputation in such societies has an enormous impact on

maintaining social control (Colson,1974). Loss of reputation is a strong deterrence to noncooperative behavior. Establishment of reputation, in the sense of making credible the threat of punishment or sanction, is a deterrence to others noncooperative behavior.

More formal methods of punishment can be handed out through the imposition of fines, ostracism, and the withholding of cooperation in other aspects of social life. In small-scale societies, characterized by dense social networks, cooperative behavior is necessary in many different aspects of interaction. The group, once it decides on a set of rules and once it decides to enforce them, may have little difficulty in doing so. The interesting question is not how rules limit actions or control behavior, but why people use rules to limit themselves.

The existence of provocability, reciprocity, and retaliation conditions means that a community should be able to establish fair rules and enforce them.

Conditions leading to failure of collective action:

Less we become too self assured, it may be appropriate to be reminded that in many instances collective action does not succeed. Either it never arises at all, or it cannot be sustained. Space does not permit more than a listing of a

number of factors that have been suggested. These include: population growth, the introduction of market economies, colonialism, intervention by centralized government; environmental stress; and technological change.

CLUB GOODS

Why a Club Model?

1) The issue of cooperation is inherent in club theory (Buchanan,1965).

2) Club goods are clearly related to res communalis type resources characteristic of CPR in which the relevant group is identifiable and exclusion of outsiders and free riders is feasible. In determining the optimal level of provision of goods produced by the CPR, we can also determine whether the CPR is capable of producing these goods on a sustainable basis. Information on carrying capacity and sustainable yields are relevant to making this determination.

3) Club model allows for a reduction of the free rider problem. Through monitoring of visits or utilization, clubs can circumvent the preference-revelation problem through a quasi-market type arrangement (Comes and Sandier, 1986) .

4) Club model is concerned with two issues of primary importance in collective action for common property resources - size of group and scale of the resource system. Club goods analysis can be matched with the various subsets of participants identified in conditions a. and b. In finding optimal levels of consumption of the club good for a particular size of user group, we can also uncover information on the level of provision necessary to supply this level of demand in a sustainable manner. This in turn can help in determining the number of providers needed to supply the club good, that is, the k group described in condition b. and finally,

5) Club model allows for institutional arrangements which depend on private collective action and self-governing efforts, thereby decreasing the need for government intervention.

The Theory of Clubs:

"A club is a voluntary group deriving mutual benefit from sharing one or more of the following: production costs, membership characteristics, or a good characterized by excludable benefits" (Sandier and Tschirhart,1980). Such groups form to exploit the cost reductions associated with economies of scale and to share certain types of public

goods. The central defining question in the theory of clubs is that of determining the membership margin, that is, the size of the most desirable cost and consumption sharing arrangement. "It is a theory of classification, of cooperative membership that will include as a variable to be determined the extension of ownership-consumption rights over differing number of persons" (Buchanan,1965). Clubs can be concerned with the production of goods and services; consumption of goods and services; and with the selection of a membership with which to perform one or both of the other two concerns - production and consumption. The theory of clubs provides the theoretical foundation for the analysis of allocational efficiency for an important class of impure public goods whose allocation can be achieved through private collective action. This collective action can compel honest preference revelation among the group, thus escaping the free rider problem associated with public goods. The theory can form the basis for analyzing the management of resources that are subject to crowding and congestion owing to use (Cornes and Sandier, 1986) .

Club Goods Model:

The goods and services provided by clubs are a type of public good, sometimes referred to as impure public goods (Comes and Sandier, 1986) . Recalling that pure public goods are characterized by nonrivalry and nonexcludability, club goods are a subclass of impure public goods whose benefits

are excludable at a reasonable cost, but remain at least partially nonrival. Because club goods are shared, this sharing eventually leads to a partial rivalry of benefits as membership in the club becomes larger. The increase in membership eventually causes crowding (congestion or overuse) which results in deterioration of the quality of the goods provided. Club goods share with CPR the characteristics of small-scale, exclusivity, and are subject to overuse.

If the optimal club size, N*, is equal to the whole population, i.e. N*=P, then the good in question is a pure public good characterized by jointness and complete nonexclusion and has closer relevance for res nullius resources. In cases where N*<P it pays for groups to consume collectively as long as crowding costs are low, the number of users small, or the average costs are decreasing at least over some range. Beyond a certain group size, crowding or congestion costs begin to rise faster than average costs fall (Berglas,1976). In those cases in which average costs eventually rise, either because scale economies are exhausted, or from the additional costs of crowding, an optimal club size smaller than the population may exist (Mueller, 1979).

