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PROCEEDINGS of the
CONFERENCE on

COMMON PROPERTY RESOURCE MANAGEMENT



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CONFERENCE on
**COMMON PROPERTY
RESOURCE MANAGEMENT**

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FOREWORD

M. S. Swaminathan

People dependent upon renewable natural resources have evolved ways of managing them properly. When they have failed to do so, the people, the resources, or both have disappeared. Communities have developed such institutionalized forms of control as irrigation councils in southern Asia, forest-cutting controls in Nepal, wildlife utilization taboos and regulations in the Congo Basin, the hema system of pasture protection in Arabia, fishermen's indigenous associations in western and southern Asia, and land use management for conservation in Zimbabwe.

When practiced at the community level, this common property resource management has often been successful, or the resources would have vanished long since. In many places, these systems, or remnants of them, still exist. In others, the management systems are more recent but have been adapted from traditional practices of other cultures and have survived modernization. Examples of this sort are the Zanjera irrigation system in the Philippines and the Islamic practices relating to land use and water rights in West Africa.

The papers in this volume, brought together as a result of an in-depth process of expert consultation and debate by the National Research Council, show an encouraging trend among academic people for this rediscovery of very old resource management practices and institutions existing among many communities. Even more than that, they show us as planners and development professionals that in many places these institutions are still alive. This is a hopeful sign, given the inability of many private and state level resource management systems to come to grips with the need for long-term sustainability of resource use issues. Restoring to the community the responsibility that was originally its own may be our only hope for the future

protection of our soil, water, fisheries, pastures,
forests, and wildlife.

M. S. Swaminathan
Director General
International Rice Research Institute
and
President
International Union for Conservation
of Nature and Natural Resources

PREFACE

Economic well-being throughout the world is directly related to the management and productivity of environmental systems. As indigenous social systems are transformed, economic emphases altered, and land-use patterns modified, human adaptations and regulatory mechanisms that earlier maintained the balance between man and his environment break down, and use of renewable resources can no longer be prudently asserted. However, drawing on the adaptations of the past, as well as on contemporary scientific insight, management systems can be improved so that the resources basic to the availability of food, fuel, fodder, and shelter can be restored and exploited on a sustainable basis.

The note of urgency regarding issues of common property resource management emerged from a series of studies and associated deliberations conducted by the National Research Council's Advisory Committee on the Sahel. The Council's Conference on Common Property Resource Management was undertaken to assess systematically differing institutional arrangements for the effective conservation and utilization of jointly managed resources. The members of the Panel on Common Property Resource Management, recognizing the global dimensions of the current environmental emergency, selected case studies drawn from four continents and a broad range of cultural and environmental settings. It is hoped that the background papers, case studies, and conclusions of the conference will contribute substantively to efforts to rehabilitate and manage the soils, water resources, forests, rangelands, agricultural lands, and other jointly held resources that constitute the global commons.

The contributions of several individuals made the conference a reality. Financial support was provided by the National Research Council, the United States Agency

for International Development, the Ford Foundation, and the World Wildlife Fund. The members of the panel were active in all phases of this effort. They contributed to the conceptualization of the conference, to the difficult task of selecting participants so as to provide appropriate geographical and topical balance, to the convening of pre-conference seminars to assist with the preparation of appropriately structured case studies, to the organization of the conference itself, and to the technical editing of the case studies. Many panel members also presented papers that appear in this volume. Emery Castle of Oregon State University, Adelaide Cromwell Gulliver of Boston University, and Robert Repetto of the World Resources Institute provided valuable criticisms and suggestions on various drafts of the proceedings.

Many other individuals contributed to this effort as well. Particular recognition must be given to Irene Martinez, whose concern, skills, and energy contributed significantly to the success of the conference and the preparation of the conference proceedings. Michael G. C. McDonald Dow frequently interrupted his own work to assist with the common property program. Other staff members who contributed to the program include Ann Harrington, who served as conference expeditor, and Hertha Hanu and Barbara Jones, who assisted with the preparation and reproduction of conference documents.

The enormous task of editing the proceedings volume fell to F. R. Ruskin, in collaboration with Patti Lowery. The final production of the proceedings was facilitated by the commitment and efforts of Susan Piarulli, Mark Dafforn, and Mary Lee Schneiders. Jeffrey A. Gritzner served as program director.

CONTENTS

FOREWORD	M. S. Swaminathan	v
PREFACE		vii
PART ONE: BACKGROUND		
1. The Common Property Challenge	Daniel W. Bromley	1
2. Conference on Common Property Resource Management: An Introduction	David H. Feeny	7
3. A Model for the Analysis of Common Property Problems	Ronald J. Oakerson	13
4. Common Property and Collective Action in Economic Development	C. Ford Runge	31
PART TWO: CASE STUDIES		
Fish and Wildlife Resources		
5. Marine Inshore Fishery Management in Turkey	Fikret Berkes	63
6. Sea Tenure in Bahia, Brazil	John C. Cordell Margaret A. McKean	85
7. Overfishing and Conflict in a Traditional Fishery: San Miguel Bay, Philippines	Wilfrido D. Cruz	115

- | | | |
|--|------------------|-----|
| 8. A Social Dilemma in a Less Developed Country: The Massacre of the African Elephant in Zaire | Emizet Kisangani | 137 |
|--|------------------|-----|

Water Resources

- | | | |
|--|------------------------------------|-----|
| 9. Common Property Management of Water in Botswana | Louise R. Fortmann
Emery M. Roe | 161 |
| 10. Private Rights and Collective Management of Water in a High Atlas Berber Tribe | Mohamed Mahdi | 181 |
| 11. Canal Irrigation in Egypt: Common Property Management | Robert C. Hunt | 199 |
| 12. Tank Irrigation in India: An Example of Common Property Resource Management | K. William Easter
K. Palanisami | 215 |
| 13. Common Property Resource Management in South Indian Villages | Robert Wade | 231 |

Range and Pastureland Resources

- | | | |
|---|--|-----|
| 14. Management of Common Grazing Lands: Tamahdite, Morocco | Neal E. Artz
Brien E. Norton
James T. O'Rourke | 259 |
| 15. Oukaimedene, Morocco: A High Mountain <u>Aqdal</u> | Jere L. Gilles
Abdellah Hammoudi
Mohamed Mahdi | 261 |
| 16. Socioecology of Stress: Why Do Common Property Resource Management Projects Fail? | Anil K. Gupta | 305 |

Agriculture Land Resources

- | | | |
|--|------------------------------------|-----|
| 17. Commonfield Agriculture: The Andes and Medieval England Compared | Bruce Campbell
Ricardo A. Godoy | 323 |
|--|------------------------------------|-----|

- | | | |
|--|----------------|-----|
| 18. Information Problems
Involved in Partitioning
the Commons for Cultivation
in Botswana | Susan G. Wynne | 359 |
|--|----------------|-----|

Forest and Bushland Resources

- | | | |
|---|--|-----|
| 19. Institutional Dynamics:
The Evolution and Dissolution
of Common Property Resource
Management | James T. Thomson
David H. Feeny
Ronald J. Oakerson | 391 |
| 20. Collective Management of
Hill Forests in Nepal:
The Community Forestry
Development Project | J. E. M. Arnold
J. Gabriel Campbell | 425 |
| 21. People and Resources in
Nepal: Customary Resource
Management Systems of the
Upper Kali Gandaki | D. A. Messerschmidt | 455 |
| 22. The Management and Use
of Common Property Resources
in Tamil Nadu, India | Piers M. Blaikie
John C. Harriss
Adam N. Pain | 481 |
| 23. Minor Forest Products as
Common Property Resources in
East Kalimantan, Indonesia | Timothy C. Jessup
Nancy Lee Peluso | 505 |
| 24. Management of Traditional
Common Lands (<u>Iriaichi</u>)
in Japan | Margaret A. McKean | 533 |

PART THREE: CONCLUSIONS

- | | | |
|---|-------------------|-----|
| 25. Closing Comments at the
Conference on Common
Property Resource Management | Daniel W. Bromley | 591 |
| 26. Issues of Definition and
Theory: Some Conclusions
and Hypotheses | Elinor Ostrom | 597 |
| 27. Concluding Statement | Pauline E. Peters | 615 |

- | | | |
|---------------------------------|--|-----|
| AUTHORS AND PARTICIPANTS | | 621 |
|---------------------------------|--|-----|

PART ONE: Background

The Common Property Challenge*

Daniel W. Bromley

The degradation of natural resources in the tropics must be stopped--not only for its own sake, but because approximately 80 percent of the world's population depend on these resources for their spare and precarious existence. If degradation problems are to be solved, they must first be understood. If we are to understand resource degradation, then we must understand human behavior with respect to those resources. The behavior that now threatens natural resources is the product of a constellation of rules and conventions. To understand resource degradation, then, we must first comprehend the full array of these rules and conventions--incentives, sanctions, rights, duties, and privileges. We must also understand how these affect an individual's relationship both to other individuals and to the group.

At the end of this conference, we will be expected to have developed several specific products. The first will be a set of performance indicators that speaks both to resource integrity and to the human dimension. That is, we cannot recommend a resource management regime that precludes any human use of the ecosystem; practicality demands

*Opening comments prepared for the Conference on Common Property Resource Management.

that we regard the social system and the ecosystem as equally important and then search for both management and use regimes that--almost as a compromise--allow both components to survive, if not prosper.

A second product will be that we have identified at least three major causes of success or failure in common property resource management situations. Therefore, as the week progresses, we should look for general principles that can be related to particular regimes. It may be that correlations are all we can acquire in this brief period. I would not despair if this were the best we could do. Causality comes dear to social scientists. A few well-founded correspondences are certainly to be preferred to even one mis-specified causal relationship. I urge caution here, and modest expectations.

As a third product, we will be expected to develop in some detail at least three major research undertakings that are the logical result of our conceptual and empirical deliberations. These research tasks should have as their central objective the greater elucidation and clarification of the relationships among: (1) the ecosystem; (2) technique; (3) the congeries of rules and conventions regarding resource use, as well as rules for making new rules; (4) the patterns of interaction among all members of the social system under study--but especially of the resource users themselves; and finally (5) the outcome or performance of this entire "going concern."

The fourth and final product we will develop consists of at least five major items for the action agenda of the development assistance agencies and the host countries with whom they cooperate. These activities must be programmatic in nature; they should not be specific projects. They will need to entail a major commitment of the host country and the donor agency in the country to be studied. And these activities must be designed and implemented so that the lessons learned can be readily transferred to other resource situations in other countries.

I suggest that the obvious starting place in our concern for common property resources is to understand the reasons in the first instance for the existence of joint-control arrangements as opposed to individual control. The anthropologist would likely suggest some survival explanation; the sociologist might look for reasons related to group cohesion; the economist might propose that joint control saves important scarce resources that might be required under atomistic control. The common thread, obviously, is that the group as a whole has some abiding

interest in survival, in cohesion, in the benefits and costs attendant to a particular use regime, and in economizing on perceived scarcities.

Quite assuredly, joint control of one natural resource may be unrelated to the control of other natural resources, as well as of other objects significant to the groups. Put somewhat differently, the group develops differential decision domains over significant objects--both naturally occurring and manufactured--depending upon some calculus regarding practicality, risk management, equity, and the costs of making a wrong decision. This means that the group keeps a diverse "set of books" over its various assets, depending on the variables just described. For some objects, atomistic control is fine. For others, either because of the physical imperatives of the object, because of the technical imperatives of using that object, or because of the critical role that the object plays in the survival of the group, group control is required.

The structure provided by Oakerson in his presentation to us is rightly concerned with institutional change and adaptation. However, for now, we may have to be content with merely describing different situations, and with offering tentative hypotheses about what we observe; proposals for change may need to be deferred until some time in the future. Indeed, I urge that we not move too quickly to "solutions." Prescription must await explanation; after all, prescription is prediction, and we do not yet know enough to predict.

I suggest that our task will be complicated by the frequent incongruence between rules and conventions and the behaviors that derive from those conventions. Oakerson talks of reciprocity as it contrasts to a "free ride." I think there is an important elaboration to be made in that regard, and I ask you to consider both positive and negative reciprocity. Positive reciprocity might be thought of as an individual's doing something because it is understood that others will do the same. Negative reciprocity is, therefore, an individual's failing to do something because it is expected that others also will not do something. Both behaviors are reciprocal, they derive from expectations about the likely actions of others, and they are motivated by a desire on the part of the individual to "go along with the crowd"--for good or for ill. The free rider, on the other hand, avoids doing something because it is expected that others will do it. Altruism is the converse of free riding in that an individual does something because others are expected not to. In contrast to

reciprocity (either positive or negative), the free rider or the altruist wants to "go it alone."

We will need to be sensitive to the conditions of reciprocity as well as to free riding, and we will need to look for indications of how incentives and sanctions for these behaviors are structured. But we must also understand that compliance with existing rules and conventions is not necessarily widespread--indeed, it may be the exception, as we will see in several of the case studies to be presented.

As we turn to that important task, we must all applaud the shift in focus away from natural resources as commodities, and toward management regimes, systems, and mechanisms. By saying that, I do not mean that the resources themselves are unimportant, but there can be no hope for progress in avoiding resource degradation if there is no progress in understanding management regimes and the rules and conventions that determine resource control.

The case studies to be presented are our data--they are means to an end. We must be both bold and cautious, bold in lumping, splitting, challenging, and searching for relations; and cautious in declaring that we have located truth. The future of donor-country/host-country relations in the domain of natural resource programs rests on what we do this week, and how we do it. I am aware of few other exercises in which pan-resource management regimes have been the object of such focused and intense analytic scrutiny by an interdisciplinary group of this stature.

Most exercises that have attempted to span several natural resources have been rather cosmic in nature--claiming that we must stop this or that immediately if we are to avoid catastrophe. The unique aspect of our task is that we recognize--even insist--that the resource needs of human beings take center stage; we are denied the luxury of simple platitudes about denying current users any future access. Idealists will be critical because we did not condemn, for instance, swidden agriculture or proper solutions that ignore immediate human need.

But we start with several constraints. First, pragmatic policy for the rehabilitation and stabilization of degraded ecosystems requires that such programs proceed so that users are able to retain their current role in that ecosystem; we cannot expect to develop programs that evict people. Second, the relations between donor agencies and host countries--and so the prospects for success in resource degradation problems--will depend upon the depth of our understanding and analysis of the problems that we

will study over the course of our discussions. If we miss essential ingredients in the diagnosis of current resource situations, then programs that evolve will miss the mark--and badly.

Let us search the case studies for lessons, for insights, for common elements, and also for their logical inconsistencies. Let us finally, after several decades of intellectual imperialism regarding the structure of natural resource regimes in the tropics, be prepared to indicate a few things that perhaps should not be done, a few things that seem to be feasible options, and--yes--even a few things that we do not yet know.

Resource management in the tropics will be much influenced by the document that is to come out of this conference; the imprimatur of the National Research Council assures us of that. The document will be studied to see whether our own framework of analysis has been sufficiently consistent and rigorous; it will be scrutinized to judge whether we have been properly circumspect in the conclusions drawn, and attentive to the imperatives of economic, cultural, and political realities.

If we accomplish little else, I hope that we will use this opportunity to give both scope and substance to the questions that must be asked of all resource management regimes in the tropics. This would provide a valuable diagnostic framework that others might find helpful as they ponder resource degradation in various settings. That framework must be action oriented, and it must be rather simple. We must develop a taxonomic structure of resource management regimes that goes beyond the mere simplicity of common property, private property, and open access. Along with a taxonomy, we must develop a diagnostic process and a set of operating procedures that will allow nonexperts to gain a general understanding of resource management regimes and problems.

I am pleased to be part of this important exercise, and I am awed by the collection of talent represented in this room. If we can but harness our collective experiences, our complementary disciplinary skills, and our individual dedication to the task before us, this conference cannot fail.

Conference on Common Property Resource Management: An Introduction

David H. Feeny

THE ISSUE

Throughout the world today, various common property resource systems are coming under increased pressure, particularly in the tropics and subtropics. Rapid rates of population growth, technological change, increases in the size of markets, and cultural change, as well as uneven growth and persistent poverty, have often resulted in increased levels of utilization of various natural-resource-based systems. Forests are being cleared rapidly; groundwater is being pumped to the surface at an often alarmingly high rate; fish and wildlife populations are declining in the face of loss of habitat and high levels of harvesting; range and pasture lands are being overgrazed; and other examples abound. Because the exploitation of these resource systems represents an important component in the livelihoods of people throughout Africa, Asia, and Latin America, their degradation cannot be ignored.

Although resource degradation is an issue of great concern in the current scene, generalizations concerning worsening conditions or their causes cannot be universally applied. More specifically, there are no simple and valid generalizations concerning the relationship between resource degradation and the type of property-rights regime. Degradation as well as successful management occur in cases of private, state, and common property. In

particular, several common property management regimes have functioned well and are still the preferred form of resource management in many places.

The basic question that motivated the organization of the Annapolis conference was how and why certain groups have been able to manage common property resources successfully while others have not. The focus was on the institutional arrangements that governed the relationships among people who were associated with each other through the use of the resource. The theme was an inquiry into the nature and causes of success and failure.

PLANNING FOR THE CONFERENCE

Planning for the conference began in the summer of 1983 and culminated in the first meeting of an ad hoc steering committee (that was later transformed into the Panel on Common Property Resource Management) in September 1983. The committee quickly reached consensus on several points. First, we were confident that there was a rich body of research on the management of common property resources in the tropics and subtropics. Second, we concurred that the existing literature needed to be identified, collected, and synthesized. Third, we agreed that by bringing the evidence together we would obtain a detailed and useful understanding of the operation of a wide variety of systems of resource management. Fourth, we felt that a barrier to the previous synthesis of this body of evidence was that it comprised a diverse set of studies that had been conducted by scholars from different disciplines, working in different regions of the world, on a wide variety of resource systems.

The committee therefore decided that a special effort would be required to identify investigators working in this field and to tap into the large body of existing evidence. To locate relevant work, a questionnaire initially was sent to a small group of investigators known to members of the committee; recipients were invited to suggest the names of other investigators. The result has been the development of the Common Property Resource Management Network, a body currently composed of more than 800 investigators who have responded to the questionnaire.¹

The committee then decided to plan a conference on common property management that would be based on a collection of case studies and focused on the institutions of resource management. The original plan was to have a case

study on each of four resources (fish and wildlife, forests and bushland, range and pastures, and water, both surface water and groundwater) for each of four major world regions (sub-Saharan Africa, Asia, Latin America and the Caribbean, and North Africa and the Middle East). Relevant studies were identified initially through the use of the network, and authors were invited to submit abstracts.

A third major decision was to provide explicitly for a comparison across case studies. A common framework for the preparation of case studies was developed (see Oakerson, Chapter 3). The use of the framework allowed the conference to move beyond the presentation and discussion of high-quality case studies into comparative work and the generation of inductive hypotheses (see, for instance, Bromley, this volume, and Ostrom, this volume).

The selection of participants and case studies for the conference was guided by the plan to achieve diversity across regions and resource systems. Given the wealth of abstracts submitted, we had little difficulty in obtaining diverse and representative case studies with a range of disciplinary approaches, and the submission of several abstracts on the management of agricultural land led to its inclusion among the resource categories represented. The committee determined that the case studies that would be presented at the conference should also represent a range of outcomes from very successful management to examples of limited success.

The committee then decided on the organization of pre-conference workshops for case study presenters. It was felt that a meeting largely focused on the discussion of the framework (Oakerson, this volume) was needed to clarify its use. The two workshops (approximately half of the case study authors attended each) also allowed for a preliminary discussion of each case study and greatly facilitated the main event by familiarizing conference participants with each other and each other's work. As a result, serious discussion was possible from the very beginning of the conference in Annapolis.

THE CONFERENCE

Drafts of the case study papers contained in this volume were read by all participants before the conference. During the conference, each author was given ten minutes to present his case study. Sessions were organized around each of the five major resource types. The brief presen-

tations were followed by active discussion. Additional sessions and discussions were organized in small groups around proposals for the research agenda, the policy agenda, and three major issues (the effects of multiple levels of management, the effects of group size, and mechanisms for dispute settlement) that transcended resources and regions.

The panel owes a debt of gratitude to all conference participants who entered into lively, stimulating, and informed discussions that cut across disciplinary and other boundaries. Knowledge of how common property resource management systems work, as well as the factors that appear to influence success, or lack of it, in managing such systems was greatly enhanced by the conference. Important items for the research and action agendas were generated. In sum, the conference accomplished a great deal and laid a solid foundation for future work.

NOTE

1. An associated common property resource management network newsletter is published by the Center for Natural Resource Policy and Management at the University of Minnesota, in collaboration with the International Union for Conservation of Nature and Natural Resources and the National Research Council. Core support for the publication of the newsletter has been provided by the Ford Foundation.

A Model for the Analysis of Common Property Problems

Ronald J. Oakerson

The subject of this paper could be stated as a riddle: how are forests, fishing grounds, pastures, parks, ground-water supplies, and public highways all alike? Answer: each one is often--even typically--a "commons," a resource or facility shared by a community of producers or consumers. The list of common property resources and facilities is highly diverse and could be greatly extended. A commons can have a fixed location or it can occur as a "fugitive" resource (fish and wildlife). Some commons are renewable (grasslands), others are not (oil pools). Some are both open access and indivisible and therefore must be organized as common property, if organized at all (large fishing grounds or large forests); others are treated as a commons by choice (small pastures). All common property nevertheless faces one common problem: how to coordinate individual users to attain an optimal rate of production or consumption for the whole community.

More precisely defined, a commons is an economic resource or facility subject to individual use but not to individual possession. It can be distinguished from both collective consumption goods (also called "pure" public goods) and private goods. The first are collectively consumed, as in the case of a street lamp, in the sense that the rate of consumption is independent of the number of consumers and the particular use made of the good. The

second is subject to the exclusive use and possession of individuals. With respect to a commons, the total rate of consumption varies with both the number of users and the type of use and, at the same time, use is joint in the sense that several individuals share the same resource or facility. Problems of coordination generally become apparent when there is some significant change in the pattern and/or level of use; such a change often is associated with increasing scarcity. If the community of users is unable to work through existing arrangements to respond appropriately to changes, destructive competition or conflict among users may follow. Resource depletion (or degradation of facilities) results--an eventuality characterized by Hardin (1968) as the "tragedy of the commons." In specific cases, the consequences may be soil erosion, overgrazing, diminishing fish harvests, disappearing species, nonrenewing woodlots, or impassable roads.

The purpose of this paper is to present a model that can be used to analyze common property problems whatever the particular resource or facility. Such a model must be specific enough to offer guidance in the field, yet general enough to permit application to widely variable situations. The trick is to develop concepts that identify key attributes shared broadly by common property problems and that can be treated as variables that take on different values from one circumstance to another. Relationships among these variables should be specified in a way that allows one to diagnose what is wrong and why in particular situations. On this basis, potential solutions can be offered.

A scholar or practitioner who is familiar with a certain problem situation will have access to a large body of technical, historical, cultural, economic, and political information concerning that situation. The model presented here invites the analyst to sort this body of information into four mutually exclusive subsets: (1) the technical and/or physical attributes of the specific resource or facility; (2) the decision-making arrangements (organization and rules) that currently govern relationships among users (and others relevant); (3) the patterns of interaction among decision makers; and (4) outcomes or consequences (V. Ostrom 1974:55; Oakerson 1981:81). Each subset is a separate component of the model. The plan of discussion, to follow, is to introduce each of the four components, to examine the relationships in the model among its components, and, finally, to suggest ways of applying the model iteratively to understand the impact of institutional change and adaptation.

COMPONENTS OF THE MCOEL

Technical and Physical Attributes

All common property problems are rooted in some set of constraints either given in nature or inherent in available technology. The technical and physical constraints can be analyzed against three concepts drawn from economics literature: (1) jointness of consumption or supply, (2) exclusion, and (3) indivisibility. Each concept can be expressed as a variable, as indicated below.

Jointness

This concept was originally used to define a "pure public good" (Samuelson 1954). Jointness means that no single beneficiary of some good subtracts from the ability of others to derive benefits; it ordinarily refers to simultaneous use, but can be modified to include serial use. The opposite of jointness defines the case in which a single individual fully consumes (and destroys) a good. As a variable, jointness refers to degrees of subtractability (V. Ostrom and E. Ostrom 1978) in the use of common property. All common property falls, by definition, into the broad range of partial subtractability. Each individual user is potentially capable of subtracting from the welfare of other users; but, within limits, all users can derive benefits jointly. The analyst should specify, as precisely as possible, the limiting conditions within which jointness can be maintained. The relevant conditions include, for example, grazing limits in a commons pasture, trapping limits in a lobsterery, and weight limits on a highway. These limits, established in nature or technology, provide essential information for devising rules to maximize the joint beneficial use of the commons. "Jointness can then characterize common property as it does a pure public good with this difference: one person's lawful use does not subtract from the lawful use of others" (Oakerson 1981). Given an appropriate set of rules, based on limiting conditions, the same economies of sharing that Samuelson demonstrated with respect to a pure public good may also be available to the users of common property.

It is important for the model, however, that limiting conditions be specified without respect to any rules in place. The relevant limits at this point in the analysis are those derived from nature or technology, not those derived from rules.

Exclusion

The "exclusion principle," also used by economists to differentiate private from public goods (Musgrave 1959), ordinarily refers to the ability of sellers to exclude potential buyers from goods and services unless they pay the stipulated price. The concept can be broadened somewhat to include the question of access to any good, including a commons. The opposite of exclusion is complete openness--unlimited access. Common property is not necessarily characterized by open access (Runge 1981). Access may be fully controlled on an individual basis or partially controlled and applied only to those outside the immediate community. As a variable, the degree of exclusion attainable depends upon both the physical nature of a resource (or design of a facility) and available technology. Historically, open range was difficult to fence; but the development of barbed wire greatly relaxed this limitation. Again, at this point in the analysis, one is interested not in an exclusion or nonexclusion policy, but rather in "excludability": the limiting conditions that apply to the possibility of exclusion--conditions established by nature and/or technology. Although common property problems do not depend upon the existence of difficulty with exclusion, these problems are clearly exacerbated by nonexclusion.

Indivisibility

Is the commons divisible? Could the property held in common feasibly be divided among private property holders? What would be the costs of doing so? If the commons is not divisible, what boundary conditions apply to its regulation? On what scale would regulation have to occur to be effective?

Underlying boundary conditions derive from nature or technology and should not be confused with legal boundaries, that is, boundaries imposed by rule. Consider the example of a groundwater basin. The common pool of water has a definite set of physical boundaries. The legal boundaries of a jurisdictional unit formed to deal with the groundwater problem may or may not correspond to the physical boundaries of the resource. Other common property resources may have less determinate physical boundaries; nonetheless, it still may be possible to assign boundaries based on physical or technical attributes of the commons.

The western range in the United States, for example, might superficially be viewed as a single commons; but variations in weather and soil conditions prompt the "division" of the range into much smaller units for management purposes.

The analysis must contain some sense of underlying boundary conditions, even if they are somewhat ambiguous. If the boundaries chosen for the purposes of analysis are too small, then relevant aspects of the problem will be left outside; if the boundaries are too large, then multiple problems may be compounded. If the precise boundary is somewhat arbitrary, the question is whether it lies within an acceptable range.

Together, the three concepts--jointness, exclusion, and indivisibility--provide a way of summarizing the physical and technical nature of a commons. In general, common property is characterized by partial jointness and the probability of some difficulty with exclusion within a limited set of boundaries. The precise conditions, of course, vary from one situation to another.

Decision-Making Arrangements

The second component of the model consists of rules--those rules that structure individual and collective choices with respect to the particular "commons" defined by the first component. These arrangements may also be thought of as "organizational" or "institutional," as the reader prefers (the designation used here is intended to convey a very broad set of arrangements that are not confined to any single "organization" or "institution"). Parts of several institutions are generally implicated in the management or mismanagement of a commons.

In general, decision-making arrangements have to do with authority relationships that determine who decides what in relation to whom. In the discussion below, decision-making arrangements are sorted into three subsets: first, rules that establish conditions of collective choice within the group most immediately involved with the commons; second, "operational" rules that regulate use of the commons; and third, external arrangements, those decision structures outside the immediate group, that impinge on how the commons is used.

Conditions of Collective Choice

Rules that establish the ability of some group to act collectively (to make decisions common to the group), are especially relevant to the management of common property. Obstacles to collective choice are at the same time opportunities for individualistic choice--decisions that individuals can make on their own without the consent of others. When a group is unable to act collectively, individual members are left free to act separately. Four different relationships can be considered to affect the conditions of collective choice: (1) the capacity of individuals to act solely on the basis of personal discretion in matters of concern to others, perhaps preempting action by others or initiating an action that creates costs of opposition for others; (2) the availability of potential sources of remedy to individuals adversely affected by others; (3) the capacity of an affected population to relax the rule of willing consent and make a collective decision binding on all parties; and (4) the presence of potential veto positions in any process of collective decision making--opportunities for one or more decision makers to say "no."

Typically, common property arrangements give use rights to individuals. Hardin's "tragedy of the commons" occurs in a context of unrestricted individual rights to use the commons. Individuals may also, however, be vested with rights that protect them from injury caused by others. Remedies may be available through such "third-party" arrangements as courts. Beyond the domain of individual decision making, a community of users may be able to act collectively to establish limits on individual use. Some decision makers may enjoy a veto capability in this process, perhaps by virtue of official position.

Operational Rules

The content of collective choice is the "operational rules" that regulate use of the commons. Three types of rules can be distinguished, each related to one of the three technical and/or physical features found in the first component of the model. (1) Partitioning rules are those that serve to limit user behavior in the interest of jointness. Behavior is partitioned into subtractive and nonsubtractive sets. If more than one type of use is made of a commons, partitioning rules should take into account

the relationships among those various uses. Some types of use may be compatible; others, sharply conflicting. At times a commons is physically partitioned for individual use without dividing it into separate parcels of property; the effect is to partially segregate different or incompatible uses (for example, a parking lot). (2) Entry and exit rules (E. Ostrom n.d.) are concerned with exclusion and seek to regulate access to a commons. This set of rules includes qualifications for participation in a community of users (entry) and whether membership in an organization of users is compulsory (exit). (3) Any organizational arrangement for governing a commons must stipulate a set of jurisdictional boundaries. These boundary rules, however, may be more or less congruent with the underlying boundary conditions determined by the technical and/or physical nature of the commons.

External Arrangements

Decision-making arrangements external to the community of users will also be relevant in most cases. The relevance, however, varies widely. Some external arrangements may be mainly constitutional in connection with the commons, establishing the capability of the community of users to act collectively. (For example, California enabling legislation that allows the formation of groundwater basin management districts.) At the other extreme, a community of users may be entirely dependent on external decision makers for the legislation and enforcement of operational rules. In this case, external arrangements are frequently bureaucratic, characterized by some combination of central rule making and field officer discretion. Third-party arrangements may also be available externally to consider disputes between users. Courts of law fall into this category, but so do such other arrangements as a bureaucratic hearing officer or a traditional local chief in areas with a tribal history. Finally, market arrangements external to the commons may be relevant in establishing economic parameters within which management of the commons can be undertaken. If there were no market in land, for example, those who use common land for grazing or agriculture would be affected differently than if land were scarce or in great demand.

Patterns of Interaction

Given the technical and/or physical features of a commons and the decision-making arrangements available to govern it, the next question concerns behavior: what patterns of interaction characterize the behavior of users and other decision makers in relation to the commons? It is assumed that the important elements of individual behavior are interdependent (Runge 1981). What matters is how individuals choose to behave in relation to one another. Patterns of interaction derive from mutual choice of strategies; that is, each individual's choice of strategy (how to relate to others) depends upon individual expectations of others' behavior.

Choices are generally viewed in terms of a comparison of costs and benefits. These economic concepts, however, are very abstract. Behaviorally, a cost can be treated as any perceived obstacle to the choice of some alternative (Buchanan 1969). Conversely, a benefit is any perceived inducement to choose one alternative over another. Individual choices thus derive from a mental image of obstacles and inducements in one's environment. Patterns of interaction cannot be understood except in terms of these elements of choice.

The basic pattern of interaction on which successful joint use of the commons depends is reciprocity. In a pattern of reciprocity, individuals contribute (through mutual action or mutual forbearance) to each other's welfare, but without the interposition of an immediate quid pro quo. Instead, reciprocity depends on mutual expectations of positive performance (Oakerson 1983). Note that a pattern of reciprocity differs from exchange (Boulding 1972). Exchange is a fully contingent relationship with each transaction; but reciprocity is contingent only through time, as individuals learn what to expect from one another. What is ordinarily called "collective action" can be understood as the reciprocal interaction of individuals.

The abandonment of reciprocity is reflected in the development of free rider strategies. Free riding is the opposite of reciprocity: one fails to contribute with the expectation that others will contribute. The prospect of "riding free" on the contributions of others can be a considerable inducement; but an even more powerful obstacle to the choice of cooperative strategies may be the expectation that others will choose free rider strategies. Decision-making arrangements attempt to avoid inducements and obstacles to choice that lead persons to abandon a pattern of reciprocity.

Although cooperation and noncooperation among users are the primary strategies of interest, there are also important secondary strategies (which in turn affect the choice of primary strategies). Within the community of users, the degree to which individuals attempt to monitor one another's behavior and to hold one another accountable to common standards of behavior is a relevant variable. If decision-making arrangements provide for the enforcement of rules and application of sanctions, then the choice of enforcement strategies by officials may be critical (other decision makers, from bureaucrats to judges, may also play a role). In general, any assignment of a decision-making capability simply sets parameters within which individuals choose strategies.

If reciprocity among users is fully abandoned, what follows is some pattern of mutually destructive competition and/or conflict. Users may try to drive one another out to preclude mutually subtractive use. Or they may engage in a competitive race to exploit the commons without regard to an optimal rate of use. Relevant patterns of interaction may include concealment, deceit, intimidation, threats, and violence.

Outcomes

Patterns of interaction produce outcomes. To supply information for this fourth component of the model, the analyst is required to (1) stipulate the use of evaluative criteria and (2) search for consequences that affect users and decision makers (and others involved) in accordance with these criteria. The study of consequences is necessarily value laden. One cannot even distinguish relevant consequences without first having in mind evaluative criteria. The most commonly used criteria are efficiency and equity. The analyst, however, must somehow convert these abstractions into operational measures of social value that can be used to appraise specific outcomes.

Efficiency

Considerations of efficiency in the use of commons generally relate to the overall rate of use. Technical and physical attributes dictate some optimal rate. Excessive use leads to resource depletion or facility degradation. Inefficiency is also present if the resource or facility

is underutilized: closed commons can create as much inefficiency as open commons. If it would be feasible to develop a rule structure to sustain joint use with greater openness, then excluding potential users is inefficient. A plan of regulation should be evaluated in terms of the value of uses foregone in addition to the value of uses retained.

To conclude that there is inefficiency in the use of common property, one should be able to use the test of Pareto optimality: if at least one person could be made better off, and no one worse off, by a modification in the use of the commons, then present outcomes are inefficient; conversely, the proposed change is efficient. The emphasis here is on identifying Pareto-efficient changes, that is, improvements in efficiency, rather than on the identification of a Pareto-optimum condition from which no further improvement is possible. Information requirements are reduced by seeking amelioration rather than optimization per se.

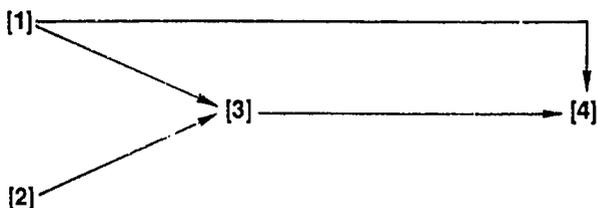
Equity

Considerations of equity are, somewhat surprisingly, closely related to efficiency concerns. The basic question of equity is this: do individuals get a reasonable and fair return on their contribution to a collective undertaking to regulate a commons? Inefficiency and inequity are apt to be mixed together in common property problems. Indeed the presence of inequities may lead to the collapse of collective efforts, resulting in inefficiency. Equity problems are exacerbated by asymmetries among users, which create opportunities for some to benefit at others' expense. This, in turn, can lead to costly conflict where all parties lose. Such situations may still admit of Pareto-efficient change. In any event, Pareto-efficient changes satisfy a minimal standard of fairness: they do no harm.

Other questions that arise from considerations of equity include the possibility of arbitrary exclusion from the common or selective enforcement of rules. Abuse of authority and/or corruption may contribute to a pattern of inequity.

RELATIONSHIPS IN THE MODEL

The first two components of the model can be thought of broadly as independent or exogenous variables in the short term. The third and fourth components are endogenous, the third intervening. The basic relationships are depicted in Figure 1 below:



-
- [1] Technical/Physical Attributes
 - [2] Decision-Making Arrangements
 - [3] Patterns of Interaction
 - [4] Outcomes or Consequences

FIGURE 1 Relationships among independent variables.

Individuals choose strategies in [3]. These choices reflect the combined set of constraints and opportunities found in [1] and [2]. The mutual choice of strategies comprises some pattern of social interaction. From interactions, consequences [4] follow, subject to evaluation.

The technical and physical characteristics of common property [1] affect outcomes [4] both through the mutual choice of strategies by relevant decision makers and independent of human choice. The constraints found in [1] are "hard" constraints. If ignored in the process of choice, constraints in [1] still affect outcomes in [4]. Decision-making arrangements in [2], on the other hand, have no effect on outcomes [4] independent of human choice and interaction [3]. Institutional constraints are "soft" constraints, made operative only through human knowledge, choice, and action. Rules found in [2] exist entirely in the realm of language, whether written or unwritten. Decision-making arrangements, therefore, need to be comprehended as commonly understood and applied by the relevant community of decision makers.

A good example of the way in which the physical nature of a resource affects individual strategies and social interaction is found in the case of Maine inshore lobster fisheries (Wilson 1977). Unlike schooling fish, the sedentary lobster inhabits small inshore areas. Thus, the fishing area is easily accessible and can be monitored daily by the community of lobstermen. Lobster traps are marked by each lobsterman in distinctive colors, so small communities of lobstermen can define and monitor exclusive fishing areas. Lobstermen from outside the community may lose their gear, but within the community mutual forbearance allows "locals" to leave their gear. This pattern of interaction allows the community to control access to the commons. Decision-making arrangements within the community are entirely voluntary. Those outside the community have no effective recourse to gain access. The physical nature of the resource sets the relatively small set of boundaries that defines each inshore area and makes it possible to exclude individual fishermen. Jointness is feasible so long as fishermen are willing to act with mutual forbearance.

Coal-haul roads in east Kentucky (Oakerson 1981) afford an example of how the distribution of decision-making capabilities [2] can affect the mutual choice of strategies [3]. Rural highway development, provision, and maintenance is largely a state government responsibility in Kentucky; but the application of criminal sanctions against violators of state-prescribed legal weight limits is in the hands of locally elected judges. Through the office of the county judge, local communities are able to maintain a free rider strategy in behalf of the coal industry. State efforts to respond with a strategy of withholding maintenance from coal-field highways proved politically infeasible because ordinary users were affected jointly with coal hauliers. State highway officials nevertheless can and do reduce the maintenance efforts on selected coal-haul routes. The outcome is a highway system subject to severe overuse and inadequate maintenance.

Each component of the model separately summarizes some portion of a problem. When an outcome [4] is evaluated negatively, one should then work backward through the model to determine relationships. How do adverse consequences [4] flow from the prevailing patterns of interactions [3]? What strategies are inherent in those patterns? What structure of obstacles and inducements contributes to those choices? How does the structure of obstacles and inducements derive from elements of decision-making arrangements

[2] and the technical and physical attributes [1] of the commons?

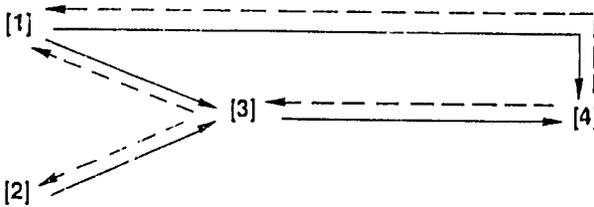
Consequences disclose the effect [4] of a difficulty. The difficulty is manifest behaviorally in patterns of interaction [3]. The source of the difficulty, however, lies in some lack of symmetry or congruence between [1] and [2]--a mismatch between the technical and physical nature of a commons and the decision-making arrangements used to govern its use. The lack of a good "fit" between these two components of the model sets up a perverse structure of obstacles and inducements leading individuals into counterproductive patterns of interaction [3].

Incongruence between [1] and [2] is first apparent in the relationship between operational rules and corresponding technical and physical attributes of a commons. Partitioning rules should closely match underlying conditions of jointness; entry and exit rules must be related to conditions of exclusion (excludability); and boundary rules ought to reflect those boundary conditions inherent in the nature of common property. If efforts to adapt operational rules to technical and physical attributes have failed, and there is a general understanding in the relevant community of the relationships between attributes of the commons and specific operational rules, one can conclude that there is some problem with the organizational conditions of collective choice. Further, if efforts to adjust the conditions of collective choice in the community have failed, the difficulty may lie with external arrangements. At some point, an analyst may choose to arbitrarily close off the analysis, accepting some larger set of decision-making arrangements as given, and inquire into means of improvement within the established order.

Having diagnosed problem conditions by working backward through the model, one can turn to questions of design: how to rearrange decision making by adjusting rules to better fit the nature of a commons. Design requires that one work prospectively forward through the model. What do key features of the technical and physical component [1] require of operational rules and conditions of collective choice? What adjustments might be made in external decision-making arrangements? How would these changes in [2] affect the structure of obstacles and inducements to choice that face decision makers? What choice of strategies, and resultant patterns of interaction [3], would the analyst predict? How would predicted patterns of interaction affect users of the commons and others [4]? Rule changes produce different outcomes only to the extent that individual choices of strategy are modified.

A DYNAMIC MODEL

Often there are opportunities to study specific problem situations over a considerable period of time and thereby observe various efforts to resolve a difficulty. Each change in decision-making arrangements can be associated with changes in patterns of interaction and outcomes. Over time, changes can also occur in the technical and physical nature of a commons. In the short-run analysis, undertaken for a diagnostic purpose, both the nature of the commons [1] and decision-making arrangements [2] are assumed to be unchanging. A long-run analysis, however, must allow for change in both sets of variables. The model is modified by adding a set of long-term relationships, shown by the broken lines in Figure 2 below:



-
- [1] Technical/Physical Attributes
 - [2] Decision-Making Arrangements
 - [3] Patterns of Interaction
 - [4] Outcomes or Consequences

FIGURE 2 Long-term relationships among independent variables.

One way to introduce a longer time horizon into the analysis is to apply the simpler (solid line) model iteratively. As changes occur in [1] and [2], changes in [3] and [4] are observed. This approach treats institutional change as exogenous to the model; the aim is simply to understand how changes in decision-making arrangements affect patterns of interaction and outcomes. Viewing change as exogenous, however, contributes nothing to an understanding of how change comes about.

The more complex model (with broken lines) introduces a set of relationships that are pertinent to understanding institutional change. Outcomes can affect patterns of interaction insofar as a process of learning occurs, causing individuals to modify their strategies. Instead of continuing to produce outcomes on the basis of decision-making arrangements as given, individuals may attempt to modify those arrangements to produce better outcomes. Similarly, individuals may invest in technological innovation that would change the technical and physical attributes of the commons. The latter may also be subject to change over time as an indirect result of strategies pursued in securing outcomes; this is easily seen if prevailing patterns of interaction result eventually in the destruction of a resource.

The effort to understand institutional change raises new issues. What opportunities are present for learning the consequences of one's action? How do existing decision-making arrangements constrain the individual's ability to make incremental adjustments in those same decision-making arrangements? This question touches upon the community's ability to make effective constitutional choices to modify perverse patterns of interaction. Moreover, what incentives promote investment in technological change?

CONCLUSION

The purpose of the model presented here is to aid in the collection and assimilation of case-by-case analysis. The ability to observe regularities across many different cases depends upon the use of a common framework for analysis. Some method is needed to array information into meaningful sets in order to examine relevant relationships in a particular case. Use of a common method by a community of scholars enhances the comparability of separate case studies. As scholars use and apply a model, and exchange ideas, the model, too, becomes the subject of change--elaboration or modification--in view of experience. The model developed here is therefore offered simply as a point of departure in a joint effort of scholarship and research.

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Common Property and Collective Action in Economic Development

C. Ford Runge

INTRODUCTION

In much of the developing world, common property provides a complex system of norms and conventions to regulate individual rights to use a variety of natural resources, including forests, range, and water. These arrangements closely resemble those that dominated the early stages of European economic development, where institutional rules specifying joint use by a village or other well-defined group prevailed as a form of resource management for at least a thousand years. With the forced enclosure movements of the fifteenth and sixteenth centuries, the common property typical of early Western Europe declined, although it did not disappear. Many localities maintain complex arrangements of joint tenancy. Common property institutions continue to be observed, for example, on Swiss grazing lands and elsewhere in Europe (Netting 1978; Rhodes and Thompson 1975).

The European experience with enclosure provides a rich background for this study. The immediate purpose of the study, however, is to explore contemporary problems of common property resource management in developing countries. Although common property has proved a stable form of resource management in some traditional societies, the combination of population growth, technological change, climate, and political forces have destabilized many exist-

ing property institutions.¹ A fundamental issue in much of the developing world is the degree to which resource mismanagement has actually been caused by common property arrangements. In the Sahel and southern Africa, for example, serious misuse of resources has been alleged to be the direct result of traditional common property institutions (see Hitchcock 1981; Picardi and Seifert 1976; Glantz 1977). In response, western economic consultants and planners have called for the imposition of private property rights (Johnson 1972; Picardi 1974).

Similarly motivated private property schemes have been attempted throughout the developing world. Many, perhaps most, have failed to stop overuse, and in many cases may have contributed to even more rapid degradation of resources and to increased inequality in already unequal distributions of wealth. Not unlike the European experience with enclosure, lands formerly held in common are often transferred to individuals (such as high-ranking government bureaucrats) who can exercise influence in the allocation of use rights. These individuals have then failed to manage these resources effectively.

Despite this record, such policies are often supported by those who argue on theoretical grounds that individual incentives inevitably lead common property to be mismanaged. Modern economists often refer to this as the "free rider" problem. When applied to resource management, the free rider problem leads to the conclusion that common property is not a viable institutional alternative.

This paper presents an alternative perspective. It describes a number of reasons why common property may be as viable as private property on grounds of both efficiency and equity. Rather than representing an atavistic arrangement of rights that inevitably results in inefficient resource use, common property institutions may actually contain much that is valuable, and new institutional arrangements with common property characteristics may also be worthwhile. In many cases, these institutions may play a key role in the effective management of scarce natural resources, complementing and combining with private rights. What follows is thus neither an attack on private property nor a wholesale endorsement of common property. It is an argument in favor of institutions that are well-adapted to the particular resource constraints facing villages and groups in developing countries. In this sense, it stems from the work on institutional constraints and innovation developed by Hayami and Ruttan (1985).

As an institution, common property is to be dis-

tinguished from free and open access, where there are no rules regulating individual use rights (Ciriacy-Wantrup and Bishop 1975). Often, what appears to the outside observer to be open access may involve tacit cooperation by individual users according to a complex set of rules specifying rights of joint use. This is common property. Empirically, it is crucial to distinguish between open access and common property if appropriate policy is to be formulated. Problems of open access arise from unrestricted entry, whereas problems of common property result from tensions in the structure of joint use rights adopted by a particular village or group. These tensions may arise from a variety of complex causes, including population pressure, changes in technology, climate, or political forces. The thesis of this article is that too often these causes have been confused, and the problem ascribed simply to the "tragedy of the commons" (Hardin 1968), in which the misuse of resources is attributed to the institution of common property itself. The problems with this view, and an alternative competing hypothesis, are investigated below.

COMMON PROPERTY AND THE VILLAGE ECONOMY

To appreciate the traditional role of common property resource management, three stylized characteristics of village life in less developed economies must be understood. The first, which follows almost from the definition "less developed," is relative poverty. Evidence of low incomes and levels of living are obvious enough conditions of poverty. What is less obvious is that this poverty, by imposing a strict budget constraint, also eliminates myriad opportunities for many villagers acting alone and many villages acting collectively. These limitations can make a joint use rights a necessity, not simply a virtuous bit of cooperation. In particular, the transactions costs of well-defined and enforced private property typical of the West may simply be too great for a subsistence economy to bear.

Consider the capacity for enforceable claims of private property, crucial to the flexibility and acceptance of such a system. Private rights--individual rights to exclude others--must be based on clear definition and assignment in connection with the thing owned, together with a mechanism to adjudicate disputes when they arise. The more things for which exclusive rights are assigned and defined, the greater must be the social investment in assignment, definition, and adjudication. If common property--the

individual right to joint use--is the norm, comparatively fewer claims must be assigned and defined. Less clarity in the assignment of rights (at least by Western standards) may also result. However, this is balanced against reduced social costs of assignment and definition. Naturally, some enforcement and adjudication of even these claims is necessary.

In developed economies of the West, the substantial social overhead necessary for a system of private rights is often hidden from view, except when one faces court costs or becomes directly involved in titling or litigation. Even then, the social overhead required by assigned, defined, and transferable private property rights, and the capacity to support this superstructure through legal fees and taxes, often goes unrecognized. This capacity is difficult to maintain without an expensive support structure capable of effectively recording, administering, and adjudicating local disputes over these claims.

In a poor, developing economy, a malfunctioning approximation to a Western bureaucratic system would likely be based on incipient titles promulgated by a centralized authority that is only dimly aware of local conditions. Such a situation may be worse than continued dependence on local level common property rules. The fair enforcement of formalized private rights and duties may be prohibitively costly compared with customary arrangements. These customary arrangements may involve some private rights that are enforced locally, as well as common rights and a wide variety of "mixed" arrangements. To suppose that these results of poverty are in fact its cause is a heroic claim, although one that has been made in studies of privatization (North and Thomas 1977).

A second characteristic of life in a village economy is that it is critically dependent on a local agricultural and natural resource base. That a majority of the work force moves away from direct dependence on this base is indeed a mark of development; as this happens, higher value-added goods are produced with inputs from points removed from the local economy, and become the primary outputs of the society (see Johnston and Mellor 1961). Because the distribution of basic natural resources such as soil or water (including rainfall) is often quite random over both time and space, the assignment of exclusive use rights to a given land area can yield an inherently unfair distribution of resources, as compared to the more equitable results of assigning joint rights of access to these resources. Such distributions may tend to become further

skewed as individuals with an advantageous initial endowment acquire more resources over time. Such increasing inequality may have dynamic destabilizing effects that are ultimately very costly to efficient local resource use.

A third characteristic of life in a developing economy is a consequence of the first two. Poverty, together with a dependence on low value-added outputs and relatively randomly distributed natural resources, results in a high degree of uncertainty with respect to income streams. Poverty eliminates the cushion against adversity represented by accumulated wealth. The random element in natural resource allocation introduces additional uncertainty for those whose income depends on the rain's falling or the hunt's succeeding. In contrast, much more of the randomness of nature is under control in a developed economy, whether due to irrigated crop production, feedlot livestock operations, or a highly developed food distribution chain, which allows local risks to be shared and hence reduces uncertainty.

In the face of the uncertainty characteristic of life in a developing economy, no individual can be assured that he or she will be spared failure. Given the intimate connection between basic resources and subsistence, unpredictable events such as floods or drought may bring disease or death. In the face of this environmental uncertainty, common property institutions may be created; rather than emphasizing the right to exclude some, these institutions provide instead for the right of many to be equally included as a hedge against uncertainty. The expectation is that when one is in need, aid will be forthcoming from others in return for a like commitment; this may indeed be more agreeable than "going it alone" in the face of nature.² This "insurance" against environmental uncertainties complements the relative efficiency of common property, especially in pastoral situations where rainfall, rather than land, is a scarce resource.

Poverty, natural resource dependency, and resulting uncertainties thus create an incentive structure that may make common property a comparatively rational solution to certain problems of resource management. In what follows, I will call this a solution to the "assurance problem," one in a class of coordination problems in which individuals organize their behavior by reference to a particular rule or norm. Sometimes, this rule may be based on joint use. Before developing the argument for common property institutions along these lines, however, it is necessary to examine current approaches to common property institutions

and their limitations. While capturing certain truths in the history of resource management, much current literature leads to the false conclusion that common property is universally mismanaged. This conclusion is not always valid, suggesting the need for a more complete explanation of incentives and choices in resource management.

THE FREE RIDER PROBLEM

The free rider problem results when an individual shirks responsibility to the community or group. It is often argued that the incentive for this behavior is logical from the point of view of narrow self-interest. Such narrow logic leads to an outcome in which the group as a whole is made worse off. An often-cited parable used to illustrate this behavior is the "tragedy of the commons," in which the private benefit of grazing an additional head of cattle on a common range exceeds the private cost, because the costs of maintaining range quality can be shifted to the group as a whole (Hardin 1968). The "tragedy" of overgrazing results from each person's incentive to free ride regardless of the expected actions of others. Even if an agreement is struck that specifies that all will refrain from further grazing, the strict dominance of free rider strategy makes such a contract unstable.

Some argue that the proper solution for overgrazing a common range is therefore to "internalize" its costs by making the public aspects of the range private. Instituting a scheme of such rights, if they are properly enforced, is argued to be a necessary (though not a sufficient) condition for creating a market for private grazing rights. This approach has led a number of economists to argue that the mere existence of common property rights over a scarce resource will lead to a tragedy of the commons (Demsetz 1967; Cheung 1970; Furubotn and Pejovich 1972; North and Thomas 1977).

As noted above, this position ignores considerable historical and empirical evidence to the contrary and is due in part to a lack of familiarity with common property in practice, and the associated failure to distinguish problems of free and open access from those of common property.³ However, the fundamental problem is that free rider behavior is assumed to be a dominant motive, against which the group is defenseless.⁴

This motive is often described by reference to the "prisoner's dilemma," a simple game in which collective

decisions produce outcomes harmful to the group as a whole without intervention by some higher authority. The two-person prisoner's dilemma is illustrated in the following gain-loss table.

Cooperate or defect represent the choices (or strategies) open to each of two prisoners. The ordered pairs indicate the payoffs that will result from a particular coincidence of choices by each person; the first number

TABLE 1 The Prisoner's Dilemma.

First Person	Second Person	
	Cooperate	Defect
Cooperate	(1, 1)	(-2, 2)
Defect	(2, -2)	(-1, -1)

represents the payoff to the first person, the second number for the second person. Imagine that the prisoners are interrogated separately. Both know that if they cooperate with each other and neither confesses, they will receive suspended sentences (1, 1); if one defects and turns state's evidence, he will be paid and released, and the other will receive a heavy prison term (2, -2) (-2, 2). If both defect, each gets a prison sentence (-1, -1). Assuming mutually disinterested motivation, the course of action represented by the pair (1, 1) is not an equilibrium. To protect himself, if not to further his own interests, each has a sufficient reason to defect, whatever the other does. "Rational" decisions by each prisoner individually make both worse off. Even if communication between the individuals results in an agreement to cooperate, both have an incentive to break it. Therefore, the noncooperative pair, (-1, -1) is an inferior Nash equilibrium.

Now imagine a village of n individuals who must graze cattle on a common range of fixed size. Each individual must choose to do one of two things. One is "stinting," or cooperative grazing on the commons. The second is grazing at a level that, while advantageous to the individual, ultimately results in exploitative overuse of the commons. This defection strategy is the free rider option. The cost of grazing to each individual is a function of the grazing decisions of all n individuals. If all

cooperate, then the common range is preserved and cattle remain healthy. But if the prisoner's dilemma logic accurately portrays the incentives of the village, no one will have an incentive to cooperate and all will defect, leading to overgrazing.

This analysis of overgrazing may be generalized as a "binary choice with externalities," of which the multiperson prisoner's dilemma (MPD) is one example (Schelling 1973; Runge 1985). The decision whether to cooperate with others in observing a stinting rule, or to defect, is binary when the choice is between cooperation and defection (C and D) and it has external effects when it alters consumption of the resource by other agents. (In trivial cases, the resource is so abundant that no negative external consumption effect occurs.) If agents derive payoffs from cooperation or defection based on the number of other agents who also choose either C or D, then among $n + 1$ individuals there are 2^n possible configurations of choice, depending on how many choose C or D. The decisions of all agents result in a particular physical product of the resource (for example, "total forage availability") from which each agent derives positive utility.

I will first consider this binary choice in terms of a uniform MPD, then extend the analysis to include multiple equilibria and the absence of dominant strategies, which I have argued elsewhere may better approximate actual common property resource decisions (Runge 1981, 1984a). This approach provides a theoretical basis for empirical testing of complex incentive structures in various resource regimes.

THE MULTIPERSON PRISONER'S DILEMMA (MPD)

The MPD is characterized by n agents, each with the same binary choice and the same payoffs. As noted above, each agent has a dominant choice, whatever others do, which is dominant for all n agents. Each also has a dominant preference for the other's choices. These preferences go in opposite directions: each prefers that all others cooperate while he himself defects; so defection strictly dominates cooperation, leading to a unique, Pareto-inferior Nash equilibrium. However, there is some number, $k > 1$, such that if k individuals cooperate and the rest defect, those who cooperate are still better off than if they had all defected. If we explicitly assume the uniformity of agents, k is independent of the particular agents who

cooperate or defect, eliminating the possibility (at this level of analysis) of "leadership." Below, this assumption will be relaxed. For now, the number k represents the minimum coalition that can make positive gains by cooperating with the rule even though others do not. Where $k = n$, no one gains from cooperation unless cooperation is universal and there are no free riders (a coalition of the whole). Where $k < n$, some free riders ($n - k$) can be tolerated while the k cooperators gain, although the $n - k$ free riders benefit more than do the cooperators.

Consider Figure 1(a), in which two linear payoff curves are drawn for a village population of $n + 1$, reflecting the benefits of cooperation and defection in an interdependent decision framework to the $(n + 1)$ th agent, where n equals the number of other resource users. The upper curve corresponds to the dominant choice of defection, D . Its left end is labeled O , the open access equilibrium, in which no agents cooperate and rents are driven to zero. The D curve rises monotonically to the right. Below it is the dominated cooperation strategy C , which also begins at the open access equilibrium O , rises monotonically and crosses the axis at point k where positive gains to cooperation begin. The number choosing to cooperate with the proposed rule in Figure 1 is denoted by the distance along the horizontal axis.

The vertical axis of Figure 1 shows the payoff to cooperation by agent $(n + 1)$ when a certain number of others choose to cooperate and the remainder defect. At $k = n/2$ in Figure 1(a), for example, positive gains are made by cooperators whenever at least half of the other agents cooperate by stinting. Because D lies everywhere above C , it is a strictly dominant strategy. Monotonicity of both curves in the same direction implies that cooperation leads to uniformly positive externalities, and defection to uniformly negative externalities. The C curve is higher on the right than the D curve on the left, reflecting the Pareto-inefficiency of the dominant defection strategy. The dotted lines show total (or average) values corresponding to the number of agents choosing the two strategies, and point m represents the maximum collective payoff for the group. The slope of these schedules may be interpreted as the marginal payoff to defection and cooperation.

In Figure 1(a), D rises more rapidly than does C , indicating that the more agents who join the cooperative coalition, the greater is the advantage of defecting. The collective maximum at point m is achieved with some agents

choosing D and some C. Point m falls to the right of k on the horizontal axis. This implies that collective gains are greater when there are more than k cooperators, and that these gains reach a maximum at point m , and diminish thereafter.

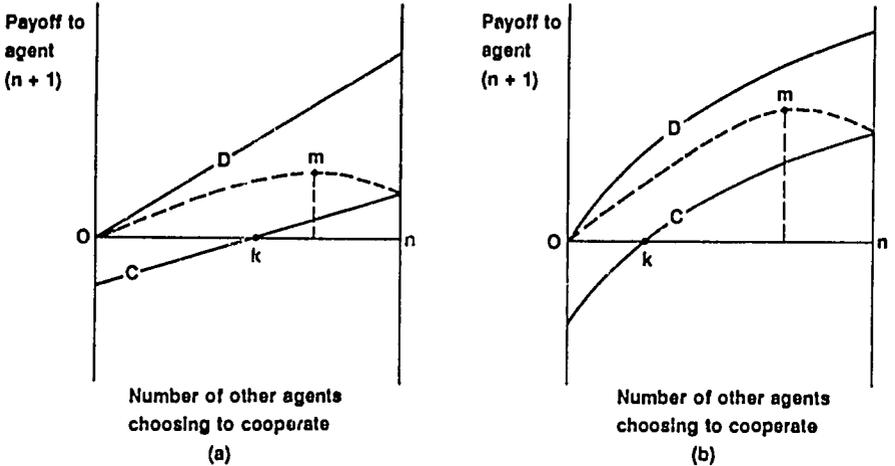


FIGURE 1 Relationships between benefits and cooperation.

In Figure 1(b), the slopes of the C and D functions reflect an alternative incentive structure: the proposed rule achieves most of its benefits after about half of the population participates, after which benefits grow at a decreasing rate and ultimately decline after reaching a maximum of m . The collective maximum occurs at about two-thirds participation, with room for gains to cooperators from point k to point m along the horizontal axis. Cases 1(a) and 1(b) represent two of an infinite number of possible variations on the MPD theme, a distinguishing feature of which is that defection strictly dominates, making some form of coercion necessary to solve the problem of collective action. Restrictive rules and the level of coercion accompanying them alter the payoffs of the C and D schedules, and thus their level and shape.

In the MPD model of common property, each individual

has an incentive to free ride and graze heavily in the near-term, thereby overexploiting the range. Each believes that he will receive a higher payoff from defecting rather than from cooperating. The incentive structure is such that it does not matter which strategy the others choose. Therefore, defecting or free riding strictly dominates cooperative stinting for each individual. Hardin, in his original article on the tragedy of the commons, wrote:

The rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another.... But this is the conclusion reached by each and every rational herdsman sharing the commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit--in a world which is limited. (Hardin 1968:1244).

The main features of this view of common property are:

- o Inferior outcome. Each individual will choose "rationally" to defect and graze at an exploitative level, leading to a situation in which all are made worse off. All are led toward this noncooperative equilibrium.
- o Strict dominance of individual free rider strategy. The result of overgrazing arises independent of the expectations of each individual regarding the actions of others. Because the choices of each are unaffected by the choices of the others, defecting is a dominant strategy, and uncertainty with respect to the behavior of others does not pose a problem.
- o Need for enforcement. Even if an agreement is struck that specifies that all will stint on the range, the strict dominance of individual strategy makes such cooperation unstable. Without compulsory enforcement imposed by an outside authority, any such agreement is unstable because each prefers that the others stint while he or she defects and grazes exploitatively (Sen 1967).

In the MPD framework, individuals may attempt to develop cooperative common property rules to enforce stinting, but they cannot resolve their problem because no

one has an incentive to keep such agreements. As a result, an enforceable rule must be imposed from outside. In this sense, property institutions are viewed as exogenous. Private property rights are argued to be consistent with this formulation because they can be imposed from outside, as were systems of enclosure. Because this approach starts from the presupposition that individuals pursue strategies regardless of the expected actions of others, the appropriate decision unit is the private individual user. A somewhat contradictory result, especially when the argument is used to support privatization, is that the strict dominance of individual free rider strategy is argued to be accompanied by rational individuals who will husband and conserve their own private range area at a rate more consistent with the preferences of society as a whole. If this formulation is correct, then only by imposing private property rules from outside can the group optimize its grazing. Any other alternatives are unstable because of the strict dominance of defecting behavior.

Three key difficulties with this model render it unreasonable on empirical grounds. First, its assumption of dominant free rider behavior leaves no place for cooperative rules unless they are imposed and enforced from outside. Second, the dominant strategy mechanism, by ruling out the importance of changing expectations of others' behavior, fails to capture the interdependence of decisions in a village economy. Third, by sidestepping the importance of mutual expectations in the formulation of individual strategy, it fails to deal explicitly with the problem of uncertainty regarding the actions of others (Runge 1981).

These objections raise questions over this theoretical approach, which is founded on the restrictive view that free riding is a dominant strategy, that private property is uniquely suited to optimal resource allocation, and that common property rules cannot be solutions to problems of resource use in developing economies. By restricting our view of the institutional opportunity set, it fails to consider a variety of institutional alternatives.

THE ASSURANCE PROBLEM AND COMMON PROPERTY

The view of common property outlined above, with its underlying premise of dominant free rider behavior, has been widely used to explain overgrazing, deforestation and other abuses of natural resources. What is striking is the extent to which resulting policies of privatization have

been driven by the unproven premise that free rider behavior dominates and the accompanying view that the expected behavior of others is irrelevant to this choice. Where there are no dominant strategies, a variety of alternative outcomes are possible, depending on the structure of mutual expectation and resulting patterns of strategic choice. This situation seems to fit most closely with empirical studies of common property. Several authors have argued that it may fit public goods and collective choice situations in general (Kimber 1981; Wagner 1983; Runge 1984a).

The very nature of village-level decisions makes dominant free riding implausible. Such decision making involves interdependent choices in which the benefits and costs of resource use are not only a function of the total actions of the group, but in which decisions to use (or overuse) resources will be affected by the expected decisions of others. If the use of common resources is conditional on these expectations, this interdependence places a premium on mechanisms that coordinate community decisions. The key observation that bears emphasis is that such mechanisms tend to arise from several different rules, customs or conventions, of which private exclusive property is only one example.

Consider the more complex and arguably more realistic case in which neither C nor D represents a strictly dominant strategy. Figure 2 shows a situation in which a linear D curve dominates a linear curve C until point y, after which C dominates D. The absence of a dominant strategy raises the problem of coordinating the expectations of a "critical mass" of agents around a particular rule change. In Figure 2, there are two equilibria: one at 0 and one at z. The problem of coordination is to achieve the Pareto-superior equilibrium at z. In cases such as these, the coalition must move beyond k to the switch point y; otherwise, defection will dominate and lead to the Pareto-inferior equilibrium at 0. Unlike the MPD, in which defection dominates at all levels of participation, implying a continual need for outside coercion, this situation rests on the contingent strategies of agents. If enough people in a village are assured that others will cooperate, then z will emerge as the equilibrium. However, if a Pareto-inferior open-access equilibrium has become established, no agent will decide to join a coalition subscribing to a restrictive rule unless he expects a sufficient number of others to do so. Achieving a Pareto-superior solution will require an organized change in behavior leading a critical mass to cooperate with the rule.

Achieving this level of cooperation may require some kind of enforcement mechanism. If the situation resembles Figure 2, however, relatively little enforcement may be necessary to organize a change in behavior. Voluntary cooperation with rule restrictions may even be sufficient to organize this change. As Hayek (1948) argued, spontaneous recognition of the need for organized collective action in many cases occurs on the part of the affected group simply because the payoff to such organization is substantial.

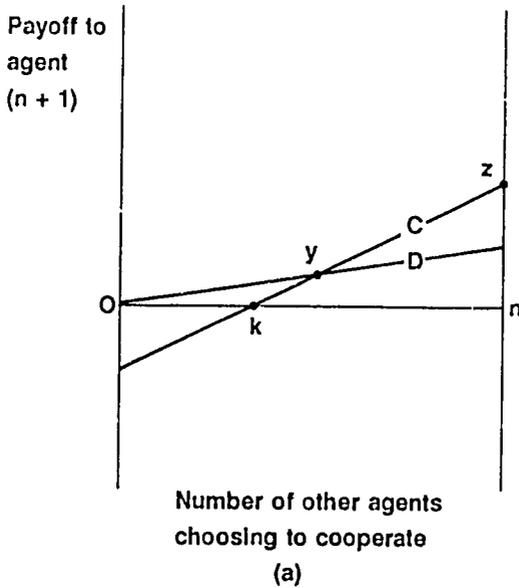


FIGURE 2 Number of agents choosing to cooperate.

In the case of a village economy, the structure of incentives may well be of this sort, and villagers will seek a rule coordinating the resource use of all villagers. This search for "coordination norms," to use Schelling's (1960) phrase, is an endogenous adaptive response to the demand for scarce information about the likely behavior of others. By providing the assurance that others will not misuse common resources, common property institutions can make it rational for the individual to respect them. Although expectations of widespread free rider behavior may be quite likely to provoke a corresponding response, leading to a downward spiral of overuse, the multiple possible outcomes suggest that careful attention also be given to

institutions that promote a critical mass of resource-conserving behavior.⁵ There is no reason to suppose that these do not include institutions of joint use.

This problem may be described in terms of an alternative to the MPD game, the "assurance problem" (Sen 1967), one in a class of "coordination problems" (Schelling 1960). The problem shown in Figure 2, where cooperation continues to refer to stinting together, and defection to overgrazing, leads to an ordering of alternatives in which a villager ($n + 1$) benefits most when everyone stints, but also benefits when a critical mass cooperates with a stinting rule, even though everyone does not. It is precisely the role of village-level conventions, including common property institutions, to reinforce expectations of collective behavior leading a critical mass of individuals to adopt such a solution as a cooperative strategy (see Hardin, R. 1982). If they function optimally, common property institutions can lead to equilibrium outcomes in which each individual is assured that a critical mass of others will cooperate, so that they will have an incentive to do so too. This is in marked contrast to the MPD, in which no one would contribute even if everyone else did. Of course, common property institutions do not always provide this assurance. The approach developed here, like other more formal approaches, emphasizes that the village can get locked into an equilibrium in which the range is overexploited, because a requisite level of assurance is not achieved.⁶ The model says that the free rider problem can be solved--not that it will be solved.

When elaborated to describe problems of resource management, this model provides an intuitively appealing way of looking at common property as a solution to coordination problems. First, coordinated strategies can evolve inside the structure of the game, rather than always being imposed from without. In this sense, such strategies model innovative, endogenous property rules initiated by a village or group. By providing security of expectation, property institutions are responses to the uncertainty of social and economic interaction (see Schotter 1981; Johnson and Libecap 1982). Second, the model places central emphasis on the interdependence associated with group decision making, and the multiple outcomes possible when agents are engaged in a search for rules of coordination when there are no dominant strategies. It allows for either cooperation or free riding, rather than saying that free riding will dominate. Third, it emphasizes the key obstacle of uncertainty, emphasizing the fact that opportunity costs

must be paid to develop support for new rules or norms of coordination.

Approaching common property in this way provides some interesting perspectives in both analytical and policy terms. In contrast to the results of the MPD, the strict dominance of the free rider strategy no longer holds. Rather, expectations of others' choices must be entered as a formal part of the determination of one's own choice. No individual can decide on a preferred strategy until it is known whether a sufficiently large group of others will cooperate. An inferior outcome is no longer inevitable; if everyone is assured that a critical mass of others will obey a common property agreement, then it is in each person's individual interest to do likewise, since this outcome is preferred.

In more complex cases faced in actual situations of resource management, the lack of a dominant strategy for each individual means that the particular outcome will depend on individual's bargaining power, the initial endowment of resources, the culture, climate, and so on. Thus, the assumption that individuals are identical and face identical constraints must be relaxed. Sugden (1984) has argued that the more homogeneous a community, the more likely are optimal outcomes; the more heterogeneous, the more difficult coordination becomes. As the heterogeneity of the group increases, and as the resource constraints facing it become more severe, common property rules (indeed, any rules) may become increasingly difficult to maintain (see Johnson and Libecap 1982). Given a heterogeneous community, however, coordination norms offer their own incentive to be kept. Naturally, some enforcement of these agreements is likely to be necessary. However, this enforcement may readily emerge from inside the group, as well as being imposed from outside it. The key element that determines the success or failure of institutions is therefore the extent to which the institutions foster coordinated expectations in relation to a particular physical and social environment (Ullman-Margalit 1977).

In this framework, it is easier to see how internal group incentives to maintain and enforce common property rights may be as strong, if not stronger, than those restricted to private exclusive use. Suppose that tradition--the result of longstanding agreement--is such that each grazer on a common range is expected to stint at an arbitrary level. The result of this property rule is to formalize the expected actions of others. If each expects all others to graze at this level, there is an incentive

to do the same, since the rule extends the set of superior allocations available to the group by preserving the range. Because the communication and transactions needed to achieve common property rules are not costless, agreement on the particular rule for grazing provides a further incentive to be retained as tradition. The social overhead costs required to maintain common property rules may be substantially lower when they are already a part of the customary structure of rights and duties. In a village economy, the benefits possible from free riding in the short term may be more than offset by costs imposed on those who break the rules. Recognized interdependence makes the costs of reputation loss high, much like losing one's credit rating in a developed economy. Other, more severe sanctions may be imposed by the village on its own noncooperative members. These costs, coupled with reductions in overall free riding if such antisocial behavior sets a trend for others, plus the opportunity costs of implementing innovative rules, may well exceed the cost of continuing to observe the common property rule.⁷

Moreover, where the resource endowment of the group or village is highly randomly distributed, additional incentives may exist to adopt a rule of joint use. In the Kalahari Desert of Botswana, for example, rainfall is both scarce and highly variable. Rather than demarcating the range and hoping that rain will fall on one's own parcel, traditional common property institutions have been reinforced by the ecological imperative to move from one area to another. The relative access afforded to scarce resources under this arrangement is both more efficient and a better form of insurance against adverse individual outcomes than a system in which a few are blessed by rain while the majority face drought-like conditions (Peters 1983).

Finally, the fairness implicit in joint access may prove a highly assuring feature of common property agreements, even if the relative benefits accruing to individual members of the group on average are somewhat less than under a system of exclusive use-rights. The expropriation of common property, as Dasgupta and Heal note, "...while blessed at the altar of efficiency[,] can have disastrous distributional consequences..." (1979:77). Since these consequences may in turn give rise to instability and lead to breakdowns in efficient use, questions of equity, efficiency and assurance are closely connected in practice over time.

This does not deny that enforcement from outside may help achieve improvements in the institutions, if the costs of such enforcement are affordable. Where local level rule making has broken down, such interventions may be necessary. In many cases, local interests may request assistance in enforcing property rights, including private rights, which local authorities alone cannot guarantee. The lesson of the assurance problem is simply to let individuals have full freedom to create self-binding property rules that best serve their needs before adding enforcement mechanisms from outside. Property rules will be better suited to these needs and more likely to succeed if they are based on this premise. These rules may come in many shapes and forms, including various agreements to use resources under some type of common property arrangement.

Furthermore, enforcement of private property rights from outside the group or village is not a sufficient condition for optimal resource utilization. Not only are the costs of such "top-down" enforcement likely to be high; they also may lead to attempts to impose patterns of land use incompatible with local needs, causing lands to be brought into or taken out of production based on criteria developed at "the top" rather than the village level (see Bromley and Chapagain 1984). This may be especially true when control over land use is in the hands of those with fewer incentives for efficient and equitable local management, such as absentee owners. Any enforcement mechanism that operates from outside and above village level institutions and that is designed to coerce local action is thus likely to involve high costs and uncertain benefits.

In summary, the analysis above suggests that common property institutions may be well adapted to problems of resource management in developing economies. Its major implication is that inferior outcomes, such as overgrazing, do not necessarily arise from the strict dominance of free rider strategy (although resource misuse may still occur) but from the inability of interdependent individuals to coordinate and enforce actions in situations of strategic interdependence (see Runge 1984b). Successful responses to these situations may be made even more difficult if property institutions developed in response to conditions in the West are imposed on the village economies of the developing world.

COMMON PROPERTY MANAGEMENT

If a variety of responses to problems of resource management are possible, the incentives leading to a particular institutional choice must result from the physical and social environment in which this choice is made. The arguments of the preceding sections may be brought together with the three characteristics of village life in a less developed economy identified above. Each suggests a reason for the comparative institutional advantage of joint use rights. First, low levels of income imply that formalized private property institutions that involve high transactions and enforcement costs are often outside the village-level budget for resource management. Even if a system of private use rights is affordable, common property alternatives can be relatively less costly to maintain and enforce and better adapted to local conditions. Since common property rules are generally enforced locally, abuses of authority, if they occur, may be less widespread than under a centralized program of privatization.

A second reason for the survival and utility of common property is that close dependence on natural resources makes survival more subject to a variety of unpredictable natural events that are likely to fall unequally in both time and space on the local population. If this inequality is threatening to a sufficiently large proportion of the group, incentives may exist to guarantee access to certain resources held in common rather than to restrict access through exclusive use. By institutionalizing a degree of fairness in the face of random allocation, common use rights may contribute to social stability at the same time that they promote efficient adaptation to changing resource availability over time.

Common property may be an appropriate institutional adaptation to resource management at the village level for a third reason: the right to be included in a group provides a hedge against individual failure. This hedge will be likely to grow in significance as the overall level of risk to group members increases. In this sense, the combination of relatively high levels of poverty, relatively high levels of randomness in allocation of natural resources, and resulting uncertainty in individual levels of welfare are all mutually reinforcing explanations for the appropriateness of common property institutions.

A more general reason for continued common property management is that the opportunity costs associated with changing established practices are high. Despite attempts

to break down traditional common property institutions, these rules are tenacious. As Malinowski observed:

[W]hile it may seem easy to replace a custom here and there or transform a technical device, such a change of detail very often upsets an institution without reforming it, because...beliefs, ideas and practices are welded into bigger systems (1961:52).

The tenacity of traditional institutions cannot be explained simply as the manifestation of "backwardness" or "irrationality." A more logical explanation is that rational individuals are not inclined to relinquish institutional arrangements that have promoted survival, even if survival has not been especially comfortable. This implies that economic development efforts should involve not only attempts to break down belief in and observance of old rules, but also promote institutions that are consistent with the physical and social environment in which resource management is to occur. In some cases, this will involve the development and promotion of private, exclusive use rights. But in many cases it will involve elaborations of common or joint use. The sooner this is recognized, the sooner problems of resource management can be addressed in a fashion consistent with the incentives of village-level decision making.

THE NEED FOR EMPIRICAL RESEARCH

The abstract observations made in the previous sections require examination and empirical testing in specific settings. While a number of recent analyses have pointed to the erroneous conclusions of the "tragedy of the commons," only a few well-documented studies of modern common property management have entered the literature. These include examples reported by Gilles and Jamtgaard (1981) and by others of pasture management in Peru (see Browman 1974; Orlove 1977, 1980), African grazing and forest management (see Legesse 1973; Horowitz 1979; Thomson 1980; Hitchcock 1981; Peters 1983); Japanese forestry (McKean 1982); and the aforementioned case of Swiss grazing (Rhodes and Thompson 1975; Netting 1978).

In the historical literature, recent research on the common field systems replaced by 18th century enclosures continues to break down the conventional wisdom that enclosure was a prerequisite to the adoption of advanced agri-

cultural methods. "Open field" farmers in fact adopted modern practices without changes in property rights (Yelling 1977). Recent empirical research by Allen (1982:950) concludes that "...the major economic consequence of the enclosure of open field arable in the eighteenth century was to redistribute the existing agricultural income, not to create additional income by increasing efficiency." Much more attention in research needs to be given, however, to the rich variety of contemporary resource management strategies that result from alternative environmental conditions and constraints.

In this volume, participants in the National Research Council-sponsored Conference on Common Property Resource Management have presented the first in a series of case studies specifically designed to explore the role of common property institutions and resource management in developing countries. These studies, dealing not only with range resources but with forestry, agricultural lands, fisheries, and water, can begin a much more detailed process of investigation focused on specific common property issues. In this way, a priori theorizing can give way to empirical investigations of whether certain resources (for example, water versus forests) are more or less likely to be successfully managed as common property, private property, or some combination.

This discussion, while essentially theoretical, directs attention to the specific resource constraints faced by groups at the local level. Rather than invoking the general superiority of one type of property institution, this analysis suggests that different institutions are responses to differing local environments in which institutional innovation takes place. Such innovations are likely to range along a continuum of property rights, from pure rights of exclusion to pure rights of inclusion, depending on the nature of resource management problems (Runge 1984b).

Institutional innovation, like technological innovation, is responsive to the relative abundance of different factors, and the resulting costs and benefits of alternative strategies (Hayami and Ruttan 1985). As Randall states:

The fact that different configurations of property rights have different impacts on both allocation and distribution illustrates the need for understanding the impact of specific configurations of rights. Collective decision making procedures must select appropriate

configurations of rights, not only specifying rights in complete and nonattenuated form but also selecting that particular bundle of rights which will provide the correct incentive structure to achieve the collective goal. (1974:53-54)

The task of identifying the appropriate configuration of rights begins with a recognition that private exclusive property is not always comparatively advantageous in the villages of less developed economies. The search for appropriate institutional responses must respect both the traditions and the constraints of local needs in specific choice environments. There are no universal prescriptions for efficient and equitable resource management.

NOTES

1. Useful historical perspective on current privatization efforts in other parts of the world is offered by the English case. Cromwell's success at rallying popular support early in the English Civil War was based in part on the strenuous objections of commoners to the enclosure of wetlands or "fens" that provided rich hunting and fishing resources. The king financed groups, called "adventurers," to enclose and drain these open meadows, in return for which one-quarter to one-half of the lands were granted as private preserves. The result was to provoke riots, which Cromwell exploited in organizing a base of opposition to royal authority. This pattern was repeated throughout the English enclosure movement. A similar process of land acquisition in the North of England and in Ireland can be seen as a partial cause of the "Irish problem" (see Darby 1940; Albright 1955; Fraser 1973:73-77). A recent comparison of the English experience with that of herders in the Andes of South America is provided by Campbell and Godoy (this volume).

2. This is the argument described in John Rawls' (1971) analysis of the "original position," in which players in a game of decision making under uncertainty must formulate rules about the distribution of primary resources. The result of a high level of risk aversion is that equality is favored, together with a stipulation (the "difference principle") that inequality must favor those who find themselves worst off. It is also the foundation for a variety of real world voluntary associations, including volunteer fire departments, in which the possibility that one agent might face disaster is mitigated by a joint contract of mutual aid. There are also numerous historical examples from seventh to twelfth century Europe of feudal institutional arrangements driven by what Duby (1974) terms "les générosités nécessaires."

3. North and Thomas, for example, describe the economic state of traditional societies as one in which "[t]he natural resources, whether the animals to be hunted or vegetation to be gathered, were initially held as common property. This type of property right implies free access by all to the resource" (1977:234).

4. The logic underlying this argument in Hardin's (1968) "Tragedy of the Commons" parable is formally explicated by Muhsam (1977). The errors, logical and otherwise, of the parable are increasingly recognized by economists. Partha Dasgupta, in a recent examination of its impact on resource management, observes that "It would be difficult to locate another passage of comparable length and fame containing as many errors...." (Dasgupta 1982:13).

5. Axelrod (1984), Taylor (1976), and R. Hardin (1982) have shown that cooperation is consistent with self-interested behavior, even inside the MPD framework, if repeated plays are allowed. Repeating the game opens the door to expectations of others' behavior. The conditions for cooperation then turn on whether the players are sufficiently forward-looking and formulate a "tit-for-tat" rule, motivated by expectations of others' cooperation and fear of retaliation in the case of noncooperation. Similarly, Sugden (1982; 1984) has noted that a "principle of reciprocity" may operate in actual situations of collective choice. This principle does not say that one must always contribute or cooperate, but that one must not free ride while others are contributing. The individual villager has obligations to the group from whose efforts he derives benefits. The model of reciprocity that Sugden develops is based on commitment to a rule of behavior, conditional on the expectation that a sufficiently large group of others also will adhere to it. This is the same concept as the "critical mass" discussed earlier.

6. Sugden (1984) and Runge (1981) emphasize that (a) equilibrium exists; (b) it is not unique; (c) one equilibrium is Pareto-efficient; and (d) other equilibria involve undersupply of the collective good.

7. Maintaining rules or norms such as common property may generate second-order collective action problems. However, the rewards and punishments underlying property institutions, once in place, may be less susceptible to defection because the costs of sanction are small in relation to the

benefits of maintaining the rule. Naturally, these rules can, and do, break down. I am grateful to a reviewer for these observations.

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PART TWO: Case Studies

Marine Inshore Fishery Management in Turkey¹

Fikret Berkes



INTRODUCTION

Third World fisheries suffer from two interrelated and worldwide problems: the failure of modernization efforts, and the conflict and allocation problems involving the inshore and offshore sectors. This paper attempts to deal with both of these issues in the context of the common property resource theory, and more specifically, in terms of the control of the resource base by fishing communities. It deals with the relative efficacy of small-scale organizations and the conditions under which fisheries can be self-managed successfully.

Many of the programs to "modernize" or to "develop" fisheries have failed. Emmerson (1980) and Panayotou (1982) have attributed this largely to the development planner's preoccupation with technology and economic rationalization, at the expense of understanding the inner logic of the existing artisanal or small-scale fisheries. "While small-scale fisheries still employ over 90 percent of all fishermen and contribute about half the edible world catch ... the emphasis has been on the development of industrial fisheries..." (Panayotou 1982:49).

To remedy this situation, there has recently been a modest shift of interest in international circles towards small-scale fisheries. For example, the 1984 report, "FAO World Conference on Fisheries Management and Development,"

states that "there is widespread recognition by governments and donor agencies of the need to support development of marine and inland small-scale fisheries" (p. 26). It refers to the "continued and assured share of the fisheries resources for small-scale producers and their active involvement in the management of the resources" (p. 26).

This last point hints at the second crisis in Third World fisheries. Throughout the world, small-scale inshore fisheries are in conflict with the expanded fleets of large-scale fisheries. Allocation problems often develop when large-scale operators are forced inshore following the depletion of offshore fish stocks. Thomson (1980) gives examples of such conflicts from Yemen, Indonesia, Thailand, India, and the Philippines--only a small sample of the global conflict between the two sectors. Many researchers have attempted to analyze and to resolve the problem. One of the more exhaustive studies of the conflict was carried out in San Miguel Bay, the Philippines (for a summary, see Smith and Pauly 1983; Cruz, this volume).

McGoodwin (1980) described the conflict between coastal shrimp fishermen in Mexico and the offshore shrimp trawling fleet that had developed with government assistance. The two sectors exploited the same stocks, first inshore and later offshore, as the shrimp grew larger and moved into deep waters during their life cycle. To protect the yield of large shrimp caught offshore by the trawlers, the Mexican government curtailed the inshore fishery; thus, "the development of the trawling industry has brought about a parallel underdevelopment of the inshore fisheries" (McGoodwin 1980). A common course of events in the conflict between the inshore sector and the offshore sector is described by Dasgupta (1982:17) with reference to a case in India:

For marine fisheries with free entry the ... problem can arise via a seemingly convoluted process. In free waters, where historical rights to the traditional fishermen are not respected, it can happen that large firms enter with modern fishing vessels. For the short run, unit harvesting costs are thereby dramatically reduced, thus exacerbating the tendency towards overfishing. Meanwhile, the traditional fishermen, unable to compete with such equipment, are left impoverished for want of any catch. But in the long run, as a consequence of continual overfishing, harvest costs increase, despite--one should say, because of--the use of modern harvesting techniques.

The significance of common property institutions in Third World fisheries is related to these two questions:

(1) Can an understanding of common property institutions in Third World fisheries provide one of the missing ingredients towards successful economic development?

(2) Can these institutions be used to resolve the conflict and allocation problems involving the inshore and the offshore sectors?

In addressing these questions, it is necessary first to have some empirical information as to how these common property institutions operate. Further, it is important to know the conditions under which these institutions can exist and successfully operate, as opposed to conditions under which they cannot.

THE STUDY AREAS AND THE STATUS OF THE FISHERIES

All five of the study areas are located in the southern seas of Turkey, the Aegean, and the Mediterranean; their fisheries share a number of common characteristics by virtue of their location: they operate in biologically poor waters and utilize a diverse assemblage of bottom-dwelling species that are of limited abundance but relatively high market value. Most of these fisheries are artisanal operations that use simple fishing gear and return daily to home port.

The role of the southern seas in the overall Turkish fishery production is relatively minor. The Aegean region accounts for only about three percent of the total catch of close to one-half million tons annually, and the Mediterranean region only about two percent (DPT 1985; TCZB 1982). The greatest part of the total yield is landed in the eastern Black Sea, a biologically productive area dominated by pelagic (surface dwelling) species and schooling species such as the anchovy. The Aegean and the Mediterranean are technically oligotrophic marine environments in which the low level of nutrients in the water is translated through the food web into low levels of fish productivity (Gulland 1971).

Most of the commercially utilized fish species of the Aegean and the Mediterranean are bottom-dwelling (demersal) species. The fish fauna is highly diverse, but none of the individual species is particularly abundant. However, many of them have a high market value, as elsewhere in the Mediterranean. Charbonnier (1977) observed that the prices for the Mediterranean fish (demersal and pelagic together) were five times higher than the average world price, and for the demersal species alone, seven times higher.

The standard small-scale operation in Turkish coastal fisheries is a 2-man, 8 m boat equipped with a 10-25 HP inboard diesel engine; some are 3-man, 10 m boats. The standard fishing equipment is the trammel net, a gillnet-like set net that captures fish by entangling them. Long-lines or a series of baited hooks on a main line attached to a float are also used. Both types of equipment are used in exploiting a diverse fauna of demersal species dominated by sea breams, basses, mullets, and groupers.

Larger-scale operations include trawlers, purse seiners, and beach seiners. Trawlers drag a bag-shaped net for demersal fish. In the Aegean and the Mediterranean, they average 15-25 m with a crew of 7 or 8. Purse seiners catch pelagic species using a net that hangs from the surface by its attached floats. The bottom of the net may be closed off like a purse when a school of fish has been surrounded. Purse seine boats average 15 m and carry a crew of 10. Beach seiners, 10-15 m boats with a crew of 5, drag nets while anchored in shallow areas.

As may be seen from the description above, the larger-scale fisheries that operate in the Turkish Mediterranean and Aegean are really not large-scale fisheries by international standards or even by the standards of the Turkish Black Sea. They may best be identified as medium-scale operations. Three of the fisheries in the study area consist only of small-scale operations; two consist of both small-scale and medium-scale.

The study area is shown in Figure 1. Three of the fisheries are located north of Cyprus on the eastern Mediterranean coast of Turkey, and two on the southern Aegean coast. Some of the characteristics of each of the five fisheries in the study area are shown in Table 1. The first three of the areas (the coastal lagoon near Adana, Tasucu near Silifke, and Alanya) were chosen for the study because they were known from previous surveys by the author to be well-run, successful fisheries. The fourth (Bodrum) was chosen as an example of a previously successful fishery that had overcapitalized (overexpanded the fleet) in the early 1970s. The fifth (Bay of Izmir) was chosen as an example of an intensive fishery in a multiple-use area adjacent to a large urban center.

In contrast to the first three fisheries, which are used by single groups of small fishermen, the last two areas are used by medium-scale operations as well. Further, in Bodrum and the Bay of Izmir, there are relatively large groups of casual or sport fishermen; however, Table 1 accounts for only the registered commercial fishermen.

The data in Table 1 were collected in 1983. These

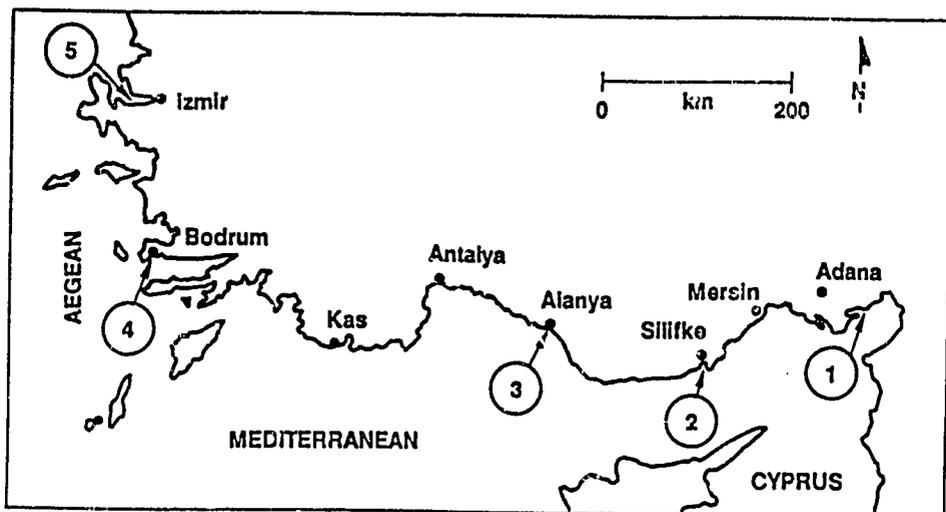


FIGURE 1 The Study Area.

five areas were selected from among some 50 fishing communities first investigated by the author in 1976-78; they are not a random selection, nor are they meant to be representative of all Turkish coastal fisheries.

USE OF THE OAKERSON FRAMEWORK: THE OUTCOME

In this paper, the Oakerson framework will be used diagnostically, beginning with the "outcome" and working backwards to investigate the reasons behind the outcome. It is therefore important to specify at the outset the criteria by which the outcome has been evaluated in this paper. Basically, four criteria are appropriate measures for this work, two from the Oakerson framework (efficiency, equity), and two additional criteria, sustainability and the expression of satisfaction or dissatisfaction by the users themselves. The latter two criteria are meant to address, respectively, the ecological and the social dimensions of the outcome. The last criterion may perhaps also provide a composite measure of the outcome as perceived by the fisherman.

Efficiency, defined as Pareto optimality, cannot be worked out because of lack of suitable data on individual yields and incomes in the study area. In any case, there may be serious complications in the application of the Pareto optimality approach to resources in which there are large year-to-year variations in productivity, and where short-term efficiency undermines long-term sustainability.

TABLE 1 Description of the Five Fisheries in the Study Area, Southern Turkey, 1983.

The Fishery	Area Used (approximate km ²)	Number and Type of Boats	Number of Registered Fishermen	Cooperatives and User Groups	Outcome
(1) The Coastal Lagoon	20	43 small inboard 80 non-motorized	103	All in one coöp; one user group	Successful
(2) Tasucu	150	90 small inboard	140	All in one coöp; one user group	Successful
(3) Alanya	80	45 small inboard	100	Half in one coöp; one user group	Successful
(4) Bodrum	(overlapping with other communities in the area)	11 trawlers 2 purse seiners 9 bottom seiners 100 small inboard	80 20 45 250	No active cooperatives; six user groups	Unsuccessful
(5) Bay of Izmir	400	27 purse seiners 30 bottom seiners 700 small inboard	300 150 1400	Many cooperatives; five user groups	Unsuccessful

Equity, as with efficiency, is difficult to calculate. It can be evaluated indirectly, however, from the general conduct of the five fisheries. In the first and third areas, there were explicit sharing mechanisms to ensure equity. In the second area, all fishermen had access to bank credit of the equivalent of U.S. \$3,000 (1983 dollars) through their cooperative society. By contrast, in the last two areas, there were no mechanisms by which a certain basic fishing income or other benefits could be obtained.

The sustainability of the harvest is an important criterion often used to evaluate the success of common property resource use. Together with other biological criteria, measures of sustainability have been incorporated into a current and ecologically up-to-date definition of conservation by several international agencies (Talbot 1980). There are insufficient data, however, to test fully whether any of the fisheries in the study area are sustainable.