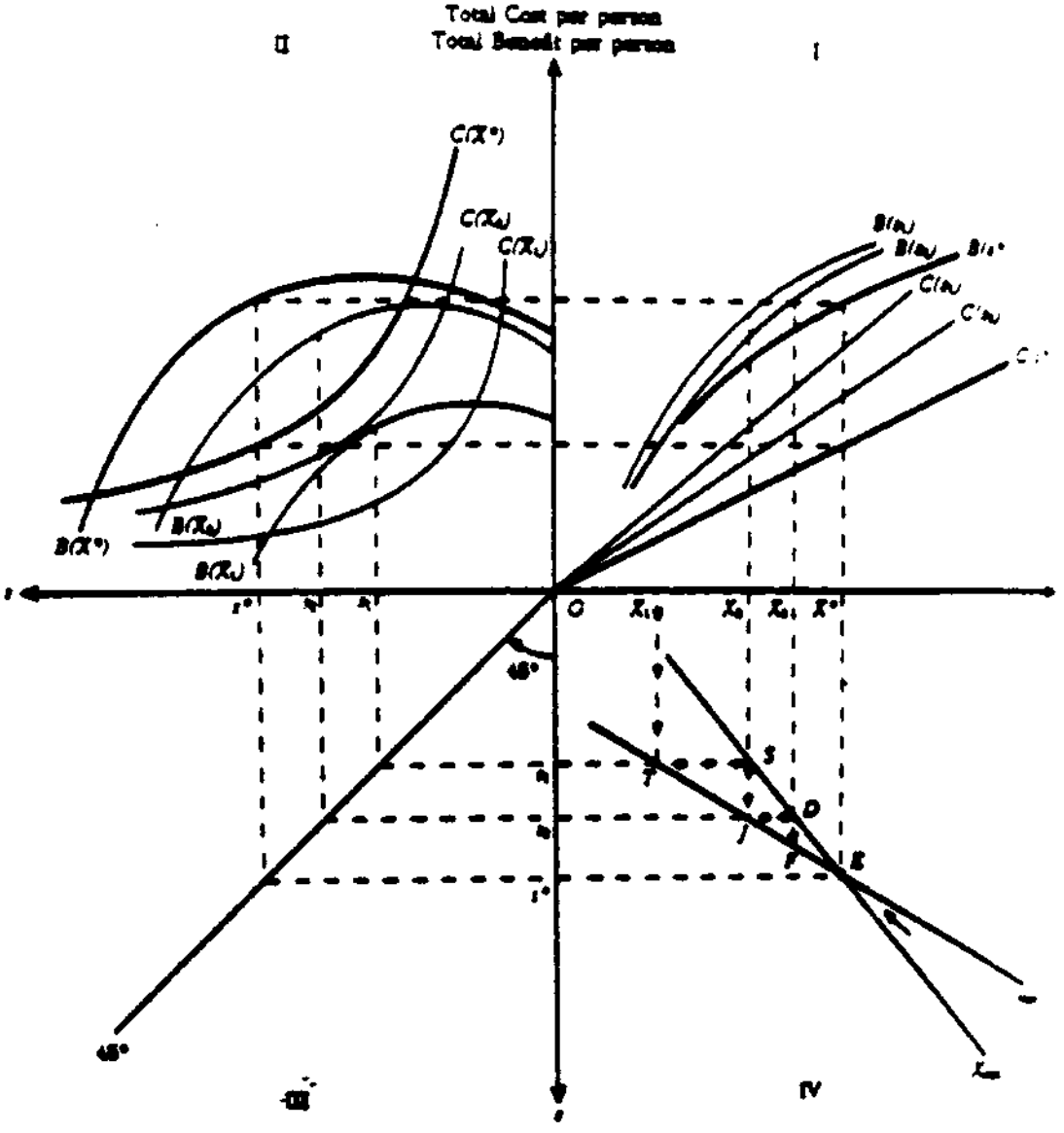
Economies of scale in clubs occur when the addition of a new member lowers the average cost of the club good to all other

members. When average costs begin to rise, it is either because scale economies have been exhausted or due to the additional costs of crowding. At this point overuse of the resource has begun.