Perhaps the most suitable measures of outcome in the present study are the usual bioeconomic criteria of success used in fisheries science: evidence of overfishing and overcapitalization (Gulland 1974). These criteria have the added advantage that they represent rough indicators of efficiency and sustainability. Together with a measure of equity, as done above, and an expression of satisfaction or dissatisfaction of the users themselves, these criteria should provide a suitably complete assessment of the outcome.

Using these three criteria, the first three study areas--the coastal lagoon, Tasucu, and Alanya--represent successful fisheries: there is no decrease in overall catches over the years, no sharp drops in the catch per unit of effort, no evidence for increasing scarcity of the more valuable species, no obvious overcrowding in the fishing area, and no indication of vessels and fishermen dropping out of the fishery. In these areas, the fishermen indicated that conflicts were largely resolved internally; the great majority of them expressed general satisfaction with the fishery.

By contrast, the last two areas--Bodrum and the Bay of Izmir--represent unsuccessful fisheries. While there has probably been no decrease in the overall yield over the years, there has been a sharp decline in the catch per unit of fishing effort. The more valuable species have all but disappeared. There are too many fishermen and too many boats chasing too few fish. In the Bodrum area, many fishermen have become occupational pluralists, catering to tourists in the summer and fishing part-time opportunis-

tically. The larger vessels have left Bodrum for lack of fish. In 1983, all but one of 11 Bodrum-based trawlers operated outside the area, and one had dropped out of the fishery. In the Bay of Izmir, many of the small fishermen of the area were forced to travel north to the outer bay, even though this meant much higher operating costs. The more valuable species were so scarce that it was said that a fisherman could more than recoup his daily expenses if he could catch a single good-sized specimen of Dicentrarchus labrax (a type of white bass) and sell it to a restaurant in Izmir. In these two areas, fishermen either talked bitterly of the conflicts or refused to talk at all. Although some expressed general satisfaction with the fishery, many said they were dissatisfied with the outcome.

TECHNICAL AND PHYSICAL ATTRIBUTES OF THE RESOURCE

The techno-environmental attributes of the resource base are much the same in the five study areas, with a few notable exceptions. Jointness is a problem in all areas: each individual user is potentially capable of subtracting from the welfare of other users, even when fishing lawfully. Certain illegal practices (such as the use of dynamite and nets with sub-legal mesh sizes) exacerbate the problems. In theory, all users can derive benefits from the use of the resource, within certain limits. To ensure this, however, it is necessary to institute limited entry or license limitation programs so that the number of fishermen exploiting the resource can be matched to the ability of the resource to sustain them. This, in most fisheries, is the limiting condition under which jointness can be maintained (Gulland 1974; Pearse 1980).

Excludability poses a serious problem in all of the five study areas. In general, access to a fishery is difficult to restrict. The first study area (coastal lagoon) is perhaps the easiest one in which to apply the exclusion principle because of its small size and geographical location. The next three coastal fisheries are less easy to defend because they are conducted along a stretch of the shoreline, and the fifth (Bay of Izmir) is much the same.

Divisibility poses both a theoretical and a practical problem. The resource itself, the fish stock, is indivisible; it cannot be divided up among private property holders. The fishing areas, however, can be divided up by using landmarks and the usual measures of location finding among coastal fishermen (triangulation). The problem in dividing up the fishing grounds is that no fish remain in

one place for long. Moreover, all of the stocks fished in the study areas range beyond the actual areas fished by the fishing communities in the study. In some open ocean fisheries, relatively few stocks (subpopulations of a species that can be considered a management unit) are quantitatively important. In such fisheries, it is theoretically possible to manage each stock. But in Mediterranean coastal fisheries with a large number of species, it is virtually impossible to manage the fishery on a stock-by-stock basis; this condition is generally true for subtropical and tropical fisheries (Pauly and Murphy 1982). In the study area, each major species has a different migratory behavior, and it would not be possible to match the management area to the geographical range inhabited by each stock.

Last, the techno-environmental attributes of the resource may include some measure of the potential demand for the resource by the human population who live in the area. On this count, there are major differences among the five study areas. The Bay of Izmir fishery is near a metropolitan area of over one million. This fishery and the one in Bodrum (a tourist center) are in areas in which there is a large recreational demand; the other fisheries are not.

DECISION-MAKING ARRANGEMENTS

Rules and institutions governing fishery resource use include laws issued by the central government and operational rules instituted locally. The Government of Turkey regulates fisheries through the Aquatic Resource Act No. 1380 of 1971 (1380 Sayılı Su Ürünleri Kanunu). The following restrictions and conditions are provided under the Act:

- o Licensing of commercial fishermen (but not license limitation)
- o Prohibition of destructive practices
- o Regulation of a minimum mesh size for nets
- o Prohibition of trawling within three miles of the coast and within bays
- o Restriction of fishing during the spawning period
- o Prohibition of the taking of undersized individuals of certain relatively rare species (such as sturgeon)
- o Dumping of substances deleterious to the aquatic environment.

The actual regulations under the Act are communicated to fishermen and the public at large through fisheries circulars that are issued annually and that specify such provisions as the length of the closed season, the names of species on the restricted species list, and the details of the restrictions for chemical pollutants.

The Ministry of Agriculture has jurisdiction over fisheries but employs no fishery conservation officers. The provisions of the Act and its regulations, such as the three-mile limit, are enforced by the coast guard and the rural police (the gendarme) of the Ministry of the Interior.

Operational rules instituted locally are one of two kinds. In areas in which the fishermen belong to fishermen's cooperatives, such operational rules are subject to the conditions of the charter of the local cooperative. The constitution, in turn, is subject to the regulations of the Government of Turkey that govern producers' (agriculture and fish) cooperatives. For example, the rules on membership allow for no discrimination on an ethnic basis but do allow for residency requirements in the local community.

Other operational rules are those that exist without any reference to formal government legislation. The rule that establishes the condition of collective choice within the group involved with the fishery is willing consent. The actual operational rules that emerge by the application of the rule of willing consent differ from fishery to fishery in the five study areas, even though "the general rules of the game" or the constraints that shape the management choices are the same. The more pertinent operational rules regarding common property management are summarized below for the five study areas.

The Coastal Lagoon Fishery at Ayvalik-Haylazli

As with all lagoon fisheries, use-rights are established by the lease of the lagoon from the Government of Turkey. Thus, members of the cooperative, all of whom come from three neighboring villages, have exclusive and legal rights to the fish of the lagoon and the lagoon's adjacent waters. All fishermen are cooperative members, and all cooperative members are active fishermen. They protect their rights by patrolling the boundary of their fishing area and chasing off or apprehending intruders. (Three outside fishing boats were apprehended in 1983.) Rules for membership are stated in the charter of the cooperative and include six months of residency in one of the

three villages. The other important condition is that no one earning wages from employment is eligible for membership.

Of the five fishing areas in the study, perhaps the clearest operational rules are found in this fishery because the mechanisms for establishing use-rights and membership are legally defined.

Tasucu

All fishermen are small-boat inshore fishermen and all belong to the local cooperative. The right to fish is not restricted to membership in the local cooperative, but cooperative membership has the attractive features of bank credit for members and a year-round guaranteed price that is seasonally adjusted. Fishing rights of the group are protected by the three-mile limit for trawlers. Boats other than trawlers may come into the area fished by Tasucu fishermen, but apparently do not because the adjacent areas are less heavily fished and therefore more attractive than in Tasucu Bay.

Alanya

Another small-boat coastal fishery, Alanya, differs from the others in that half the fishermen belong to the local cooperative, and half do not. This fishery is located on the edge of a deep basin, and the inshore zone suitable for setting nets is very limited. The operational rules for the use of this zone are established on the basis of willing consent, and organized by the community of fishermen informally.

- o Each September, a list of eligible fishermen is prepared, consisting of all licensed fishermen in Alanya, regardless of cooperative membership.
- o Within the area normally used by Alanya fishermen, all usable fishing locations are named and listed. These spots are spaced so that the net set in one does not block the fish that should be available at the adjacent spot.
- o These named fishing locations are in effect from September to May, and the practice applies to the use of the large mesh (80 mm) nets for bonito and large carangids (Sarda sarda and Lichia spp.).
- o In September, the eligible fishermen draw lots and are assigned to specific fishing locations.

- o From September to January, each fisherman moves each day to the next location to the east. After January, the fishermen move west. This gives each fisherman an equal opportunity at the stocks that migrate east to west between September and January, and reverse their migration from January to May through the area.

These operational rules are based on a broad interpretation of the Aquatic Resources Act, which states that the cooperatives have jurisdiction over "local arrangements." They are enforced by having each fisherman endorse the list of fishing locations, and depositing copies of the agreement with the mayor and the local gendarme. Violations of the rule of assigned locations are dealt with by the fishing community at large, in the coffee house. Violators may come under social pressure and, on occasion, threats of violence. The threat of removing the violator's name from the list, to our knowledge, has never been carried out. (The organizers concede privately that such an action would not be supported by the government.)

Alanya is unusual in that there are no problems with trawlers. The coastal zone is steep and deep enough (1,000 m deep at 1 km out in some places) to discourage trawlers. There are no known operational rules to deal with small fishermen of adjacent communities and with the increasing flux of spear-fishermen and sport fishermen.

Bodrum

In this area, the traditional small-boat fishery collapsed after the development of a trawl fleet in the 1970s that coincided with the development of Bodrum as a tourism center. A local cooperative tried unsuccessfully through the 1970s to mediate between small boats and trawlers; by 1983, the cooperative had completely disappeared. No single organization is likely to speak for all fishermen and organize the consensus necessary to establish operational rules because in 1983 there were six distinct groups of fishermen: (1) small-scale coastal fishermen, (2) larger-scale operators including trawlers and beach-seiners, (3) semiprofessionals who obtain their own fish and sell the occasional surplus, (4) large numbers of unskilled sport fishermen, (5) spear-fishermen licensed as sponge fishermen but who sell fish on the open market, and (6) charter boat operators who fish to feed their clients and occasionally sell the surplus.

Bay of Izmir

This fishery differed from the Bodrum fishery by the presence of two large cooperatives, both based at the Izmir fish market, one representing small-scale fishermen, the other comprising large-scale fishermen; there were also several local cooperatives within the bay area. The Bay of Izmir was similar to Bodrum with respect to the presence of several distinct groups of fishermen: (1) purse seiners, (2) small-scale gillnetters, (3) small-scale liftnetters, (4) larger-scale beach seiners, and (5) sport and semi-professional fishermen from the urban metropolitan area of Izmir. Each of these groups reportedly conflicted with at least one other group, and in some instances, with more than one. There were no operational rules in place to allocate the fish, to reduce the conflicts, or to limit crowding.

PATTERNS OF INTERACTION

The use of the resources in the five study areas is under somewhat similar constraints with respect to technical and physical attributes of the resource and decision-making arrangements for the use of the resource. Yet the outcomes are different, perhaps partly due to differences in urban and recreational demands on the resource. Alanya is different from the others because the narrowness of the continental shelf in this area restricts possible fishing sites. To explore these differences further, each of the five fisheries will be described in terms of patterns of interaction of the users.

The Coastal Lagoon Fishery at Ayvalik-Haylazli

In this successful fishery, the fishermen have taken good advantage of the options open to them. The cooperative was established in 1974 to make a bid for the lease of the lagoon, which had previously been operating under a private company. A few of the members had been employed as laborers by the company. Taking advantage of a provision under the Aquatic Resources Act to give priority to cooperatives in the leasing of lake and lagoon fisheries, the Ayvalik-Haylazli Cooperative was successful in its bid. Even though very few of the members had fishing experience, they were able to run the lagoon profitably. The cooperative initially included members from a nearby town and those who held wage employment. Subsequently, the cooper-

ative interpreted its charter more strictly and expelled members who lived elsewhere and who could not choose between fishing and wage employment. However, many of the 1983 members were themselves part-time fishermen: some 80 percent were part-time farmers and only 20 percent full-time fishermen. To maintain the profitability of the fishery, they have rejected requests for membership from a large nearby village. The relatively small size of the area makes it possible for the cooperative to police the boundary of its fishing area.

The limitation of membership makes it possible for the cooperative to capture a larger resource rent than would be possible. As compared with other fisheries, the cost of fishing is kept low by the use of rowboats. Fishermen work in groups of four, using two rowboats and one motorized vessel per group. The rowboats are towed to the fishing area, and the motor boat then anchored, thus saving fuel. Each group owns its means of production collectively and splits the income equally. Cooperative officers take turns in accompanying the cooperative truck to the city of Adana, a large market only one hour away by truck.

Aside from the occasional problem of sales accounting (which seems to be so common with cooperatives), and aside from the discontent of those excluded from the fishery, the operation appears to be a successful example of common property resource management. Even though the membership is open to all residents of three villages (combined population 2,500), the organizers do not foresee a crowding problem in the near future.

Tasucu Fishery

The Tasucu Fishing Cooperative is often cited as an example of a producer's cooperative that works. There is a substantial literature on it in Turkish, including a book (Ozankaya 1976), and the head of the cooperative is somewhat of a folk hero. At the time the cooperative was established in 1968, there were two motorized fishing boats in Tasucu and five rowboats. Most of the others who made their living from fishing used dynamite. The cooperative banned dynamite-fishing and promised fishermen financial help to allow them to obtain proper means of production. In 1970, the growing cooperative confronted trawlers that operated (illegally) within Tasucu Bay, and chased them off with shotguns (Ozankaya 1976). By 1971, cooperative members owned 40 inboard boats and controlled their fishing area. Membership appears to have reached a peak of 180 in

1975 (Ozankaya 1976), and then declined through the loss of members from adjacent communities who formed their own associations.

The cooperative appears to have been exceptionally successful in fighting competing users. In 1983, it was preparing to go to court over allegedly illegal night fishing with scuba equipment, and also to block the relaxing of the three-mile limit to allow trawlers to fish shrimp inshore for two months. Cooperative members, meanwhile, were developing techniques to fish shrimp from small boats.

The cooperative has also been successful as a marketing enterprise, perhaps because its leader is a successful local businessman. By operating a large freezer facility, the cooperative has been able to stabilize and control the market and guarantee the price of fish for the producers. Further, the cooperative has been able to obtain for its members a bank credit of \$3,000, sufficient capital for a new fisherman to buy the essential equipment. The cost of most two-man boats averaged about twice that amount. Some fishermen have apparently made enough to pay off the loan in a year: \$2,800 is probably a reasonable estimate of the mean annual gross income (200 fishing days per year times 10 kilograms per day times \$1.40 per kilogram).

This cooperative was thus able to build up the membership, a strong financial position, and political power. The leadership did not appear to be concerned about overcapacity and stock depletion, arguing that the Bay of Tasucu could probably support some 300 boats, provided that destructive practices (trawling, night fishing with scuba) are controlled.

Alanya Fishery

The fishery at Alanya emerged from its "dark ages" when the fishermen decided to cooperate with one another for the use of the limited number of fishing spots. The rotation system they developed by trial-and-error over 15 years is based on the principle of preventing fishermen from cutting off one another's "rightful supply of fish." This is done by spacing the fishermen sufficiently far apart so that they would not intercept each other's fish between September and May when migratory fish dominate the harvest. The system has the support of the great majority because it optimizes production at the best fishing sites, and in turn allocates these sites by lottery, with a rotation provision that ensures all fishermen an equal chance to fish these best spots. According to fishermen, the most

desirable feature of the system is that it reduces conflict.

Thirty seven boats were on rotation in 1983 (three others were not fishing for various reasons). There were 34 named fishing locations, including two prime sites and five sub-prime sites. When a boat finished its turn at each of the 34 sites, the fishermen had the option of repairing equipment or going long-lining in deeper waters or simply tying up for three days. After May and through the summer months, fishermen sought large and valuable members of the Sparidae family and red mullet (Mullus barbatus), all nonmigratory species for which the rotation system was not deemed necessary.

All of those eligible were licensed fishermen; none appears to have been excluded in 1983. However, membership into the fishing community probably required more than the acquisition of a valid license. A fisherman who wants to participate in the system has to know the rules of the game and the named fishing spots. (As one fisherman put it, "Suppose some guest worker comes from Germany in his Mercedes car and wants to fish, do you think we would allow him? No way.")

The organizers of the rotation system had sufficient support from the community of fishermen as a whole to supervise it because the system benefited everyone except those who once monopolized the prime sites. The organizers were cooperative members, but the cooperative was not formally involved in the rotation system. Yet the organizers often cited the legal authority of cooperatives over "local arrangements" to legitimize the system. The reasons for this contradiction are not clear. Some of the differences between Alanya and, for example, Tasucu may be due to the lack of a strong cooperative organizer and to a greater sense of individual entrepreneurship in Alanya. (Again, a fisherman: "Fixed prices as in Tasucu? Well, our fishermen in Alanya would never stand for that. We are individualists; we sell to whomever offers a better price.")

About half of the Alanya fishermen were not members and sold their catch through buyers who were able to offer a slightly better price than the cooperative ("by evading municipal taxes," according to the cooperative secretary). The nonmembers were thus preventing the cooperative from building a stronger financial base and accumulating political power. The cooperative was therefore unable to offer its members the kind of service the Tasucu cooperative was able to give.

Bodrum and the Bay of Izmir Fisheries

Both of these fisheries were overcrowded and the stocks overexploited. In the case of Bodrum, the overfishing appeared to be due to the financial success of trawlers in the early 1970s--a success that attracted new entries until the cost of fishing exceeded the revenues of the fleet as a whole--a textbook example of rent dissipation in a fishery (for example, Gulland 1974). Most of the trawlers then abandoned the area, leaving the depleted stocks to small-boat fishermen. The spokesmen for the trawlers expressed dissatisfaction with this turn of events, not so much because the stocks had been depleted, but because the trawlers had become very restricted in their area of operation. According to trawlermen, in the 1970s the government had encouraged them to build the new vessels and had rarely enforced the three-mile limit, much to the anger of the small fishermen. However, with tighter regulations on trawling, trawlers could no longer make a living in the Bodrum area and went to the shrimp grounds near Mersin.

Meanwhile, in Bodrum, conditions had become no better for the small fishermen. The booming tourist trade resulted in higher prices for fish, but this also brought a great many part-time fishermen and charter boats into the fishery, and created apparently insurmountable problems of conflicts within user groups.

A similar situation with conflicts within user groups also existed in the Bay of Izmir, although the line-up of groups was somewhat different. But here the problem was not the trawlers (none were allowed in the bay). Rather, the problem was due to the proximity of a large urban center, a lucrative market but also a source of large numbers of semiprofessional fishermen. Unlike Bodrum, cooperatives did exist in this case, but represented only the narrow interest of various groups competing over the share of the markets.

With over 750 licensed commercial boats (Table 1) and a great many semiprofessional fishermen, the area was so crowded that it was simply not possible for any group to defend a fishing area. In fact, many trammel net fishermen found it difficult even to defend their own nets. This explains the existence of liftnet fishermen as a distinct group. The liftnet fishermen do not set and leave the net in the water to be retrieved later, but rather set and lift the net repeatedly over a wide area and look for visual evidence of such fish as the gray mullet (Muqil cephalus).

CONCLUSIONS

Fishing is a zero-sum game in which the limiting condition under which jointness can be maintained is to match the fishing pressure with the ability of the stock to sustain it. Since there is no license limitation in Turkish fisheries, overcapitalization develops if the demand is high enough (Bodrum and the Bay of Izmir case studies). However, if the local community has sufficient control over the resource base and can also act cooperatively, the problem can be avoided by instituting closed-access conditions (the case studies of the lagoon fishery, Tasucu, Alanya). Thus, it appears from the case studies that the most important condition under which coastal fisheries can be self-managed successfully is local control.

This also is the key to solving the conflict and allocation problems involving the inshore and offshore sectors. The development of large-scale offshore operations is encouraged by the government so that supposedly underutilized offshore stocks can be fished. The biological reality is that, except for extensive shallow seas and a few upwelling areas such as that off Peru, offshore waters are biologically unproductive and therefore costly to fish. In many cases, the "offshore fleet" ends up coming inshore and conflicting with the coastal fishery (Thomson 1980; Dasgupta 1982; Fanayotou 1982). Thus, the historical and traditional fishing rights are relevant for the solution of this allocation conflict (Dasgupta 1982), and the protection of these rights becomes a necessity (Thomson 1980). There is a fairly large literature on this (for example, Berkes 1985).

This study shows that the presence of cooperatives or "traditional" fishing communities are not necessary pre-conditions for successful self-management. Local "operational rules" for resource management can evolve relatively quickly: 15 years in Alanya and Tasucu and 9 years in the coastal lagoon fishery. The presence of producers' cooperatives is not a necessary condition for successful fisheries management, but it certainly helps if the cooperative is able to act as a management institution in making sure that "common property" is not "open access." Whether or not this can be done depends not solely on the technical/physical nature or the decision-making arrangements or the actual behavior of the users, but a combination of these.

NOTE

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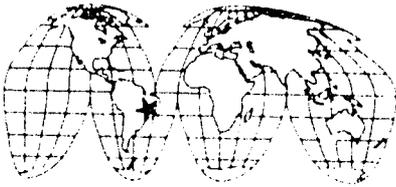
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Sea Tenure in Bahia, Brazil

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INTRODUCTION

Property institutions--systems of rules specifying permissible and forbidden actions and the rights and obligations of individuals and groups with respect to the resources in question--are potent forces in social evolution (Bromley 1978; Runge, this volume). Knowledge of the formation and functions of property systems, however, is largely confined to studies of terrestrial economies, western countries, or legal institutions. There have been few inquiries into the nature of sea ownership or fishing rights aside from theoretical or public policy studies and ongoing debates over the international law of the sea. Even less is known about matters of "sea rights" in the Third World, of de facto fishing property arrangements, and of hereditary claims in small-boat fishing communities. Curiously, the issue of customary sea rights and laws--a paramount concern for many coastal fishing peoples--has almost never been raised by anthropologists otherwise interested in the territorial rights observed by indigenous and traditional cultures (e.g., Bodley 1981).

In recent years, however, ethnographers have begun to investigate the neglected domain of customary property relations in maritime fisheries and have discovered "sea tenure"--collectively managed informal territorial use rights in a range of fisheries previously regarded as

unownable (Johannes 1978; Acheson 1981; Christy 1982; Cordell 1986). Sea tenure is concerned with ways in which inshore fishermen perceive, name, partition, own, and defend local sea space and resources. Western authorities have conventionally viewed coastal sea space and fishing grounds as resources to which no property rights are attached, where the "commons" are open to all comers, and where fishermen engage in unrestricted competition for a limited product (Christy and Scott 1965; Gulland 1974; Crutchfield 1982). Because no single user has exclusive use rights in the resource or any right to prevent others from sharing in its exploitation (Christy and Scott 1965:6), individual users have no incentive to restrain production (Christy 1964:2). No consideration is given to the possibility that certain arrangements of property rights, jurisdiction, or ownership might be able to reduce resource use (Christy 1982). Where these authorities do admit the existence of cooperation in maritime communities, they see exclusively selfish motives (Muir and Muir 1982).

It is worth noting that maritime networks for all their egalitarianism are not based on friendship. Friendship implies an emotional relationship which supersedes economic advantage. You'd give a friend the shirt off your back. That makes a friend an economic liability ... maritime networks don't rely on trust or the emotional bonds of friendship (Muir and Muir 1981).

Moreover, the well-entrenched "culture of poverty" school of thought on Latin America construes social marginality as a foremost obstacle to any adaptive community organization or stable resource management (Lewis 1952; Varallanos 1962; Oberg 1965; cf. Pearlman 1973; cf. Lobo 1982). From this perspective, the marginal fishermen of Bahia would be especially incapable of regulating their own fishing behavior and protecting the ecology of tropical marine resources.

These conventional views fail us in two respects: first, they cannot account for the allocation of exclusive joint use rights that we find in traditional inshore fishing regimes. Second, they fail to take into account the powerful currency of reciprocity and cooperation--even generosity in poverty--or their mollifying effects on potentially destructive competition and their capacity to assist in sustaining and regulating fisheries and other renewable resources. In fact, many maritime communities have "informal" systems of rights to resources and sea

territories that are supported by unwritten laws and subtle interpersonal relationships within close-knit communities. Even if they are not evident to the outside, these arrangements are just as real, socially binding, and ecologically consequential as standard catch quotas, seasons, and selective licensing programs used by governments to manage fisheries for sustained yields. Indeed, in certain non-industrial inshore settings they are more effective.

This paper looks outside mainstream Euro-American definitions of fishing rights to document fishermen's sea tenure in shallow, near-shore waters in Bahia, Brazil. Southern Bahia is one of the few tropical coasts where traditional sea tenure has been sufficiently documented for us to perceive its social logic, ecological basis, and strategic role as a resource management institution. In view of the well-known difficulties of designing and enforcing regulations in fishing, valuable lessons may be learned from traditional "unofficial" management practices. This ethnography of Brazilian sea tenure suggests some of the benefits of studying and working to maintain local tenure and customary fishing rights in the marine commons.

Four salient features of sea tenure in peasant communities of rural Bahia are discussed: (1) physical and technical attributes--the environmental parameters conducive to subdivision of the fishing grounds into "closed community" territories; (2) the decision-making arrangements--the rules and mechanisms of collective action and group sanction that work to legitimize and uphold the tenure system; (3) the patterns of interaction--the social contexts in which sea rights are extended, in which disputes arise, and in which conflict is resolved; and (4) outcomes--the problems of uncontrolled coastal belt and fishery development that undermine village solidarity and break down territorial autonomy in local fishing, with detrimental impacts on the equity among fishermen and also on long-term efficiency and productivity of inshore fisheries.

PHYSICAL AND TECHNICAL ATTRIBUTES

Throughout the Latin American tropics are many impoverished fishing peoples who have not made the transition to modernity. Among the poorest are the fisherfolk or beirados (shore dwellers) of southern Bahia in the Brazilian Northeast. Fishing for subsistence or for a small cash or supplementary income has long been a critical livelihood

alternative for the poor in this region. Today's predominantly black maritime communities developed as successive generations of hinterland plantation laborers lost out in the wider economy and took refuge in the mangrove swamps that no one else had the need or stamina to exploit. These fishermen still work from dugouts, slogging through the mangroves day after day often with little more to eat than the crab bait left over from their traps and trotlines. There is no upward mobility out of swamp fishing into the Brazilian economic mainstream. The Bahian canoe fishing population has no stable market involvement and at times even suffers the failure of its "last-resort" fishing strategies. There is an unmistakable decline in living standards at the landward edge of the swamps where a majority of fishermen live.

In the Brazilian economic hierarchy, fishing has low visibility: in 1976, revenue from fishing was 1.31 percent of the gross national product and only 2.5 percent of total agricultural production (Morris 1979). Traditional fishermen, assumed to be primitive and inefficient, are often blamed for the low productivity of the industry. Yet Bahia's traditional marginal fishermen still land roughly 70 percent of the catch on the southern coast (Silva 1979), and thus contribute substantially to the area's internationally acclaimed cuisine, help to sustain the vital tourist industry, and seasonally stock the domestic seafood market with fresh fish. They are struggling to maintain control of their mangrove, estuarine, and coral reef sea territories as large seafood companies, high-tech fleets, and export and interstate markets increasingly dominate both inshore and offshore fishing in most other parts of Brazil.

The Bahian coastline is indented by estuaries, swamps, and tidewaters dotted with sedimentary and coral reefs. These comparatively sheltered waters seem conducive to marking off micro-habitats for fishing claims. In addition, the proximity of fishing grounds to home ports affords the fishermen great ease in guarding their territory. Typically, the inshore fishing pattern centers around local plantation ports and provides coastal and immediate hinterland markets with fresh catches. Day-trip operations and many traditional methods (e.g., the calao, a purse seine) have changed remarkably little since their introduction by sixteenth century Portuguese settlers. Fishermen on the southern Bahian coast still work mainly from sail canoes, using customary lines, nets, traps, and corrals to harvest more than 200 different species of fish and shellfish. They lay claim to extensive fishing grounds in the

1,000 kilometer strip of shallow waters between Salvador and the Abrolhos Banks (see Figure 1).

The calao is a shallow-water purse seine, finely adapted to catching large schools of estuarine-spawning fish; it is operated by eight-man crews from dugout canoes 6 to 10 meters long. New nets may cost from \$200 to \$700, depending on size, quality, and elaborateness of mesh; few caloes are bought brand new. They are usually inherited in various advanced states of use and have been extensively repaired. Owning such a net is a fishermen's foremost economic aspiration and a mark of high social standing. A 200- to 300-meter calao typically represents the investment of a fishing captain's life savings.

Purse seining must conform to the intricate tidal changes along Bahia's estuaries and creeks that wind back into the mangrove swamps. A system of reckoning tides based on phases of the moon enables the canoe bosses (mestres) to monitor closely the behavior, migratory routes, and life cycles of fish (Cordell 1974). Seining and nearly all canoe fishing moves in a circuit: at neap tide, fishermen concentrate along the northeastern shores; as the tide begins to rise, they move inward into the main body of the fishing grounds. At spring tide, activity shifts to the southern reaches, and finally, as the tide falls, boats move back up into the main channels. The contours of the estuary are affected by currents, so a spring tide in the inner reaches of the fishing ground is like a neap tide in the outer reaches and vice versa. The result is that fishermen can use most of their techniques every day, as long as they choose fishing spots appropriate to the day's current regime.

Favorably located water space becomes valuable, and netcasting spaces are ranked according to criteria such as ease of access during foul weather, distance from port, past production history, and so on. Because fish and fishermen alike must move from spot to spot, it is neither possible nor desirable to create physical barriers around each fishing territory, so rules must substitute for fences to exclude interlopers from each spot. The elaborate system of rules and enforcement mechanisms that has evolved then allows the fishermen to maintain considerable jointness of use of the inshore fishery as a whole. In sum, whereas in most fishing systems, including those of Bahia, the limiting condition on production is ultimately resource availability, a more immediate check on sea tenure relations is the waterspace opportunity configuration for purse seines.

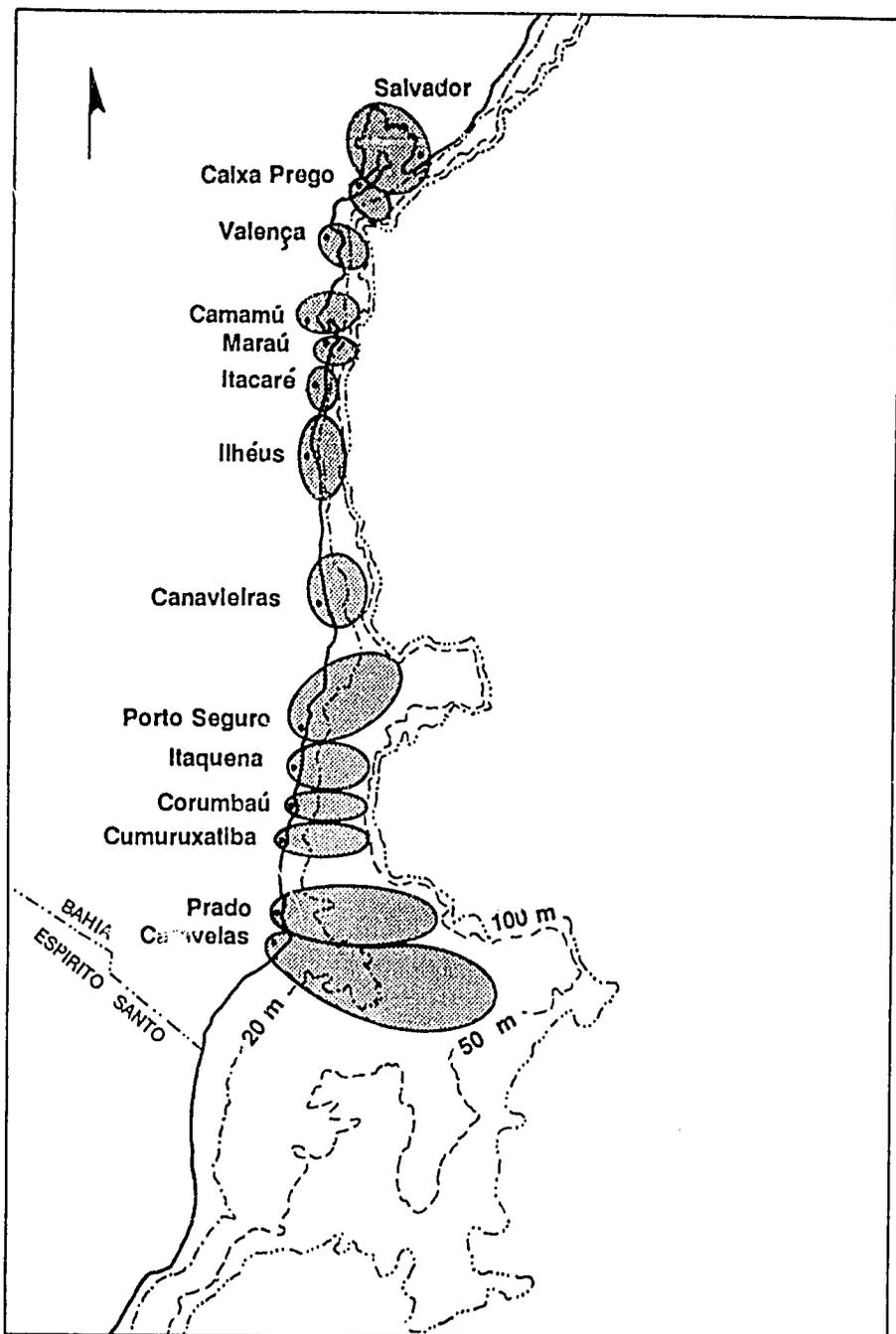


FIGURE 1 Fishing territories of Southern Bahia.

Decision-Making Arrangements

It is important to note at the outset that the forms of sea tenure practiced in rural Bahia are not acknowledged by any formal governmental body; in fact, they contradict national fishing codes that stipulate that Brazilian territorial waters are public property. As far as the national government is concerned, any Brazilian boat registered in a national port can move anywhere and take any amount or species of fish. SUDEPE, the fisheries bureaucracy, simply does not have the capability to play a significant managerial role in fishing. The fact that Bahian and other similar fisheries in the Northeast exist outside the purview of the national fisheries administration poses critical questions for marine resource use: What happens when fishermen are left to their own devices? Are resources and fishing activities essentially unmanaged? Do local fishermen share the government's view of their resources as available to all? Is fishing destined to degenerate into what Hardin (1968) calls the "tragedy of the commons"? What happens when traditional fishing collides with modern markets and fleets that penetrate previously isolated fishing grounds?

Bahian canoe fishing systems reveal a number of paradoxes and hidden strengths of life within the confines of marginality. Within their inshore domain, Bahia's rural fishermen, even those heavily dependent on creditors and middlemen, are their own bosses. They take advantage of the screen of geographical and cultural marginality to work unencumbered by government regulation. They are able to avoid purchasing licenses for their boats and gear or paying dues to the corrupt local fishing guilds, and they instead market a large portion of their catch clandestinely to avoid special docking and municipal fisheries tariffs. Though they do not have to deal with national regulations and laws, they do not live in local anarchy; rather, they create, maintain, transfer, and defend an elaborate system of fishing rights outside the written law of the sea. Thus, the destitute and politically powerless fishing population of Bahia can own large stretches of shoreline sea that Brazilian law regards as open-access public property.

It is impossible to determine with any finality how and when sea tenure evolved or how canoe bosses consolidated control over premium water space in Bahian canoe fishing. There are no court records or laws to support fishermen's claims. Yet sea tenure in the form of space controlled by

the community, by individuals, and by social networks has existed over the span of the oldest net bosses' memories, including their knowledge of fishing in previous generations. It is a century-old tradition at the very least. Fishing grounds range from 400 km² to 600 km² and are restricted in size by how species are distributed close to shore, by the fact that the sail canoes (even if motorized) cannot effectively carry ice or maneuver at sea, and by the rhythm of markets in local ports and the hinterland, where consumers demand a daily supply of fresh fish.

In the northern part of the fishery around the port of Valena there are 258 traditional net-casting spots (pesqueiros), each accommodating a range of methods (hand lines, trotlines, set nets, traps, and seines). To prevent people using different techniques from interfering with each other, pesqueiros are subdivided into nonoverlapping lanos, or minimal water spaces, as determined by fortnightly current changes, daily tide-level changes, lighting conditions during different phases of the moon, position of the lano relative to the shore slope, bottom conditions, and the interactions of wind and current. Names are bestowed on the spots by fishing captains who exercise exclusive use rights over these tiny chunks of lunar-tide fishing space.

Tenure may vary from sequential net-casting claims on migratory species lasting hours or a few days to long-term private claims covering brackish water spawning grounds, reefs, and net fishing spots defined by the lunar-tide cycle (cf. Forman 1967; Cordell 1974). Relative mobility of gear and fishing craft, seasonality, micro-environmental zones, life cycles of fish, and a whole host of social variables enter into the constellation of tenure arrangements found in a given locale. Rights to fish are characteristically transmitted in limited numbers of apprenticeships, kinship, and other long-term social relations connected to the work setting.¹

Tenure-holding units vary from loosely allied groups of fishing captains, families, or informal partnerships to extended ritual kin groupings and individual canoe fishing captains who monopolize clusters of net-casting locations. Knowledge of how to fish under this system is passed on in a limited number of apprenticeships; these may last as long as 10 or 15 years. Not all apprentices become proficient net-casting specialists and equipment owners, and consequently do not inherit rights of access to the most valued fishing grounds.

Marginal areas of the fishing grounds also include

areas of essentially unclaimed sea space where new fishing spots are discovered and staked out from time to time. There is also a series of intervillage buffer zones, where rights are defined loosely, if at all. Yet even in the most marginal waters, special agreements exist for exercising well-ordered, sequential temporary claims to net-shooting areas. This system of property rights and rules has evolved slowly and only as a response to endogenous competitive pressures; there is no formal assembly of all rights holders, nor are there constitutional rules (rules for making rules) by which rights holders may convene to change the operational rules for fishing the inshore sea. Instead, existing kinship and other social relationships provide the arena in which rules are enforced.

Patterns of Interaction

Purse-seining is the occasion for much social drama. These large, encircling caloes are thought to be particularly deadly for the catfish, which is greatly prized locally for its flavor and tenderness, though worth relatively little on the official market. Thus a good calao catch reaffirms a man's faith that God will continue to send him runs of fish. A captain can take great pride in bestowing these fish on friends and relatives, paying off debts to middlemen, and holding beer-drinking fests. A bar floor littered with broken beer bottles at dawn is a sure sign that a fishing captain has been celebrating great good fortune and skill: empty beer bottles are valued storage containers in swamp-fishing neighborhoods, and to break them is considered extravagant.

Purse-seining gives people a special opportunity to air their grievances through soap box oratory, to bestow or withhold favors, to praise or ostracize their companions, and to mobilize participants in social networks. It is necessarily a cooperative enterprise, as many people may be involved in a single net-casting sequence--sometimes several crews of eight to ten men each--and catches are shared. Risks are great because there is often precious little time to deploy and haul a net against the tidal flow and get the fish back to market without ice at peak hours before they spoil (Cordell 1974). And it is naturally conducive to conflict because the stakes are high relative to the catch and earning potential of other techniques. Fishermen spend many hours debating and analyzing what goes

on in calao fishing. What is condensed here of their storytelling and fussing illustrates how sea space is named, owned, partitioned, and governed by an implicit social contract or reciprocity and an ethical code of respeito (respect); this constellation of techniques regulates access to premium net-casting locations and minimizes conflict.

Cooperation

The ethical code associated with respeito is much more encompassing than is superficial fishing etiquette, and far more binding on individual conscience than any government regulations could ever be. Where material wealth is scarce, debts obviously arise from reciprocal exchanges among fishermen, and the respeito that ensures that these debts will be honored is the measure of a person's worth. It is impossible to fish for long in a given community without receiving and showing respeito. People honor each other's claims because of respeito, which is created, bestowed, and reaffirmed through sometimes trivial and sometimes substantial acts of benevolence bordering on self-sacrifice. Fishermen need not be physically present to defend their territories or to make them real. Shore-side economic necessities continually reinforce cooperation.

Marketing fish, obtaining bait, building canoes, borrowing and lending equipment, mending nets and sails, locating crew, and acquiring information on weather and catches create opportunities to perform small favors, building up dependencies for future exchanges. Some favors up the ante: giving tows, helping someone string a trotline, or bringing special wood of the white mangrove to form crossbeams for a house. Gifts of fish, income from the catch, and shares taken filter down through the neighborhood and village networks. All these exchanges set up comfortable interdependencies that carry over into fishing and make it a distinctly sociable undertaking.

Perhaps the most explicit show of cooperation and respeito is made during the peak catfishing season in June and July. Good net-fishing spaces are narrow due to tidal fluctuations, so the chance of conflict over water space is great. To relax spatial access codes in the lunar-tide property system during this time, fishermen enter into temporary partnerships that are dissolved when the spawning runs subside. This turns out to be a very practical

scheme, since catfish are liable to enter the estuary in such large schools that a single boat and crew cannot possibly catch all the available fish. If the catch is too large to fit into several boats, one crew's net is used to construct a temporary fish corral out on the tidal or reef flats. Once the main catch is delivered, more live fish are retrieved from the corral net.

Another important occasion for bestowing favors involves marketing fish. Some captains double as fish hawker-gamblers (pataqueiros). These people are supposed to be officially licensed by the mayor's office, but there is considerable moonlighting, and it is difficult to bring the activities of hawkers under the control of the local prefecture that oversees the operation of the fish market. Fishermen can always find black market buyers who usually pay slightly less than the going rate in the official market. But selling fish to a hawker enables one to avoid paying a weight and class-specific tax and eliminates the annoyance of going upriver into the market to unload fish. Hawkiers have a clientele in mind, and they have a fairly good idea of what the demand will be for the fish available. The problem with selling to hawkiers is that they seldom have cash on hand for an on-the-spot transaction. A fisherman, then, may choose to sell to a hawker on credit.

A great deal of mutual trust must accompany such transactions: selling on credit is a vote of confidence in the hawker's reputation. Another fisherman and his hawker provide an audience for the display of respeito. When a price is agreed on and a transaction falls through, the hawker must cover the loss himself. If the hawker fails to fulfill his end of the deal, witnesses to it can usually bring enough pressure to bear by way of gossip and verbal censure to extract the amount due.

For Bahian purse-seiners, the ultimate test and strongest demonstration of the cooperative ethic occurs in the context of godparenthood networks, with their distinctive rituals and obligations. As summer weather opens up the outermost ocean-beach fishing spots, boats from ports upriver and in the swamp fan out to the ends of their territories, and intervillage conflicts can arise over net-casting space and schools of fish. Becoming a godparent is one strategy to gain access to new territory and to fish safely in waters of an adjoining community. The first step is to arrange to sell a catch to hawkiers in neighboring territories, to make gifts of fish all around, and if the catch is good, to pay for a beer-drinking ses-

sion. After initially displaying good will, the visiting captain may either volunteer or be asked to be a godparent to another fisherman's child. These relationships are frequently established after only a brief acquaintance, and a major benefit is to confer summer fishing rights. These ongoing rights may endure for many years, reinforced by other types of cooperation.

Alternatively, a captain planning to fish close to another community's sea space will arrange to take along a crew member who has a local friend. This is a necessary precaution to ensure that his crew will receive good treatment if they have to go ashore, and to avoid the threat of competition during net-casting sequences. Some people will venture into interstitial areas to fish only when they have a network of friends or actual kin in adjoining villages.

The phenomena of becoming a godparent and establishing networks of informal contracts to ensure sea rights result in wide-ranging circles of fishermen bound by respeito, and also account, in part, for the cooperative extension of sea tenure within a community. Canoe fishermen, purse-seiners in particular, have huge personal networks with many godparent connections that often run through a series of villages. Such ritualized extension of sea rights restores an element of flexibility in fishing opportunities where waters are otherwise exclusively used and claimed by single villages.

Another tactic is used to minimize the possibility of competitive encounters: when a captain wishes to fish in a particular spot outside the system of lunar-tide property rights, he announces his intention--including what tide level or series he will use in casting nets--several days in advance at a local bar where fishermen like to congregate. All that is required is for another fisherman to be present as a witness. To ensure the claim, the captain must follow his proclamation by going to the chosen spot the day before fishing to leave a canoe anchored with paddles sticking up in the air. This forewarns competitors that the casting space has been taken. Fishing captains go to considerable lengths to support each other in this routine, which is part of the sea tenure politics that shore up the entire fishing system.

A cogent illustration of the honor code is the way fishermen cope with potential and actual competitive encounters while fishing the intervillage buffer zones. What often happens to create territorial conflict in unclaimed or less-fished waters is the simultaneous arrival of several boats, sometimes from different ports, to go

after a sizable school of fish when the tide offers room and time for only one optimal net cast. Net bosses follow a standard procedure of drawing lots to decide who will cast first. Once an order is established, a tide marker, usually a pole stuck in the bank, dictates a sequence of net-shooting rights. Not more than one tide-level change is allowed each boat. On this basis, captains decide whether to remain. Sometimes this queuing pattern works out well, but often a boat will not close its seine and draw in the catch in the specified time. If the next boat in line begins its operations regardless, the two nets can become fouled.

Within a community's fishing grounds, where tenure privileges to lunar-tide space are clear-cut, accidents happen. Although units of net-shooting space have been worked out over time so boats can operate at a safe distance from one another, one prime casting space will occasionally overlap with another immediately upstream or downstream that belongs to a different phase of the tide cycle. In this case, fishermen may observe spatial boundaries correctly but miscalculate time boundaries. The resulting territorial infringements might appear trivial, but nonetheless have the potential to disrupt fishing operations and social relations.

Bahian fishermen take a certain amount of competition and boundary fuzziness for granted. The limits that people will tolerate depend on the extent to which potential competitors are linked by the honor code. Within these limits, which vary between individuals and social networks, people try to get away with whatever scheme will increase their fishing success. Canoes, for instance, have a way of disappearing before a critical fishing expedition and later turning up adrift on the tide. Nor is it unusual to find a fishing captain buying drinks for a competitor's crew, in hopes of getting them too drunk to leave in the time required to reach a mutually desirable fishing spot.

In any of the above situations, however, where there is a potential conflict over a fishing claim as a result of net crossing, most captains would rather act deferentially toward a competitor than force the issue. At first glance, the rationale for this ostensibly one-sided concession may appear self-defeating. However, the posture of noninterference increases a skipper's respectability, upholds the cooperative ethic, and sets up reciprocal debts of gratitude to be paid at a later date. As a captain goes out to work borderline fishing grounds, it is especially important to know who can and who cannot be trusted to stay

within acceptable bounds of competition and honor the prior occupancy rule.

Failure to cooperate in these practices can be much more devastating for a fisherman than would be breaking a government law. Respeito is a cognitive reference point to the community conscience. It influences how fishermen evaluate each other's actions on and off the fishing grounds. It is a yardstick for measuring the justice of individual acts, especially in conflicts. Collective social pressure to conform to the ethics of fishing is reflected in the ôlho do povo (watchfulness of the community's eye, or sense of justice), reminiscent of the forceful moral and ethical standard in Palauan fishing, "words of the lagoon" (Johannes 1981). Reputations rise and fall in terms of the ôlho do povo. The ôlho do povo determines whether territorial competition in fishing is deliberate or accidental, and whether it is antagonistic enough to require counteraction.

Conflict

Just as the community confers rewards on those who follow respeito, it may withdraw the benefits of exchange and reciprocity from people who consistently create conflict in fishing. The most severe gesture occurs when an entire network of fishing captains decides to deny territorial use rights to a troublemaker who does not respect their lunar-tide claims. They can do this by sabotaging equipment, disavowing the prior occupancy rule and competing fiercely for space, engaging in deliberate net crossing, or boobytrapping net-casting spaces. These strategies and withdrawal of cooperation on shore are powerful incentives for renegade fishermen to mend their ways or leave the community.

From time to time, competition within the traditional community gets out of hand and escalates into disputes, calling into play a coercive and punitive set of social controls on fishing. Most captains espouse an "eye-for-an-eye, tooth-for-a-tooth" brand of swamp justice. They recognize a danger in letting someone get away with violations of claims or codes and consider it their prerogative to redress grievances so no one will become addicted to wrongdoing.

But the backup social controls are also strictly channeled. In cases of serious rifts, certain individuals are

called upon as mediators (aconselheiros). Were it not for the concerted efforts and personal examples set by these key individuals, the cooperative ethic might remain more symbolic than real as a binding force in social relations. Mediators are people to be emulated. They epitomize respeito in all they do. They are usually retired fishing captains, or in some cases fishermen's widows. These individuals take an active interest in the welfare of the fishing community and are constantly sought out for advice and to exhort fishermen to maintain respeito in times of controversy.

Although more or less deliberate incursions into private fishing space are a common feature of disputes, they are seldom the root cause. Conflicts of this sort usually have a long history. Mediators must be able to comprehend and soothe the social relationships that have fluctuated and festered over a long period of time. Prolonged disputes resemble the legendary Appalachian feuds: they reach across several generations and are marked by vengeful acts and general hostility among coalitions of fishermen and their families and friends. Most fishermen's disputes begin with rifts onshore and carry over into fishing with its peculiar competitive possibilities. Contesting captains may try to claim each other's fishing slots by force. The victims are likely to retaliate by poaching, stealing equipment, sinking canoes, or boobytrapping fishing spots with jagged tree trunks and boulders capable of ripping an intruder's net to shreds. In extreme cases, people fight with machetes. Disputes over fishing claims frequently result from family quarrels over infidelity, wife-beating, or inheritance of assets (such as a house or fishing equipment). Once a confrontation (such as ramming a canoe) occurs on the fishing grounds, much drama in the fishing neighborhoods is bound to arise, especially if anyone is physically hurt. The heated public exchanges, threats, and counter-threats that follow surely have reverberations in subsequent fishing trips.

There is only one way to end a state of disunion among fishing captains, crews, and families once grievances have escalated to violence: the combatants must be willing to air their grievances before a mediator. To promote reconciliation, the mediator must invoke respeito, the cooperative ethic, as it is reflected in the ôlho do povo, and bring it to bear on individual consciences.

Thus, the way out of a dispute is not to fix blame and then to punish the wrongdoer, but to negotiate reunion (by appealing to the sense of justice) and to restore equality.

A simple face-saving gesture by either one of the parties will suffice for openers. This involves humbling oneself and showing that one no longer wishes to carry a grudge. If successful, this strategy will lead to an exchange of favors or kindness. The conciliatory gesture may consist of a gift, perhaps a fish or a tow in from fishing in bad weather, which might otherwise seem insignificant. Through an exchange of just such small favors and concessions, fishermen are frequently able to come to terms, reestablish respeito, renew cooperative relations, and reaffirm the value of honor and deference in avoiding water space challenges.

In most cases, fishermen involved in disputes not only feel justified in selective acts of reprisal, but consider themselves immune from punishment by police in nearby towns. At the request of the local sheriff, civil disorders are usually handled by state military police who have garrisons in the major seaports along the southern coast. Fishermen see little threat from these authorities, however, because they contend that their swamp neighborhoods are outside the jurisdiction of the state and local townships. They believe that their homes and fishing grounds come under the control of the Brazilian navy and federal jurisdiction.

Under Brazilian law, there is in fact such a separation in authority over land and sea, and the navy historically has been the central figure in regulating fishermen's activities and registration in professional organizations. But most of these regulations never penetrate the mangrove swamps, and fishermen's only contacts with naval authorities are with indifferent local port captains who for the most part leave fishermen alone. Because of their peripheral social status and dissociation from government, fishermen believe that they cannot be prosecuted on land for illegal acts committed in fishing. Taking advantage of the thinness of national political and legal authority in rural coastal fishing areas, a fisherman charged with a serious crime will flee to the recesses of the swamp until things blow over, because he will be on federal territory and supposedly safe from prosecution. Accordingly, fishermen exercise their own brand of "bush" justice in the course of fishing disputes, most of which are ultimately a response to harmful acts committed on shore. This laissez-faire situation underscores the marginality of traditional swamp fishing with respect to modern Brazilian politics and the legal system, and it allows Bahian fishermen to create and enforce their own rules for sea tenure.

OUTCOMES

For many years, Bahia's inshore sea tenure traditions operated smoothly. There was no evidence that coastal fisheries were being exploited in an ecologically damaging manner, indicating that the practices described above were a successful arrangement for managing common property resources. A true self-regulated fishery presumes that fishermen know both the limits of their resources and the impact of their equipment on resource availability, and furthermore that they have the ability to keep their rates of exploitation in line with the productive capacity of the environment. It is doubtful that there is a traditional system anywhere that would meet this presumption. Many commercial species are transboundary or highly migratory, and no group of inshore fishermen can manipulate the fate of entire species over their life cycles (cf. Johannes 1981).

Yet this is not to say that deliberate conservation strategies do not occur or that fishermen cannot assess the effects of their gear on resources and accordingly adjust their fishing efforts. Captains possess various means to gauge how much their production system can safely expand (Cordell 1977). Perceptions of what constitutes a "safe" number of people on fishing grounds, however, are primarily based on acceptable levels of boat crowding rather than on estimates of the reproductive reserves of fish that are necessary to sustain certain levels of production.

Resource management in purse seining is socially diffuse and does not involve decisions by a controlling group or individual; neither does the configuration of territorial ownership control fishing. Rather, fishing is controlled by the special cooperative relationships fishermen develop with one another. Sea tenure is an extension, almost an epiphenomenon, of these personal networks. Within their sea tenure networks, fishermen exercise controls on participation in fishing that may directly or indirectly limit the intensity of exploitation. Apprenticeships and associated channels for the recruitment and mobility of fishermen serve to limit entry to the fisheries in question, in turn curtailing fishing pressure. Although there is no evidence that tenure patterns were intentionally elaborated for conservation purposes, fishermen have species-specific knowledge of reproductive and migratory behavior and display a sophisticated and biologically well-founded perception of the natural limits to their production system.

The sea territories are collectively defensible, and only local fishermen know how to work them safely and productively on a sustained basis--both of which discourage encroachment. Left to their own devices, local fishermen can enforce their territorial claims against competitors of similar economic means. However, since sea tenure is legitimized only by internal mechanisms like respeito, it can easily be subverted by the modernization of fishing technology and the expansion of markets. Traditional fishermen are extremely vulnerable to territorial displacement, loss of sea rights, and resource "piracy." All that is required to shatter the balance is for an external power to assert domain--easily done in Brazil because of national laws declaring the shore to be public property--or for a local enclave to begin using competitive technology. Local fishermen cannot cope indefinitely with entrepreneurs who have more capital or with nonresident vessels that have no respect for local customs and no need to cooperate because they will move on after they deplete local resources. At that point, the internal code among local fishermen loses its own *raison d'être* and breaks down; there is no longer anything for the local fishermen to gain through cooperative fishing or respect of traditional authority or autonomy.

Such encroachment by inappropriate gear and nonresident boats began in the early 1970s, when nylon nets started to compete with traditional gear for identical species and water space; the consequences for traditional fishing were very destructive. We do not have the statistical data on costs and catches for different fishing methods that would be needed to evaluate the efficiency of different techniques, but we do know that overfishing of certain species and areas has occurred since 1970, and that traditional fishermen are even poorer in relative terms than they used to be. Hundreds of monofilament nylon gill nets and seines were introduced by the fisheries agency (SUDEPE), which provided loans and tax incentives for investors.² Affluent strangers using nylon nets were unable to coexist peacefully with the established purse seiners, and cut-throat competition for limited net-casting spaces began in earnest. This rivalry has altered the distribution of equipment in Valença and the concentration of ownership in the different categories represented. There is a tendency for traditional nets to be abandoned in favor of secondary methods, such as mobile trotlines and fish corrals, which have a fixed seasonal location and an uncontested exclusive or even private tenure status. By far the greatest

reduction of gear has occurred in the category of traditional natural-fiber nets. On the whole, net fishing has been in decline since 1970; but traditional purse seining, which is remarkably well adapted to estuarine fishing and to the social organization and redistributive food networks of poorer neighborhoods, has been making a slight comeback since 1976.

As a result of encroachment, rich nursery-area fisheries have been gravely damaged, and short-term speculation and overcapitalization have led to sudden overfishing of a number of native estuarine and reef species. Previous studies of the Valença Delta (see Figure 1) have recorded the debilitating changes in canoe fishing society that were set in motion with the arrival of nylon gear (Cordell 1973; 1978). Since 1970, conditions have worsened in the Valença Delta and along the southern coast of Bahia, as far as the Abrolhos Archipelago. Uncontrolled exploitation of land and sea resources in the coastal zone has reached a critical intensity (cf. Kottak 1983). Over the past 15 years, investors and economic planners have targeted the southern shore for every conceivable kind of development--not just fisheries but also oil exploration, shipbuilding, tourism, lumber, agriculture, aquaculture, mining, and heavy metal processing. New roads have been built into the region, making it accessible from the large urban centers of southern Brazil and the state capital, Salvador.³ The greatest exploitation of fisheries has been near the major cities and near shore. A critical area of actual and potential overfishing now extends from the landward range of mangrove swamps out to a depth of 50 meters, which roughly corresponds to the limits of most inshore fishing gear.

Two of the most visible and possibly destructive pressures on inshore species are the aforementioned use of monofilament nylon nets and the "pirating" of peasant fishing territories by out-of-state trawlers and longliners. The unregulated use of nylon gear--a single vessel may set several kilometers of nets--is implicated in territorial conflicts, equipment foul-ups, and reduction of catches from traditional gear. The blockade effect of gill nets stretched across a channel may also adversely affect spawning runs. There has been a continuous escalation of trawling in waters with depths between 20 and 50 meters. Large power boats with tiny meshed seines for shrimp kill many other demersal species. In general, modern trolling and trawling interfere with the operation of traditional methods and can irreparably damage the set gear of small-

scale fishermen. Particularly during spawning runs, they compete for the same spots and species.

In Valença and other southern ports, excessive netting of major commercial varieties of finfish has produced a spillover effect on shellfish. Many local fishermen work the mangrove shellfish habitats, and migrants to and from cities often settle in the swamp areas to scavenge. More and more fishermen who conventionally work in the estuaries and farther offshore with large encircling and dragged nets have been forced to turn to the swamp for survival. Recent studies indicate that the intensity of foraging for some mollusks and crustacea exceeds the sustainable-yield levels (Cordell 1973; Blanco 1978). Near Valença, swamp-fishing settlements must shift frequently to achieve a satisfactory ratio of work-to-production from shellfish-collecting ranges. Change in these fishing communities has taken different forms and has differing effects on the economy and the power structure.

Nylon nets have been selectively introduced in parts of the delta fishing community; other parts still use traditional technology. Some communities have switched their economic dependence from the traditional power base of captains and middlemen to factory bosses, wealthy merchants, and speculators from the Salvador fish and grain markets. This new power base purchases nylon gear and canoes for a small segment of townspeople, some of whom have little or no fishing experience but are desperate enough to work at fishing for very low fixed wages. Traditional captains must be conservative with their equipment (usually representing a lifetime's investment), unlike their competitors with nylon, who can afford to precipitate spatial conflict that destroys gear. The chaotic expansion of a nylon-outfitted fishing enclave in the narrow corridor of brackish water between land and sea marks the end of an era in which marginality was the small-scale fishermen's hedge against encroachment and overexploitation of the fish.

Today in Brazil, capital is available in unprecedented amounts to fund the expansion of interstate seafood markets, and developers are reaching out with advanced technology to capture even the most residual supplies of fish and shellfish. They are diverting local food supplies, which the coastal poor have always fallen back on for subsistence in times of scarcity, to elite urban and foreign markets. Technical innovation per se is not destructive. But the way in which change proceeds does disrupt customary sea tenure and removes the informal spatial and political

autonomy local groups must enjoy if they are to fish sustainably and without conflict. Escalating conflict in Bahia's fisheries demonstrates that the tragedy of the commons is catalyzed when institutions break down that have supported traditional sea tenure. Indeed, traditional sea tenure seems to prevent the tragedy.

CONCLUSIONS

Both the conventional view that fisheries are invariably open-access resources and the argument that poverty inhibits constructive collective action fail to account for what we find in Bahian fishing communities before the arrival of outsiders: the successful management of inshore fisheries resources by marginal, traditional fishermen. Both theories assume that there is no relatedness or strategic interdependence among people who use resources jointly (cf., Runge, this volume). Both contain a certain cynicism about human nature; neither allows for community. Fishing in Brazil, if anything, indicates that cooperative sea tenure is a logical mechanism for allocating perilously scarce resources, and that poverty strengthens these incentives to cooperate all the more. Sea tenure, legitimized through respeito and reciprocity, is embedded in the culture; what has been all too casually deemed self-regulation in small-scale fishing (e.g., Acheson 1981) is actually a subterranean economic system that overflows into every facet of social life.

With extended maritime jurisdiction, many countries, including Brazil, assume sweeping new powers and responsibilities for managing resources without any coherent frame of reference or forum to evaluate fishing claims, particularly traditional ones, or to define and justify new allocations of use rights. Arguments concerning the relative superiority of public or private ownership ignore the value and legitimacy of a third category, that of collective ownership. This study shows that there are practical reasons for the development of inshore tenure. Fishing productively and sustainably near shore requires regulation of access (cf., Stiles 1976). Governments might support such traditional institutions by giving fishermen something approaching guarantees of exclusive community tenure and recognition of the importance of their customary, limited-entry recruitment procedures.

If Brazil and other tropical countries are to begin serious long-range management of their marine resources,

they must be prepared to take into account a wide range of customary rights and claims to the sea that they do not now acknowledge. The real managerial strengths in Third World coastal fisheries are indigenous, vested not in the state or its bureaucracies but in fishermen's own informal institutions, norms, and cooperative organizations.

It is difficult to convince fishery authorities that traditional sea tenure even exists in places like Bahia, much less that it is worth preserving. Fishermen's laws are nontechnical and, admittedly, somewhat intangible to the uninitiated. Sea tenure is a kind of invisible wealth, created and maintained for both material and nonmaterial ends. Yet beneath the ragged, impoverished exterior of swamp-fishing communities are rational and proven solutions to problems of sharing, partitioning, and maintaining the fishery. In a traditional context, these solutions minimize conflict and ease fishing pressure by limiting the number of people and types of boats and gear that can fish compatibly in fixed territories close to the shore. Together with fishermen's extensive ecological knowledge of the sea, the tenure arrangements are valuable resources in themselves, worthy of some type of formal protection.

Fishing is one of the few economic alternatives available to the coastal poor in Bahia and other parts of northeastern Brazil. Establishing sea tenure through their own unwritten laws helps local fishermen transcend the misfortune of being born "marginal." Sea rights, in place of land rights that seem forever beyond their reach, give fishermen a group identity, honor, some sense of security, and a chance to own something in the highly class-stratified society of northeastern Brazil. Paradoxically, the marginality that keeps them poor also allows people the independence to invent and speak boldly of their "sea rights," and sometimes to sing like birds and dance as they walk.

NOTES

This research builds on Cordell's earlier fieldwork in Bahia, Brazil, (Cordell 1973, 1974, 1978), but is principally based on materials collected on the southern coast during an 18-month marine conservation survey sponsored by the World Wildlife Fund in the U.S. in 1982-1983. For assistance in preparing this study, Cordell gratefully acknowledges the support of the World Wildlife Fund and a fellowship awarded by the Social Science Research Council.

1. Studies elsewhere in northeastern Brazil (Kottak 1966; Forman 1967, 1970; Robben 1984) contain valuable clues and observations concerning the emergence of territorial systems among similar groups of small-scale fishermen.

2. For the past 25 years, Brazil has pursued policies of unrestricted fishery development, encouraged by a number of fiscal incentives for entrepreneurs and investors.

Decreto-Lei 221/67 provided tax exemptions of 25 to 75 percent on personal income invested in fishing; it suspended both import tariffs on fisheries technology and craft and various federal taxes on catches destined for luxury internal and export seafood markets. These incentives supersede the 1938-39 fisheries codes (Codigos de Pesca), which contained some potentially useful, though unenforceable, management concepts (such as exclusive zones for fixed-territorial methods like fish corrals). The tax incentives remain in effect at this writing, and will probably be prolonged despite recent sobering catch statistics.

Falling catches are illustrated by changes in shrimp and several other major species. With one of the most extensive coasts in the world (nearly 8,000 kilometers) and a favored climate, Brazil ranks among the 10 largest shrimp-producing countries. However, the total shrimp harvest, which reached a high of 129,000 tons in 1972, had decreased to 79,000 tons in 1979 (Silva 1979). Exports rose somewhat during this period from 6,783 to 7,172 tons, but per capita consumption decreased from 0.506 kg to

0.197 kg (Silva 1979), due to steep increases in the price of shrimp on the domestic market. Overall, catches in Brazil rose from 280,000 tons in 1960 to 816,000 tons in 1974 (Anuario Estatístico do Brasil 1976:158). This growth was largely spurred by tax incentives (Silva 1979:28-43). Between 1974 and 1979, the total catch only increased from 816,000 to 858,000 tons (Anuario Estatístico do Brasil 1981:354-355), indicating a nationwide leveling-off of production. The five principal species caught--tuna, corvina, shrimp, lobster, and sardines--have been in a state of decline since 1979 (Nascimento 1982).

3. Additional impacts on coastal fishery resources that are difficult to quantify are: stepped up drilling and exploration by the Brazilian oil company, PETROBRAS; biocide runoff from plantations in the littoral zone; increasing landfill for highways, resorts, and other construction; and widespread extraction of coral for cal, lime manufacture. Dynamite is heavily employed in this mining process, and according to coral-reef specialist Laborel (1969) who worked in Bahia, the Itaparica reefs in Salvador Bay were practically dead due to the extraction of lime-rich deposits.

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Overfishing and Conflict in a Traditional Fishery: San Miguel Bay, Philippines¹

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INTRODUCTION

San Miguel Bay in the Camarines Sur province of the Philippines is a major fishing ground on the country's Pacific coast. The bay, located on the Pacific coast of Luzon island, is relatively shallow and very productive. While a great variety of fish make up the aggregate catch, shrimp are the most important in terms of economic value. Apart from its productivity (and consequently its economic relevance), the bay is instructive as a case study because it is a very well-defined fishery where the patterns of technical change and resource overexploitation may be clearly identified.

Government intervention in increasing the amount of fishing and the introduction of nontraditional techniques have triggered instances of conflict that cannot be resolved in the current institutional context of traditional fisheries in the Philippines. While the exploitation of the coastal fishery would be better controlled with the introduction of common property approaches to management, the formal institutional structure for resource use does not recognize the common property attributes of the fishery. Government policy therefore treats the resource management problem in much the same way as a conventional private property problem--merely a case of enforcing fishery access rights. The result is that the management sys-

tem fails to address the growing problems of fishery overexploitation and conflict among different groups of resource users.

After presenting the data sources and describing the physical and technical characteristics of the bay fishery, the paper will relate how government intervention and the introduction of new technology (specifically, trawling gear) have engendered conflicts that transcend the changes that will result from the increasing population pressures in the area. The discussion highlights the presence of a resource sustainability threshold beyond which transitions are neither gradual nor peaceful; indeed, they are characterized by conflict.

DATA SOURCES

San Miguel Bay is located in the Camarines Sur province in Region V (Bicol) of the Philippines (see Figure 1). The primary data on this area is based on fieldwork in four municipalities of Camarines Sur that border the bay: Sipocot, Cabusao, Calabanga, and Tinambac. Most interviews were conducted during 1981, but follow-up fieldwork was done in 1984.

Interviewees were chosen to ensure that all the important fishing gear types and the complex of institutional arrangements governing the utilization of these gears would be sampled. Gear was ranked according to popularity of use in the area based on the results of a major survey of the bay conducted by the University of the Philippines Institute of Fishery Development and Research (IFDR) and the International Center for Living Aquatic Resource Management (ICLARM) in 1980 and 1981. (See Smith, et al. 1983 for a full description of this research.) Thereafter, the relative popularity of each of the ten types of gear in each of the survey villages was determined by dividing the number of a particular gear type by total number of fishing households in the barrio. The listing of the top ten gears and their relative popularity is presented in Table 1.

The primary technique used in the investigation was unstructured interviews with informants involved in the relevant fishing activity in each of the villages. The choice of the informant was based on his familiarity (as ascertained by barrio captains and IFDR-ICLARM field researchers) with the history, the operation, and the institutional arrangements pertaining to a particular gear. (See Appendix for the list and description of respondents.)

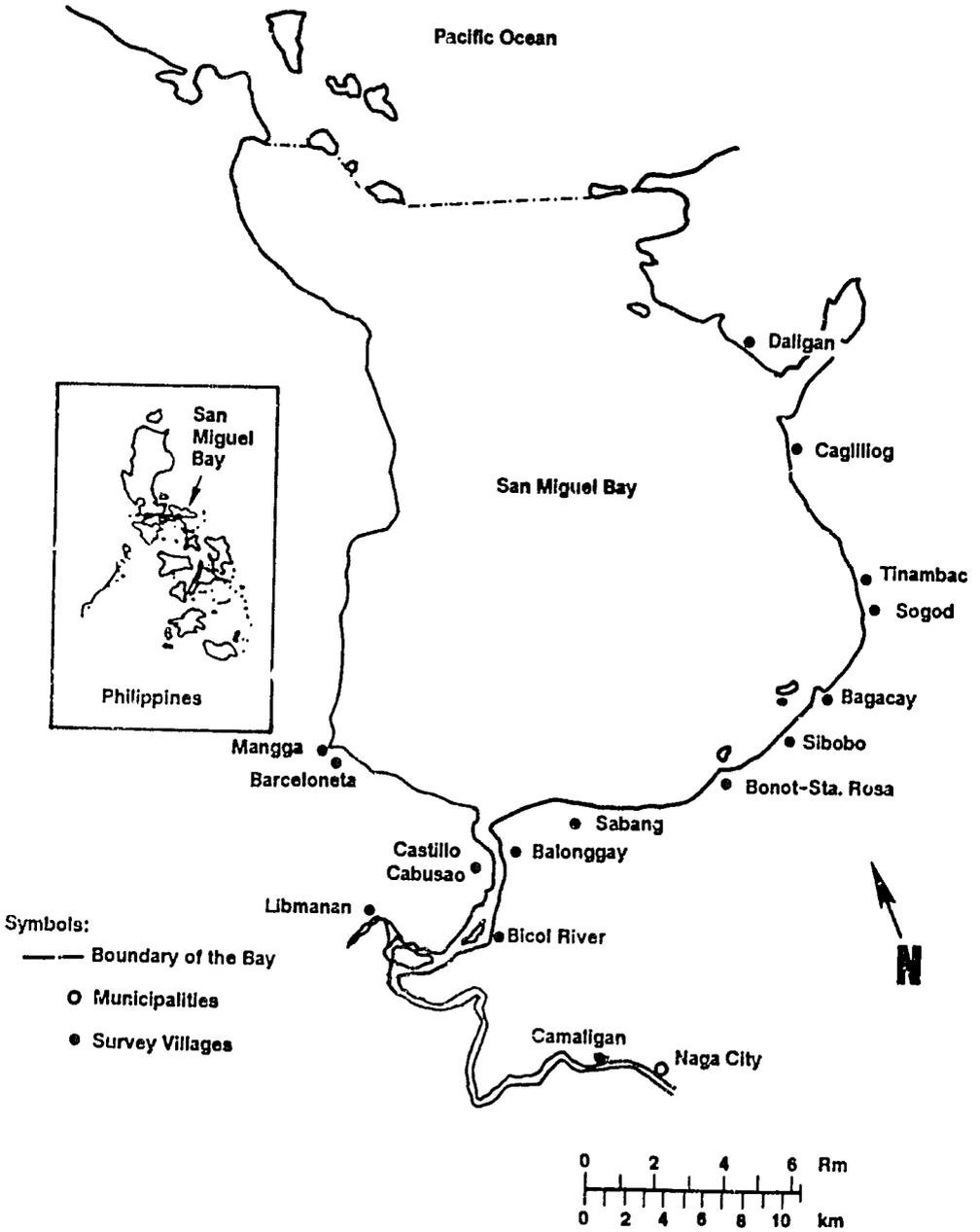


FIGURE 1 San Miguel Bay.

TABLE 1 Ranking of Gear Types and Their Relative Popularity in San Miguel Bay Communities.

	Rank of Gear									
	1	2	3	4	5	6	7	8	9	10
Gear ^a	Gill net	Sakag	Banwit	Baby trawl	Kitang	Bocatot	Itik-Itik	Bubo	Saqkad	Biacus
Number Used ^b	486	105	68	62	55	47	44	31	18	17
	Relative Popularity ^c (%)									
Sipocot Mangga	91	23				5			2	
Cabusao Castillo	71	71	2	1			29		1	8
Calabanga Sabang	37		1	27			44			
Balonggay	27	27	71		2				7	27
Bonot-Sta. Rosa	58	68	10		5	62	2	2	2	
Sibobo	81	53						12	15	
Tinambac Sogod	21		61			5	6			
Daligan	47		22		1			52		18
Bagacay		75		9						
Caglilioq						52				

^aSee Table 2 for a description of gear types.

^bNumber of each corresponding gear reported in use the bay from IFDR-ICLARM survey.

^cRelative popularity computed as number of particular gear divided by number of fishing households in the community; data based on IFDR-ICLARM community inventories.

RESOURCE ATTRIBUTES AND FISHING TECHNOLOGY

Because of its location, San Miguel Bay is only fished during certain seasons. From April to September, the period of the southwest monsoon (amihan), the entire bay is fairly well-protected. However, very little fishing activity can take place (except along the Tinambac village side) during the northwest monsoon (habagat) from October to March.

The bay itself covers approximately 840 square kilometers with a modal depth of less than 7.2 meters.² The bottom of the bay is generally muddy, which makes it an ideal trawling ground.

Consistent with the multispecies nature of the fishery, a great variety of fish make up the aggregate catch; shrimp are the most important, but croakers, anchovies, sardines, and mullets are also found along with such trashfish as undersized slipmouths and goat fish.

The resource is clearly renewable. The Bicol River introduces large quantities of freshwater into the bay, giving the fishery estuarine characteristics and very high productivity. It has recently been estimated that the aggregate catch is 19,000 tons (Smith et al. 1983) of which shrimps make up the most part (South China Sea Program 1978).

Exclusion is very difficult except along the river and the shore where the right to set fixed gears has traditionally been allocated by informal village resource managers called amoionadors (boundary setters).³ While the fishing activity itself is essentially open, a potential exclusion point is at the fish landings since the catch, in the absence of ice storage in most of the boats, must be disposed of immediately, and there are limited landing areas (normally one per village).

Fishing Technology

A great variety of fishing gear is used in traditional small-scale fisheries, due to the different fishing environments exploited and to the presence of many different types of fish. Even within a household, more than one gear is available, at least for the different fishing seasons during the year.

The villages are located in diverse ecological areas, so there are variations in the types of species and their seasonality. These variations result in differing choices

and uses of gear. While such choices are necessitated by the resource environment, the prevailing techno-institutional context tends to impose basic similarities in resource use that cut across the different gears. On the whole, gears are simple and usually constructed by the household. Accordingly, access to the technology is quite easy for most members of the fishing community (see Table 2);⁴ the capital required to acquire gear is low, consistent with the generally low levels of accumulation that obtain in the fishing community. Another aspect of the prerequisite of techno-institutional consistency may be pointed out: with respect to the marketing channels for excess production, the low volumes of catch and the important species in the catch are associated with a particular type and level of development of product distribution and processing. Consequently, attempts at innovation require a sensitivity to a much broader range of problems and potentials than is generally recognized.

This concept of techno-institutional consistency pointed out above allows us to group the variety of gears in use into two major types. From Table 2 we may note that the "baby trawlers" (medium and small), characterized by high energy use, large capitalization (relative to labor absorption), and a primarily market-oriented level of catch represent an essentially capital-intensive technique of resource exploitation. On the other hand, the proliferation of all the other gears generally represents a strategy of exploiting different species in as many locations and during as many months of the year as possible--an extensive form of resource use. Capital requirements for some of these traditional gears have recently risen because boats (used for operation of gill nets, lift nets) have been motorized, the costs of traditional construction materials (especially for stationary gear) are very inflated, and synthetic materials have been substituted for traditional ones (especially for nets). Thus the construction of traditional gears has changed--somewhat improving efficiency--but their basic ability to exploit the resource has not changed. More important, their use is not as dependent as the baby trawler system on markets for factor inputs (especially fuel) and for specialized fish or shrimp harvests.

TABLE 2 Gear Description and Requirements.

Gear Type	Description	Capitalization in Pesos ^a	Number of Employed	Marketing ^b
Stationary: <u>Rocatot</u>	Stationary lift net that works best in sheltered shallow waters (characteristic of Cagliligog); requires a maestro skilled in operating lights and lifting the net	6,400- 9,700	4-5	Specialized handling of significant volumes of anchovies
<u>Biacus</u>	Filter net requiring placement against a current, usually set at the mouth of a river (typical of Daligan and Balonggay)	2,200- 3,300	1-2	
<u>Sagkad</u>	Fish corral needing shallow, sheltered water	2,000- 4,000	1-2	
Net:				
Gill net	Drift or set gill net	1,100- 3,800	2	
Trawl:				
<u>Itik-itik</u>	Very small trawl, usually run by a 16 hp engine; operates in shallow water	4,300- 7,100	2	Specialized markets for <u>balao</u>
Baby trawl	Small trawler weighing about 3 G.T.; uses a 190-240 hp engine	44,500 59,300	4-6	Large volume of catch to be marketed
Others:				
<u>Banwit</u>	Hook and line used for large fish species in rocky or coral-bottomed areas; requires knowledge of good fishing ground	500- 3,200	1-2	
<u>Kalikot</u>	Hand-operated scissors net used in shallow muddy water	30-50	1	
<u>Bubo</u>	Fish traps used for large fish species in rocky or coral-bottomed areas	300- 3,400	1	

^a Capitalization figures are approximate ranges for 1981 based on experience and observations of informants. Gill net and bocatot costs include motor boat (10-16 hp and 5-16 hp, respectively). Biacus and sagkad costs include non-motorized boat. The upper limits for banwit and bubo represent inclusion of small motor (about 5 hp).

^b Unless specified in marketing requirements column, specific gear needs no special marketing capability.

Overfishing and Conflict

Standard overfishing occurs when both increasing fishing effort and declining catch are observed in a fishery. This is based on Gordon-Schaefer models of the relation between effort and catch.

Before the 1950s, population growth rates for the Bicol region, the Camarines Sur province, and the San Miguel Bay were generally above Philippine rates (see Tables 3 and 4). Presumably, the demands of the growing communities surrounding the bay were also increasing in this period. Since the 1950s there has been a decline in population growth rate for San Miguel Bay (relative to regional and national rates); this may be due to the limited absorption capacity of the area's economic base--the fishery. Fish catch information for both periods, however, is not available, so it is not possible to make any definite conclusion on whether overfishing occurred.

While the role of population pressure in natural resource exploitation is potentially significant, its importance in San Miguel Bay has been overshadowed since the 1970s by technical changes that have exacerbated trends toward fishery overexploitation that followed population growth. This is due to two specific developments. The first is the government's program, initiated in the mid-1970s, to upgrade fishing technology by offering low-cost loans for motorizing fishing boats. In San Miguel Bay, 1,206 municipal fishermen received loans of about P4.5 million (Philippine pesos) for this upgrading program (Smith et al. 1983). At about the same time, an unusual form of technical innovation--the baby trawler--was introduced in the fishery. Capitalized at about P50,000 each in 1981, these are shallow-draft boats powered by diesel engines (of 200 or more horsepower) that allow the boats to pull trawl nets. They were designed to meet the small-scale classification (less than 3 gross tons) so that they could trawl within coastal waters. These two factors have substantially changed the level of resource exploitation and the pattern of distribution that has resulted in conflict in the fishery by the early 1980s.

DECISION-MAKING ARRANGEMENTS AND PATTERNS OF INTERACTION

The appropriateness of decision-making arrangements regarding access to or control of resources needs to be evaluated in the context of available resources and growing

TABLE 3 Population Growth Rates for the Philippines, the Bicol Region, Camarines Sur Province, and Four San Miguel Bay Survey Municipalities, 1918-1975.

Place	Annual Growth Rates					
	1918	1939	1948	1960	1970	1975
1 Philippines	1.92	2.22	1.91	3.06	3.01	2.79
2 Bicol Region	1.75	2.38	2.21	3.13	2.25	1.48
3 Camarines Sur	0.81	2.74	4.10	3.72	1.47	1.54
4 Four SMB Municipalities	0.00	3.51	4.82	4.65	1.49	0.99

Basic Source of Data: Republic of the Philippines, Bureau of Census and Statistics, 1975.

interdependence among resource users. The fisheries of San Miguel Bay, like other coastal fisheries of the Philippines, were traditionally characterized by open access exploitation.

With an abundance of fishery resources (relative to the demands of a small population), the degree of specific institutional controls on decision making and interaction was quite limited. The notable exception was that near-shore areas were allocated to specific families for exclusive use for fixed gear, due to the limited availability of such sites even during periods of relative abundance. In general, therefore, as long as basic rights were respected (e.g., the right not to be disturbed once one's boat and gear have been set for the particular day's fishing), there was much room for individualistic decision making.

Aside from this environmental and demographic context, which was conducive to individualistic decision-making arrangements, the technical nature of the fishing activity itself contributed to this pattern. In contrast to rice farming communities--where intravillage work is closely coordinated through exchange labor groups, irrigation associations and village councils--the traditional fishing

TABLE 4 Population Densities for the Philippines, the Bicol Region, Camarines Sur Province, and Four San Miguel Bay Survey Municipalities, 1903-1975.

	Place	Land Area (km ²)	Population Density						
			1903	1918	1939	1948	1960	1970	1975
1	Philippines	300,000	25.2	34.4	53.3	64.1	90.3	122.3	140.2
2	Bicol Region	17,632	36.5	47.6	76.4	94.5	134.0	168.3	181.1
3	Camarines Sur	5,267	36.8	41.6	73.2	105.1	155.6	180.1	194.4
4	Cabusao	47	66.1	54.4	100.9	109.2	170.6	193.2	219.1
5	Calabanga	164	43.6	48.5	92.0	132.9	173.6	211.7	233.7
6	Sipocot	212	13.2	12.9	37.4	85.3	172.9	180.0	191.8
7	Tinambac	316	16.8	17.4	34.6	44.6	91.5	115.1	108.9
	Sum of 4-7	739	25.0	25.4	52.4	80.0	138.1	160.1	168.1

Basic Source of Data: Republic of the Philippines, Bureau of Census and Statistics, 1975.

village exhibits relatively few instances of institutional control. In general, the organization of work in fisheries is characterized by fewer interdependencies among production units so that traditionally basic rules (e.g., constraining the use of destructive fishing techniques) have sufficed for resource management.

However, when population growth increases the competition for fixed fishery resources, arrangements for access to or control of such resources may become quite complex. It is necessary to distinguish between the degree of control over the resource and the form that such control takes. While the tendency for resource control tends to be monotonic (generally increasing), the same cannot be said for the form of control. In some fishery case studies (Forman 1970; Cordell 1980; Spoehr 1980), it has been shown that decision making and control tend to be cooperatively done so that the resource management system follows the common property model. In other instances, a more formal government role is introduced with population growth, and the fishery becomes part of the public domain. The government then allocates the use of the resource through licensing or leasing systems.

In the Philippines, the current system follows the second pattern: public ownership of the fishery is divided between the off-shore resource, which is directly under the national government's jurisdiction, and the coastal fishery, which is assigned to municipalities. The boundary between these fisheries has been set at three nautical miles from the shore. Additional depth limitations are set for the use of trawling equipment: trawlers of more than 3 gross tons may operate only in waters more than 7 fathoms deep, while the lighter ones may operate to as shallow a depth as 4 fathoms.

In the case of San Miguel Bay, based on charts of the Philippine Bureau of Coast and Geodetic Survey for the area of the four municipalities, maximum water depth in no instance exceeds 5 fathoms. In fact, only very small portions of the area exceed 4 fathoms in depth (mostly off Cagliliog in Tinambac). Thus, not even municipal trawling is legal in most areas.

Implications for Patterns of Interaction

The problem with this system is that while the apparent control of fishery resource use is assigned to government

policymakers, the de facto system of exploitation of off-shore fisheries is closer to open access. Indeed, even the coastal fishery rules are difficult to enforce with the limited resources available to most municipalities. In this situation, there arises a large discrepancy between the formal decision-making system that is supposed to govern resource use and the actual pattern of interaction.

This underscores the fact that formal decision-making rules comprise only one set of determinants of the pattern of interaction that prevails. At least two other sets are important in San Miguel Bay as well as in other coastal fisheries--the first encompasses the informal rules that are based on local beliefs or practices; the second has to do with the differential technical capabilities of users in exploiting the resource. The relative importance of these two latter groups of factors can have critical implications for the pattern of interaction that may arise.

A useful way of distinguishing between interaction patterns is to determine whether they are primarily conflict-oriented or cooperative. In the bay, cooperative forms are characteristic of the traditional fishery, while the relationships between the traditional and the trawl fishermen are conflict-oriented.

In the case of the traditional fishery, conflict as a pattern of interaction did not arise, even when external regulation from government was very limited. In the period of growing population pressure (since the 1950s), interaction within the traditional sector has nonetheless been characterized by coordination or cooperation, even in the face of declining average catch.

For example, UPCF-ICLARM survey data show that in spite of the increasing pressure on resources and growing interdependencies, the majority of fishermen considered traditional techniques not to be destructive of the resource. Almost a quarter of all fishermen linked declining catch with the growth of effort in the fishery. However, almost a third believed that the destructive activity was due only to the operation of trawlers in traditional grounds.

Informants in Castillo say that fishermen from the neighboring municipality of Mercedes seasonally transfer to Castillo for the balao (tiny shrimp) season late in the year, yet no apparent conflicts have developed, suggesting the efficacy of traditional rules of access in coordinating these traditional activities.

On the other hand, in the case of the entry of commercial trawlers, the pattern of interaction has tended to be

largely conflict-oriented. In the first place, the destructive technical capability of trawlers in overexploiting the resource is very different from that of traditional gears that are quite selective with respect to catch. Indeed, some fishermen reported that trawlers are not only destructive of the resource but also of other gears. Nets and traps, for example, are often damaged by indiscriminate trawling activities. The operation of trawlers therefore runs counter to traditional perceptions vis-à-vis destructive fishing techniques.

And in the second place, trawlers demand an unusually large capital investment, meaning that only those who are economically well off will benefit from the fishery resource; an unusually large proportion of catch is therefore captured by the very small group of wealthy fisherman who can afford to purchase and operate the trawlers. This undermines the more equitable sharing patterns that are characteristic of traditional fisheries.

Moreover, and to compound the problems thus far described, traditional fishermen are aware that the operation of the trawlers within municipal waters is often not legal. The effect is widespread friction between the traditional fishermen and the trawlers.

OUTCOMES AND IMPLICATIONS FOR MANAGEMENT

When resources were abundant, fishery catch was dependent primarily on the level of technology and not on differential access or endowments of rights to the resource (except for the case of near-shore fixed gear locations). Income distribution was therefore interesting only in terms of fishermen's access to technology and not in terms of resource endowment.

The growth of population pressure from the 1950s did not necessarily bring with it widespread dissatisfaction with resource management practices. While the overall catch in the area might have been stable (or might have in fact slowly increased), there is no doubt that average catch started to decline in this period. The distribution of the catch among traditional gears, however, did not significantly change. Indeed, easy access to the different low-cost gears must have been an important factor in stabilizing income distribution.

The increase in effective effort (since the mid-1970s) coupled with the entry of the trawling fleet (in the late

1970s) radically changed both overall catch and distribution conditions. Latest estimates for the fishery (by Smith et al. 1983) show that of the 19,000 tons total catch in 1981, the 5000 or more small-scale fishermen caught only 60 percent of the total while the 95 trawlers in the bay got the rest. The situation is worse when reported in terms of the value of catch: the baby trawlers, which represented only 3 percent of fishing units and employed only 7 percent of labor, got 42 percent of the P53.5 million worth of catch and over 50 percent of resource rents.⁵

Because of the rapid pace at which this transition has occurred (trawlers were introduced not more than 5 or 6 years before this 1981 estimate), and because of the unusual inaccessibility of this technology, this trend toward resource overexploitation and increasing concentration of the benefits of resource use has led to widespread dissatisfaction among traditional fishermen over the inability of current institutional arrangements to control trawling.

Inadequate enforcement of municipal fishery regulations has fueled a growing discontent among traditional fishermen who complain not only of the indirect effect of trawling in terms of decreased catch but of numerous instances where trawlers have destroyed nets and traps. Cases of violent confrontations between trawlers and traditional fishermen have been reported. Active organizational work among traditional fishermen has occurred especially in the communities in the eastern side of the bay where municipal leaders have tended to take the side of the small fishermen versus the owners of the trawlers.

Implications for Management

A program of fishery management for the bay needs to address the problem of growing interdependence (and conflict) due to: (1) a general increase in population levels leading to more potential conflict among traditional fishermen, and (2) a sharp increase in effective effort linked to the greater role of commercial trawlers in near-shore areas.

These two concerns point to the need for greater control and management of the fishery on the basis of techno-institutional and environmental considerations. With the growing interdependencies in fishing activity--

both among traditional fishermen and between the commercial and traditional sectors--the community will be forced to evolve essentially new forms of cooperation for management of the resource--forms that may require greater interaction within the village level and more formal means of assuring access to resource use.

On an essentially technical level, near-shore fisheries need to be demarcated from offshore fisheries with the distinction being based on the technical capacity for resource exploitation of the traditional versus the commercial sector.

By reserving near-shore resources according to the capability for exploitation by the traditional sector, the community is allowed a greater opportunity for internally generated adjustments, and the potential is reduced for both recruitment and growth overfishing in the coastal areas (which principally arises from commercial intrusion). At the same time, if commercial fleets (primarily trawlers) are limited to the offshore areas that cannot be exploited by traditional techniques, capital will be channeled to the resources where the traditional fishery cannot intensify its efforts.

Because the determination of access to near-shore resources is tied to the capability of traditional techniques, such a program will be acceptable both in terms of historical access and current regional programs that implicitly differentiate access to fishing grounds by techniques used. Indeed, this approach may be interpreted as a rationalization of current trends; however, it also introduces the main advantage of providing a theoretical (versus arbitrary) basis for the regulation of techniques of capture.

It can be shown that this approach represents a rare case in which less developed countries' apparently conflicting national goals for fishery development of increasing production and promoting maritime community assistance (Emmerson 1960) can both be adequately met. With respect to assistance, preventing commercial trawlers from exploiting near-shore resources will undoubtedly have beneficial implications for employment in the traditional fisheries.

Although not as obvious, it is also the case that the limitation of technology in near-shore areas does not imply any long-term decrease in output potential. It merely suggests the imposition of a particular distribution of income because the maximum sustainable yield of the

multi-species fishery is essentially fixed; the real question is who can appropriate the catch. Given the presumption that, without management, the commercial fishery will not only monopolize the catch but deplete the stock as well, this program of management not only contributes to a viable fishery but assigns the problem of exploiting the more inaccessible grounds and adjusting to a smaller proportion of catch to the commercial sector. With the flexibility and resources that such adjustment requires, the commercial sector will be in a better position than are traditional fishermen to make the investment or to find alternative income sources.

Apart from the technical aspect, a major problem remains the failure of municipal fishery officials to recognize the inadequacy of current institutions that are expected to govern the bay. In the current setup, the common property attributes of the fishery and the potential for interdependent decision making and action cannot be exploited because the regulatory mechanism uses a licensing system that is dependent on centralized enforcement. Because such enforcement (given the extensive nature of the resource and the limited funds available to municipal authorities controlling the bay) does not work, there is a clear need to establish regulatory mechanisms that can utilize instead of ignore the common property attributes of the fishery. To be sure, the growing interaction within villages and organizational efforts of local fishermen point to local participation that is just waiting to be harnessed.

For example, municipal governments (while retaining their jurisdiction over current traditional fishing grounds) may increasingly formalize systems of village control over fishing grounds and fish landing sites. Especially in the case of landing sites, local sanctions against catching immature fish or against the use of illegal gears may be established through the local village organization. The specific form of organization should be determined from a detailed management study. On the one hand, the structure may require nothing more than a variation of cooperative organization. On the other hand, it may require separate legislation that assigns to the village explicit legal rights and obligations for fishery management.

APPENDIX

Survey Areas, Sample Size, Description
of Respondents, and Topics Discussed

<u>Location</u>	<u>n</u>	<u>Informant</u>	<u>Topic</u>
Sipocot Mangga	1	<u>Pangke</u> (gill net) operator	
Cabusao: Castillo	3	Municipal Development Officer	General conditions of enforcement of fishing laws and problems of fishermen in Cabusao
		Fish buyer	Systems of marketing and gill net fishing in Castillo
		<u>Itik-Itik</u> (mini trawl) operator	
Calabanga: Sabang	12	Baby-trawl owner	History of trawling in San Miguel Bay: operation of gear
		Trawl-net maker	Design, measurements of different trawl types
		<u>Kuto-Kuto</u> (mini trawl, <u>Itik-Itik</u>) operator	
		Baby-trawl operator	
Bonot-Station Rosa		<u>Bocatot</u> (lift net) operator	
		<u>Kalikot</u> (scissors net, <u>sakay</u>) operator	

APPENDIX
(continued)

Survey Areas, Sample Size, Description
of Respondents, and Topics Discussed

<u>Location</u>	<u>n</u>	<u>Informant</u>	<u>Topic</u>
Calabanga (continued):			
Sibobo		<u>Pangke</u> (gili net) operator	
		<u>Sagkad</u> (fish corral) operator	
		<u>Bubo</u> (fish trap) operator	
Balonggay		<u>Banwit</u> (hook and line) operator	
		<u>Biacus</u> (filter net) operator	
		<u>Bintol</u> operator	
Tinambac:	7	Acting Municipal Mayor	Lift net fishing conditions; trawler, gill net operation; conflicts
Sogod		<u>Banwit</u> operator	
Daligan		<u>Biacus</u> operator	
		<u>Bubo</u> operator	
Bagacay		<u>Kalikot</u> (scissors net variant) operator	
		Baby-trawl operator	
Cagliligog		<u>Bocatot</u> operator	

Notes: For the different gear operators, the interview guide was used. These are detailed interviews; short interviews with minor informants are not listed here.

NOTES

1. This paper draws on information gathered for the author's dissertation research (during which he benefited from the scholarly generosity of the staff of the Institute of Fishery Development Research and Management) and more recent data from an ongoing project funded by the International Development Research Centre (Project 3-A-83-4926). The author, of course, retains sole responsibility for the contents of the paper.
2. Much of the discussion of the characteristics of the bay is taken from Vakily (1980).
3. The amoionador loosely translates as "the one who sets the boundary." According to informants, they were primarily respected elders in the community who had a good grasp of the history of family claims on fishing sites and whose primary duty was to regulate the entry of new gear to ensure the least interference on the activity of existing gears.
4. Before the entry of commercial fleets and government gear upgrading programs, very few boats were motorized, and consequently even these were inexpensive.
5. Trawler ownership is concentrated among very few families who are resident in the municipalities and who also control a substantial part of the fish marketing and processing activities.