The standard economic model of club theory, initially developed by Buchanan (1965) finds the conditions for optimal membership size and the optimal scale of provision of the club good and the interaction between these two variables. The graphic representation in Figure 1. is taken from Sandier and Tschirhart (1980) It is a combined four quadrant representation of the geometrical analysis presented as three separate graphs in the original Buchanan (1965) model. Quadrant I finds the scale of provision of the club good, X's, for varying size of membership, s's. An analogous exercise in quadrant II finds membership size, s's that maximize per person benefits for varying amounts of the club good. Quadrant II transposes scale of good and membership size information to quadrant IV, where the point of equilibrium, E, identifies the optimal size of the club, s opt, and the optimal scale of provision of the club good, X opt. (A more detailed description of the graphical presentation of the model is available from the author).

The characteristics of the club model most relevant to the analysis of collective action in CPR are : optimal membership size, optimal scale of provision, toll or

FIGURE 1


Total Cost per person
Total Benefit per person
II
I
III
IV
O
45°
45°

utilization conditions, financing conditions, income effects and monitoring costs. The club model can determine what the optimal group size and optimal scale of provision of the club good will be. "Optimal" needs to be understood as an ideal point toward which to strive. If club analysis of collective action for CPR indicates suboptimal levels in membership size or scale of provision of the good, this does not necessarily mean that the collective action is unsuccessful. It can rather be interpreted as indicating that improvements can be made either in reducing (or increasing) membership size, or utilization rates, or scale of provision of the good to a level of sustainability. Whether any of these actions should be undertaken, and how, remains a question to be addressed at the next step in the process of developing a more complete theory of collective action. Recent work by Elinor Ostrom (forthcoming) provides valuable insights to these institutional aspects of collective action.

What the club model provides is a systematic framework for understanding important parameters of CPR in which collective action is an ongoing process or can be recommended as an intervention for the successful management of such resources. Club analysis can tell us: i) if the CPR is being overused at current levels of exploitation and by how much; what optimal level of provision is needed to satisfy consumption by the group. This data can be compared

with information on carrying capacities for the CPR and help in determining parameters for sustainable use; ii) it will give some idea as to what the costs will be, including: utilization costs, exclusion costs, crowding costs, and monitoring costs; and iii) what the finance conditions will be; what amount of tolls will be necessary for covering costs, whether a two part tariff may be needed to cover costs, i.e. a fixed membership fee and a utilization fee.

The information derived from the club goods framework can then be employed to inform more specific institutional analysis for both ongoing situations and those with potential for collective action intervention.

Membership Considerations:

A unique contribution of the theory of clubs is its analysis of membership. It is in essence a theory of membership, defining ownership-membership arrangements in terms of the identity and size of the sharing group, the allocation of costs, and the sharing of benefits. The central question in club theory is that of determining the membership margin, the size of the most desirable cost and consumption sharing arrangement. For a given size facility or amount of the club good, some optimal size club will exist. This level is determined at the point where the derivatives of the total cost and total benefit functions are equal.

As additional persons are allowed to participate in the sharing arrangement, the individual's benefit initially rises but then begins to decline at some point. There may be both an increasing and a constant range of the total benefit function, but at some point congestion will set in and the individual's marginal valuation of the good will fall. Thus, total benefits curves will be concave for goods that involve some commonality in consumption.

Provision Considerations:

These derive an optimal goods quantity for each size club. Referring to the graph in Figure 1, to determine optimal goods quantity, for a single member club, we may find that the optimal goods quantity is zero; the total cost function may increase more rapidly than the total benefit function from the outset. As more members are added, the total costs to the single member fall (proportionately if equal sharing is assumed). The total benefit function will slope upward to the right but after some initial range it will be concave downward and at some point reach a maximum.

The provision condition does not differ much from Samuelson's provision condition for public goods, except in terms of the number of individuals aggregated and the interaction of the membership condition and provision condition. The optimal membership size occurs when the

relevant marginal rate of substitution (MRS) equals the marginal costs of increasing membership size.

The institutional form of provision may vary. There may be competitive provision, market provision, private collective provision, imperfectly competitive provision, monopoly and oligopoly, or government provision.