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A Social Dilemma in a Less Developed Country: The Massacre of the African Elephant in Zaire¹

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INTRODUCTION

The recent interest in management of common property resources has been greatly stimulated by Hardin's classic article, "The Tragedy of the Commons" (1968). Applied to the hunting grounds of elephants (*Loxodonta africana*) in Zaire, the economic analysis of the tragedy of the commons (or social dilemma) proceeds from the fact that open access to elephants within the context of applicable law creates a situation in which ivory hunting is encouraged.² Personal benefits exceed personal costs.

This paper investigates the manner in which open access to the hunting grounds has emerged, and it examines the types of regimes that have controlled elephant hunting grounds in Zaire, especially in the northeastern regions. It is suggested here that, since the commons is potentially characterized by exclusion, the right to use or exploit it is ultimately founded on the ability to forcefully or contractually exclude potential competitors. The first section discusses the nature of the hunting grounds in which elephants are established and the nature of the elephants themselves. The second section examines hunting activities in the traditional setting. Subsequent sections provide an empirical investigation of the political processes that have resulted in the sequential shifts in ownership of the hunting grounds from indigenous groups to

colonial settlers, and then from settlers to a currently ambiguous public trust.

NATURE OF THE HUNTING GROUND AND OF THE ELEPHANT

Zaire is a country of approximately 30,261,000 inhabitants, and occupies an area of approximately 2,344,885 square kilometers. The terrain is undifferentiated, with some scattered hills--largely outliers of the highlands of Shaba and the eastern borderlands. The country is wholly tropical, with abundant rainfall (more than 1,500 mm per annum) and broadleaf evergreen forest characterizing the Congo Basin and ample, but more seasonal, rainfall and savanna dominated by broad-leaved deciduous trees typical of the surrounding uplands. Elephants are actively hunted in more than half the country, and are particularly vulnerable in areas where the relatively poor distribution of water supplies results in seasonal migration and congregation.

An elephant drinks an average of 52 gallons of water daily and consumes at least 400 pounds of food (Offermann 1951). The way this mammal feeds is devastating to its natural habitat: it breaks down trees, pushing them over to obtain leaves and roots, and debarking them, and its weight (4.5 short tons for an average elephant) damages younger trees and inhibits regeneration.

Elephants live in family units of anywhere from 2 to 20, led by old females (Laws 1970), but on occasion, larger aggregates of 25 to 40 may form. Bulls tend to live separately in small groups or alone with short-term associations with family units when a female is in estrus (Croze 1974). A given herd may be composed of 50 percent nonadults and 50 percent reproductive adults in which 20 percent are males and 30 percent are females (Offermann 1951).

The elephant's gestation period averages 22 months. The calf is nursed for about 2 years, and becomes sexually mature between the age of 8 and 19 (Laws and Parker 1968). On average, an adult female reproduces every 4 years; thus, maintaining the sustainable yield of elephants requires harvesting no more than 5 percent annually (Offermann 1951). Laws and Parker (1968) point out that after the elephants reach maturity, the proportion of pregnant females increases to a maximum of 43.2 percent in the

31-35 age group, but subsequently declines to 8.3 percent in the 51-55 age group, and falls to zero thereafter.

The African species, Loxodonta africana, of both sexes have tusks (by contrast, the Asian female has none), making the African species more attractive to ivory hunters than are its Asian congeners.

Given the nature of the forest and size of the elephant, the fear of hunting alone has made hunters operate in groups. Moreover, hunting in groups was enhanced by a strong belief in traditional Zairian communities that the hunting ground must first benefit the whole community, even at the expense of the individual. This belief was institutionalized through mythological and ritual emphasis of the need to respect nature as the source of life. In the long run, however, the introduction of new technology for hunting game (for instance, motorized vehicles and guns) and an expanding human population have provided individual users both the capability and motivation to exploit the hunting ground for personal profit.

Excludability, on the other hand, has also been a major attribute of the hunting ground as different actors compete for its products. For centuries, the hunting tribes--the BaMbuti pygmies--have been effective owners of the hunting ground because of their familiarity with the forest and other tribes' fears of getting lost. With the arrival of Europeans and their technology, selective exclusion became more difficult.

Another physical attribute of the resource is divisibility. Although the hunting ground may be divisible among users, the elephants may be difficult to divide because their migratory movements transcend regional boundaries. Nevertheless, the fact that the elephants may live in herds near rivers may create temporary ownership of a given herd by a hunting group living close to the area. Here again, technological means such as guns, motorized vehicles, small airplanes, or helicopters may assign a given group in the community some advantage in keeping a number of herds in specific locations, whereas in a traditional setting, the hunting tribes had to pursue the elephants wherever they migrated.

The hunting grounds of the elephants became more accessible to the technologically superior Europeans, who were able to exclude the natives. The hunting ground has also become subject to relatively high divisibility and subtractability. In the short run, the technological and structural attributes of the hunting ground may be as sig-

nificant as the extent of the area occupied by the elephants, particularly as their range is reduced through environmental degradation. Water availability remains the main factor affecting migration, herd size, mating, and reproduction.

Three different periods related to the management of the hunting ground of the elephants are discussed in the following sections: the traditional setting, the colonial era, and the post-colonial period.

MANAGEMENT OF THE HUNTING GROUND IN THE TRADITIONAL SETTING

Until the colonization of the Congo in the 18th century, the natives of Zaire hunted the elephants primarily for food: one elephant could furnish meat for an entire village. Ivory had only limited use and exchange value. For instance, ivory was used as a hammer by the BaBira tribesmen, but had no direct use for the BaMbuti pygmies, although they traded it for metal, agricultural crops, and protection from their powerful Bantu neighbors. The patron-client relationships between the BaMbuti and their Bantu and Sudanic agricultural and pastoral neighbors had begun in the 12th century (Turnbull 1965). These relationships resulted in the adoption of a patron language by the BaMbuti, but did not influence other aspects of their lives or livelihoods.

Decision-Making Arrangements

As hunters, the BaMbuti may be divided into net-hunters and archers. This technological distinction has shaped their social, economic, and political organization with respect to the management of the hunting grounds.

The net-hunting bands were much larger, 15 to 30 families, because the use of the net to capture the elephant required more cooperation, whereas the archer hunting bands were much smaller, ranging from 7 to 15 families. In the net-hunting groups, women and children were usually associated with hunting activities, whereas in the archer bands they specialized in gathering operations. Thus, the lack of specialization in net-hunting technique was associated with a social system that was more egalitarian than that of the archers (Turnbull 1965).

While both categories of hunters respected the elderly, individual skill in the archer bands was a sign of maturity; a skillful young archer could gain a voice in the council of elders in vetoing a decision or in conflict resolution. Mutual trust and mutual cooperation, enhanced by the small size of the hunting bands, sustained intra-group cohesion and harmony; obligation to the community was balanced against self-interest, and the elders were seen as the source of wisdom and hence authority. (There were no formal or elected chiefs.)

Another mechanism in resolving conflict was an institutionalized system of flux that always occurred either in the beginning or at the end of an arbitrarily determined period called the "honey season." Flux may be understood as the constant changeover of personnel between local groups and the frequent shifts of campsites through the seasons (Turnbull 1968).

For the net-hunters, the honey season was the period of plenty and the time to dissociate antagonistic members. At the end of this season, the bands reformed, avoiding unreconciled members. The archers, on the other hand, hunted together in the honey season, which for them is a period of poor hunting, and split into small groups thereafter. In both groups, ostracism was the solution of last resort to resolve conflict.

In the traditional hunting society of the BaMbuti, informal rules arising from the technological capabilities of the hunters, and from traditional beliefs, regulated exit and entry into the hunting grounds. For example, the net-hunting technique produced the surest and largest supply of meat, but it frightened the animals, while the archer's technique usually did the opposite. Therefore, the former technique necessitated frequent changes of site resulting in a limited system of inheritance and little personal ownership. The archers, on the other hand, were more attached to their hunting grounds. In both cases, however, every band possessed at least several hundred square miles of forest territory for hunting and gathering operations (Turnbull 1965), usually separated by natural obstacles or by the proximity of agricultural tribes.

The net-hunters and the archers believed that while they held an ancestral, and therefore inalienable, right to the hunting grounds, an elephant became property only when killed. This belief regarded the forest as the only constant in their lives--more important even than social relations--because of its life-giving qualities, providing

them with a strong feeling of attachment towards the forest. Fluctuating social relations served not only to resolve conflict, but also deemphasized stability in personal relations and weakened the concepts of unilinear descent and affiliation.

Furthermore, the fact that the surrounding tribes feared the forest made the BaMbuti less open to external control in their exploitation of the hunting grounds of the elephants. However, the patron-client relationship established through the centuries in which the Bantu and Sudanic villages provided metal, food crops, and protection to the pygmies in exchange for elephant meat and ivory, encouraged the Bantu to try to impose control over the Sudanic villages. One major way the patrons exerted their influence was to take a leading role in the arrangement and financing of intra-pygmy marriages. Through this relationship, the patrons claimed hereditary rights over pygmy offspring through patrilineal descent (Turnbull 1965). But the BaMbuti developed devices to evade the system either by changing bands during periods of flux or by calling for villager specialists to perform magic in the forest to improve hunting. (The pygmies themselves hardly believed in magic.) Calling for the magicians was merely a political maneuver to avoid total commitment to trade, because by doing so they could persuade their patrons that the Bantu magic had failed and, consequently, they had very little to trade, even though their hunting efforts were in reality highly successful.

Patterns of Interaction

Patterns of interaction existed here at four levels: (1) within a given hunting band, (2) between bands using the same techniques, (3) between bands using different hunting techniques, and (4) between hunting bands and their patrons.

Intraband patterns of interaction were characterized by reciprocity. Hence, the lack of anonymity in hunting made free-riding behavior a very costly choice. In addition, mutual trust and mutual cooperation through consanguineal ties provided the individual hunter a sense of membership and made each individual believe in the ability of others to extract a livelihood from the environment.

The second and third types of interaction were charac-

terized by lack of competition. The system of flux has permitted different bands to exchange members, thereby resolving interband animosity. If joint hunting was rare, interband cooperation was encouraged by attending another band's dances and festivities. These activities were regulated by the lineage elders (Schebesta 1941).

Finally, the trade between the patrons and their clients involved another type of reciprocity. Unlike close kinship ties that elicit cooperation in which reciprocities are long-term and often intangible, relations between patrons and clients were distant and generally tangible. Being non-kin relatives, they involved short-term reciprocities and voluntary cooperation only as long as protection was provided by the patrons. In other words, close consanguineal bonds are perpetual and based on affiliative obligation regardless of choice, whereas non-kin bonds are of varying duration and based on self-interest.

Outcomes

In the traditional setting, the sustainable yield of the elephants was in no way threatened. Primitive hunting techniques and belief systems kept the hunting tribes' consumption patterns at a level that corresponded with their daily needs, either through trade with their patrons or through their flux system. Some observers (among them Sahlins 1968) have even argued that hunting communities were affluent societies.

The exchange patterns made the traditional system operate efficiently through specialization. That is, the hunting ground was left to the hunting tribes and arable land left to the patrons for agricultural purposes. In both cases, trade was highly valued. Trade allowed the patrons (unfamiliar with the forest) to avoid the high cost of being lost or killed that are associated with hunting, and allowed the pygmies to avoid the high cost, to them, of settling down to a sedentary agricultural life.

The pygmy system of reciprocity was noteworthy insofar as sick or weak individuals were never deprived of their benefits as members of the community. For example, after an elephant was killed, sick and weak hunters were given their shares before active hunters received theirs (Turnbull 1965).

These traditional patterns of exchange began to

disintegrate around the second half of the 18th century when ivory became an object of intensive trade. It is reported that only ivory and slaves were traded for turkedi (textiles).³ Four attractive turkedi were worth a slave or four 55-pound (30-kilogram) pieces of tusk. That also meant that for four 55-pound (30-kilogram) pieces of tusk, any slave trader in West Africa could purchase a slave if he wished. Thus, the massive arrival of European settlers during the 1800s had two impacts on the hunting grounds and the tribes exploiting them. First, it unbalanced the traditional regime in the composition of its population, in its consumption patterns, in its group size and composition, and in its technology. Second, an increasing demand for ivory created a discrepancy between the demand for elephant meat and its supply.

EARLY BELGIAN RULE IN ZAIRE:
THE LEOPOLDIAN REGIME⁴

Decision-Making Arrangements

The clash between Europeans and the natives in the late 19th century brought animosity. The agricultural tribes resisted the invaders, and the hunting tribes that could locate the elephants in the forest refused to cooperate with the alien hunters. Confronted with this behavior, the Belgian settlers faced occupational difficulties in the Congo Basin. Their first reaction was to break up traditional family ties and patron-client relationships associated with the hunting grounds through the introduction of a coercive labor system for hunting and gathering operations. This was coupled with per capita taxation in natural commodities. Ivory became the principal commodity with which the citizens could fulfill this obligation.

This move meant that hunting and gathering activities were no longer the monopoly of the hunting tribes. With the increase in the size of the hunting population and the disruption of social ties and obligations, individuals began acting on the basis of personal interest in order to pay their taxes and survive.

The second European reaction in the face of occupational difficulties was Leopold II's decree of July 1, 1885, expropriating the land from the natives. In the absence of any judicial court system in the early colonial period, compensation for expropriation was unlikely. Thus,

expropriation enabled the Leopoldian representatives to begin selling the land at 1.6 Belgian francs an acre (4 francs per hectare) with ulterior preemption rights over the surrounding areas (Merlier 1962). The new owner--being either an individual settler or a charter company--also received the monopoly on hunting and gathering products from these areas. (For more information concerning the charter companies, see Merlier 1962: chapters 1 through 6.)

The new system was totally alien to the natives, for whom land was not a marketable commodity. To gain the natives' compliance, the Leopoldian bureaucrats began appointing chiefs who were willing to cooperate with the settlers, thus eliminating those who were resistant to the new system. Indeed, the death sentence was invoked when cooperation could be obtained no other way.

The Leopoldian regime was thus an increasingly powerful and barbaric centralized bureaucracy (see James 1943) that took considerable discretion with respect to land use as they implemented laws drawn up in Belgium to regulate the hunting grounds in Zaire.

Patterns of Interaction

Relationships between the bureaucrats and the new charter companies were cooperative insofar as the charters' interests were safeguarded. The first opposition broke out, however, after Leopold II established the monopoly on ivory by the domainal decree of 1891, through which he became the sole owner of ivory. The charter companies opposed this decree and those who tried to implement it.

On the other hand, patterns of interaction between the settlers and the natives were those associated with dominant/subordinate relationships. So far as interaction among the natives themselves was concerned, compulsory taxation based on individual responsibility made the individual native try to maximize his acquisition of ivory, whereas in the traditional setting the individual acted as part of a corporate group.

Rural discontent rose as individuals became more isolated and were subjected to forced labor and coercive taxation. In 1895, several native revolts broke out in protest against the Leopoldian system. These revolts subsided in 1911 after more than 15 million natives

were massacred (James 1943).⁵

Outcomes

The Europeans brought to Zaire a new technology (gunpowder) and various sophisticated means of transportation, which together destroyed the equilibrium that had existed in the feudal and tribal economies. The destruction had three important manifestations. First, the increasing size of the European population meant a reduction of the number of hectares of arable land per native, and encroachment into the hunting grounds by human settlement and agriculture. Second, communication between traditional patrons and the new settlers was unsatisfactory, since the latter spoke only French. Third, the arrival of Europeans fragmented the group at the tribal level and gave a new, and more limited, meaning to the concept of "family."

This disequilibrium had two consequences. First, the introduction of trade with the accompanying money economy required Zairians to adopt conflicting strategies to survive. That is, they had to maintain their agricultural cycle and, at the same time, they had to manipulate new markets as much as they could to avoid becoming totally dependent on the new means of exchange. Second, the introduction of compulsory taxation and unpaid labor forced the Zairian men off their land, leaving the subsistence agriculture to women and children.

If the Pareto optimality test were applied to determine efficiency and equity, then the Leopoldian regime would be both inefficient and unfair. That is, it heavily favored the minority Belgian settlers at the expense of the majority natives in its laws regarding the use of the hunting grounds. In addition, the supply of elephant meat exceeded its demand, because the increased acquisition of ivory also resulted in the increased availability of meat. In fact, in only 23 years (1885-1908), at least 200,000 elephants were killed for the ivory trade (Fallon 1944). This killing yielded almost 2 million short tons of meat. Furthermore, if "abuse of authority and arbitrary exclusion from the common property resource" (Oakerson, this volume) are used as criteria to assess equity, the Leopoldian system would again be unfair. It is, indeed, Leopold II's abuse of authority and selective enforcement of rules by his bureaucrats that led to the

arbitrary exclusion of the natives from their land and precipitated their revolts, revolts that were not subsequently crushed without bloodshed. The awakening of metropolitan concern hastened the demise of the Congo Free State, which was terminated through the annexation of the Congo to Belgium on November 4, 1908.

In brief, the establishment of new uses for, and exploitation rights of, the hunting grounds was motivated neither by scarcity due to market pressures nor by an increase in population. The elephants were plentiful and roamed almost everywhere. The native population dropped by more than half during the period described. The European settlers represented approximately 4 percent of the total population. So we see that it is not always accurate to associate the formation of new property rights with scarcity as Levi and North (1982) have argued. Scarcity may be the effect of a law that modifies property rights in an attempt to overcome environmental and internal constraints such as unknown customs, uncooperative behavior, and the like, or a law that intends to enrich one individual, or a group, at the expense of the majority.

THE POST-LEOPOLDIAN REGIME: COLONIAL MOVES

The annexation of the Congo to Belgium was the beginning of a new form of exploitation. Indeed, despite this annexation, the colony was forced to be self-financing, and ivory became one of the main currencies in achieving this goal, in lieu of such mineral resources as gold. Ivory was no longer employed for the payment of taxes. The system of forced labor permitted the Belgian settlers to collect ivory without incurring any monetary costs.

Decision-Making Arrangements

The first colonial move toward managing the hunting ground of the elephants came 26 years after the colony was established, by the decree of November 26, 1934, that created the Institut des Parcs Nationaux du Congo Belge. This decree established the limits of the first national parks, in which hunting, fishing, and tree felling were prohibited. (Note that the parks covered an area of 17,380

square miles [45,026 square kilometers], whereas the elephant reserves spread over 6,000 square miles [15,544 square kilometers] in 1940). This decree also placed a fine of \$169 to \$845.70 per elephant and a two-month prison sentence for the killing of elephants already living in the parks. The prison sentence and the fine were more severe for hunters who had no licenses for hunting elephants.

The hunting licenses were regulated by the decree of April 21, 1937, that required a nonrefundable \$2.00 deposit for a one-year license to be issued by the state, as well as a tax of \$5.00 for every mature elephant killed outside the parks. This tax increased to \$20.00 in 1956. Thus, the tax requirement automatically excluded the majority of natives from hunting activities; this amount was beyond their yearly income.

A third move carried out by the colonial rulers in the 1930s was the domestication of elephants and their use for farming in the environs of Gangala na Bodio. The cost of maintenance and domestication was valued at \$25,372 per year for 80 elephants. This domestication of the elephants helped the Belgian rulers to justify the protection of these mammals, and hence to press for money through an increase in per capita taxation of the natives.

To carry out these policies, a corps of Belgian officers and native employees was created in 1937 by the decrees of September 27, December 23, and December 26. This corps had to prevent people from killing elephants either in forbidden zones or during the rainy season--the period during which elephants reproduce in the savanna zone.

Unlike the embryonic Leopoldian bureaucracy, the colonial regime was a vertically centralized bureaucracy with Belgians occupying all the positions from the top to the bottom within the administrative hierarchy. In this context the villages were no longer autonomous entities, but rather became executory agents of the colony.

Patterns of Interaction

The colonial regime was a coercive system ruled by three interconnected entities: the administration, responsible for the enforcement of the law; the capitalist economy, which commercialized ivory; and the Catholic church, which was responsible for reporting all illegal

activities. The natives, furthermore, were considered to be second-class citizens without legal rights to the hunting ground. The coercive nature of the system and cooperation between the charter companies and the church elicited native cooperation and sharply reduced any incentive for smuggling.

Outcomes

The creation of national parks and the regulation of hunting grounds were justified by the colonial rulers as being necessary to maintain the elephants at carrying capacity through a culling system. The goal of culling herds in the national parks was twofold: first, to prevent the overpopulation of elephants to avoid the destruction of woodland and forest; and second, to allow natural forces in the parks and reserves to operate to the fullest extent possible in creating and maintaining a dynamic equilibrium. Within that context, the Belgian authorities decided that each year some of the mature elephants would have to be cropped to satisfy the national meat market as well as the international ivory markets and zoological gardens. Theoretically, this annual crop was supposed to be less than 5 percent, an amount large enough to relieve pressure on the ecosystem but small enough to allow time to study the biology of the elephant. Practically, from 1937 to 1959, at least 200,000 elephants were killed and almost 69 million pounds of ivory were exported (Jeannin 1947; Institut National de la Statistique 1950-1959; Offermann 1951).

The result of colonial policies after 1936 is outlined in Figure 1. First, the largest quantity of ivory exported was from the mature group of elephants (which also included nonreproducing females), that is, elephants over 55 years of age, bearing two tusks each weighing at least 33 pounds (15 kilograms). Second, the minimal years in ivory exports were either years during which the colonial authorities issued few shooting licenses, or years that followed decrees increasing the tax for every elephant killed outside the parks. Third, the low level of ivory exports from every reproductive age group between 18 and 55 years--in contrast to the exports from the 56-and-over age group--may be attributed to the fact that the colonial ruler rarely allowed the registration of ivory exports from these three groups.

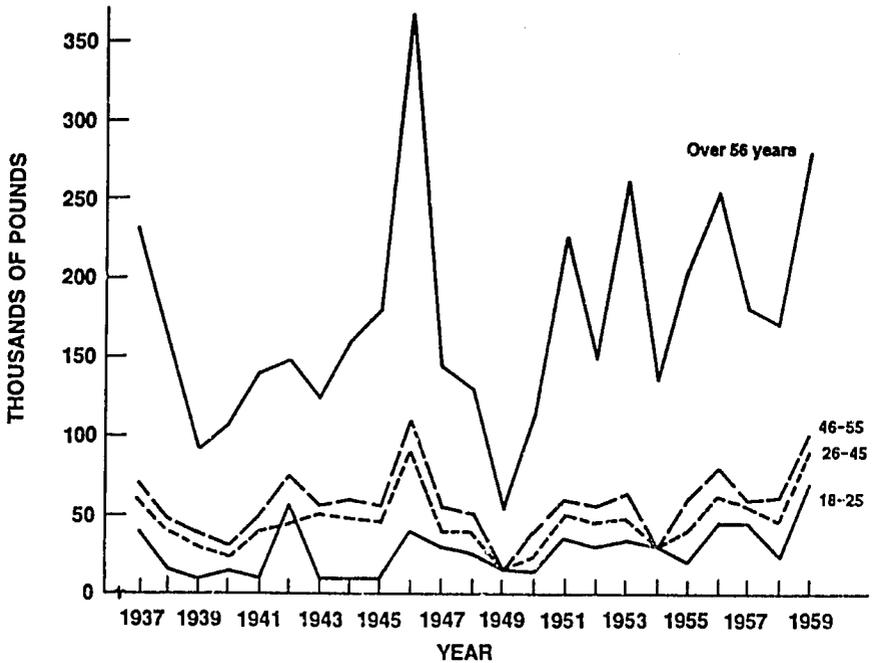


FIGURE 1 Exports of ivory per age group of elephants.

Source: Institut National de la Statistique 1950-1959; Jeannin 1947; Offermann 1951.

Because of the coercive colonial regime, the elephants were rationally utilized in farms and killed when mature; the colonial regime may have been efficient, but it was also an unfair regime.

The creation of national parks gave the Belgian authorities an alibi for excluding the natives from the land without any compensation, and this move forced the natives into mining and plantation agriculture. This was usually accompanied by bitterness and frustration arising from separation from the family and the village. Prohibition on hunting, fishing, and tree felling in the parks and reserves extended over an area of 11 million acres (4,455,000 hectares), 8.2 million acres (3,321,000 hectares) in the northeastern regions. Any native caught in these areas was beaten to death. Merlier (1962) reports

that for the sake of saving the flora and the fauna in Albert National Park (now Virunga Park) in the Kivu region, five villages were erased from the colonial map for having hunted there, thirty for having fished, forty-two for having illicitly circulated, and four for allegedly having set fires.

The goal of colonial law was to induce native cooperation by force, and to transform the structure of property rights to justify the exploitation of common property resources by the politically dominant group, the Belgian settlers. For instance, in looking at 1946 and 1959 (see Figure 1), no proposition of effectively protecting the elephants is tenable. Ivory exported from young elephants in 1946 rose 300 percent over the previous year, which can be explained only by the effort of the Belgians to reconstruct their postwar economy. An increase in the hunting of the same group of elephants in 1959--just one year before the impending Zairian independence--surely had no connection with the preservation of the herds.

Another effect of colonial rule was that most Zairians had limited access to the reserves and parks, and no access at all to the private and public decision-making bodies that created and maintained these areas. Therefore, it can be inferred that the colonial conservation policy was unilaterally designed to serve the recreational and economic interests of European settlers. With the declaration of political independence on June 30, 1960, the natives gained a measure of access and political control over the parks, reserves, and hunting grounds.

THE POST-COLONIAL REGIME I: THE NATIONAL BUREAU FOR IVORY AND MANAGEMENT OF COMMON PROPERTY RESOURCES

Between 1960 and 1972, the degree of exploitation of the elephants in Zaire is almost unknown. Assessing the number of elephants killed becomes more difficult because of a lack of data and also because no policy was formulated regarding elephants during that period. It can, however, be reasonably asserted that the political and economic instability that has followed Zairian political independence encouraged an erratic exploitation of the elephants. The first post-colonial policy was the decree of January 5, 1973, which established a monopolistic agency called the National Bureau for Ivory (NBI). It survived for only three years.

Decision-Making Arrangements

The law creating the NBI explicitly recognized the common property character of the hunting grounds: it specified that the exclusive goal of the agency was to buy ivory from native hunters and sell it on international markets. As the law was mute about the content of colonial decrees, the elephants living in the parks were still protected by the state. Accordingly, the creation of the NBI gave rise to two types of resources. The first, public in character, were the various national parks, from which no one could be excluded; moreover, these parks were indivisible among users.

The second, the hunting grounds of the elephants that had been erratically exploited after the Belgian departure, could not be controlled by the mere act of creating the NBI. Besides, the government system of price controls over ivory was similar to colonial controls insofar as the law did not differentiate licensed hunters from hunting tribes. For the agency, anyone desiring to hunt elephants had to possess a hunting license, without which any possession of ivory was a crime subject to prison sentence and fine.

So the response of the Zairian government, fearing local initiative and decision making, was to impose control from the center upon local authorities. Licensed hunters were simply instructed to sell ivory at the fixed price of 3 zaires (\$6) a pound and the government would buy it. This law prohibited the hunting tribes from living their traditional life. But fear of the forest made licensed hunters rely on the hunting tribes for information on locating the elephants.

Furthermore, local bureaucrats of the NBI were supposed to act as channels of communication between different communities and the state government, but instead they acted in their self-interest. As Crowe (1969) has asserted, there is considerable evidence that when national regulatory agencies are utilized as the only administrative apparatus for dealing with common property resources, small, highly organized groups have subverted the regulatory process to their own advantage. Whereas the formal decision rules proscribe work outside of one's bureaucratic functions or for personal gain, the NBI bureaucrats became involved in smuggling activities and the agency became the instrument of those in power.

Patterns of Interaction

The ceiling price instituted by the NBI--which in microeconomic terms was below equilibrium price--increased illegal poaching and smuggling of ivory. Furthermore, because the fine and prison sentence were not prohibitive (gain from smuggling or poaching illegally exceeded the cost of bribing a customs official or police officer), smugglers easily crossed the Zairian borders to trade ivory in exchange for new Toyota pickups and Fiat trucks in the neighboring Sudan.

The increase in smuggling activities that has followed the 1973 decree clearly indicated that the colonial decrees were obsolete. First, unlike the colonial regime, the post-colonial superstructure lacked the united tripartite structure that had shaped the colony (the bureaucracy, the capitalist economy, and the Catholic Church). Second, the NBI was designed to solve the problem of regulating ivory activities rather than managing the hunting ground of the elephants. Third, the use of the state apparatus for personal gains has led even high-ranking officials to hunting activities, and the result was the politicization of the NBI.

Outcomes

The main result of the creation of the NBI has been the proliferation of bribes in hunting activities, and hence a tremendous increase in elephant hunting operations. For instance, the police are paid to look the other way when illegal pieces of tusks are being unloaded. They also make a habit of not studying a ship's manifest, which might prove that a tusk was obtained illegally or from the parks. Police behavior may be explained by the fact that their real wages have fallen below subsistence level, so bribes have become a quasi-institutionalized way of distributing income. For all of the groups involved in ivory activities, the government controls favoring some segments of the populace were discriminatory. Complying was analogous to conditions during the colonial period when people were required to render service for the colonizer.

This situation has made the state's control of ivory activities inoperative in and out of the national parks. In 1976, the NBI was reduced to an agency without any ivory

to sell in international markets: more than 90 percent of the ivory sold was reportedly smuggled (Banque du Zaire 1976). In the same year, the Zairian authorities opted for liberalizing all ivory activities by abolishing the NBI. To use the evocative metaphor borrowed from d'Arge and Wilen (1974), the prey (the hunters) became so big they ate the predator (NBI).

THE POST-COLONIAL REGIME II: THE AFTERMATH OF THE SUPPRESSION OF THE NBI

Decision-Making Arrangements

The law abolishing the NBI was meant to induce Zairians to create small cooperative hunting groups that would harvest the mammals and would also have an incentive to conserve them as their source of income. Unfortunately, this law was unclear on how to achieve these private but collective arrangements. The result was the emergence of an open access system² for harvesting the elephants living outside parks. But as the NBI was also the official enforcer for protecting the parks, the massacre of elephants began with those living in the parks as well.

In the absence of any agency regulating the use of the hunting ground, the local authorities were left to act according to their discretionary power. In the Upper Zaire and Kivu regions, the "official reproduction period" of the elephants was not decided according to the climate (reproduction usually occurred during the rainy season) but according to the mood of the regional governor or of his directors of environmental or economic affairs. Anyone caught with ivory in the decreed reproduction period could be jailed if the price of bribing an official was not right. An alarming report in 1978 (Departement de l'Economie 1978) made the Zairian central government prohibit the sale of ivory in April 1979. (Note that ivory exports had been banned in 1978.) Unfortunately, the government had failed to prohibit the consumption of elephant meat, so the acquisition of meat became the ruse by which hunters circumvented the ivory law.

Patterns of Interaction

In analyzing social formations as a combination of capitalist (market) and noncapitalist (nonmarket) modes of

production in which capitalism dominates, Wolpe (1980) points out that the conditions of this domination tend to be left unspecified so that the conservation of noncapitalist modes appears to be explained in terms of the functions performed for capitalism. Accordingly, the vagueness of the law abolishing the NBI may be seen as the result of the coexistence of the noncapitalist mode of production of elephant meat/ivory and the capitalist mode of distribution. First, ivory is produced either illegally by the hunting tribes or through poaching, and is then distributed in the capitalist economy, where high prices in Zaire (\$12 per pound in 1981) command huge profits. These high prices are also the major cause of smuggling activities in Sudan where a Zairian smuggler with one ton of ivory can obtain a large new Fiat truck (the unit net price, including cost, insurance, and freight, at the Zairian main port, Matadi, was \$40,000 in 1981).

Second, the coexistence of these modes of production shapes patterns of interaction that result in one's being able or unable to exploit the hunting grounds of the elephants; who you know seems to be the critical consideration. In 1979, ivory activities were prohibited, but because the consumption of elephant meat was not forbidden, hunting the elephants for the national meat market became a de facto way of selling ivory. In this context, those with connections (kin or friendship relation and the like) with top-ranking officials or enough money to bribe police or custom officers are not severely sanctioned when caught with ivory; but sanctions are meted out to the less well-connected who break the law. So connections and money provide Zairians an unequal access qualification with respect to the hunting grounds of the elephants. In other words, while poaching and smuggling ivory are independent of the state, they are connected to it by the fact that to hold government office means having access to the hunting ground. Paradoxically, the present erratic exploitation of the elephants is well-organized in the sense that only the presidential clique, the presidential brotherhood, a few members of the new aspiring bourgeoisie, and those who are connected to these groups are highly involved in hunting the elephants. What can be expected from this free-riding behavior of the ruling group? Olson (1982) provides a general answer: he argues that the tendency of special interests to free ride on national economies always results in the decline of the entire economic and political system.

Outcomes

The ivory rush after the abolition of the NBI has increased the hunting activities to such a great extent that one could have expected the extinction of the elephants in Zaire. However, despite this massacre, the elephants can be found in herds of 4 to 18 in some parts of northeastern Zaire. This capacity for survival may be attributed to the reproductive capacity of the animal itself and to the belief by some Zairian tribes that wild-life should not enrich people or be worn as a jewel. But the recent increased use of poison to kill the elephants for ivory is threatening their reproductive capacity. Poisoning water and fruits kills not only mature elephants, but also kills female elephants and calves.

In addition to human predation, increased demand for land and crops (as well as drought) in some areas of Zaire has seriously reduced the range within which the elephants used to live. Independent Zaire inherited approximately 150,000 elephants in 1960, scattered all over the country; by 1976, these mammals had disappeared in several districts (for instance, South Kivu, Lualaba, and North Shaba) and in some reserves (Epulu, Djungu, and Faradje). This is a clear indication of overexploitation.

Finally, the decrees written since the abolition of the NBI had but one purpose: to eliminate competition for the well-organized, well-capitalized, well-connected hunters. These decrees have failed to specify boundaries within which the rights of the hunting tribes (or others) must be exercised; thus, the politically and economically powerful groups have used the state apparatus for excluding the least fortunate Zairians from the hunting ground of the elephants.

CONCLUSION

This paper has attempted to provide a relevant perspective on the process by which different regimes in Zaire have tried to profit from the hunting grounds of the elephants. Accordingly, this study has shown how different laws regulating common property resources have discouraged cooperative behavior by increasing the feelings of anonymity and invincibility of the individual, leading him to focus his attention upon himself and relieving him of the consequences of his own actions. The outcome has been the

conception of bureaucracy as a tool not for the execution of national or community objectives but for the fulfillment of ethnic loyalties. Externally induced, directed, and imposed laws without any internal support are bound to be dysfunctional in the short run as well as in the long run. Therefore, the only way that common property resources can benefit the community is through structural arrangements starting from the unit at which the individual is more at ease, that is, at the level of the community.

NOTES

1. Thanks to C. Ford Runge, Gatsinzi Basaninyenzi, John Orbell, William Mitchell, and two anonymous readers for their comments on an earlier version.
2. This paper refers to the elephants now living in Zaire as a nonexclusive resource, and as such they are characterized by open access that arises from unrestricted entry to the hunting grounds.
3. The turkedi were the largest hand-made textiles in the 18th century. See the link between turkedi, ivory, and slaves in West Africa in Jeannin (1947:92-93).
4. By the General Act of Berlin, February 26, 1885, signed at the conclusion of the conference held in Berlin in late 1884, the European powers agreed that activities in the Congo Basin should be governed not only by freedom of trade and navigation but also by principles of neutrality in the event of war, suppression of slave trade traffic, and improvement of the condition of the indigenous population. The conference recognized Leopold II of Belgium as the sole sovereign of the new Congo Free State. He later became involved in one of the bloodiest operations ever known. For more details, see James (1943).
5. According to James (1943:305), this estimate varies from 11,500,000 to 31,500,000 deaths.

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Common Property Management of Water in Botswana

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INTRODUCTION

In 1974, the Botswana Ministry of Agriculture established a policy of constructing small dams that would be managed by groups that had (before construction) agreed to stock limitations and management rules. The policy was intended to prevent overstocking, overgrazing, and improper dam maintenance. The groups would have the right to use the dam if they abided by the conditions of the initial agreement. By 1980, the policy was considered a failure: the dams were overstocked and overgrazed and group management was nonexistent. Much of this alleged failure was attributed to people's treating their dams as if they were open-access property free for anyone to abuse. This study of the use and management of these dams will show otherwise.

BACKGROUND INFORMATION

Definitions

Excluding a few large villages, the communal areas of eastern Botswana contain approximately 20 percent of the country's land, 60 percent of its human population, at least 40 percent of its cattle, and most of its crop

production. Tribal land, statutorily defined as land under the allocative and adjudicative control of government land boards, comprises the majority of this area. It is commonly considered to be communally held, since it cannot be owned on a freehold basis. Communal areas include small villages, cultivated areas, and cattleposts on tribal land. "Lands" denotes both cultivated fields and the general area where they are found. "Cattlepost" means both the places where livestock are penned and the adjacent grazing areas. The major water sources include boreholes, open wells, and surface water catchments, namely dams, haffir-dams and haffirs.

Seasonal Cycles

Water management in rural areas reflects the inter-related changes in residence and activities associated with the seasonal cycles of agricultural production and rainfall. Highly variable, average annual rainfall in eastern Botswana averages between 350 and 500 mm. Unreliable rainfall makes crop failure probable once in four years.

Seasonal rainfall determines which sources contain water. The agricultural season generally begins with the rainy season; the timing of the agricultural season in turn affects where people and their cattle will locate and the nature of their water needs. Water use in a given locality varies with these changes in residence.

When the first rains fall, people move to the *lanōs* and start farming. Convenient lands water supplies are in great demand at the beginning of the cropping season, the busiest time of year for most farmers. Once harvesting is finished, the scarcity of surface water at the lands and cattleposts drives many household members back to their villages. After the harvest, there is an increased demand for water for making beer, which also supports the residential shift back to the better watered villages.

Each village, lands, and cattlepost has its own seasonal resource base and activities. Its social and economic activities may change over the course of the year. For example, after harvest, a number of lands become grazing areas and villages, places for celebrations and social gatherings. These interrelated places and population shifts make the multiple locality (the village and its lands and cattleposts) the most appropriate unit of analysis for rural land and water use.

The Fallback Strategy

The seasonal water use pattern for livestock can be seen in increased reliance on groundwater sources in the dry season as surface water use declines (Bailey 1982:174). Shifting water sources reveal a highly adaptive household fallback strategy of water point use and management to ensure a reliable supply over time for household purposes. The sensible household has a flexible backup system of water supplies. As one water point goes dry or breaks down, the household shifts to other, sometimes less convenient, but more reliable water points.

Water Point Typologies

Rural water supplies may be typified by four characteristics: (1) their locational frame of reference; (2) the interaction between their physical structure and the degree of seasonality of use and management; (3) the distinction between management of the water point and management of its use; and (4) the types of management.

The Locational Frame of Reference

Water management involves four locational frames of reference: the water point site; the locality; the multiple locality; and the rural water sector as a whole. For example, a borehole plays multiple roles in an area because of this locational frame of reference. At the point, the borehole is or is not used for domestic and/or livestock purposes. In the locality, the borehole may be the village water supply free to all. Within the multiple locality, it may serve as the drought fallback water point, the use of which is rationed during the drought. Within the sector, the borehole's operation may be hampered by the government's limited recurrent budget for all of its boreholes.

Water Point Structure and Season

Knowledge of resource availability underlies the temporal mobility and flexibility that is at the heart of the household fallback water strategy. As seen in Table 1, this in turn is affected by whether the water

point structure is fixed and whether use and management occur seasonally or year-round.

TABLE 1 A Typology of Water Point Structure, Use and Management.

Water Point Use and Management	Water Point Structure	
	Fixed	Unfixed
Seasonal	Many dams	Emphemeral puddles
Permanent	Some wells and boreholes	Sandriver (<u>wadi</u>) pits redug in different sites of the same riverbed

The Management Matrix

"Water management" blurs the distinction between water point management and water use management. The examples in Table 2 make this distinction and indicate how easily different types of open-access resources can be confused. To some, open access water means case 4; others would add cases 2 and 3; a few would call case 1 open access if the water were public property.

TABLE 2 A Typology of Water Use and Management.

The Water Point	Water Use	
	Managed	Unmanaged
Managed	1. Managing operation of some dams and boreholes	2. Unherded cattle breaking through a dam's bush fence
Unmanaged	3. Cattle herded into open-access dam or river for drinking	4. Cattle freely watering from puddles and pits

Management Type

Classifying a water point by management type is complicated. A group-operated, government-owned borehole may be managed as if it were a private borehole, i.e., a single person or family dominates. A privately owned well may be used by residents of a locality as if it were a communally held open-access facility. It is not uncommon to find a water point with a different owner and manager or being used in a way not originally intended by either.

Thus, it is useful to classify water point management in three ways: (1) by owner, (2) by manager, and (3) by the kind of access locality members actually have to the water point. Owners and managers can be separated into four categories: (1) private individuals or families; (2) small non-kin groups; (3) government authorities; and (4) communities. Access to a water point is defined by whether its use is open or restricted in practice.

In general, community owned and managed natural water sources are open access. But there is no one-to-one association between private ownership, private management, and restricted access. A group-managed water source can be managed as a restricted access water source.

THE CASE STUDY: AN APPLICATION OF THE OAKERSON FRAMEWORK

Physical and Technical Attributes of Small Dams

Small dams, with steep walls and deep excavation pits, appear to have structural aspects that affect the jointness, exclusiveness, and indivisibility of their water supply. But, as seen in Table 1, water point structure cannot be isolated from factors that make its access and operation variable over time and place. While the structural features of water point technology are fixed, almost all of their effects are variable.

The constraining effects of water point technology depend on location, when the water is available, how is it made available, and how the source is managed. The availability, quantity and quality of labor used to draw water bear profoundly on the bundle of physical constraints associated with the use and management of a particular dam. The same dam, with the same amount of water, presents a fundamentally different set of physical constraints to users in the month before and after a harvest.

Decision-Making Arrangements: The Theory

Here we consider the rules people were to follow for the Ministry of Agriculture's small dams; these are discussed according to our locational frame of reference. At the dam, group behavior was to be guided by the terms of agreement the group signed with the government as the condition for takeover of the dam. Within the locality and multiple locality, a major rule used by land boards required that there be at least 8 kilometers between livestock watering points to minimize the potential for overgrazing between them. The water sector was affected by traditional norms defining and regulating common property land and water resources. Finally, the formulation and implementation of the dam policy were conditioned by broader institutional and national concerns.

At the Dam: The Terms of Agreement

Under the dam policy, the dams were to be primarily for stock watering in the lands and cattleposts; they were not intended to provide domestic (human drinking) water to villages. A dam group was to consist of approximately 15 members, who, on average, owned fewer than 20 adult cattle each, with no single person allowed to water more than 50 head. Each group, consisting of farmers who wanted the dam and were "willing to control their grazing," was to be formed before the dam was constructed and was to sign standard terms of agreement as a precondition to handover. The major conditions in the agreement were threefold: (1) group members would maintain and repair the dam; (2) each member would pay an annual fee per adult animal to provide revenue for dam maintenance and repair; and (3) no more than the equivalent of 400 adult cattle would water at the dam.

It is unclear whether the terms of agreement were a binding legal document, although they included a clause enabling local government authorities to take "appropriate action" if conditions were not fulfilled.

Within the Locality and Multiple Locality: The Eight-Kilometer Rule

Whether any official government document ever stipulated an 8-kilometer spacing between livestock watering

points is unclear. Yet, both inside and outside government, the widespread impression is that land boards should follow such a rule as an unofficial policy. The assumption has been that this rule was appropriate for spacing permanent livestock watering points for between 300 and 500 head of cattle. The rule applied to the spacing of small dams built under the 1974 policy.

Within the Sector: Differing Norms and Institutional Concerns

Traditional common property norms in Botswana often contrast sharply with the Ministry of Agriculture's institutional objectives. The expatriate planners of the 1974 dam policy appear to have been unaware that many users perceive dams--especially those built by the government--as common property facilities (Schapera 1943). The government believed water scarcity justified a flat-rate water charge to discourage overutilization of the dam. This ran counter to the traditional norm that all who needed it could use surface water, particularly when it was scarce. Officials argued that water prices were necessary to impress water scarcity upon dam users, failing to recognize that water was scarce only seasonally and that traditionally the Botswana had managed scarce common property resources without resorting to explicit prices.

Moreover, at least since the 1960s drought, many government authorities have considered forage the first limiting factor in tribal area livestock production. In this view, livestock deaths (including drought deaths) were caused by lack of grazing due to excessive overstocking around permanent water supplies. So making government water point development conditional on user stock limitations appealed to many officials. The small dam policy was justified as a lever for obtaining better grazing control, both through constructing new dams in a more dispersed fashion and through stock control measures. But surveys suggest that rural households see grazing land as a seasonally renewable resource, not as a limiting factor, and they attribute overgrazing to poor rainfall rather than to overstocking.

There is also a subtle difference in perceptions about the extent to which access to new grazing areas is restricted by the lack of man-made watering points. Some Ministry of Agriculture staff believe that the development of livestock watering points in a new grazing area

increases that area's effective carrying capacity. But the availability of "frontier" grazing and water sources has probably worked against the more efficient use in the older established areas, and has undermined the stated government intention of treating water and grazing as scarce resources, because Botswana stockholders believe it is cheaper to get forage and water in new areas than to manage them more effectively in old areas.

Finally, small dam policy reflected three strong Ministry of Agriculture institutional biases at the national level. These are described next.

Anti-overstocking Bias Sensitive to charges that earlier large dams had encouraged overgrazing and overstocking, officials tried to control stocking rates at the 1974 dams through stock restrictions in the terms of agreement and by designing smaller dams with lower watering capacity.

Sandveld (Desert) Bias Extending livestock water supplies into the sandveld areas has been a major government objective since at least the 1950s. The view of isolated desert boreholes operating far from alternative water sources led some government staff to the erroneous assumption that reliable livestock watering sources were similarly spaced everywhere and that therefore existing points would be managed.

Reliability Bias The small dams were intended to be managed year-round, with the assumption that water supply reliability is the single most important factor in rural water demand.

Decision-Making Arrangements: The Practice

In practice, the realization of the decision-making arrangements described above was substantially different from the original intent.

Patterns of Interaction at the Dam

Information on the terms of agreement was collected on 24 of the estimated 99 small dams constructed under the

policy between 1974 and 1980. Of these, 21 had some sort of group management in the form of maintenance, regulation, and/or revenue-collection activities.

Maintenance Functions Dams require no technically complicated maintenance unless they collapse or silt up, reasonably infrequent events in Botswana. Maintenance is largely preventive and its absence is not immediately apparent. About half of the groups did some maintenance. No dam group did all stipulated maintenance. Most maintained the fence enclosing the dam wall and reservoir, less to lengthen dam life than because regulation of use depended on them.

Regulatory Functions All groups tried to regulate the use of their dams. As the alternative water sources began drying up, the groups began restricting access to the dams. The regulations did not always follow government forms (no dam group set stock limits), but they did lead to water management. Four kinds of regulation were common:

- o Limiting Numbers of Users. Managers generally turned away outsiders, even those willing to pay fees, rather than nonpaying members of the group or of the same locality.
- o Restricting Types of Use. Some dams were limited to domestic purposes only, either permanently or seasonally as other sources went dry. The success of such limitations depended on the availability of alternative and fallback water points.
- o Controlling the Manner of Use. Limiting direct cattle access into the reservoir was generally found at dams used for domestic purposes. Ironically, this regulation desired by the government occurred mainly in conjunction with a use for which the dams were not primarily intended.
- o Regulating the Time of Use. Some dams are closed completely at certain seasons. In some cases, dams were used as back-up points for other water points subject to breakdowns, such as boreholes. Other dams were part of the sequential system of fallback points.

Revenue-Generating Activities Dams have few, if any, operating costs, so dam users perceived less need for fees than did those who used such water points as boreholes with obvious and compelling operating and maintenance costs. Nine groups said they charged fees; none used the recommended flat-rate fee for livestock. Revenue was generated in response to specific needs, often as a contribution, e.g., paying a caretaker for the dam. It was the rare case when lack of funds prohibited a group from taking essential action.

The next section examines why groups did what they did. Since much of their behavior is explained by operating norms and perceptions within the water sector as a whole, discussion of the use of the eight-kilometer rule is deferred until later.

Patterns of Water Sector Interaction: Dam Operating in Perspective

Why People Followed Some Government Management Procedures

Dams served a useful purpose. But, contrary to the ministry's perception, dam users valued convenient and cheap water supplies, not just reliable ones. Since time and money invested in transporting water could be applied elsewhere, it was worthwhile to protect and preserve a nearby supply. Fences were maintained because people saw their effectiveness as management tools. Similarly, when the water in a dam came under stress within a fallback system, its use was regulated. The rest of the year the dry dam was of little interest to its users.

Why People Did Not Follow Other Government Management Procedures

Both technical and social organization factors seemed to have encouraged groups to depart from the terms of agreement.

o Technical Factors

- The Small Capacity of the Dams. Dams were intended to provide water through the dry season given adequate rainfall. But even given sufficient rain, many small dams cannot provide water because of improper siting or the pressure of an excessive number of stock. If a dam is perceived by its users as likely

to go dry, it makes sense to "mine" the water while it is there, especially if other water points are available.

The small capacity was the result of a Ministry of Agriculture's decision to opt for smaller dams to prevent overstocking. But by choosing smaller dams, the Ministry reduced the dam's reliability for year-round livestock watering, and thus decreased the incentive for permanent management.

-- Dams as Low Maintenance Facilities. Many people favor dams precisely because maintenance requirements are perceived to be low, and the need to pay fees is minimal.

-- The Role of Dams in the Fallback System. During the rainy season (when water is plentiful) and often during the late dry season (when many people have returned to the villages), dam management does not pay. Management makes sense only when the dam is used as a fallback point or needs repair. If fees are collected, it is typically at this time. Management occurs under stress at the time when dam water is critical.

-- Dams as Multipurpose Water Points. If livestock access to dam water is restricted, users are more likely to use the water for domestic purposes. Twenty of the twenty-four dams surveyed were used for drinking water. Management of dams providing both domestic and livestock water often differed from those used for livestock only. For example, users looked upon domestic water charges with even less favor than livestock watering fees, since domestic water was supplied free of charge in most villages.

o Social Organization Factors

-- Shortage of Labor. Dam use was affected by a perceived shortage of agricultural labor, especially for cattle-herding. Herders would much rather open a gate and allow cattle to water freely than pump water into a trough.

Labor-intensive dam maintenance activities may not be done for lack of labor. Indeed, the very lack of fences and deep reservoirs may have increased the value of some smaller dams to labor-short stockholders who only used them to water live-stock. This, however, ensured that these dams would not be managed as required by government.

-- Local-Level Perceptions Affecting Dam Use.

Government dams are generally considered to be government property, the local feeling sometimes being that the government should take care of them as it does its other property. The policy of group formation prior to construction--meant to foster a sense of local ownership--did not always succeed. Because of the traditional norm of open access to many surface water sources, a small dam was commonly perceived as belonging either to the government or to the people of the locality in which it had been sited; rarely was it seen by residents as belonging exclusively to a small group of people in that area, even if they had been registered by the government.

-- Dam Groups as a Government Creation. Dam groups had little or no basis of local legitimacy. The official members were not particularly deserving of a dam; they were simply in the right place at the right time. From the government's viewpoint, the group had been given the right of exclusive use of the dam and the responsibility to manage it properly. But other residents of a locality were often not prepared to recognize this "right." The communal land on which the dam was built "belonged" to all residents, including the neighbors of group members. The dam itself was constructed by the government at no cost to the group. The water was rain water. This distinguishes the dam groups from individuals whose private right to wells or dams comes from the labor or capital invested in their development. Dam groups cannot draw on traditional norms to support their claims. Moreover, as long as there is mutual assistance among neighbors, dam group members hesitate to turn away people who might help them in other circumstances.

- The Declining State of Self-Help. The absence of community sanctions against those who did not support the management of a dam might have reflected the low priority that all self-help activities received in an area. An increasing lack of trust and cooperation in some localities may explain why some elected to not contribute to dam management.

- Insiders Versus Outsiders. Rural Batswana consider their major water and land difficulties in the communal areas to lie less in developing or managing the resources directly than in managing the conflict caused by differential access to and control over these resources. People complain about their neighbors being uncooperative in assisting in the operation of a water point. Others complain about marauding "outsiders" who come in and use locality resources without permission. There is conflict at all levels over the use and management of tribal land and water resources in many parts of eastern Botswana, where determining who is an insider and who are outsiders to a locality and its land and water is fast becoming the central feature of this conflict.

Patterns of Interaction in the Locality and Multiple Locality: The Eight-Kilometer Rule

The small dams at the survey sites were often closer than eight kilometers to other permanent water sources, and in four sites dams were less than eight kilometers from each other, indications of the many exceptions made to the eight-kilometer rule.

Technical Ambiguities in the Rule. The rule was intended to prevent exceeding the carrying capacity of the rangeland through the spacing of permanent water points with capacities of up to 500 adult cattle. There are a number of technical problems with its underlying assumptions.

- o Carrying Capacity A key problem is using a 450-500 kg animal as the standard of carrying

capacity. Because of local production strategies, cattle in these areas often weigh considerably less.

- o Grazing around the Water Point Since existing livestock watering points in the east are often nearer than eight kilometers to each other, grazing does not always improve with distance from a water point.
- o Watering up to 500 Head Stocking rates are difficult to assess since they usually vary by season. Comparing two watering points with numerically equivalent stocking rates at different seasons of the year would require normalizing stocking rates and estimating equivalencies for seasonally variable forage conditions.
- o Eight-Kilometer Spacing This rule implicitly requires an animal to trek eight kilometers or more a day although this is inadvisable for certain types of animals at certain times of the year. Hydrological and topological conditions also affect the practicality of standard spacings.

The Political Mandate for the Eight-Kilometer Rule Despite these technical difficulties, it is precisely the technical aura of the rule that is politically appealing to land boards. The Tribal Land Act gave land boards statutory authority over land and water allocation and adjudication, but left them with the task of establishing the legitimacy of their exercise of that authority. The rule represents a resource (Comaroff 1978) that can be manipulated to assert a land board's claim over regulating the use of a site. Closer spacing is often allowed when an appeal is made to other "rules" the land board claims it can also apply to govern land and water use (cf., Roe and Fortmann 1982:132-133).

Outcomes

Equity

The government's program of building and operating village boreholes for drinking water has clearly helped both rich and poor users (Fortmann 1981:57; Fortmann

and Roe 1981). But the dam-building policy, intended primarily for stock watering, may have excluded the poor who have no livestock.

Using a Guttman scale of relative wealth, Fortmann found no statistically significant difference between the richer and poorer households in their domestic use of dams and haffir-dams (Fortmann 1981:57; Fortmann and Roe 1981). All households using the small dams, whether for livestock or domestic purposes, benefited from the generally free water.

Data on use of government-provided livestock watering points (including a few boreholes) show that the very poorest cattle holders used such sources to a greater extent than did other economic classes. (Small sample sizes argue for caution in interpretation.) Collapsing economic classes into two categories showed, however, that, while some poorer cattle-holding households had access to government-provided sources, a greater proportion of the richer cattle-holding households used them. Since this comparison is based on cases of use,¹ it is not known how many head each economic category watered at such sources or how crucial they were for each class. Still, the larger percentage of richer cattle holders using these sources indicates that they benefited more for cattle watering purposes. While the dams were not intended for domestic use, it is probably the case that this use not only led to much of the observed management at the dams, but also made the overall effect of the dam policy more equitable.

Efficiency

To determine whether small dams had encouraged overstocking and overgrazing, dry season and wet season counts of livestock numbers (converted into standard livestock units) were taken at 39 regularly monitored water points at 12 sites; and a dry and wet season range condition was scored at 46 points, with 34 water points common to both surveys. Nonparametric statistical tests of significance were used to measure differences between physical and management types.

Few significant differences were found among the range scores of different physical types. Small dams were not noticeably better or worse than other water point types. In contrast, group-owned and managed water points did have significantly better dry season range conditions than did

privately operated sources. Type of access accounted for the greatest statistical difference. Restricted access water sources had clearly better range conditions than did open access sources, particularly in the wet season. (These results are more fully described in Roe 1985.)

This evidence strongly suggests that group-operated small dams were in fact less intensely grazed than were open access sources. Many of the private water sources were open access or operated for longer periods of time than the group dams, which often were restricted access and were not in operation throughout the year. In fact, since use of these dams typically occurred within a fall-back system, livestock watering numbers rarely exceeded the limitation of the terms of agreement. Only 12 percent of the recorded daily counts at the 15 government small dams monitored were over 400 livestock units, and most of these counts were recorded at one dam. Contrary to the ministry's view, these dams were probably no more intensively grazed than were other water sources.

In a sense, though, the ministry was correct. There was overgrazing around the dams. But there was overgrazing (often relatively worse) around almost every other water point. Statistical tests should not detract from the fact that the absolute values of the range scores were often less than half of what the ministry thought appropriate for the area.

Such evidence simplifies measuring the costs of overgrazing induced by dam development, since it suggests that at the margin, the addition of one dam in an overgrazed area will only slightly worsen range conditions. The conservation loss due to increased degradation probably is small compared to the dam's capital and operating costs and potential benefits.

While a new dam may have little impact on the conservation efficiency where grazing has already exceeded maximum sustainable yield, overgrazing does affect the economic efficiency of livestock feeding off that grazing. Outside the experiment station, it is next to impossible to measure the marginal productivity of water for livestock production controlling for all the factors. Nonetheless, the figures in Table 3 suggest that the more water points per unit of land area, the greater the overstocking, associated overgrazing, and liveweight losses.

The recorded weights are less than expected for a 450 kg heast (around 240 kg), illustrating some of the loss incurred by the poor grazing as well as the production strategy that emphasizes numbers. Still,

variability in range condition and stocking rates tied to water point density probably does have an economic cost in terms of cattle condition.

A rough estimate indicates that building a new dam in an area will, on average, lead to a 1 percent decrease in carcass weight for each stock unit (SU)² which, if aggregated over the life of the dam and converted into livestock units, would represent a loss of about 3 SU over 15 years, at about 5 cents per cubic meter of water in the average dam. Even if this figure were doubled, it is a relatively small increment to the total cost of water. Bailey (1980, 1982) estimated that at a 12 percent interest rate and assuming

TABLE 3 Dry Season Carcass Weight and Indicators of Range Pressure.

Village	1979 Dry Season Carcass (wgt/kg) ^a	1979 % Households Grass Problems ^b	1979 Range Score (dry) ^c	Stocking Ranges (ha/SU) ^d	Water Point (Density/km ²) ^e
1	207.8 (178.3)	41.2%	19.2	8.8	0.03
2	179.7 (150.8)	53.3%	9.9	5.4	0.06
3	163.3 (106.6)	94.4%	14.6	3.3	0.17

^aCarcass weight figures in parentheses include condemnations. Data are from three livestock marketing cooperatives selling cattle in September and October 1979.

^bPercent who had trouble only with grazing (Bailey 1982:116).

^cFigures are 1979 dry season lower layer species scores. The higher the value, the better the range (Fortmann and Roe 1981:91).

^dSU are standard livestock units equivalent to 450 kg. (Bailey 1982:107). In reality, an adult animal is smaller.

^eBased on the area and numbers of water points mapped for each village water use area using Bailey's estimates for available grazing area (Fortmann and Roe 1981:158-160). Water point types were standardized for the percentage of total livestock months spent at each type by the households sampled (Bailey 1982:126-137).

a service life of 15 years, the annualized unit cost of a cubic meter of water from a government dam was around \$2.20, a figure probably on the low side since dam water is less available than originally intended. At a 2 percent interest rate, the cost would be around \$1.20/m³ in 1979/80 prices. His computations for boreholes and open wells show that, on cost effectiveness grounds, small dams are comparatively cheaper.

In a number of mixed lands and cattleposts, the dams have become a major part of the fallback water point strategy. They allow households to arrive early and leave the lands later, which can lead to increased crop production. They provide a more convenient source of both domestic and livestock water for a number of households when convenience and reliability are at a premium. As such, a cubic meter of dam water probably represents a cost of between \$1.25 and \$2.25 for those communities that find it a strategic water source. Indeed, the intensity of some dam management is the best indication that willingness to "pay" exists for such sources.

CONCLUSION

We have presented a bare-bones analysis of communal water use and management in Botswana. It has been shown that villagers manage water in a systematic and rational fashion, although not necessarily in the way the government thinks is right and proper. It has also been shown that the factors affecting water management differ according to the level of social and spatial organization. A complete analysis of any water use and management system therefore will require careful data collection at a number of levels.

NOTES

1. "Cases of use" is the sum of all water points used by all households in the survey. If one household used two water points and a second household used three water points, there are five cases of use represented by those two households even if they are using some of the same water points. This does not measure volume of water used or frequency of use.
2. A stock unit is a standardized measurement equal to a mature zebu cow with calf at foot.

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Private Rights and Collective Management of Water in a High Atlas Berber Tribe¹

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This paper discusses the forms of water management utilized by the Erguita mountain tribe in Morocco.² The Erguita consider water a collective good; its management links the various social groups composing the tribe and reveals the links among them. The use of the term "collective good" to describe water must be understood in context.

Water is a collective resource in the sense that its management is the business of the community, an affaire de tous. It is also an object of private ownership. The double identity that characterizes the regulations surrounding water use is a topic of primary concern here. Another concern is the specific manner in which the water is managed. In fact, the original objective here, in addition to analyzing the process of water management, was to understand the organization of the Erguita through their management of water.

As precise and as complicated as they appear, the systems of water sharing serve only as theoretical guides to the actual distribution of water among rights holders. In fact, the strict observance of these rules is often constrained by social tension and disorder. As ingenious as it might be, any rule is subject to the caprice of men. The same Berber who enthusiastically describes the delicate system of water sharing that controls his life will also, with good humor, explain how the system can be

circumvented, as getting around the rules is seen as merely another way of dealing with water shortages. In reality, the different systems passed down from father to son are neither rigid nor blind to circumstance. In practice, they are often corrected and adapted to the difficulties of a particular moment. A harmonious existence of brothers is more important than rules, and recourse to a rigid adherence to the rules signals a crisis in the group; rules and systems are seen as solutions to practical problems of the past, and are not necessarily valid for contemporary circumstances.

Rules may conform to normal practice, but they are ignored periodically or temporarily to deal with unforeseen events. The system serves as a foundation, but it is supplemented by improvised rules and daily adjustments in situations not addressed by the rules. These adjustments are not part of traditional law but are derived from local folkways and mores. Not surprisingly, then, it is difficult to understand how water is distributed on a daily basis. These complications are such that the tribesmen prefer to discuss their system in the ideal terms of "water rights" instead of actual utilization of the resource.

Water rights may be seen as private property, but they are not as precise and clear as land rights. Property implies fixed limits, but water rights are confined and limited in a complex system of social relationships. The oral history of water use is the key to the operation of the system. This knowledge is held by specialists who distribute water and by notables of the village. By virtue of being monopolized by a few, this knowledge can be manipulated on occasion. The status of those who share water and the balance of power within a group are factors that determine how water rights are interpreted and enforced, but these factors are never constant. Hammoudi (1982) emphasizes that one must distinguish between water as a substance and water rights as a relationship among group members:

If I call substance all that is tangible (in known quantity), limited, fenced (land), or measured, it is evident that the property in water rights that an individual possesses is not a substance. All that he possesses is opposed to substance. It is a relationship measured in time with other users. It is by the intermediary of the irrigation system, and by the fruit of collective labor that a person obtains the water to irrigate his properties.

system of group opposition and interdependency that is fundamental to understanding the management of water among segmentary groups such as the Erguita. This system will be more comprehensible when we discuss the relation of groups within the fraction.

We have talked about water as a collective, indivisible resource that is the property of a group. We will now discuss the impacts of tribal structure on this group property, and the concept of indivisibility.

Among the Erguita, two theoretical models of communal ownership of water coexist: property of the fraction and that of the village. The fraction normally has the responsibility for the management of water. But there are exceptions. The spring, the diversion dam, the basin, and the canals are the property of the four villages that constitute the Tamadgost fraction; another village not of the fraction is also a co-proprietor. This village belongs to a neighboring fraction; its right to use the system was acquired by the force of arms several generations ago (demonstrating that topographic frontiers are not inviolable). Thus we see that a group's water rights may be the result of geographical, historical, or military factors, or any combination thereof.

In some instances, a single village has full rights to an irrigation system. The cases of the village of Tigouliane of the Id Waftkout fraction and Bitaljane of the Ait Makhloui fraction will serve as examples. Such exclusive use is normally justified when a village uses large amounts of water and/or has a high population density.⁴ But these villages are, in many ways, pseudo-fractions, "islands" that coexist along with other villages within their fraction. At other times, two or more villages within a fraction may manage water together.

This collective ownership of water changes its form as one goes from very large social groups to smaller ones. It is possible to distinguish between the water rights of a fraction, those of one or more douars (villages), those of one or several lineages, and even those of an extended family. Within the fraction, the opposition to the rights of various groups is often manifested between the lineage and village groups. The douar transcends the lineages within--members of one douar will coalesce to meet a threat imposed by other douars. Similarly, the lineage transcends individual families in conflicts with other lineages.

The water management system of mountain tribes is characterized by the appearance and disappearance of the rights of various groups. Water may be the property of those who possess it by virtue of their location below a

PHYSICAL AND TECHNICAL ATTRIBUTES

We will attempt to show how physical and technical constraints lead to a joint use of water by groups, while at the same time these constraints exclude outside groups from using it. This will give a unique meaning to the concept of indivisibility.

The mobilization and use of water cannot be seen as an individual activity. The difficult physical and technical conditions affecting irrigated agriculture in the region can only be overcome when individuals unite their efforts; this need for cooperation applies equally to both stream irrigation and basin irrigation.

Stream irrigation involves taking water directly from the stream using a fragile diversior dam constructed of rocks and branches. Originating at the dam, a dirt canal winds along the slopes above the streambed and the terraces.³ Along this canal, turnouts serve secondary distribution canals. These, in turn, serve the ditches that irrigate each small parcel. Stream irrigation is not common among the Erguita.

Basin irrigation relies upon spring water. A spring feeds a large accumulation basin constructed below it. The spring itself is venerated and is the object of a sacrifice of blood each year just after the maize harvest, called the "sacrifice of the spring."

Clearly, the physical and technical environment requires joint use of water, and thus leads to the social and communal aspect of water management. The co-users are the members of groups within the tribe. The Erguita tribe consists of nine rather large groups or fractions, each of which can be divided into several villages. Each village is a conglomeration of lineages made up of several extended households. Each fraction is identified with a specific territory whose limits are known and recognized by neighboring groups. Each of these can be viewed as an independent mountain "island" whose inhabitants share a community of interest.

In adapting to its valley, each group appropriates the natural resources found there. Each fraction has three facets--one of territory, one of common social origins, and one of mutual defense. As a result, the members of a fraction share a strong social identity.

The fraction exercises its jurisdiction over the water of its valley. It assures defense against the ambitions of neighboring groups and also is responsible for managing water for the benefit of its members. This results in a

spring or along a stream, but in reality it is the relationship between villages that actually determines water rights. At the village level, water is appropriated according to which part of the fraction (quarter) the villages belong. Within these divisions, the lineage rises to claim its water rights, thus eclipsing the rivalries.

Paralleling the collective "ownership" of water is ownership of hydraulic equipment (diversion dams, canals, and basins) that is constructed and maintained by groups in order to distribute water to fields. Whether the group utilizes streams directly or uses the basin has important sociological implications. Direct appropriation of water from the stream itself requires a constant mobilization of human energy--a continuous relay system and detailed supervision among users. It requires specific methods of water distribution as well as rather strong social ties among the groups that are engaged in the maintenance and construction of collective works.

The basin method does not require continuous action because of the waiting time involved while the basin fills, but maintaining the system does require collective work. The tank was constructed by the ancestors, but its care is an obligation of all males who have reached the age of fasting irrespective of the quantity of irrigated land or the water rights their families claim. Males who fail to participate in system maintenance are punished by a fine (equal to one day's wage) levied by the assembly of the group.

The technical requirements for the collection and utilization of water influences the organization of groups and the rules surrounding water use. Each group confirms its identity by emphasizing its ownership of water from a spring or basin (for example, the water of a spring belongs to the Ait Tamadag). At the level of the spring or the basin, water is appropriated in the name of the entire group.

MANAGEMENT POSSIBILITIES AND THE PLACE OF RULES

The group must face a dual challenge in managing its water: that posed by the natural environment (which the group overcomes by using its technical knowledge), and that posed by other groups who compete for water. Water management is also constrained by judicial and technical rules and norms of social conduct. The response to all of these demands affects how a group will choose between two

water management strategies available: (1) a collective option centered on the problem of collective irrigation; and (2) a private option that requires complicated rules of division and distribution among rights holders.

The Collective Option

We must reemphasize a basic point central to our preceding discussion of water as property. Above a system of canals, water management is collective. It is only below the basin that it becomes a "private affair." The community can, however, extend its prerogatives beyond the basin and substitute itself for individuals to manage water in their place. When this happens, we have collective irrigation.

Even though collective irrigation does not normally occur, it is a well-elaborated system. It is defined by the type of contract that establishes it, by the institutions it requires, and by the collective solidarity it realizes. Collective irrigation is chosen when conditions favor it. In the main, these conditions involve:

- o The availability of water: the scarcity of water, (especially in summer) causes co-users to carefully oversee the minute details of water distribution and to engage in disputes over water with their neighbors. Abundance of water permits the collective utilization of water.
- o The level of social tension: even when water is abundant, the level of social tension among group members will determine whether they are willing to irrigate collectively.

The choice made by individuals or subgroups in favor of either individual or collective irrigation depends upon the importance assigned to each of the above factors. The decision to irrigate collectively is made at a meeting of an assembly of representatives of each lineage in a group. In reality, however, this council's deliberations are open to all male members of the group that the assembly represents.

Collective water management leads to collective irrigation, which is the responsibility of specially designated officials who are charged by the community to service all of its irrigated fields. These irrigators are

called imazzalen. The institution of imazzalen appears in humid years when the water available exceeds the quantity of recognized water rights. In such cases, the complicated rules governing the partitioning of water disappear. The imazzalen are put in charge of the irrigation and the maintenance of individual parcels. There are no water allotments to distribute, and no rotations to observe. It is a gentlemanly system where the social and economic distinctions that normally influence the management of water are reduced; even those who have virtually no water rights can benefit. The rigid observation of minute water shares (and the rationing of parcels that results from it) are suspended; everyone can farm at will.

To examine the organization of the imazzalen institution, we will use the example of the douar of Tagadirt. Tagadirt is divided into four quarters. The members of the village "own" two days of water from the basin called timansakht, which belongs to them and the fraction of Tamadgost. Each quarter contains two or more lineages. The division into quarters reflects an old but careful decision to maintain an equilibrium of power among various lineages. This division is important to understanding collective irrigation because each quarter provides two imazzalen, making a total of eight for the village.

A second division is on a territorial basis and is as important as the first. Land to be irrigated is divided into two halves corresponding to the two days of water rights that belong to the village. Formally, each half receives one day's water. The system is further complicated by the fact that each half is divided again into the land served by a single canal. Each half of the village land is served by four canals. The number of imazzalen corresponds to the number of canals. The social divisions of the group and the physical division of its territory determine the number of irrigators.

Compensation of the imazzalen poses a problem. Their nomination is preceded by long debates among representatives of each quarter and lineage over the criteria to be used for the compensation of irrigators. Three possible criteria are discussed: percentages of harvest, water rights possessed, and by number of takatines (extended households). Landholders with large parcels obviously reject any compensation based upon the amount of water rights possessed and prefer payment based on the household. A levy based on the number of couples in a takat will treat the rich and the poor equally. A compromise involves

payments based on a percentage of the harvest. These quarrels are repeated each time the imazzalen are named.

Determined by local custom, the "law of water" in the mountains cannot be understood simply by referring to concepts of jurisprudence originating from either the Muslim or Roman tradition. We must add that water is a resource without precise limits or shapes. Concepts more appropriately drawn from sociology than from jurisprudence better illuminate our understanding of the rules of water distribution. Erguita water rights would fall into the category of "collective regime," where each individual rights-holder has his share of water because of his membership in a particular group. Water rights are mediated by other factors. In order to exercise his rights, a person must refer to certain rules that authorize him to use his rights and that define the relationship of one proprietor to other proprietors in a system of collectively appropriated water. Water rights, then, are best understood through the rules that govern the division and distribution of water.

The rights-holder has been defined as a social unit, to whom a quantity of water is allocated in a block--such as a day of water, a night of water, a portion of a day or night--and may be shared by other units. The more we descend through the hierarchical structure of the tribe from larger to smaller units (especially to lineages and households), the smaller water shares become, and the more difficult it becomes to identify them. We will discuss below how water shares are allocated to each individual taken separately as rights-holders. Water is defined as quantifiable so that it can be distributed.

Private Option

Water is divided into a specific number of parts or water turns. The groups of the Tamarout taqbilt will illustrate the manner in which water turns are distributed among douars, then between lineages, and finally between lineages and takatines (plural of takat).

The water turns of each village have names. There are eighteen of them at Ifri Quassif, a basin belonging to the four douars of Tamarout. Every turn is divided into two periods to increase the number of turns to thirty six. These turns are subdivided into halves, thirds, quarters, or eighths.

The appropriation of water by a village poses no problems. The villages (rights-holders) and the water turns assigned to them are easy to identify. It is within the douar, once the first stage of distribution has been passed, that the distribution of small quantities of water becomes problematic. At the level of divisions of water between douars, one is still at the level where the ownership of water turns is collective. It is only at the lower levels (lineages, households) that property becomes real and is subject to minuscule division.

Water Turns: Lineages, Sublineages, Families

Just as at the douar level, water is allocated to each lineage (ikhs) in a block. The Ifri n'barr Wamane basin is a case in point. Water of this basin is the property of the lineage "Two Halves," which makes up the village of Assif Quagadir. As above, each water turn is identified by name. There are thirty-one water turns in this case. The odd number of turns resolves the delicate problem of which users have daytime water turns and which have night turns. All of the odd numbered turns will be daytime turns for one cycle and night turns in the next cycle.

It is the sharing of water among members of the same lineage that poses the greatest problem. The water turns identified by name are subdivided in order to be distributed among households. At this level, it is the flow in one's ditches that counts rather than some abstract right.

The initial division of water reflects the history of lineages. For example, water is divided into three parts that correspond to the three extended families making up the Ihouline lineage--Ait Said, Ait Bella, and Ait Abderrahman--and their three water turns. The Ihouline takatines will say that their water is divided into talt or mtalta (both of which mean thirds). In doing so, they are referring to this first partition, which corresponds to the geneology of the lineage.

The partition of water derived from the first level partition, here the second and third degree partitions, are more complex. The thirds are redistributed among members of each of the three takatines. New rights-holders appear at each step in the evolution of the groups and it becomes even more complicated as right-holders not belonging to the lineages begin to appear (heirs, spouses, etc.). Each of the original thirds is further subdivided into thirds or

fifths (khomes). These divisions represent the history of the group and the modifications of the shares held by each right-holder in the course of a lineage's historical evolution.

The "ownership" of water among the lineages, however, does reflect the lineage's actual informal composition and present organization. The formal unity of the lineage is counterbalanced by the particular interests of those who compose it--not only those of extended families and households, with all the individual rights-holders, but also with absentee members. For example, women born into the lineage but living elsewhere still maintain their rights in the lineage's territory.

Systems for Partitioning Water

Water must be measured if it is to be distributed to those with rights to a particular share. Several systems of measurement are practiced in the various tagbilt of the Erguica. Each system has its own units of measurement. At least four distinct systems are currently in use:

The Solar System. A brief description of this system will make the solar system of measurement intelligible and may help to explain the complex approach to water use that is its corollary. (There is an interesting variation to the method of collecting water in a basin that is found in the Tamarout fraction.)

This system is referred to as the solar system because it relies on the movement of the sun (which is tracked on a rock or other visible protrusion--called an azmaz) to signal whose turn it is to use the irrigation water. Those who make use of this solar system rely on two basins--one that collects the stream flow and is therefore the principal source of irrigation water, and a second (also known as an azmaz) that recollects the water once it has been released from the principal basin. When the water is released from this secondary basin, the process is referred to as azmaz. When the sun hits the azmaz (rock), the person using the principal basin opens it to flood his crops; this is also a signal that the azmaz (the secondary basin) is to be closed.

As is the case with the concept of "azmaz," "imdai" and "timane" are also terms used to refer simultaneously to a unit of time and a volume of water (that is, the volume of water that can be released during the measure of time

designated by either word). Moreover, the last unit of time/volume of water (timane) is also coordinated with the hours of prayer, and thus these become the demarcations for the flow of water when the sky is overcast. These three time/volume divisions (azmaz, imdai, and timane) represent the points on an imaginary triangle carved into a mountain's slope, each of which point is reached by the rays of the sun at regular intervals.

The Gauge System of Measurement. In general, this system of measurement utilizes a notched stick to indicate the different shares of water. The unit of measure utilized is called the takarroubt, which is the equivalent of one-eighth the content of a basin. Eight principal notches are marked on the basin to indicate these divisions. At Tigouliane, each takarroubt is 20-22 cm--and is, in turn, marked again in both thirds and eighths. Other measures include the hand (afous) and the finger of water (addad n'wamane). A finger of water is obtained by placing the four fingers of the hand on the measuring stick (the thumb folded on the palm) and marking the two sides of the hand on the stick. Each takarroubt is divided into three fingers and the number of fingers in the basin is thus twenty-four.

If the owners of a day of water are all members of the same lineage who agree to use water together, the use rarely poses problems. This system can establish fair distribution for the multiple users of a day of water. In addition, those who are the first to use water in one rotation of irrigation water (which is seven days at Tigouliane) will be the last to have a turn in the next cycle.

The Tattast System of Measurement. The same can be said for the system of the tattast. The tattast is a copper bowl with a small hole pierced in the bottom. When this vessel is placed in a bucket of water, it slowly sinks until it is totally submerged. A tanast corresponds to the quantity of water that flows from a basin or a stream during the period that it takes the tattast to sink. Sub-unics of the tattast (halves, thirds, quarters, and eighths) are marked inside the container. A conversion is possible between the takarroubt and tattast systems. A quarter of a takarroubt is the equivalent of one tanast.

Time Measurement. Only one tagbilt of the Erguita uses a clock to measure water. The introduction of this system is due to unique circumstances. This tagbilt once had a system of water distribution similar to those described above but, over time, the system was altered in favor of a local chief (Id l'Houssein) who had increased his appropriation of water through forced purchases. After independence, the peasantry demanded that their property be restored to them. The Moroccan authorities were overwhelmed by the difficulties of restoring the old order, so chose a simple option. They decreed that each extended household in the tagbilt receive one-and-one-half hours of water. It is the only example among the Erguita where the state intervened to change water rights inherited from the colonial period.

INTERACTION BETWEEN THE COMPONENTS OF THE SYSTEM

Constraints imposed by both the physical and social environments influence an individual's choice between individual and collective forms of water management. The physical environment so severely limits the choice of action that to act as an autonomous individual would be suicidal.

The consequent need to act collectively gives water its communal characteristic. But strong group affiliations add impetus to the move for collective management; an individual's membership in the group gives him access to communal resources. This membership creates a sort of interdependence among group members and promotes the idea of a community of interests. The first community interest is the respect for things that are communal or collective.

Individual behavior, as such, does not exist; the individual always operates from within a group. Even though the group may be very small, such as an extended household, it nevertheless controls the individual. Indeed, the option of ostensibly private water management has its "group" side. Many forms of exchanges among co-users are required if the system of individual water rights is to operate properly; water turns are exchanged and are lumped together, and agreements are made over which blocks will be irrigated to reduce water loss that would occur if isolated plots were irrigated. At times, parcels may be temporarily exchanged to permit better use of scarce water.

By belonging to a group, a person is required to obey

all of the rules governing it--moral, social, and technical. Violation of one category of rules by the theft or abusive use of water may lead to social stigma and negative sanctions. These are reinforced under many circumstances--at celebrations, meetings, and at certain sacrifices where young people do satiric mimes of one's actions during the past year (that are forms of symbolic punishment).

Social disapproval may be coercive. Even though banishment is no longer practiced, one can still hear the words "go away from the people of this country" pronounced against those who violate customs. Social coercion is especially evident in the way village notables resolve conflict, and in the way they testify if resolution of the conflict should go before government authorities. The rules of water sharing, as described above, help to constrain individual behavior.

Thus, two sets of factors influence the decision about individual or collective water management. These factors are the relative scarcity or abundance of water, and the amount of conflict or consensus within a group. As Bouderbala et al. (1984) put it, "everywhere that water is scarce, we find a strong belief in individual appropriation, regardless of the type of system and the characteristics of water users." Scarcity stimulates the desire for private control, and leads to a proliferation of regulations. These rules disappear in times of abundance, but one must qualify these statements. As we saw during our discussion of the distribution of water, the smaller the social units or the shares of water, the more likely it is that the share of each individual is insignificant. At such a level, the scarcity of water encourages cooperation and leads to joint actions.

Conflict and consensus are not eternal conditions. Both are temporary states that will be transcended by brotherhood, which usually prevails and is kept in reserve by the group to regulate tension. It is the principal tool for keeping a group's internal contradictions within reasonable limits.

RESULTS AND EVALUATION OF THE SYSTEM

Is the system of water management among the Erguita efficient and equitable? Certain canals (tiny ones of course) gather their water from seepage out of uphill canals. The existence of a series of such canals along a

valley attempts to prevent all such losses. Irrigation among the Erguita is a struggle to benefit from even the smallest amount of water. The current practice of lining canals with concrete is a manifestation of the ancient concern about waste, but it creates its own problems: lining a canal means that certain other canals will be deprived of water.

In addition to the purely hydraulic measures of efficiency, the impact of irrigation on the surface over which this water is distributed must be considered. Even if all arable land were served by one canal, a minimum of cooperation between irrigators would be required in order for all to subsist or for water to be available. Thus appears the need for informal arrangements. In times of shortage, these may lead to quarrels, but they can also favor tighter cooperation. Collective irrigation creates a kind of equality among users and is an efficient form of water management.

From an equity standpoint, it must be pointed out that Berber society is hierarchical and inegalitarian. This inequality is the result of unequal population growth and of the status differentials of each group.

The different participants in the system must deal with the inequalities of fate. When we look at the shares owned by each takat and by each lineage, we can see that inequalities exist not only between various groups, but also within groups. An individual takes part in the construction and maintenance of the irrigation system not as an individual but as a member of a group (lineage). The balance between the contribution of an individual to the maintenance of the common irrigation system and the benefits that an individual takes from using the system cannot be simply evaluated on an individual basis. Equity of distribution is contingent both upon the distribution of water within a group and upon the unequal distribution of resources between them.

NOTES

1. The research that served as a basis for this article was conducted for a doctoral thesis that was defended June 1983 at the Faculté des Sciences Juridiques, Economiques et Sociales, Casablanca. It is based on two visits to the Erguita, the first for one month in December of 1981 and the second for three months during the summer of 1982. The fact that my parents are both from this group facilitated the work. I would like to thank Richard Riddle and Jere Gilles for translating this article into English.

2. A tribe in the Western High Atlas Mountains north of Taroudant. The Secretary General of the Ministry of Interior furnished us with the following statistical information on the "tribe":

Population: in 1971: 11,319; est. 1980: 13,647
Number of villages: 46
Land area possessed: 200 square kilometers
Lands possessed: 1,195 hectares cultivated (475 hectares irrigated, 1,519 unirrigated) 9,770 hectares of forest.
Livestock owned: 1,287 cattle, 3,081 sheep, 12,066 goats, 34 camels, 1,165 horses, donkeys and mules.
There are 531 members of the tribe who have emigrated to Europe and many more have gone to Moroccan cities.

3. The water coming from a small ravine may be water of an extended household or even of an isolated family. Here we only speak of the larger (village or intervillage) systems of irrigation.

4. The spatial organization and the dimensions of such a village reproduce that of the fraction. The lineages are scattered in space in the image of the villages in a fraction but at the same time they maintain common interests in the management of such common resources as water and sacred objects.

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Canal Irrigation in Egypt: Common Property Management¹

Robert C. Hunt



A geographic territory contains many different materials, sources of energy, and spaces. A resource is created only when a technology and the intention to exploit the resources come into being and are brought to bear on the territory. For the purposes of this paper, the territory involved is the Nile Valley from the Aswan High Dam to the mouth of the Nile Delta.

The technology includes dams, canals, and water lifting devices, domesticated plants and animals, and the industrial inputs for agriculture, including fertilizers, insecticides, improved seeds, fossil fuel, tractors, etc. Unlike marginal situations, here we are involved with a stable and deeply organized capital-intensive form of resource exploitation.

The resource is water for irrigation. Virtually all of the fresh water for Egypt derives from the Nile, and most of it from the river's headwaters. Since the 1960s, Egypt has had over-year storage of Nile water behind the Aswan High Dam, and during this time period the volume of irrigation releases from the dam have been virtually identical from year to year. The water stored in Lake Nasser has multiple uses, including hydroelectricity, drinking water, navigation, and industry, in addition to irrigation of plants.

The Ministry of Irrigation (MOI) receives water from the dam, and distributes it throughout the irrigated

territory by means of barrages, canals, and gates. The water flows year-round, to about 2.6 million hectares of irrigated fields (except for the shut-down for maintenance in January). MOI engineers are responsible for operating and maintaining these structures. In Egypt, cropping discipline and the supply of water are dominated by the national government.

Irrigators must submit to cropping discipline by mutually coordinating plant-growth cycles. Where farmers get water from a common canal, there are serious consequences if the crops grown by one farmer do not need water at the same time as the crops grown by another. For the allocation system to work smoothly, some sort of cropping discipline must ensure that the water needs of the plants are coordinated with the schedule of water delivery, and that the plants are coordinated from one field, and one farm, to another.

The cropping discipline in most of Egypt is provided by a complex set of arrangements designed and operated by several national ministries. Every year, the Ministry of Supply determines how much of several commodities the country is to produce (cotton, wheat, rice, etc.). These amounts are communicated to the Ministry of Agriculture (MOA), which calculates the amount of land, seed, fertilizer, etc., needed and then draws up a plan and a timetable for the country (Alderman et al. 1982).

A major feature of the agricultural plan is the administration by the agricultural cooperatives (Harik 1974). In principle, every farmer belongs to some cooperative; the cooperative receives its quota of crops to be produced from the MOA, and then sets about the job of assigning particular crops to particular fields with a timetable. There is some negotiation, but essentially the plan comes down from above. The MOA plan is also communicated to the MOI, which designs water delivery schedules according to the agricultural plan. Crop discipline then is officially imposed by the national government, and there should be a good fit between the timing and distribution of the plants in the fields and the timing and distribution of the irrigation water (Alderman et al. 1982).

The MOI extracts water with barrages on the Nile and sends it down the MOI canals. In the district (the lowest MOI level), the water is rotated from one canal to another on a regular and stable schedule. The mesqa is a ditch that receives water from the MOI canals, and from which the farmers draw most of their irrigation water. Short,

shallow, and small, compared with the MOI canals, mesqa usually serve fewer than 100 farmers. The system is designed so that when the MOI district canal has water, the perpetually open outlet allows water into the mesqa at the same time on the rotational schedule. Each one is supposed to get the same amount of water per feddan (Egyptian measure of area, = 1.04 acre) of agricultural field (Mehanna et al. 1983). A study conducted by the Egypt Water Use and Management Project (EWUP) determined that some upstream mesqa may get more water per hectare of irrigated land than would some downstream (Wolfe et al. 1979:16). Each farm within a mesqa is supposed to get the same amount of water per hectare. Skold et al. (1984) argue that there may be differential distributions here as well.

Most mesqa in the delta, and some in Upper Egypt, are below the surface of the fields, so that the water must be lifted 50-100 cm. Three ancient devices are used to lift water: the shadouf, a counterweighted bucket, the tambour or Archimedean screw, and the saqia, a wheel powered by animals. Large steam-driven pumps were introduced in the 19th century (Hopkins n.d.), and portable diesel-engine powered pumps recently have been included in the water lifting technology. In the Fayum, there are a number of gravity-flow mesqa.

COMMON PROPERTY MANAGEMENT OF IRRIGATION²

In common property management, there are local groups that have rights to the resource; the groups are organized to manage the use of that resource, and individuals within those groups enjoy individual rights to the benefits arising from the joint use. Two such groups are visible in irrigation in rural Egypt. One is associated with the mesqa, and one with the saqia (the wheel). The resource managed by common property institutions is the water that small groups of farmers acquire from the MOI canal system, and that they then divide up among themselves.

Most of the thousands of mesqa in Egypt are below field level, and apparently have no formal organization. They each have a score or more of saqia, which are formally organized. In the Fayum, which has a relatively large amount of topographic relief, the mesqa are formally organized; this organization is discussed here.

The mesqa is said to be a private ditch, and to be totally under the control of the farmers (Wolfe et al.

1979:6-7). The farmers who draw water from it are responsible for operating and maintaining it. Since the water is available only part of the time (due to rotation among MOI canals), the farmers must arrange to use the water while it is available. The formally organized mesqa in the Fayum (munawaba) has a chief executive officer (ra'is), and subdivisions (taraf) that also have officers (Mehanna et al. 1983:66-7, 77). These officers have lists of water-rights-holders, how much water each is to receive, and where in the intra-mesqa rotational system the farmer's turn occurs, and they are responsible for administering allocation turns within the mesqa.

Maintenance of the mesqa is the responsibility of the farmers who draw water from it (Wolfe et al. 1979). Maintenance is organized by the officers, and all farmers are supposed to provide able-bodied workers. Some do the maintenance work themselves, while others hire substitutes.

Conflict within the mesqa is handled by the mesqa organization itself. As in most stratified agricultural economies, however, whatever disputes this group cannot handle by itself will be dealt with by a series of notables, who may or may not be members or officials of the group. Some breaches of the norm (violence, killing) automatically call in the conflict resolution offices of the state.

Access to mesqa water is supposed to be proportional to the amount of land owned that is watered by the mesqa. In the one studied in the Fayum, it was said to be common knowledge that the shares of water were not proportional to land; notables had much more than their share of water (Mehanna et al. 1983). Membership in the mesqa group is a function of owning land watered by the mesqa. It is clear who are members and who are not. The group vigorously objects to nonmembers who try to take water that belongs in (and to) their mesqa. The mesqa group manages the behavior of the members with respect to the resource (water) and with respect to the technology (the mesqa) itself. Internal sanctions are available for use against breaches of the norms.

It is not clear how effective the sanctions are against free riders. When the call for group participation in maintenance comes, it is a major notable of the village who makes the call, not officers of the mesqa, and there are always some members who do not turn out (Mehanna et al. 1983).

The saqia, a pump driven by a cow or water buffalo, is

designed to lift water 50-100 centimeters from the below-field-level mesqa. Saqia ownership is divided into 24 equal shares (qirat); the ownership of 1 qirat entitles one to 1/24th of the water, and obliges one to pay for 1/24th of the expenses. Each farmer may have one or more qirats in one or more saqias, and must either power the device with his own animal or rent the time of someone else's animal. It is almost always the case that a saqia has two or more participants. Most below-grade mesqa have a score or more of saqia.

Each saqia has a formal leader, usually a relatively rich and senior cultivator who lives near the saqia. He keeps an essential part of the machinery in his house, arranges turns on it, organizes for maintenance and collects the relevant fees, and resolves conflict (Mehanna et al. 1983). The leader of the saqia is responsible for seeing to it that every member gets his share of saqia time. There is no discussion of recruitment to saqia membership in the literature. Presumably a person either inherits a set of shares, or is able to buy in.

Accounts of saqia operation in the 1980s report no trouble. However, it is said that before 1979, time on the saqia was a serious constraint and there was much conflict. Now with the availability of portable diesel pumps, this time constraint problem has been solved (Mehanna et al. 1983). It is also reported, however, that one consequence is increased tension over scarcity among saqia on the same mesqa (Harik 1974). This implies that the saqia group did not always manage to control competition for access to the technology, and thus to the resource.

DISCUSSION

Each of the farmer groups that allocates access to the mesqa and saqia does so in terms of a rule of fairness. Each feddan is supposed to get as much water as any other feddan. Each share in a saqia is supposed to get as much water as any other share.

The outcomes would seem to be largely good ones. Egyptian agriculture is generally quite productive and environmentally stable. Crop yields are very respectable by world standards (Dotzenko n.d.:2), and there is no evidence of environmental degradation in the old agricultural lands (Hunt 1985b).

It is clear that both the formally structured mesqa and the saqia groups are organized local groups successfully using a common pool resource by means of common property management. Before proceeding to a further stage of the argument, several features of this Egyptian case need to be highlighted.

First, the common property management group is appropriating the common pool resource from another social institution, not from "nature." The water is extracted from nature at the Aswan High Dam by the national government. Water for irrigation is taken from the Nile by the MOI, and is controlled by that ministry until it is released into the mesqa. The mesqa, and subsequently the saqia, then, acquire the water from the MOI. There is a change in the management principles of the common pool resource, water, at the point where it is transferred from the MOI to the mesqa. Most examples of common property management involve the acquisition of the common pool resource from nature (as in the case of forest, or mountain pasture, or fish). In the case of irrigation in Egypt, it is most emphatically different. Common property managers do exist for irrigation water, but they are downstream from other institutions.

Second, the analysis of the notion of property needs to be given more attention. In discussions of common property, "common" receives the lion's share of the discussion, and there is often little or no analysis of the "property" involved. We need to know more about property rights in the territory, the resource, and the technology. A detailed analysis of the property involved, including what is owned, what the rights and duties are, under what conditions those rights and duties may be alienated, and whether the "owning" entities are individuals, groups, partnerships, etc. remains to be worked out.³

In canal irrigation, the physical facility for managing irrigation water (the technology) and the water (the resource), have been referred to in property terms. Irrigation water can be owned as private property. (In some irrigation systems, water can be bought, sold, rented, and inherited. Cf. Maass and Anderson 1978.) Most empirical descriptions of irrigation systems contain references to water rights that clearly are not private property. Rarely, however, is there any discussion of what the rights are, how such rights are created, whether they can be alienated, and if so how. There is, in short, very little discussion of the property aspects of the irrigation

water itself.

Our understanding of property rights in the physical facility has begun to improve. Coward (1983, 1985) has recently pioneered a focus on property in the physical facility, and argues that the viability of local irrigators' groups may well be intricately connected with these property rights. This new thrust of research is very welcome.