Costs and Finance Considerations:

The club model also undertakes analysis of costs and financing conditions. Exclusion, transaction, monitoring, and congestion costs can all be considered and related to self-financing mechanisms. Exclusion costs are associated with the erection, maintenance, or existence of a mechanism to limit club utilization or membership (Sandier and Tschirhart, 1980). They can be treated as waiting or queuing costs, which depend on the number of users; as a resource cost of exclusion; or by including the extent of exclusion in the transformation function by comparing the marginal benefits of utilization (nonexclusion) with marginal exclusion costs. This last approach is important because it distinguishes between publicness in consumption models where the degree of rivalry is exogenous to the problem and publicness in production, where rivalry is an endogenous variable (see Kamien, Schwartz, and Roberts, 1973).

Self-financing and efficient tolls and optimal provision of **the shared good:**

The finance condition states that the sum of the tolls paid on a unit of the shared good should cover the marginal costs of provision. The toll is multiplied by the average utilization rate when determining toll revenues on a unit of the shared good because each unit can be utilized more than once. While an efficient per unit toll serves to finance marginal costs, the toll fails to finance the shared good whenever average costs exceed marginal costs. That is, when there are increasing returns to scale. In this situation, a two-part tariff can levy a fixed membership fee and a utilization fee. The fixed fee attempts to recover the needed revenue required to self-finance the provision of the shared good. Some outside intervention, such as subsidies, may be necessary for financing when a fixed charge is not assigned.

Most transaction costs are independent of the level of use and provision; however, some may vary with the membership size or provision. Choosing between alternative institutional forms requires careful consideration of transaction costs and welfare levels implied by different institutional structures.

Income effects:

The optimal club size, for any quantity of good, will tend to become smaller as the real income of a member is increased. Goods that exhibit some "publicness" at low income levels may, therefore, tend to become "private" as income levels advance. This suggests that the number of activities that are organized optimally under cooperative sharing arrangements will tend to be somewhat larger in low-income communities than in high-income communities, other things being equal.

CONCLUSIONS. IMPROVING CONDITIONS FOR SUCCESSFUL COLLECTIVE ACTION.

I would like to conclude by briefly suggesting three ways for improving the conditions for successful collective action: making the future more important relative to the present; changing the payoffs to the players; and teaching the players values, facts, and skills that will promote cooperation.

Enlarging the shadow of the future:

It was shown above that mutual cooperation can emerge and be sustained if the future is seen to be sufficiently important relative to the present. This is because the players can use an implicit threat of retaliation against the other's defection if the interaction will last long enough to make the threat effective. Cooperation can be enhanced by

enlarging the shadow of the future by making interactions more lasting and more frequent. Prolonging interactions allow patterns of cooperative behavior to become established Increasing the recurrence of interaction tends to promote cooperation, since the next move occurs sooner and therefore looms larger than it ordinarily would. Both of these characteristics can be expected to be found in villages where relations are concentrated in a dense social network and where cooperative behavior can permeate many aspects of social life. Closely linked with enlarging the shadow of the future is increasing the payoffs both current and future, available from cooperating in CPR use and management.

Changing the payoffs:

Changing a situation from a Prisoners" Dilemma to one of cooperation is in effect changing the payoff structure to the participants. While such a shift might require a rather large transformation in the payoff structure (Axelrod, 1984), even small transformations can help to make cooperation more appealing. In order to promote cooperation through modification of the payoffs, it is not necessary to go as **far** as to eliminate the gap between short run incentives and long-run incentives. It is only necessary to make long-run incentives for mutual cooperation greater than the short-run incentive for defection. This involves both carrot and stick type conditions discussed above. Making the costs for short-run defections greater through sanctions and

punishments, while at the same time increasing the benefits to be gained from long-run cooperation.

Another way to change to payoffs is to increase the value of club goods produced in the CPR system. This can be done by rationalizing their production for marketing through the creation of community based small enterprises that permit the participants to capture value additions to CPR goods. This can lead to incentives for improved management and increase active participation in the provision of the club goods.

Finally there is the issue of teaching people how to cooperate. When there is no central authority, people must learn how to rely on themselves to give each other the necessary incentives to elicit cooperation rather than defection. A community that understands reciprocity can police itself. By effectively punishing noncooperative behavior, the community can make such a strategy unprofitable. Thus in teaching the participants how to cooperate, both reciprocity and reward and punishment should be high on the curriculum. The education process needs to be extended to policy makers and government. Collective action by groups of villagers should not be perceived as a threat to the social order. Rather, it needs to be understood as a viable and perhaps necessary tool for effective, fair, and sustainable management of CPR.

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