Several issues need further research. In Egyptian irrigation, we would like to know whether there are contexts in which water for irrigation is defined as property. Does the MOI have property rights in irrigation water? What are the conditions for appropriation and transfer of water if and when it can be property? In the case of the technology (mesqa, saqia), these facilities may be common property if they are property in the legal system of the surrounding nation, or if the local appropriation, as if it were property, is effectively ignored by the nation. Property rights in the saqia are probably clear to the participants, although they have not been discussed in the literature. The mesqa is another matter. It has been referred to as a "private ditch," yet some agricultural cooperatives and the MOI both assume some oversight responsibilities (Wolfe et al. 1979; Mehanna et al. 1983). Much is yet to be learned about the mesqa, and not just with respect to property. In the context of canal irrigation generally, a much more detailed and focused account is needed of local and national property concepts in the water source, the water once extracted, and in the physical facility.

Third, in terms of outcomes, the Egyptian mesqa and saqia do not work perfectly. There is evidence of free riders (Mehanna et al. 1983), of unequal access to shares of the commons (Mehanna et al. 1983; El-Din and Dardir, n.d.; Skold et al. 1984), and of conflict (Mehanna et al. 1983). The widespread assumption is that successful common property management will motivate all members in such a way that breaches of omission and commission will tend to be eliminated. Some analysts seem to feel that conflict is less in local irrigation groups than it is elsewhere. There is no authenticated report of an irrigation system that totally lacks conflict. Any such claim, if it is to be reasonably lacking in uncertainty, must first solve the problem of measuring relative amounts of conflict in different irrigation systems. Such measurements do not exist now, and they are exceedingly difficult even to think

about. The long-range goal should be to develop measures of nonparticipation, and apply them to empirical cases. Then we will be in a position to test empirically the proposition that positive motivation has better outcomes than does coercion. I would not expect that common property managers of irrigation water would be without conflict, would have no free-riders, or otherwise be problem-free.

IMPLICATIONS

Does the Resource Determine Its Management?

Comparative study of irrigation organization shows quite clearly that several different forms of organization are possible, and indeed are found quite widely distributed (Hunt n.d.a, n.d.b). The entirety of a canal irrigation system can be managed by common property principles, or the entirety of a system can be managed by a bureaucracy of the state, or there can be a variety of mixtures of the two principles. There is nothing inherent in the resource, or in the technology, that forces a particular form of management.

Some canal irrigation systems are under fiercely local control by the farmers themselves. One can refer to Japan, Spain, and the western part of the United States for convenient examples. In all three nations, systems of substantial size (up to 20,000 hectares) are owned, managed, and operated by an organization of the farmers. These farmers manage the headgate, operate the canals and gates, do the maintenance, the conflict resolution, and the accounting. They acquire the common pool resource from nature and convert it into property at that point. Irrigation communities are operating with many or all of the common property institutions (Beardsley et al. 1959; Glick 1970; Maass and Anderson, 1978; Kelly 1982; cf. Hunt, n.d.a, n.d.b).

Some canal systems have been organized by a central authority that is responsible for everything down to the delivery of water to the farm gate. There are no common property elements in the management or organization of such systems. The Cezira scheme under British management is the prime example of this, and there are many examples in Mexico as well (Farbrother 1973; Hunt 1985a).

Some canal irrigation systems have a mixture of the two

principles, usually with an irrigation community at the farmer's end of things, and a bureaucracy at the top end. Southern Iraq as described by Fernea (1970) is a prime example: the British and national canal authorities managed the level of water in the major canals, and were responsible for operation and management down to the outlet pipe into small ditches. These ditches were the responsibility of small groups of farmers, who are also sets of kinsmen. These latter are organized in terms of irrigation communities, and operate with a commons.

These cases demonstrate that irrigation does not demand a particular kind of management regime.

Convergent Development

There appears to be a convergence of thinking about the social organization of canal irrigation. For some years, scholars have been working on the organizational features of small-scale traditional irrigation systems (cf., Millon 1962; Hunt and Hunt 1976; Coward 1977). From another point of view, there has been much interest in promoting water users associations for organizing small groups of farmers within larger bureaucratically managed canal systems (cf., Bromley et al. 1980; Wade 1980; Montgomery 1983; Steinberg 1983). With the essays on irrigation in this volume, common property management joins the fold and adds another perspective. All share a concern with the organization of local groups, and with motivations for getting work done.

Coward and I have been particularly interested in the comparative analysis of "traditional" or "indigenous" irrigation systems (cf., Coward 1977; Hunt 1979). Out of this work has come a clear recognition of several crucial principles that characterize what I have called the irrigation community (a local group with rights to water that are enforceable in the courts of the nation, with a locally chartered executive officer, and with a system of rights and duties). The irrigation community is a system of tasks and roles. The group itself has enforceable rights to receive water, and once the water is received the group has rights to distribute that water within the group. The leadership is accountable to the users of the water, as Coward (1979) has shown, and the leadership roles are organically connected to a system of tasks (Hunt n.d.b). Recently, Coward (1983, 1985) has argued that such groups

have a property interest in the facility (due to having invested in the construction), and that this property interest is probably connected to the enduring and successful operation of these systems.

What is striking about the common property management literature is how closely it approaches the concept of the irrigation community. The common property management model includes local groups with rights to the resource, who will manage it jointly, carefully, and efficiently, control free riders, and spread benefits around equitably. All of these features usually characterize the irrigation community. The common property tradition adds a focus on the property dimension of these irrigation systems.

There is a third tradition for thinking about the local organization of irrigators, that of farmers' participation. In the development community, there is a general position that it would be beneficial if the farmers in large bureaucratically run irrigation systems could be organized in small groups to manage the tail-ends of the systems. These groups are usually referred to as water users associations (WUA). The benefits to the farmers are supposed to be a more reliable supply of water for a larger number of farmers and more control over their own destiny. Few attempts to construct such groups have been successful. The findings of those interested in irrigation communities, and in common property, are relevant to the WUA problems. I have demonstrated that the WUA is based on a very weak analogy with what I have called the irrigation community (Hunt 1985a). Irrigation communities have control over the water once it is delivered to the group, and provide an arena for negotiating effectively with the system-wide authorities over problems in the delivery of water to the local group. All irrigation community systems so far examined own their own water and control how it is to be allocated.

In general, these WUA are expected to perform the maintenance and to control the problem of free riders. However, the articulation of the WUA with the rest of the system is seldom examined, nor is there any consciousness of a system of tasks and roles. The WUA are not supposed to have final control over the allocation of the water, and there is no attempt to conceptualize, much less solidify, the rules by which the WUA can ensure delivery of water by the system.

We have then three fairly distinct sets of propositions about the effective management of irrigation water at the

farmer level. The common property tradition encourages a focus on the property relations. The irrigation community emphasizes the internal systems of the local groups. Both traditions have largely ignored the problems involved in attaching such groups to larger, often bureaucratic, organizations, and this subject needs careful and concentrated investigation as well. This is a convergence that appears to be interesting and productive. What is needed is a deeper look at local groups for irrigation, combining the most productive aspects of these three converging traditions.

NOTES

1. Fieldwork in Egypt in 1984 was funded by a grant from the Whiting Foundation, by a grant from the Sachar Fund of Brandeis University, and aided by a sabbatical from Brandeis University. I am grateful to Nicholas Hopkins for reading two versions of the paper. The manuscript has benefited greatly from the editorial judgments of David Feeny and Daniel Bromley. The opinions presented here are mine, and do not reflect the position of any of the supporting institutions.

2. I was very fortunate while in Egypt in 1984 to receive the full attention and generous sharing of information on the part of Professor Nicholas Hopkins of the American University, Cairo, and of Layton and Naguib of the Egypt Water Use and Management Project (EWUP), jointly sponsored by the MOI Egypt and Colorado State University. When I arrived in Egypt, I was handed a draft copy of the Social Research Council (AUC) monograph on the local organization of canal irrigation in Egypt (Mehanna et al. 1983), and was also privileged to be able to walk the canals in Upper Egypt and the Delta with an AUC group. EWUP personnel have been generous with their time, and have in addition shared with me a large number of research reports. Without these two sources, this paper could not have been written. I hope that I have done them justice.

3. On property, see Appell (1974); on corporate and corporation, see Dow (1973); on the relationships between forms of property and groups, see Appell (1983).

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Tank Irrigation in India: An Example of Common Property Resource Management

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INTRODUCTION

Although most of the tanks (small reservoirs) of South India are nominally the responsibility of government, in practice they are managed as common property resources. These tanks irrigate anywhere from a few hectares to about 1,000. In the southernmost state of India, Tamil Nadu, nearly 40,000 tanks are used to irrigate 910,000 hectares (rice during the wet season and, in some cases, a dry season crop.) Most of these tanks have been in use for almost a century.

The effectiveness with which the tank water is used varies widely. Most of the irrigation facilities are in some degree jointly operated, but cooperation is necessary if one farmer's overuse or misuse is not to subtract from another's water supply. Problems of coordination and cooperation generally become apparent when significant changes occur in the pattern or level of water use. These changes are often associated with increased water scarcity. With regard to many of the tanks, water scarcity and the need for cooperation are the rule rather than the exception.

If the users are unable to cooperate in the use of the resource, then competition emerges; the resulting conflict quickly exhausts the water supplies. Several attributes and relationships bear on the use of tank water and influence the overall management of the tank systems. In

this chapter, these attributes and relationships are analyzed in terms of the four components of Oakerson's framework (this volume). Each component is analyzed using the tank management characteristics of 10 tanks in South India (Tamil Nadu State).

TECHNICAL AND PHYSICAL ATTRIBUTES

Each farmer in the tank command area is eligible to receive water from the tanks in proportion to the size of his farm until the tank supply is exhausted. The water supply is quite variable; it is limited by the tank's storage capacity and the quantity of water available to fill the tanks; some tanks are filled more than once a year while others may be completely filled only once in every four or five years.

Siltation and agricultural encroachment in the fore-shore area have reduced the storage capacity of many of the tanks, thus reducing farmers' water supplies. The location of the sluices (outlets) in the tank, whether upper or lower, also affects the amount of water delivered to farmers (the upper sluices in the silted tanks cannot provide water unless the tank water level is high). In years when the tank water supply is inadequate, farmers served by upper sluices may get little or no water.

In years of water shortages, farmers at the outer reaches of the system are excluded by virtue of being located at a great distance from the tank. What little water they receive will arrive late. Sometimes this exclusion by location is due to poor engineering rather than distance: two of the ten tanks we studied were constructed based on a faulty design; the sluice gates were placed below the level of the upper command area. Thus the farmers in the upper command area are excluded because of their location even though there is ample water to serve them.

The source of water is another physical constraint that influences both the water supply and the degree of exclusion because of location. The primary tanks have water rights on such perennial sources of water as large rivers or reservoirs and have adequate water supplies to irrigate one crop for all farmers in the command area. In contrast, supplementary tanks suffer frequent water shortages since their main source of water is runoff from rainfall. Consequently, farms irrigated by supplementary tanks, particularly those in the tail-reaches, are frequently excluded because of location.

The installation of private and community wells in the tank irrigated areas have helped overcome some of the water supply constraints. Return flows from surface irrigation and the tanks themselves recharge groundwater. The wells allow farmers to recapture some of the water lost through excessive irrigation.

The tank investment is a typical indivisible large investment. However, the rights to the water in the tank can be subdivided and those rights can be either public or private. Thus, the indivisibility aspect does not necessarily pose any special problems to resource management once the tank and its subsidiary systems are built. Canal maintenance is the one exception: responsibility for maintenance of canals that serve more than one farmer must be agreed upon and enforced. Must the person at the end of the canal maintain the whole canal while those at the head only maintain its upper part? How should the responsibilities be divided to maintain this indivisible asset? These problems plague irrigation systems all over the world.

Finally, the boundary of the resource demand is defined on the physical side by soil, hydrology, and the construction of the tank and canals. The irrigated area must be downhill and a reasonable distance from the tank and the canals. On the supply side, the resource is defined by the capacity of the tank and the source of water. The capacity of the canals can also limit who gets water during peak irrigation periods. But when the source of water is a large river, and the delivery system is ample, then there are few water supply constraints, except in extreme drought years, and jointness in supply exists. In contrast, supplemental (rainfed) tanks frequently suffer water shortages and jointness poses a problem since one farmer's use subtracts from the supplies of others.

DECISION-MAKING ARRANGEMENTS

Collective Use

Decision-making arrangements and rules result mainly from the nature of technical and physical constraints and from the farmers' primary goal of obtaining their share of the tank water supplies; these have evolved both at the tank and farm level.¹ The conditions for collective use arise when the scarcity of tank water forces farmers to

compete for their share of water; informal water users' organizations (WUO) develop to handle such situations, and there is a high correlation between the degree of water scarcity and the level of activity in the WUO. Even in the primary tanks, where water is usually not scarce, farmers cooperated during the 1983 drought by implementing a water rotation schedule to conserve their limited tank water supply.

A second condition that encourages collective use at the tank level is the probability of a reasonably uniform distribution of benefits. One measure of this uniformity is the amount of variation in the size of farms in the tank command area: the smaller the variation in farm size, the greater the likelihood that farmers will participate in organization decisions and form a WUO (see Table 1) because they believe that they will obtain approximately equal benefits and have equal influence on the allocation of inadequate water supplies. Trusted leadership is a key factor in the success of a WUO, and hence in the efficient use of tanks. The leadership must successfully organize community irrigation activities and be honest in handling of community funds used for irrigation. Both inadequate funds and the misuse of finances have caused a WUO to fail or become inactive (see Russell and Nicholson 1981; Tubpun 1981).

The president of the WUO informally nominates one farmer in each distributory (secondary canal) to monitor the water distribution and collect fees and solicit labor for canal and tank maintenance. These representatives report to the president if any problems arise. The WUO members usually meet once every two weeks during the irrigation season to deal with problems. The frequency of meetings usually increases during the end of the cropping season when the water supply is low and irrigation critical.

Operating Rules

The collective use of tank water in our study involved the following operating rules: (1) rotation schedules for tank water and individual canals; (2) water release and closing dates at the tank; (3) a minimum water level in the tank for fish production; (4) canal maintenance charges in rupees and/or man days of labor to be provided by each farmer according to the farmer's location and area owned²; and (5) sanctions and penalties against farmers who violated the tank water management rules.

TABLE 1 Tank Management in Relation to Farm Size Variation, Water Supply and Farmer Organization, South India, 1982.

Tank number	Average farm size (acres)	Farm size variation ^a (percent)	Water supply level	Active water users' organization	Overall tank management ^b	Water management expenditure Rs./acre ^d	Net benefits from water management Rs/acre ^f
1.	2.0	31	Low	Yes	Good	9.8	70
2.	3.1	66	High	No	Adequate ^c	0.3	--
3.	2.5	51	High	No	Adequate ^c	0.2	--
4.	1.3	24	Low	Yes	Good	4.7	43
5.	2.0	86	High	No	Poor	0.4	--
6.	1.9	72	High	No	Poor	0.5	--
7.	1.9	91	Low	No	Poor	2.2 ^e	14
8.	1.9	91	Low	No	Poor	2.7 ^e	15
9.	1.1	33	Low	Yes	Good	7.4	73
10.	2.3	104	Medium	No	Poor	1.8	--

^aThis is the coefficient of variation in farm size.

^bOverall tank management is based on a subjective judgment of the tank's operation in terms of water storage, water allocation, water conflicts and crop yields. It is a comparative judgment among all tanks in our study.

^cTanks 2 and 3 are primary tanks and have surplus water in most years. Thus, little water management was required to achieve high yields in 1982.

^dRs. = rupees.

^eFunds were used to help convey a request to the government for additional water as specified in previous agreements.

^fBenefits from additional water equals the cost of buying well water in the tank area.

Source: K. Palanisami and K. William Easter 1983a.

Several additional rules were introduced during periods of extreme drought: (1) rules for sharing well water when demand exceeded capacity; and (2) priority concerning tank water use for those who could not obtain well water because of their location.

The rules for tank water rotation were usually activated once the tank supplies were known to be inadequate. In general, the operating rules did not exist in cases where: (1) farmer conflicts prevented cooperation (as was the case for tank 10); and (2) there was a surplus of tank water supply (tanks 2 and 3 in 1982).

All five of the operational rules were in effect in only three of the tanks; these were the three tanks that had WUOs. However, farmers in most of the tanks did establish water release dates and collect money for maintenance. For one of the two primary tanks, farmers established a minimum water level for fish production.

Sanctions and penalties were used only in tanks with a WUO. Those who violated the water management rules were deprived of tank water or required to pay a fine of Rs. 20-30 per acre. When police cases were filed by farmers against violators, the leaders of the WUO usually interceded and resolved the problem.

External Arrangements

After India's independence in 1947, ownership rights to private tanks were abolished and the government of India expropriated them from the Zamindars. The tanks became a common property resource; farmers who own land in the area served by each tank have the right to use the tank water. The tank restoration scheme, which was established to survey and improve each physical tank structure, helped to fix standards for future structural improvements. The government also provides grants for periodic tank maintenance above the outlet; maintenance below the outlet is the responsibility of the farmers. However, government funds available for maintenance cannot meet all the needs, in part because there is no relationship between the water fees the government collects from farmers and the budget allotted for maintenance of each tank. The fees go into general government revenues and maintenance funds are allocated to each administrative division of the public works department on an arbitrary basis. The funds tend to be allocated to each division for emergency repair needs while minor repairs are neglected.

The government of Tamil Nadu has issued patta (rights to land) to encroaching farmers, has introduced social forestry activities inside the tank water storage area, and has instituted tank rehabilitation measures. Encroachment on the tank foreshore area is a very common and serious problem in tanks that do not fill to capacity in most years. Farmers have gradually cultivated as much as 20 to 50 percent of the foreshore (water storage area) areas of many tanks. After they have had growth crops in the foreshore area for several years, cultivators begin establishing their rights to these lands (Department of Agricultural Engineering 1982). The cultivators petition the government requesting that they be allotted the foreshore lands, arguing that the lands are idle. The government, after receiving a number of petitions from cultivators, issued patta to these farmers. This right, called kulamkorvai patta, legally changed the tank foreshore lands to cultivated lands (Palanisami and Easter 1983a). The government's decision encouraged encroachers to expand their cultivation of the foreshore areas. In one of the tanks in our study, this generated conflicts between encroachers and farmers who irrigated from the tanks, and resulted in inefficient tank water distribution and low crop yields.

The government also intervenes in tank management through the farm forestry program on vacant lands, including the water storage area. Currently, this program is initiated by the government of Tamil Nadu through the state forestry department with funds from the Swedish International Development Agency (SIDA). Acacia nilotica trees are grown on a 10-year rotation. Farmers believe that in about 10 years the trees will be large enough to reduce the tank water storage capacity and make it difficult to desilt tanks, a belief that is being ignored by the Tamil Nadu state forestry department.³ The social forestry program may thus have some negative impacts on tank irrigation.

In recent years, there has been more interest in improving crop production from tank irrigated areas. Since many tanks are supplemental tanks, various measures are being tried to increase the water supply delivered to the farmers' fields. The government has introduced rehabilitation measures in selected tanks; these include lining the main canals and the provision of community wells. Community wells have been installed in two of the ten sample tanks, and canal lining was completed in another. All of these investments had rates of return equal to or better than investments in the private sector (Palanisami and Easter 1984).

Patterns of Interaction

Given the technical and physical constraints and the decision-making arrangements for tank management, it is important to identify the patterns of interaction that characterize the farmer's behavior in tank management. The primary pattern of interaction in the successful joint use of tank water is reciprocity, which depends upon mutual expectations of positive performance.

Some of the patterns adopted involved a direct substitution of management for scarce water. In three of the tanks studied, serious efforts were made to substitute management (which required cooperation) for scarce water. This occurred in tanks 1, 4, and 9, where the amount spent to improve management was Rs. 9.8, 4.7, and 7.4 per acre, respectively. The net benefits due to additional irrigation (achieved as a result of improved management) ranged from Rs. 14 to Rs. 73 per acre, or an average of Rs. 43 per acre (see Table 1).

Farmers also interact to increase water supplies. Farmers who own wells have established an informal organization that determines the price of groundwater based on the expected demand for and supply of groundwater during the season.⁴ In several cases, tank farmers got together and contributed to a common fund for diverting extra water from other (upper) tanks or streams. The funds collected were used to make diversion channels and to clear the existing channels. In one tank, farmers diverted water illegally from a nearby canal when the water supply in the tank was low during the middle of the crop season. In certain tanks, private pumping is allowed from within the tanks, particularly when the water in storage has fallen below the level of the sluice gates.

The government provides loans and installs community wells to supplement tank water supplies in the wet season and for full irrigation in the dry season. The farmers who benefit from the wells must pay the operating, maintenance, and investment costs. During the wet season, a well irrigates around 40 acres, but during the dry season only a limited number of farmers can obtain water due to the capacity constraint.

Farmers have organized both to support and to oppose the idea of connecting a series of tanks to a nearby large reservoir. Currently, there is no connecting channel and water flows from one tank to another in an inefficient manner. In fact, a number of the lower tanks now receive less runoff than they did before the large reservoir was

built. Farmers from the lower tanks organized to recommend to the irrigation department that it construct a separate canal to deliver water to all tanks simultaneously; in this way, upper tanks would get less water but lower tanks would get more, and the improved water distribution would provide a larger effective water supply and total production would increase. This could be construed as a Pareto-efficient change by only redistributing excess water from the upper tanks. But, as should be expected, upper tank farmers organized to oppose the plan since they could not be assured that they would get adequate water supplies, particularly in drought years.

In a number of cases, farmers have also organized at the tank level to ask the government to remove the trees growing in the tanks. This runs counter to the government's program of social forestry, but farmers feel trees reduce the water supply and make desilting difficult.

In several tanks where the farmers are not organized, the free rider problem is apparent. For example, in tank 10, the water supply was reasonably adequate for the crop season, but due to conflicts and lack of cooperation, the water supply was exhausted through repeated unauthorized opening of the sluice gates. Operators farming the foreshore area (encroachers) opened the gates at night to release water and make more foreshore land available for crop production. This caused drainage problems for the farmers in the head-reaches of the command area and low yields throughout the irrigated area. Because of these unauthorized releases, some of the farmers in the tail-reaches only received two irrigations as compared to eight in the head-reaches.

When water is scarce, as it is in many of the tanks, mutual action is required. To allocate water other than by continuous flow requires mutual action and forbearance: when water is scarce, farmers next to the canals must allow water to flow by their fields and go to their neighbors. Finally, mutual action is the basis for obtaining additional water through water diversion activities, through the creation of channels, and/or through improved system maintenance.

Outcomes

The effects of technical and physical attributes of the tank area, of the decision-making arrangements involved in tank use, and of the patterns of interaction can be seen

in the average size of crops of farmers who irrigate with tank water and the percent of the tank command area that is actually irrigated.⁵ Both efficiency and equity or fairness can be achieved in tanks where the management level is high; these tanks should achieve higher crop yields and a larger irrigated area, other things being equal, through timely and uniform water delivery. Equity is achieved in tanks where farmers with approximately equal holdings cooperate in the distribution of water supplies based on farm size (this assumes that the numbers of landless laborers is small).

Equity or fairness problems arise when a few large farmers try to dominate water deliveries. Inefficient water use results when head-reach farmers overuse water; lower-reach farmers suffer water shortages. Finally, the tragedy of the commons occurs in tanks where water is scarce and the level of the tank management is poor. The end result involves losses in both efficiency and equity.

The water management strategies adopted by the farmers in certain tanks show how both equity and efficiency can be achieved through improved tank management. The technical and physical attributes of the tanks, the decision-making arrangements, and patterns of interaction decide the equity and efficiency levels that can be achieved. These relationships suggest that to achieve a better outcome (area irrigated and crop yield), these three sets of variables should be studied in detail.

The relationships among rice yield, area irrigated, and the management variables can only be shown qualitatively (see Table 2). In general, tanks 1, 2, 3, and 9 had relatively high performance in terms of yield and area irrigated. For two of these tanks, 1 and 9, the performance required good decision-making arrangements and patterns of interaction to overcome physical and technical water supply constraints. In the two primary tanks (2 and 3), the same level of decision-making arrangements and patterns of interaction were not needed to achieve high performance because there were no physical or technical constraints in 1982. Tank number 10 is an interesting example of a tank with few physical and technical constraints but low performance--the lack of cooperation among farmers led to a misuse of the abundant water supply, which resulted in relatively low yields. In tank 4, the severe water supply constraint kept yields low even though decision-making arrangements and patterns of interaction were good. For tanks 5 and 6, the performance was poor because of design problems that prevented irrigation of the full command area. Finally, farmers served by tanks 7 and

TABLE 2 Tank Performance and the Level of Water Management, South India, 1982.^a

Tank number	Physical/technical constraints	Decision-making arrangements	Patterns of interaction	Percent of command area receiving water	Rice yield in metric tons/ha ^b
1.	Medium	Good	Active	84	3.41
2.	Low	Adequate	--	99	4.13 ^c
3.	Low	Adequate	--	97	3.58 ^c
4.	High	Good	Active	85	2.72 ^d
5.	High	Poor	--	58	3.90
6.	High	Poor	--	21	3.66
7.	High	Poor	--	88	2.74
8.	High	Poor	--	90	2.87
9.	Medium	Good	Active	93	3.58
10.	Low	Poor	--	88	3.11

^aThe grouping of the variables low, medium, and high, and good, adequate, and poor are based on their overall performance during the 1982 study. The grouping is based on factors discussed in the Palanisami and Easter report, 1983a.

^bThe yields are for the area irrigated and not the total command area.

^cThese tanks are primary tanks and receive additional water from perennial sources.

^dThe yield is low due to very low 1982 rainfall. The community well in this tank covers only a small area in the total command area.

Source: K. Palanisami and K. William Easter 1983a.

8 faced a water supply constraint and were able to obtain an additional water allocation; even so, they could not organize to make better use of the available water.

CONCLUSION

Management of the tank irrigation systems is influenced by technical and physical factors. Several decision-making arrangements (rules) are required to manage the tanks effectively as a common property resource. Farmers' interactions to adopt decision rules are needed to achieve equity and efficiency in water use and management, which in turn results in higher crop yield and a larger area that is irrigated. The following actions could be taken to help improve the management of tanks as common property resources:

- o Identifying the technical and physical constraints for each tank or group of tanks so that efforts to improve tank management could focus on strategies to relax these constraints through appropriate planning and investment
- o Encouraging formal and informal water users' organizations by providing incentives in terms of technical assistance, training, legal authority, and funds for organization
- o Transferring ownership of tanks from the government to farmers once they are organized into viable WUO.

This can reduce the government's burden in collecting water fees from the farmers and in allocating funds (which are currently inadequate) for tank management. Such a decision will represent a property-enhancing strategy at the community level. By assisting the local community in its property-enhancing strategy, the government could induce farmers to make more investments in the tank system.

NOTES

1. Share is usually defined in terms of the acreage irrigated. Thus, farmers with the largest acreage generally receive the largest shares.
2. Originally, the contribution of labor by the farmers for tank maintenance and repair was a regular feature (called kudimaramathu, which means cooperative repair work), but it is not prevalent among Indian tank users today.
3. Both the encroachment and the problems created by farm forestry might be eliminated if the WUOs had legal status. If they were considered legitimate by the government, then they could more effectively argue their cases against the misuse of farm forestry and encroachers. Currently, only one of the three WUOs is a legal entity; its tank is the most effectively managed of all we studied.
4. The well owners are the most influential farmers in the tank command area. They influence such matters as opening and closing of the sluices, water allocation schedules, and common fund collections. In times of scarcity, they even give away their share of the tank water to others. But in several tanks, the well owners constrained tank management with a view to selling their groundwater for a longer period at a high price. (For details, see Palanisami and Easter 1983b).
5. An analysis of rice production in the area served by the ten tanks suggests that fertilizer is the other major input besides water that influences yields. However, the use of a simultaneous equation model shows that tank and well water influence the level of fertilizer applied. Thus, it appears that in this area of uncertain rainfall, water availability and its use are the key determinants of fertilizer use and crop production (Palanisami and Easter 1983a). Consequently, crop yield and the percentage of

command area irrigated should be a good measure of tank performance, when the comparison is made among tanks having about the same per-acre water supply. Thus, primary tanks 2 and 3 should be compared with each other, but they should not be compared with supplementary tanks, which have lower water supplies. When crop yields and/or the percentage of command area irrigated are relatively low, then performance or outcome is low.

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Common Property Resource Management in South Indian Villages¹

Robert Wade



INTRODUCTION

How do Indian villagers manage such common pool resources as canal irrigation water and grazing lands? In one small area of South India, villages vary remarkably in the degree to which they organize themselves to undertake such management. Some are more highly organized than anything hitherto reported in the literature on (nontribal) Indian villages; others, perhaps only a few miles away, have no village-level organization at all. This paper sets out in broad terms an explanation of this variation.

The presence or absence of village-level organization has a great deal to do with the degree of risk of crop loss faced by many or most farmers of the village; this risk is in turn related to ecological conditions of soil type and water scarcity. These conditions influence the demand for joint management of some common pool resources. Within the limits of the sample studied here, it seems that some villages are organized and others are not because of variations in the demand for common pool resource management rather than variations in the village's capacity to supply such management. This does not mean that the sorts of supply-side obstacles to collective action emphasized by the public choice theorists are irrelevant in these villages. What it means is that such obstacles as the free rider problem have been effectively checked or

bypassed by a series of ingenious institutional arrangements. To extend the argument beyond the sample, however, one needs both a theory of demand and a theory of supply to explain the presence or absence of common property resource management institutions.

"Indian society today," says the sociologist V. R. Gaikwad, "is an atomized mass, composed of individuals who are not in any organized fold except the family and the extended kin-groups which form the sub-caste" (1981: 331). Much the same has been said not just of Indian peasants, but of peasants in general. Such writers as Foster (1965) and Popkin (1979) have given great emphasis to the unimportance of the village as a focus of collective action and sentiment. This theme of the peasantry literature resonates with a theme of the "public choice" literature, which stresses the difficulties of voluntary collective action in any kind of society other than, perhaps, certain kinds of communes. Common sense would suggest that people who perceive a joint interest will join together to pursue this interest, and hence that a perceived common interest is a basic element in explaining collective action.

The public choice theorists say that common sense is misleading. The rational individual, they say, will not voluntarily contribute to a common goal if the group is large and if he or she cannot be excluded from enjoying the benefit. The individual will, instead, seek a free ride. As a result, any collective action (in other than very small groups) that is not based on coercion or on the availability of selective incentives tends to be fragile, and tends to supply fewer public goods than the members would be prepared to pay for on the market--if the market were an option (Olson 1965).

Not everyone would agree that collective action and the voluntary supply of public goods must be explained only in terms of the behavior of rational, self-interested individuals. We do, after all, observe a good deal of voluntary collective action that seems on the face of it difficult to explain simply in terms of the selective benefits provided to participants (ecological lobby groups, for example; see Kimber 1981). In any case, whether or not the axiom is accepted, there remains the empirical question of the conditions in which varying types and degrees of collective action are found. Yet questions of degree and difference have been overlooked by many writers on peasantry because they have been so concerned to emphasize the difficulties of collective action.

Much of the literature on collective action and public choice has dealt with the question of what conditions propel individuals to make voluntary financial contributions to the provision of a public good. We can turn the same kind of analysis to common pool resource management by rephrasing the question as: under what conditions will individuals formulate, and agree to abide by, a rule of restrained use of common pool resources? In this case too, as in the case of financial contributions to the provisions of a public good, there seem to be built-in incentives for the rational, self-interested individual to free ride--to cheat on the rule of restrained use while everyone else abides by it, on the assumption that others will not notice; so there seems to be an inner imperative for regression from abiding by the rules to unrestrained use. Certainly the literature describes many violations of rules of restrained use of common pool resources (such as grazing, irrigation water, and trees) that deplete the resource. But the literature also contains many cases of local groups that have been able to agree upon rules of restrained use and have enforced the rules using authority from within the group rather than outside (e.g., government). In these cases, we can talk of a "public realm" within the group, which consists of the rules and roles involved in common pool resource management.

Indian Villages

The conventional understanding of Indian villages is that they do not have any real public realm. A number of men are usually regarded as "big men," as being in some sense first in the village. But there is no clearly defined social domain or institution separate from state authority where activities of a "public" nature are carried out, no center of community management other than the bottom levels of the state apparatus itself, and no machinery for raising resources for public (village) purposes other than through state-sanctioned taxation.

My research suggests a more complex picture. I compared forty-one villages in an upland part of South India in terms of the range and strength of their public realm. Thirty-one of the villages are irrigated from a large canal system; ten are dry. A significant number of the forty-one do show a common purposefulness and ability to provide public goods and services. The arrangements

are local and autonomous. They are not integrated with, initiated, or sustained by outside bodies, whether government or voluntary agencies. The scope and degree of local collective action in these villages exceeds that reported previously in the literature on Indian (nontribal) villages. On the other hand, such villages are not in a majority; most villages in my sample do fit (roughly) the "atomized mass" characterization, and only a few miles may separate a village with a substantial amount of corporate organization from others with none.

The Public Realm

The public realm consists of four main institutions:

(1) a village council (quite distinct from the statutory panchayat of local government legislation, which is moribund in all villages in my area);

(2) a village standing fund (distinct from local government moneys);

(3) a work group of village field guards, employed by the council to protect the crops from the depredations of livestock and thieves; and

(4) a work group of "common irrigators," employed by the council to distribute water through the government-run irrigation canal.

The council, and through it the field guards and common irrigators, are loosely accountable to an annual meeting of all the village's cultivators. In addition to the central services of crop protection and water distribution, the council also organizes the supply of many other public goods and services, such as well repairing, monkey catching (to rid the village of monkeys), donations to help meet the cost of a new primary school or of a building where sick animals can be treated, and so on.

All these services except water distribution are financed from the village standing fund, which the council administers; the standing fund is fed by a variety of income-raising devices that the council also administers.

Take K village as an example. It has a population of just over 3,000. Its council generally consists of nine members; the number is fixed for any one year, but varies slightly from year to year. Together they have authority to make decisions affecting all the village. The village's standing fund spends about rupees (Rs.) 10,000 a year in

an economy where a male agricultural laborer gets about Rs. 4 a day outside of seasonal peaks. The standing fund pays the salaries of the field guards. Four field guards are employed full-time for most of the year, and another two to four are added near harvest time. As for those who work as common irrigators, about 12 are employed for up to 2.5 months, to cover about 1,200 acres of first-season rice. At harvest time, the common irrigators, no longer needed for water, supplement the field guards, giving K a total of some 20 village-appointed men for harvest crop protection.

In the sample of 31 canal-irrigated villages (all in the Kurnool district of Andhra Pradesh), eight villages have all four of the main corporate institutions--council, fund, field guards, common irrigators; 11 have some but not all; and 12 show no trace of any of them. The sample was not drawn randomly but rather with an eye to ease of access and a representative range of water supply situations, so no conclusions can be drawn from these proportions about how frequent the corporate forms are in the area as a whole. But they are clearly not rare. Moreover, many dry villages have some of the same institutions. In a sample of 10, 8 have field guards, 6 have a village council, and 6 have a village fund. So some of the dry villages have a more clearly defined center of community management than do some of the wet villages.

Kurnool district is semiarid--its rainfall averages 620 mm per year in a unimodal distribution. Population density averages 105 people per square kilometer (1971), up from 53 in 1870. Seventy percent of the cultivated area is under food crops; only 12 percent of the gross cultivated area is irrigated. Thirty-four percent of villages are supplied with electricity (1971). There is one tractor per one or two irrigated villages, and many fewer in rainfed villages (1980). Most variation in real wage rates is contained within the range of 3 ± 1.5 kilograms of food grain per day. It is a poor district, and in no way atypical.

RESOURCES AND DECISION-MAKING ARRANGEMENTS

The irrigated villages have two main types of commons: grazing land and canal irrigation water. The grazing land is of two types: year-round grazing along the verges of roads and fields as well as on the (relatively small) areas not under cultivation, and the

stubble area left after the crop harvest. Both water and grazing land are commons in the sense that many people share the use of the same resource, and each individual user can reduce the welfare of other users. When water is scarce, one person's use may reduce the amount available to others. When crops are still standing, grazing by one person's (mobile) animals poses risks to the owners of standing crops nearby. Privatization as a means of reducing these "externalities" is made difficult by the nature of the resource and the technology: running water is inherently difficult to privatize, and the cost of fencing precludes privatization of the verges or the stubble.

The impetus for central control at the village level, therefore, comes from a demand for protection against the externalities of others' decision making with respect to water and grazing. In those villages that have them, the collective rules are intended to limit individualistic choice on how much care to put into shepherding one's own animals, and on when and how much water to take for one's paddy. If the rules are enforced, their effect is to assure each decision maker that others will restrain their behavior too, so that if restraint is exercised one will not be duped (Runge 1984).

An organization is required to decide the rules and provide enforcement. If, as in these villages, enforcement is by the employment of specialized work groups, the work groups must be recruited, empowered, and paid. Procedures to settle disputes must be established. These requirements are met by a village council.

The authority of the council derives largely from the wider stratification order of caste and private property, its membership being drawn from the dominant caste and the wealthier landowners of the village. However, the users of the commons do not depend on external decision makers for enforcement, and in that sense the external dimension of this arrangement is unimportant.

Cross- or sub-village units of collective action are also unimportant, which in part reflects features of land tenure and canal layout. There is relatively little cross-village land holding (a person living in one village will have little or no land within the boundaries of another village), and the canals are designed so that most outlets serve the land of only one village. That sub-village units of collective action are not important partly reflects economies of scale in monitoring and

enforcement, economies that are especially valuable to ensuring cost savings.

Field guards must be paid, and payment by means of a levy on each protected acre is vulnerable to free riding. The "corporate" villages are those with all or most of the corporate institutions, and they generally have devised a number of ways of raising income to pay the field guards, all of which depend on the village's acting as a unit. For example, the village council may restrict the right of access to a resource or profit opportunity, and then sell that right to an individual or small group. The money from the sale of the franchise goes to the village fund, and the individual or small group keeps the profit between what they paid for the franchise and what they earn from it. The most important resource that is subjected to this franchise is the stubble left on the harvested area. But a variety of other resources within the village boundary may also be so treated--the council might sell the right to collect tamarind nuts, or dung dropped in public places, or fish in the village tank. These constitute another category of common pool resources in addition to those discussed above, in that they permit exclusive use by an individual; consequently, the body that is able to sanction that exclusion can therefore use the resource to raise revenue. In addition, the council may also raise money for the village fund by selling the franchise to a profit opportunity based on something other than natural resource use--the right to collect a commission on all sales of grain from the village, or the right to sell liquor. With some of these revenue-raising arrangements in place, the council may be able to supply tangible public goods and services rather than just ensure a reduced risk of water scarcity or of animal damage to standing crops.

I now describe these arrangements in more detail, taking K village by way of example.

THE MANAGEMENT OF GRAZING

K has a population density of 159 people per square kilometer. Boserup (1981) predicts that with this density one would expect to find a farming system characterized by annual cropping (at least one crop per plot per year) and multiple cropping where irrigation permits. Indeed, this is the case in K. Little waste or yearly fallow land is left; the village has no "common" in the sense of a large

area available for common grazing for a year or more. But oxen and buffalo are needed in this agriculture for traction, and they must be fed.

During the crop growing season, the animals must graze close to standing crops on the verges or on small areas of fallow, which are treated as commons. With no fencing, crop protection is accomplished through shepherding or tethering. The problem is that the incentives for careful shepherding or tethering are distinctly asymmetrical: I may not be unhappy to see my animals getting fat on your grain. The open-field system of husbandry familiar during the medieval and early modern period in Europe was a response to the same problem. But whereas the open-field system operated primarily by regulating the cropping, these Indian villagers regulate the livestock. The rationale of the field guards is to make the incentives on tethering and shepherding less asymmetrical.

The field guards patrol the village area and make sure no animal is grazing a standing crop. If they catch an animal in the act, they take it to the village pound, where it remains until its owner pays a fine. If just a few animals are involved, the fine is a flat rate per head-- Rs. 2 during the day, Rs. 4 at night, with the council setting the rate. The field guards collect and keep the fine, dividing it equally amongst themselves so that the arrangements contain a built-in incentive for enforcement. If large numbers of animals are involved, the council decides the fine case-by-case; the fine may run into hundreds of rupees in some instances. The field guards collect the fine, keep 25 percent, and hand over the balance to the standing fund. (In most villages, the owner of the damaged crop is not compensated.) Notice that the field guards do not enforce "stinting." The decision about how many animals to own and graze is left to each individual.

Limited year-round grazing in the village or its environs means that most of the village's grazing animals are "big" stock--oxen and buffalo needed primarily for draught power. Relatively small numbers of "small" stock--sheep and goats--are owned by villagers. However, after most of the rainfed crops are harvested in February, large areas of stubble become available for grazing. Note that all the irrigated villages have some area under rainfed crops as well, and in most irrigated villages the area under rainfed crops is larger than the irrigated area. It would be possible for each landowner to reserve the stubble on his own land for his own animals or for others he would

allow in. The owner could do so by posting guards around each field, or by fencing. However, the cost of either method of exclusion--the cost of privatizing the stubble--is very high; all the more so given that (as is commonly the case in peasant societies) any one landowner has holdings divided into a number of scattered plots (McCloskey 1975). So, as in the open-field system of Europe, the stubble is put in common, and private rights to the product of the land extend only to the crop, not to the crop residues.

How is this commons managed in the "corporate" villages? Recall that the village's own stock of animals is adjusted to the year-round grazing, which is much less than the grazing that becomes available after the harvest of the rainfed crops. There is thus an opportunity for the village--for a village authority--to earn revenue by renting out the village's surplus grazing. Large tracts of the district are hilly and arid, covered in scrawny scrub, and unsuitable for more than desultory cultivation of sorghum and millet. Herding sheep and goats is a major source of income for the local residents. After the harvest of the rainfed crops, they come down into the irrigated tracts seeking grazing for their livestock. The herders want the grazing and water, while the farmers want their fields manured and cleared of stubble.

The market for grazing and manure is organized in two distinct ways. In the first, a small group of herders comes to a village and bargains with the village council for exclusive access to the village's grazing.² The agreement states how many sheep and goats they will bring, when they will come, how long they will stay (in terms of a date before which they will not leave and a date by which they will be gone), and most important, how much they will pay for the franchise. Once the agreement is made, that group of herders has exclusive claim to the village's grazing, and other herders can enter only as some leave. Their flocks graze over the stubble by day. By night, when the animals drop most of their manure, they are folded, flock by flock, on the plots of particular landowners, who pay them an agreed rate per head for the manure. So the herders as a group pay the village fund a lump sum for access to the commons; and they individually get back part of what they pay through the sale of manure.

The second method (used in K and other villages) is more complex. A group of herders, as before, obtains exclusive access. But instead of a group entry fee or rent, an auction is held at a regular interval (every four

days in K) to decide who will have each flock on his land at night until the next auction. The auction is arranged by the village council. Half the amount of the winning bid for each flock is then paid to the herder, and half goes to the village fund.

In K, between 9,000 and 13,000 head commonly enter the village at this time. They graze the stubble on that part of the 4,000 arable acres of land that is not still growing a crop. The village fund commonly gets about Rs. 5,000 in return, in the space of about six weeks.

However, the entry of such a large number of animals at a time when some crops (mainly the irrigated ones) are still standing poses a serious risk of loss for the owners of those crops. The response is to tighten the regulation of the livestock in two ways. One is to stipulate a set of rules for both herder and landowner. The second is to appoint full-time field guards. A village's rules of grazing are read out at the first auction of every year, and may be read out again if there are infringements. They are worth giving here, because they tend to contradict the belief that Indian villages show no deliberately concerted action.

The rules for the herder: (1) He must take the flock to the designated field by 6:30 p.m. and keep it there until 8:00 a.m. (2) He must not allow the flock to graze standing crops. (3) Half of the amount he is to be paid for the first "turn" (four nights) must be put on deposit with the council. If he leaves before four turns (16 nights) have been completed, he forfeits this amount to the village fund. (This structure is to discourage the herders from leaving early before the farmers have had their fields manured and cleared of stubble.) (4) The herder must stay within the village boundary; if the farmer asks him to go to a field outside the village boundary, he must refuse.

The rules for the farmer: (1) He must keep the flock within the village boundary. (This rule is to ensure that the farmers of the K village, rather than those of some other village, get their fields cleared of stubble. It also helps to reduce the conflict between villages, because if a farmer from K brought a flock into another village where he owned or rented lands, he might ignore that village's own implicit or explicit rules about grazing and be less subject to formal or informal sanctions.) (2) If he wishes to pay the fund or the herder in kind rather than in cash, he must make the conversion at the rate of Rs. 1.25 per measure of hybrid sorghum or Rs. 1.50 per

measure of "local" sorghum (early 1980 price). (3) He must send men to help the herder guard the flock at night, at the rate of two men per 2,000 head. If hired, the men must be paid Rs. 3 per night, or grain equivalent (to prevent the farmer from sending non-ablebodied men, who could be paid less).

Such tight specification of responsibilities by the council reflects the real danger of loss to standing crops on unfenced fields. Rules of this kind, however, are not self-enforcing. Any one farmer would have an incentive to cheat by failing to provide the stipulated number of herd guards or by bringing the flock to his field outside the village boundary. So the second intensification of joint regulation is by means of village-appointed field guards to monitor observance of the rules.

Field guards must be paid a salary, however. It would be possible for the council to lay down a flat rate, so much per cultivated acre, that each landowner would have to pay the field guards. But this arrangement is vulnerable to free riding. A farmer may delay payment indefinitely, expecting that others will not similarly delay; in this way he can continue to benefit from the general discipline of livestock that the field guards provide while not himself having to pay a part of their cost. Most villages address the free rider problem by finding a method of raising income for the field guards' salaries that does not depend on individual contributions. The chief source of revenue is the one we have been considering: namely, the income from renting out the village's grazing. Once a village decides to rent out its grazing, the amount of money that can be earned is much more than is needed to provide a guard force for the period when large numbers of outside stock are in the village. Here, then, we see the impact of the free rider problem: in the context of field guarding it is a serious matter, and institutions are designed to avoid it by divorcing the supply of the public good from individual contributions. However, the bypass institutions are more costly to administer, and in small villages (500 people or less) farmers will often try to institute the individual payment method for meeting the field guards' salaries. Recurrent free rider problems then tend to force villages towards a more complex arrangement like selling the franchise to the grazing.

Indeed, the "corporate" irrigated villages tend to have several sources of revenue for the standing fund, almost all of them based on the sale of council-sanctioned

franchises. One income source is the franchise to sell liquor in the village. Some villages auction the right to collect a commission on all grain sales from the village. Still others may have an irrigation "tank" (small reservoir) within their boundaries; each year the council stocks it with fish, and later in the year auctions the franchise to catch the fish, the money going to the fund. The income sources vary considerably, but the grazing franchise is the most common. With a standing fund in surplus above the field guards' salaries, the fund can then be used to provide additional public goods and services, such as those mentioned earlier.

In short, the main advantage to the farmers of organizing the sale of such franchises is that they then benefit from the supply of collective goods and services made possible by the sales. Of these, the most important is crop protection provided by the field guards, and the most important franchise (in terms of revenue) is the sale of the stubble. By organizing to control access to the village's stubble, the farmers are able to raise income for the immediate purpose of employing a work force to protect those amongst them whose crops would be endangered by the arrival of large numbers of free-ranging animals; the income raised, once the franchise is organized, is sufficient to provide crop protection for all the farmers for most of the year. The alternative would be for each farmer to arrange crop protection individually or in small groups of field neighbors. The village-wide arrangements allow economies of scale in providing monitoring and policing of the grazing animals, and also save on transaction costs.³

THE MANAGEMENT OF IRRIGATION

Irrigation is the second source of conflict and possible production loss. In any irrigation system where water is scarce, there is an inherent conflict between "upstream" and "downstream" farmers. Upstream farmers have first access and their supply is relatively abundant; their water use determines how much water those downstream will get. Without the intervention of regulation and rules of restrained access, constant conflict and crop loss are likely.

The villages under study are fed from large-scale government-run irrigation canals. Paddy is the only significant first (wet) season crop, being transplanted in

late July or early August, and harvested in December or January. By the end of September, the heavy rains have normally stopped, and the crop is dependent largely on canal water. The common irrigators are appointed shortly thereafter, and do the job full-time until the harvest. Their job is to allocate the scarce and fluctuating supply of canal water over the village's land; they also help procure more water for the village from the government-run supply, by one means or another (such as surreptitiously blocking the outlets of higher up villages). The irrigators are not normally employed in the second (dry) season, however, when little paddy is grown.

Two things are to be noted about this arrangement. First, the common irrigators do not influence decisions about how much land will make a claim to the irrigation water--those decisions are left in the hands of individual cultivators, as are decisions about how many animals to graze. Second, once the common irrigators are appointed, they take very important irrigation decisions out of the hands of individual farmers, in the name of a village-wide authority.

Each field is entitled to be "adequately wetted" and it cannot then receive water until all the other fields beneath that outlet have also been adequately wetted.

This is quite different, then, from the open access, first-come-first-served rule that prevails before the common irrigators are appointed. Adequately wetted is also quite different from the basic criterion of water distribution in Northwest India, where canal water is constantly scarce. There, a "fixed-time-per-acre" principle is used, such that during a fixed period of the week any one field may receive whatever water is flowing in the watercourse--but cannot receive water again until its fixed time of the week comes around. The difference presumably relates to the difference in the crop-water response function for rice and all other crops.⁴ If rice gets less water than potential evapotranspiration, the falloff in yield is much more severe than for other crops. Adequately wetted at least ensures that each time around some fields will be saturated, and whose fields they are depends simply on their position in relation to the fields that were saturated the last time around.

This difference in rules of water allocation illustrates an important supplemental factor. Whereas "fixed time per acre" is self-policing (the next farmer in line knows exactly when his turn should start), the judgment of adequately wetted cannot be left to each individual

irrigator. Use of this criterion requires a superordinate authority to make the judgment in the common interests. And so we find an intriguing transition: water that was previously allocated by an open-access, first-come-first-served rule becomes, after the common irrigators are appointed, allocated by a village-wide authority. Plants show a somewhat similar transition: crops are privately owned, but what is left behind after the crops are gone from the land becomes subject to the rules of the same village-wide authority. As the season progresses, water shifts from open access to common property; crops cease to be private property as crops and become common property as residues.

Individual irrigators who steal water--who try to influence how much water they get once the common irrigators have been appointed--are liable to be brought before the council and fined. During a drought, when the common irrigators are "spreading water like money" (to use a village phrase), the fines may run between Rs. 20 and 50 per offense; but the main penalty is the loss of reputation that results when the offender is dressed-down in front of the council.

The common irrigators are paid at harvest time by means of a levy on each irrigator (so much per irrigated acre), not from the village fund. The rate is set by the council. Is this not vulnerable to free riding? The short answer is no, because the collection is made at the time of harvest, in kind, the one time of the year when every irrigator patently has no excuse to delay payment in kind. More important, however, common irrigators not paid one year can more readily damage the nonpayer the next year. The withdrawal of common irrigator services from one individual's land has more serious implications than does the withdrawal of field guarding services from that individual's land. So again the free rider issue is relevant; the fact that financial free riding could be more easily punished in the irrigation case, and that if others were to follow the example the consequences of widespread free riding would be serious for a downstream free rider, means that the council does not have to extend itself to raise more revenue for the fund so as to pay the salaries of common irrigators as well as field guards.

THE ECOLOGICAL BASIS OF COMMON PROPERTY RULES

I have discussed how things are done in the "corporate" villages, those that have all or most of the four corporate

institutions. Although most of my detailed information comes from K village, there is in fact remarkably little variation in the principles of organization of the four key institutions from village to village, even though the institutions evolved autonomously and were not imposed from above. However, many villages have no corporate organization: there is no village council and no standing fund; the villages have no village-appointed field guards (though private landowners may sometimes appoint their own, occasionally coming together into small groups to do so), and no common irrigators. Here the rule of open access to irrigation water continues through the irrigation season, though informal turn-sharing may develop along some watercourses. Here uncoordinated groups of herders may enter a village's land at will (they may have the permission of the headman for which they have paid nothing), and will negotiate individually whose fields they use to fold their flocks, and for how long each time. Often the farmer does no more than provide the herder with meals. Why the difference between the "corporate" and "non-corporate" villages?

The first point to note is that the corporate irrigated villages are located towards the tail-end of irrigation distributories (roughly, the bottom one-third of the length, where typical distributories may be 5 miles long or more). The second point is that the corporate dry villages tend to be located in black soil rather than red soil areas. The third point is that in the semiarid tropics generally, black soil areas tend to be lower down a watershed than red soil areas. So irrigated villages towards the tail-end of a distributory (given that distributories run from higher to lower ground) also tend to have a higher proportion of black soil areas.

Black soils are more water-retentive than red soils, and permit a wider range and higher yield of rainfed crops. Black soil villages thus have a more abundant and more varied supply of stubble after the harvest of the rainfed crops. More herders want to bring their sheep and goats to graze in them. With unrestrained access, too many animals might come in, causing the soil to become excessively impacted. But also, with more herders wanting to come in, the opportunity for earning money with which to pay for field guarding (not just while the animals are at large but also through the rest of the year) is more attractive. Moreover, the risks of crop loss are higher: in the more varied black soil cropping pattern, large

areas of stubble from the early harvested crops will become available while later harvested crops are still standing. With higher risks of crop loss, the premium on being able to organize a regulation of the livestock is also high. This provides the impetus to field guards and a sanctioning village council in the black soil areas, while the herders' willingness to pay for good black soil grazing provides a way to finance the field guards.

This causal nexus operates in all black soil villages whether irrigated or not (recall that most irrigated villages also have a large area under rainfed crops). It is then reinforced in tail-end irrigated villages by water scarcity, and the consequent risk of conflict and crop loss. Of course, if the power structure of the village were such that no collective action could be sustained without the agreement of small number of households, and if these households held all their land close to the irrigation channel, then they would have no interest in rules of access. In practice, however, holdings are typically scattered about the village area in small parcels, partly to diffuse risk and partly because of inheritance practices: a landowner with a plot close to one irrigation outlet may have another plot close to the tail-end of a block fed from another outlet. This greatly helps the consensus on the need for rules and joint regulation. It may be that the degree of scattering is greater in black soil than in red soil villages, perhaps because owners wish to utilize the greater variety of soils in the black soil areas so as to spread risks. The movement of water laterally through the soil and subsoil profile is also more complex in black soil areas--so it is not always the case that land closer to the irrigation outlet is more desirable than land further away.

Areas of rainfed cultivation higher up a distributory have more red soil than those lower on the path. Since red soil dries out sooner after the rains stop, these areas support less stubble, and so herders are less interested in grazing there. And higher-up irrigated areas tend to be under paddy in both seasons; but sheep and goat manure is wanted mainly for non-paddy, so both the demand and supply of animals and grazing is less in higher-up villages. In higher-up villages, also, canal water is more plentiful and less fluctuating.

Thus both sources of conflict and crop loss are stronger in villages lower down a watershed than in villages higher up. The evidence of my sample suggests that lower down villages are very likely to have a

differentiated public domain in which the appointment, supervision, and payment of specialized work groups are carried out, and in which rules of common pool use are decided upon and enforced. The existence of this sort of organization does not seem to be very sensitive to variations in the standard sociological variables, such as caste structure, factions, and the like. Common need--or demand--seems to be an almost sufficient condition, in contrast to the argument of the "public choice" literature. Free rider problems remain, and they do shape the organization of the supply of public goods; but they do not generally destroy it.

At the same time, however, my evidence also questions the common generalization that irrigation per se induces a more clearly defined pattern of community management. Some of the dry villages have more corporate organization than any of the abundantly irrigated villages. The social response is not to irrigation per se, but to risk of conflict and crop loss. Where water is abundant, that risk is small.

What about the effects of the rules of restrained access on resource use? This question turns out to be exceedingly difficult to answer, in particular because of the difficulty of finding pairs of villages that have similar ecological conditions, but dissimilar corporate institutions (meaning, essentially, that one has such an institution and the other does not). All one can say with some confidence is that both production and equity are higher in the villages with these rules and institutions than they would have been in those same villages in the absence of the rules and institutions. Whether the current levels of provision of public goods and services are in some sense "optimal," given the transaction and enforcement costs of the village-level institutions, is a question that must be raised, but that my data cannot answer.

My explanation for presence and absence uses a simple combination of individuals' self-maximization interests joined with variations in ecological risk. I say that where there are substantial individual benefits from joint action, that action is likely to be forthcoming. This is not to say that the free rider problem, the temptation for self-interested individuals to go for immediate gain, is minor. The need to respond to the free rider problem has a basic effect on the organizational design. We have seen how it affects the amount of revenue the council must raise by means other than individual contributions. But we also noted that the council has developed formidable mechanisms

for enforcing the rules, for precisely the purpose of convincing individuals that other people will probably abide by the rules, so that if they too abide by the rules they will not be the loser. These expectations come not only from the enforcement mechanisms. They come also from the social composition of the council, an elite body with no pretense at "representation," which draws upon the power and prestige of its individual members to bolster its legitimacy in the resource management sphere. And they come from the length of time that the council and its rules have been operating, which is, in all these villages, several decades at least.

So an assumption of methodological individualism is used to explain why certain resource management rules have emerged in some villages but not in others. That is to say, I do not think a sense of obligatory group membership, or a belief in "cooperation" as a desirable way to live, are important factors. There are no grounds for thinking that general social norms of solidarity and cooperation vary amongst the villages in the study area. On the other hand, the rules and institutions I have tried to explain are distinctly "second order," not first order; they presuppose a wider and more fundamental set of rules and norms making for a general pattern of social order. I do not believe that these first order rules and institutions can be explained in the same sort of terms, that is, as the result of earlier rounds of individual maximizing (Field 1984).

LESSONS FOR ORGANIZATIONAL DESIGN

Suppose local common interest groups are to be deliberately induced by an outside authority (the "water users associations" or other kinds of normal rural cooperatives)? What design principles does this study of autonomously evolved groups suggest? The first is that, in the South Indian context at least, villagers are likely to follow joint rules and arrangements only to achieve intensely felt needs that could not be met by individual responses (Johnston and Clark 1982). These are likely to be concerned primarily with the defense of production (avoidance of crop or animal loss), secondarily with the enhancement of income, and finally (and a long stretch from the first two), with education, nutrition, health, and civic consciousness. The opportunities for avoiding losses

or making income gains by collective action will only be taken if the losses or gains are large. This is the significance of the fact that, of the irrigated villages in my sample, corporate organization to manage common property is found, with hardly any exceptions, only towards the tail-ends of distributories (where resources are most scarce).

The second principle is that the generation of authority (the right to decide for others) is likely to be problematic within such common interest organizations, and if the organization is to be sustained it should draw on existing structures of authority. In practice, this means that the council will be dominated by the local elite, which is a disturbing conclusion for democrats and egalitarians. Would it not be better to prescribe a representational rule and/or a majority vote rule for selection of decision makers?

If the experience of these Indian villages is a guide, the answer is no. One reason is that such rules carry little legitimacy in the eyes of the powerful. But more importantly, the robustness of the organization depends on its councillors' all having a substantial private interest in seeing that it works; and for the kinds of functions we are considering here, that interest is greater the larger a person's landholding (assuming that landholdings are typically in scattered parcels). By including on the council only those who have a substantial private interest in seeing that the collective good is provided, the council itself comes close to becoming the minimum coalition whose members find it in their private interest to bear the transition costs of organizing others to share in the costs of providing the collective good (a modified version of Olson's "privileged" group: 1965:50). This effect is then greatly reinforced by the greater power of the elite councillors versus the mass of the population; the tendency of the non-elite to cheat, hoping that because of large numbers no one else will notice, can be checked by sanctions contained in the wider order of property and stratification. Without these wider sanctions, the formal penalty mechanism would in all likelihood constitute an inadequate barrier to cheating. This is a point that the "public choice" literature tends to overlook because it assumes a context of free and equal individuals.

One specific implication is that, where water users associations are to be deliberately fostered, the village rather than the water unit is likely to be a more viable

unit of organization. The attempt to induce irrigators who depend on one canal outlet to form a water users association (an outlet-based group) is likely to be fragile if such a group has not already been mobilized for other purposes. It will simply not contain enough authority. Yet many programs for irrigation improvement in India assume that the "natural" unit organization is the outlet.

If the elite run the organization, will the organization not become another instrument of exploitation? That it does not become so in these Indian villages reflects the third basic principle: the council is concerned only with benefits or costs that cannot be privatized. It is not involved in input supply other than water. It is not involved in settling disputes unrelated to the husbandry of water. It does not try to compensate the owner of animal-damaged crops using the fine levied upon the animal owner, for that would generate conflict about privatizable value. In K village, the one time the council tried to intervene in the allocation of privatizable goods--namely, in allocating rationed sugar from the state--the conflicts over who got it became so strong that the organization almost ceased to function. The council eventually resolved that henceforth it should have nothing to do with rationed sugar. All the activities it is involved in (with this one temporary exception) are characterized by strong publicness, and most also have important externalities.

But the restrictions on scope go much further. Several kinds of decisions with important externalities do not involve the council: notably, each village household's decision about how many livestock to hold, and each farming household's decision about how much paddy area to plant (that is, the council is not involved in "stinting," and not involved in restricting claims to irrigation water). To become involved in such issues would evidently require the council to wield a great deal more authority than it does at present. The implicit rule of selective involvement within the set of issues with strong externalities may be: do not become involved in households' investment decisions, even in ones with strong externalities; but do organize ways of mitigating the externalities generated by those investment decisions.

The fourth principle is that the council will add on other, less vital functions only as it becomes well institutionalized in the performance of the vital

functions. In all the study villages, the less essential things (well repairing, monkey catching, and so on) are only done by a village-wide organization when that organization also does the core activities of field guarding and common irrigating; but only a few of those organized to do the essentials also do many of the less essential tasks.

The fifth principle is to keep the techniques of calculation and control simple. When the councils intervene to mitigate the externalities of households' investment decisions (with respect to livestock and paddy), they do so by using rules that are simple, easily monitored, and consistent with general notions of equal treatment. They would probably withdraw from involvements where this principle could not be met. At the same time, however, all the councils have some procedures for record-keeping and accountability, so as to "institutionalize suspicion," in Ronald Dore's phrase (1971). The procedures only make sense on the assumption that the treasurer, for example, might have stolen some funds. But it is in the interests of the treasurer, as well as the contributors, to follow procedures that would tend to expose his stealing. In this way, the suspicion that the treasurer might have stolen is given regular, institutionalized expression. In these Indian villages, the annual general meeting of all cultivators to discuss the forthcoming season, ratify the new council, and receive nominations for field guards is a simple technique of this kind. So also is the rather simple kind of record-keeping on standing fund income and expenditure, which is read out at the general meeting. Meetings of the council are held in the open, and anyone who passes by can listen in.

Governments and voluntary agencies can perhaps help to promote local collective action by measures that reduce the transaction costs of establishing and operating arrangements such as those described here. Enabling legislation, permitting devolution of limited fiscal powers to local communities in specified conditions, is one step. Another is to promote knowledge among farmers of the various sorts of arrangements that have been autonomously designed. Any more active promotion measures should be targeted at areas where there is a good chance that farmers will respond-- areas that can be identified by means of the kind of analysis illustrated here.

CONCLUSIONS

I have examined spatial variation in common pool management within an area of South India small enough for technology, tastes, and general social norms to be constant, while resources, notably soil and water, are varied. The central conclusion is that village-wide institutions are only likely to be formed and sustained when the risks of loss are relatively high; but within the limits of the sample, the chances that such institutions will exist in the relatively high-risk situations are good. That is, the relationship between risk and social response seems to be an almost sufficient one (risk and social organization are almost always related to one another in the predicted way). The conclusion is thus in line with the argument of several economists writing about induced institutional innovation, such as Coase (1960), Hayami and Ruttan (1971), and North and Thomas (1973), who have tended to argue that when the benefits of institutional change exceed the costs, change will occur.

However, the limits of the sample are very narrow. Wider testing will almost certainly show that the relationship between risk and social organization is affected by numerous contingent conditions, variations in which will cause the risk/social organization relationship to vary also. The structure and functioning of power is the most obvious contingency that can be expected to have an important effect on the social response to opportunities for risk reduction. In these villages, it is very important that the most powerful households tend also to have scattered holdings, which gives them an interest in what happens over the whole village area. What the councils do is certainly in the interests of the elite, but the fact of scattered holdings helps to ensure that the councils' actions also promote the common interest of landowners. *Such factors as the government's workable authority in the countryside might also be important: where the irrigation agency is more effective at spreading water scarcity evenly down a distributory, there would be a less close relationship between village location and corporate organization. I suspect that the contingencies are not so strong within India as to make the occurrence of this type of corporate organization rare; I suspect that much more autonomous local group organization for resource management exists in the Indian countryside than is generally thought. In the general case, one has to recognize that risk reduction is only one kind of benefit. Other

benefits in other situations may also create a demand for collective arrangements.

Finally, I wonder whether we can learn something about the conditions for the original formation of states from the study of autonomous local group organization. We see in these Indian villages a clear example of how in some circumstances individuals can agree to assure mutual cooperation via mutual coercion (with some individuals more coerced than others). If, with some political theorists, we look upon the state as based on a conjunction of contract and coercion, and if we think of the first states as constituting a relatively advanced stage of evolution of a public realm in local communities, we might then draw on an understanding of how the conjunction of contract and coercion is sustained in these Indian villages today for insights about how it emerged in the agricultural communities of pristine states.⁵

NOTES

1. This paper is based on a forthcoming manuscript provisionally titled, Peasants and Public Choice: Group Action in Irrigated Open-Field Villages of South India, Cambridge University Press, to which the reader is referred for more details and references. The paper has benefited from the editorial suggestions of David Feeny.
2. I know little about how the herder groups are organized. At the start of the stubble grazing, K normally admits a group of 8 to 10 herders, each with a flock ranging from 800 to 4,000 head. Some come from as far as 50 miles away, but most live within 30 miles. About half the herders who come in one year will have come the previous year.
3. There might also be benefits to the farmers derived from bilateral monopoly in bargaining with the herders (a point I owe to David Feeny). But such benefits are checked by the mobility of the herders--they can decide to go to other villages without controlled access. However, the quality of the grazing and the availability of water matter more to the herders than their net payment per head of livestock. In K's auctions of 1980, the price paid by farmers per head of stock per night averaged Rs. 0.038, of which half went to the herder; this represented the herder's net profit, because he did not pay to come into the village.
4. Rice is the traditional first irrigated crop in the area of my study, but it has not until recently been grown in the northwest.
5. The first test would be how well the argument made here fits with accounts of the evolution of states in South India itself. My argument seems to be consistent with

Stein's account (1980) of the formation of the "peasant state" in medieval South India.

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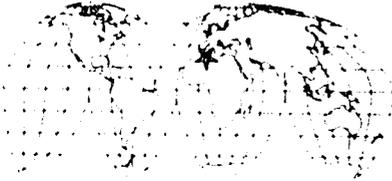
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Management of Common Grazing Lands: Tamahdite, Morocco

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INTRODUCTION

The purpose of this paper is to apply the common resource model proposed by Oakerson (this volume) to analyze shifts in institutional regulation of grazing on a unit of common grazing land in Morocco. The information presented was generated in the course of a two-year study of the development implications of heterogeneity in a pastoral population (Artz, forthcoming). The study site was a portion of an administrative unit, the Rural Commune of Timahdite, in Morocco's Middle Atlas Mountains. Its roughly 20,000 hectares contain: state domain forested with cedar, oak, and juniper; privately owned fields producing winter wheat and barley, potatoes, and corn; and about 13,500 hectares of collective grazing land, ceded to the area's tribal inhabitants, which support several grass and shrub complexes. This analysis focuses on the collective land.

Elevations range from 1,800 to 2,100 m. The climate is semiarid with hot summers (August mean highs of 31°C) and cold winters (January mean lows of -3°C). Annual precipitation is extremely variable, with annual averages ranging from 350 to 800 mm across the area, most of it occurring in spring and fall. Snow falls for between 15 and 40 days each winter.

The area's inhabitants are the Aït Ben Yacoub, a Berber fraction or tribal subgroup numbering about 2,000.

The fraction is further subdivided into four sub-fractions, the smallest units above the nuclear family in an agnatic lineage extending to the tribal level. Some are farmers, others herders, but most engage in both activities.

Until the 1930s, the Aït Ben Yacoub had no permanent dwellings and few cultivated fields. They followed a transhumant cycle with their herds, wintering with neighboring tribes on the azaghar, an adjacent, lower-lying area, and passing the rest of the year in the mountainous area they inhabit today. As cultivation of lower areas spread, and as government policies to settle the Berbers became effective, the old reciprocal agreements with neighboring tribes broke down. The Aït Ben Yacoub were confined to their current territory.

Most continue to follow a seasonal circuit, but it is much reduced from earlier times. They winter their herds near their homes; the herds graze nearby fields and uncultivated areas and are given varying levels of supplemental feeds. Herds are stabled at night and during inclement weather. When spring weather permits, herds are moved out onto the collective, usually accompanied by the herd owner or a herder and tent-dwelling family. Herds range from a few head to about 300, but individuals own as many as several thousand head divided among a number of herds. The area currently supports approximately 40,000 sheep, 2,000 goats, and 1,000 cattle. The most pressing problems manifested are the most fundamental ones: overstocking and improper seasonal use.

TECHNICAL AND PHYSICAL ATTRIBUTES

The physical nature of this common grazing resource and the level of available technology constrain institutional regulation of grazing. These constraints are consolidated as three variables drawn by Oakerson from economics literature: jointness of consumption, exclusion, and divisibility.

Jointness

Joint use of common grazing lands can be maintained only as long as the grazing capacity of the land is not exceeded for a significant period of time by the cumulative herd of the joint tenants. However, the deceptive simplicity of that statement becomes evident when the

concept of grazing capacity is examined. Grazing capacity is not a biological constant, but an abstract management concept. A plant produces a certain amount of forage across a given season that can be consumed by herbivores without reducing the plant's productive potential; that amount, however, especially when measured in terms of animal requirements, is a function of many variables, both physical and technical: When in its growth cycle is the plant grazed? By what herbivore(s)? What parts are removed? How frequently and intensely is it grazed? How do climatic patterns, the plant's growth cycle, and these grazing management variables interact? Is a conservative or an opportunistic grazing strategy being pursued? What products are desired from the land supporting the plant? Each of these variables affects the amount of grazing a plant can tolerate without suffering a loss of productivity. When they are multiplied across countless plants of different species forming diverse communities the complexity we attempt to encapsulate in an estimate of grazing capacity is daunting: this study identified 13 vegetation types on the Aït Ben Yacoub collective.¹

Grazing capacity can realistically be approximated only over time, climatic variation, stocking rate and other management variables; vegetation condition also must be constantly monitored. Since such monitoring has not been done on the collective, we can only study the available records on grazing history and the current status of the vegetation to conclude that the grazing capacity has been exceeded in some areas, and that the common resource has begun to be degraded. How grazing capacity might be affected by alternative management strategies remains an empirical question, but current conditions clearly threaten jointness.

Exclusion

No natural barriers separate this collective from other lands, but the boundary is marked on maps and known to pastoralists in the region. By law, tribal groups must keep their herds within the limits of their own collectives unless special arrangements have been made, but some trespassing in both directions across the collective boundary is tolerated. For example, one of the region's important, dry-season springs lies several kilometers inside the northern limit of the collective, but herds from adjoining areas are allowed to water there. Also, Aït Ben Yacoub

herdsmen who live near the western boundary graze the adjacent Ain Leuh collective before Ain Leuh's herds are moved up from lower elevations in the spring.

Trespass, whether tolerated or not, is easily detected by the herdsmen who spend most of their time on the collective and know with whom they share it. For government officials, the task is more difficult because the collective is large, herds of sheep look similar, and trespassing herders can claim local origins when questioned by an outsider. To facilitate exclusion, a development project in the area has proposed to fence each collective unit.² But fences are neither common nor popular among Berber pastoralists, and if they are not desired by the groups they separate, their costs may well exceed their benefits.

We conclude that the physical nature of the collective and the limits of available technology combine to make exclusion of illegitimate users problematic. Currently, trespass could only be controlled if the Ait Ben Yacoub would actively cooperate.

Divisibility

Nothing in the physical and technical setting precludes dividing the collective into private holdings. In more arid, Saharan zones of Morocco and other countries, factors such as climatic variability make division untenable; where precipitation is low in quantity and extremely variable in spatial and temporal distribution, forage becomes almost a fugitive resource, impractical to harvest from a small, fixed plot. Under prevailing conditions in the Timahdite region, precipitation and forage production are sufficiently uniform to allow the division of common grazing areas into private parcels.

Such a shift in property rights would be expensive in terms of the technical inputs required to divide the land, fence the parcels, and develop the facilities required by private ranching operations. The potential social costs are also enormous. Physical and technical limits would determine whether enough viable, private production units could be created to allow those who currently hold grazing rights to own a private parcel. Even if enough units could be created, the issue of equality would make allocation a nightmare. The equality issue might be defused somewhat by creating larger private holdings and ceding them to groups rather than to individuals--indeed,

the collective is already partitioned de facto among the four sub-fractions.

The point to be made is that, within certain limits, the effect of physical and technical constraints on boundary conditions is negligible. We chose to focus on the Aït Ben Yacoub collective in this analysis, but the analysis would not be substantially changed if the focus were shifted down to the sub-fraction level or up to the tribal level. The collective constitutes the smallest legally recognized unit of common grazing land. Problems evident at this level are characteristic of the system from a physical and technical perspective.

DECISION-MAKING ARRANGEMENTS

Radical changes in the institutional regulation of grazing on the Aït Ben Yacoub collective have occurred since the French Protectorate government undertook to settle the Berbers of the Atlas Mountains in 1912. The changes can be summarized as a steady erosion of traditional, endogenously generated and enforced controls paralleled by the evolution of a strong central government. The inability of the vestigial traditional institutions to protect Morocco's common grazing lands spurred the central government to intervene in their management. The form of that intervention described in the Dahir (royal decree of 1969³) has been difficult to implement. The Aït Ben Yacoub are left today with bits and pieces of traditional institutions and the poorly understood prospect of state control over their use of the collective. While the current situation is the focus of this analysis, some description of history will help set the stage. We employ Oakerson's (this volume) breakdown of decision-making arrangements: conditions of collective choice, operational rules, and outside regulations.

Conditions of Collective Choice

Rules that established the ability of these herdsmen to act collectively were the essence of the traditional institutions. Decision-making mechanisms were similar at the level of the sub-fraction, the fraction, and the tribe or confederation of tribes; at the level of the sub-fraction, decisions involved such day-to-day management issues such as dates of camp displacement, while larger

problems (such as how to acquire additional grazing areas) were decided at the tribal level.

Each of the four Ait Ben Yacoub sub-fractions had a jmaa or council of elders that was the forum for managing most of the group's affairs. The jmaa selected an amghar n'tougga, literally a chief of grass, to make final decisions on the regulation of common grazing. His tenure lasted as long as consensus supported him. His decisions involved, among other things, the timing and location of transhumant movements, the timing and location of deferred grazing areas (called agdals), and the granting of grazing rights to outsiders recruited into the group. Decisions were binding on the entire group, and those who broke the rules were brought before the jmaa to be judged and punished--typically, minor infractions were reconciled by the accused's preparing a feast for the elders. Rules were made, infractions detected, and judgment passed all within the group.

This began to change when the protectorate government, with its primary mandate to pacify the Berbers, altered the structure of things. The French were determined to install a strong central government with as little bloodshed as possible. Toward this end, they attempted to maintain le droit coutumier, the traditional laws, while still ensuring peace. They placed collective lands and their management under the guardianship of the Conseil de Tutelle, a national council created by the Ministry of the Interior and made the traditional offices of sheikh and mcqqadem, at the fraction and sub-fraction levels respectively, salaried posts of the ministry and part of a bureaucracy stretching to the capital. Finally, they created the Ministry of Justice, which set about developing a penal code.

Although the traditional institutions were maintained to preserve order, they were weakened. Herdsmen, especially those who had cooperated with the state, began to perceive options and to realize that they need not be bound by the old institutions. Mutually dependent relationships developed between herdsmen and agents of the central government, and those herdsmen could effectively bypass the traditional strictures. Recourse to outside institutions began to disarm endogenous authority. As time passed, different institutions developed different clienteles: some herdsmen adhered to the weakening traditional institutions; others opted to ally themselves with the state; others looked to Islam to sanction their activities; and some chose to operate alone, seeking no one else's support.

This process, described in more detail later, degraded the ability of the Aït Ben Yacoub to act collectively. Today, no single institution binds all the herdsmen, and collective action is a rare occurrence.

The situation can be summarized by addressing the four relationships identified by Oakerson (this volume) as affecting the conditions of collective choice. (1) The process described above has increased the capacity of individuals to act solely on the basis of personal discretion in matters regarding use of the collective. (2) The immediate sources of remedy that had previously been available to individuals who had been adversely affected by the actions of others have been replaced by less sure, non-local sources. (3) The old institutions were based more on binding, collective decisions than on willing consent, but collective decisions are no longer the norm. (4) In the same vein, it seems that under current conditions any herdsman can veto collective decisions. Decisions are now voluntary rather than binding and collective.

Still, the situation may not be as grim as it seems. Recent legislation⁴ provides incentives for collective action, encouraging the formation of milk and wool marketing cooperatives, supplemental feed cooperatives and live-stock producer associations. Most of the Aït Ben Yacoub seem to appreciate the need for some collective action. Moreover, vestiges of traditional institutions remain, and the state is most interested in fostering cooperation. Taken together, then, these three conditions create the potential that the group's capacity to act collectively in managing their shared resources will be reactivated and institutionalized.

Operational Rules

The operational rules that currently regulate use of the collective are a combination of surviving remnants of traditional institutions and those that have been formalized in law. Following Oakerson (this volume), these operational rules are segregated into three categories that relate to the three technical and physical variables described in the first section.

Partitioning Rules

These rules, implemented to maintain jointness of use of the collective, take several forms, as illustrated by the following three examples.

By law, all Aït Ben Yacoub have the right to graze where they choose on the collective; there are no legally recognized internal boundaries. By convention, however, the area is divided among the four sub-fractions according to traditional patterns of use. Some of the internal limits are disputed, unclear, or ignored, but all herdsmen recognize their existence.⁵ Generally, the sub-fractions have access to portions of the collective nearest to their settlements and cultivated areas. The four portions are not equal in size or in abundance of forage or stock water. Use rights to the collective are thus unequally partitioned among the four subpopulations of users.

The construction of houses, stables or any other permanent structures on common lands was forbidden under traditional rules. However, when the Aït Ben Yacoub were confined year-round to what had been their summer range, they were obliged to alter their management strategies to deal with mountain winters. Livestock shelters were essential, and some herdsmen chose to construct stables on the collective. From about the end of World War II until the mid 1960s, when the state put a halt to such construction, about 25 Aït Ben Yacoub herdsmen built complexes of houses and stables in some of the most desirable areas of the collective. This provided those few herdsmen with increased access to common forage resources. Other herders avoid grazing in the vicinity of someone else's dwelling, and the herds stabled on the collective can graze adjacent areas when inclement weather keeps other livestock close to shelter outside the collective boundary. Such construction yields differential use rights, affording the fortunate few the opportunity to extract more benefit, in terms of space and time, from the commons than can their peers.

Traditional institutions include a rather sophisticated measure for controlling the use of key areas of the collective; agdals are areas closed to grazing, or open only to certain types of livestock, during specific seasons. On this collective, agdals are typically adjacent to fields and/or dry-season stock water. They are closed to grazing, or open only to draft animals and sometimes dairy cattle, from the time snow melts off distant, higher areas of the collective until harvest time or until

ephemeral water sources dry up in the higher regions. Three benefits result: forage availability near fields is assured when the harvest demands all the family's labor; forage availability in the vicinity of permanent water is assured when no stock water is available elsewhere; and use of some of the most heavily grazed parts of the collective is deferred, allowing plants to reproduce and restore carbohydrate reserves. The closure of aqdals is decided at the sub-fraction level, is binding on all herdsman, and must be registered and approved by the Ministry of the Interior's local agents. Unfortunately, this practice is becoming rare, for reasons detailed in the section on interactions.

Entry and Exit Rules

Traditional rules regulating entry, and thus exclusion, have remained basically intact and been formalized under law. Only members of the Aït Ben Yacoub fraction, of that agnatic lineage or who have been officially accepted into the fraction, have the right to graze the collective. In the past, herdsmen employed from the outside or marrying into a local family might petition the jmaa for acceptance into the group, but this practice is no longer possible. Grazing rights holders are currently defined as those heads of household whose names appear on a list compiled by each mogqadem, the sheikh and local Ministry of the Interior officials. While some outside herders who remain in the service of powerful Aït Ben Yacoub herdsmen appear on the list, others whose great-grandfathers worked their way out of such servitude long ago are excluded. Aït Ben Yacoub who might be working in France or in the military employed as herders elsewhere, or even in prison retained grazing rights whether they used them or not. Recent legislation will change that by reserving grazing rights for those who depend on pastoralism for their livelihoods. There are no exit rules.

Boundary Rules

While the elders (the jmaa) of the sub-fractions still meet, especially on weekly market days, to discuss the group's affairs, they seem to have lost any capacity to regulate use of the collective under their traditional jurisdiction. In most respects, the collective and the

four subdivisions it comprises have become the jurisdiction of the individual herdsmen who use them.

Outside Regulations⁶

The first important piece of legislation affecting Morocco's common grazing lands was the Dahir of 1919, the protectorate government's first move toward settling the Berbers. It called for the delimitation of collective lands, ceded them inalienably to the tribal group using them at the time, and placed them under the guardianship of the Ministry of the Interior and the Conseil de Tutelle.

After several decades, however, legislation had been passed that permitted the alienation of tribal lands for use by colonial farmers and stockmen. Those laws were rescinded as Moroccan nationalism began to grow. Seven years after independence, the Dahir of 1963 ordered tribal groups down to the level of sub-fractions to select nuab, representatives who would speak for the group when the state dealt with affairs involving collective lands.

The next important piece of legislation was the Dahir of 1969; this defined the state's involvement in the management of collective lands. It was enacted to halt degradation and improve the management of those lands. It called for the creation of pastoral improvement perimeters and charges various agencies of the Ministry of Agriculture with the design and implementation of management plans for them. These plans were to be based on the Western, state-of-the-art range management techniques; the perimeters were to be fenced, divided into pastures and provided with physical improvements such as roads, water points, houses for Ministry of Agriculture technicians, forage store-houses, livestock shelters and parasite dips. Vegetation manipulation was to include clearing undesirable plant species, planting improved forage species and windbreaks, and fertilizing seeded and natural vegetation. Rotational grazing systems were to be implemented, and up to one-fifth of each perimeter could be closed to grazing to allow natural regeneration or seeding establishment. A list of grazing-rights holders was to be compiled for each collective. Those individuals were to be issued cards identifying them as rights holders and specifying the number and type of livestock, and the time period they would be allowed on the collective. The legislation outlawed arrangements under which rights holders could herd animals belonging to others for a share of the

profits unless the animals' owners were also rights holders on the same perimeter.

It called for the formation of local pastoral improvement commissions responsible for determining stocking rates on the perimeter and for regulating management based on rotational and deferred grazing. The commissions were to be composed of the provincial governor, a magistrate designated by the governor, the president and two other members of the provincial assembly, three representatives of the Ministry of Agriculture, a representative of the national agricultural credit organization, a representative of the Ministry of Finance, the caids and supercaids (local officials of the Ministry of the Interior) within whose jurisdictions the perimeter is located, and one representative from each tribal group that uses the collective.

The legislation identified which costs of development would be borne by the state and which would be repaid by the pastoral beneficiaries. Finally, it specified which articles of the national penal code would apply to various infractions of rules regarding the management of the perimeter.

Some rules regarding marketing of livestock have been instituted sporadically over the last several years when drought conditions prevailed. In three of the last five years, the King forbade the ceremonial slaughter of rams for the feast of aid Adha (aid el Kbir), a Moslem ritual. Other controls kept reproductive ewes from being sold. The intent was to maintain the largest possible reproductive herd on the country's rangelands to permit a rapid recovery of productivity after the drought.

PATTERNS OF INTERACTION

The Arab sociologist and historian Ibn Kaldoun described the 14th century inhabitants of the Atlas Mountains as vicious and untrustworthy, and Berbers have ever since been characterized as contentious. Prior to the formation of the modern Moroccan nation, Berbers were unconquered and never unified, living in a state of siba, best defined as institutionalized dissidence. However, they have historically demonstrated the capacity to organize themselves effectively for defensive or offensive purposes.⁷ Large-scale threats--impending regional power struggles--typically spurred the alignment of tribal and social groups that were anything but allies during peaceful times. Once the danger was passed, the hierar-

chical organization broke down to component parts on the scale necessary to contend with lesser problems. It seems that Berber social institutions evolved to counter some deep-seated love of dispute, and allowed the society to function in an environment requiring cooperation.

The Evolution of Destructive Interactions

The traditional institutions to regulate communal grazing were generally organized according to the following description. The jmaa council was the forum for discussion of management decisions, but those decisions were ultimately made by the amghar n'tougga. He served at the discretion of the group, but his decisions were binding as long as he served. Hard rules were in place to provide herdsmen assurance regarding the expected actions of others using the shared resource. There seem to have been few avenues of appeal, little access to higher authority. One obeyed the rules or swiftly and surely suffered known consequences.

The inducements and obstacles that shaped behavior under traditional institutions seem to have fostered generally efficient, reciprocal interaction among the herdsmen involved in managing the collective grazing area in the past. Two conditions in particular seem to have been essential to the functioning of traditional institutions. First, affiliation with a strong and cohesive social network was a great advantage, if not a necessity, for a herdsman. Second, all the rules regulating use of the common resource were produced and enforced by the immediate group. The incentive structures faced by herdsmen were clear, palpable and similar across the group, and expectations and actions were coordinated within the group.

These conditions, as well as others that bear less critically on this situation, have changed since the imposition of a central government, beginning with the French protectorate and continuing since independence in 1956. Some of the traditional institutions (such as the amghar n'tougga) have disappeared or have been abolished at some fixed point in recent history. Others (such as the jmaa) continue to exist, though their authority and power have eroded significantly. Further, rapidly increasing human and animal populations have stressed most pastoral production systems. The two conditions that were noted above as being essential to the functioning of the tradi-

tional institutions are no longer in place. The old social network now provides little protection or sustenance-- beyond the grazing rights conferred by tribal affiliation-- to herdsmen, and, as more and more traditional authority and power have been co-opted by the central government, incentive structures have become complicated, extending beyond the immediate and comprehensible realm of the herdsman, and ultimately differentiated across the group. The net result has been a progressive fragmentation of the society. Each level of the social hierarchy have become less important to the level below. At the bottom, changing conditions have presented individuals with progressively more inducements to "ride free" or otherwise pursue narrow individual strategies, competing rather than cooperating for the good of the group. A few examples will illustrate this process and the sorts of behavior it has produced.

Early in the protectorate period, the government dispatched officers to the Berber tribes; the officers were to argue the case of the French government quietly and identify sympathetic leaders and groups who would ease the establishment of a strong central power. In the Timahdite area, these agents were resisted by the group in power at the time. While the largest, most respected and powerful of the four sub-fractions became involved in extended guerilla warfare against the French, another sub-fraction took the opportunity to work with the foreign power and profited from the association. By the time the resistance was crushed, a few members of the latter sub-fraction had gained private use rights to areas that were formerly used collectively by the resistant sub-fraction. They inserted themselves in areas of the collective not traditionally accessible to them, vastly increased their land and livestock holdings, and established a sort of patron-client relationship with the central government that continues today. Those herdsmen saw inducements in the changed milieu to break from the group, ally themselves with the exogenous power structure, and conduct their affairs as individuals rather than as components of the traditional social network.

Another sub-fraction had traditionally used the southern part of their portion of the collective as an agdal. It was close to their fields and to permanent water, so they closed it to grazing in the spring, obliging everyone to move north to an area where the forage was better but water was sparse. With this institution in place, the sub-fraction could be confident that, when the ponds and seeps in the north dried in June or July and the

harvest required all of a family's labor, both forage and water would be available adjacent to the cultivated areas. However, the agdal was effective only if respected by everyone. As the sanctions of the traditional system weakened, some individuals of this sub-fraction and of neighboring ones opted to take the risk of grazing the closed area. Periodic droughts exacerbated the problem, making it more difficult to keep herds off the agdal when no forage was available elsewhere. After all, on paper the whole collective was open all the time to all members of the fraction. In the end, the sub-fraction gave up the practice. While a majority of the herdsmen said the agdal was a good idea, they felt it could continue to function only if everyone agreed to respect it, and that had become impossible.⁸ In this case, the traditional mechanisms for enforcing collective management decisions had eroded to the point that the regulations could be ignored with impunity. Free riding, and the expectation of free riding by others, undermined the efficacy of the agdal and, thus, constituted an obstacle to a cooperative strategy.

The story of the sheikh of the fraction provides an example of the lengths to which an individual free rider strategy can be successfully pursued. This traditional authority is now salaried by the Ministry of the Interior; his selection is negotiated by the powerful members of the community. As background, it is important to know that irrigation water is a common resource in this society, and its allocation is supervised by a chief selected by the group, the amghar ou asif, whose role parallels that of the amghar n'tougga who managed use of collective lands in the past. At a weekly market, the sheikh was hounded by a throng of irate neighbors who claimed he had kept the water turned on his fields for two days when he was entitled to only a half day. They demanded he respect the rules. The amghar ou asif, who happened to be of the sheikh's sub-fraction, was summoned, but he offered to resign rather than to try to force the sheikh to obey the rules. The neighbors then demanded that the sheikh accompany them to the office of the supercaid, the Ministry of the Interior official responsible for the entire administrative unit, located 35 km away. The sheikh accepted happily, offering to drive everyone in his truck, so sure was he that the supercaid would support him. The neighbors, seeing no further option, desisted. The sheikh, a major player in collective decision making, could evidently opt to ignore those same decisions and appeal to a sympathetic, outside authority.

The Situation Today

Management of the collective along traditional lines has not degraded as far toward anarchy as might be thought. Outsiders are not free to graze; construction on the collective is again prohibited, and the informal division of the collective among sub-fractions is in force, with some exceptions.⁹ However, the traditional institutions, with the alterations imposed on them by the state, were not able to allay degradation under the pressures of modernization. The state was thus compelled to intervene, creating new management institutions as detailed in the Dahir of 1969.

The state's commitment to improving the management of the collective increased the number and diversity of persons involved and produced new interactions among them. The most telling of these are described below, starting at higher administrative levels and finishing with the herdsmen themselves.

Before many of the pastoral improvement perimeters can be laid out, the boundaries of units of collective land they encompass must be delimited. As noted, this activity was legislated and begun in 1919, but still has not been completed. Two large sectors of the Aït Ben Yacoub collective's boundary, and therefore the boundary of the improvement perimeter containing the collective, have been disputed for years and are not yet fixed. This demonstrates the difficulty in achieving agreement about even the most simple aspect of collective grazing areas, their boundaries.

The perimeter development strategy has likewise proceeded slowly. Since 1969, 29 perimeters have been identified, but work is underway on only a handful. The Timahdite perimeter was among the first to be identified. A pastoral research station was appropriated from the collective land, an act legitimized by the 1969 Dahir. Development of the station was begun in 1977. The station provided a site for studies of optimal stocking rates and soil and vegetation manipulations, adaptability of improved forage species, sheep diet and the impact of grazing on natural vegetation. A house for a Ministry of Agriculture range management specialist and a storage facility for supplemental feed were constructed in 1980, but no range specialist has been induced to live at the station, and no feed has yet been placed in the still roofless storage hangar. Ministry of Agriculture staff from Meknes are assigned to work at the perimeter, 100 km

to the north, but provided less than \$10 per month for gasoline, not enough for one round trip. Clearly, the current rate of progress is tortoise-like, mobilizing field staff is difficult, and funds to support field operations are quite scarce.

The herdsmen themselves, most of whom have only a distorted, second-hand understanding of the planned perimeter, are divided in their response to it. Those who have profited by collaborating with the government in the past, and thus may be better informed about current plans than are their peers, give rubber stamp approval. Those who by their own choice or the design of others have historically been left out of state-run programs have no opinion except that they will continue to be left out. Herdsmen who have suffered from past interventions are more active in their distrust of the proposed scheme, refusing to attend any functions associated with it or participate in any way. The research station, in the opinion of most herdsmen, is simply 200 hectares of their land expropriated by force by the state for its own unknown purposes.

These examples illustrate the difficulties the state faces in attempting to secure the future of its communal grazing lands and pastoral people by creating new management institutions to replace what are perceived to be archaic and ineffective ones. The plan outlined in the 1969 legislation is ambitious, especially in view of the progress made to date. The plan requires massive expenditures of manpower and capital, which are currently in severely limited supply. Further, it requires that the gulf of ignorance and mistrust that separates state policymakers and their agents from the herdsmen be bridged. If that could be done, the policymakers might perceive some advantage in creating an institutional setting that would induce the fragmented Ait Ben Yacoub society to reconsolidate, cooperate rather than compete, and devise and enforce rational management strategies with state assistance, rather than forcing the state to develop an entire exogenous regulatory system that will be expensive and ineffective.

OUTCOMES

The criteria used to evaluate the outcomes of this situation are those suggested by Oakerson, efficiency and equity. Given the number and diversity of players involved in the management of this collective, it is probable that

the two criteria would be assessed quite differently depending on the perspective of the evaluator. For example, recent Moroccan land reform activities indicate that an immediate reduction in the rate of urban migration is a top state priority. Therefore, management institutions that keep the Ait Ben Yacoub at Timahdite might be perceived by some as more efficient than institutions that maximize the sustainable rate of output of animal products from the collective. Given the purpose of this analysis, efficiency is assessed according to the latter measure, and equity is appraised according to equality of access to the collective under different institutional forms.

Efficiency

As noted in the introduction, the issue of efficiency is a delicate one partly because of the complex nature of the physical resource base, and also because of the lack of consensus among range scientists about generalities regarding optimal grazing management. Nonetheless, efficient grazing management requires two conditions: the capability to monitor closely and continuously the status of vegetation and livestock, and the means to control grazing by adjusting its timing, intensity and duration, in response to shifts detected by monitoring the system. Traditional systems that meet these requirements can function efficiently, while technically sophisticated systems that do not meet them will fail. These two factors are therefore the principal criteria used to judge the relative efficiency of the grazing management institutions on the Ait Ben Yacoub collective.

Traditionally, all decision makers were herdsmen in close, daily contact with their land and livestock. Monitoring the workings of the system was a natural consequence of their livelihood. We have described some of the traditional, endogenous controls over grazing and their decline under the pressures of modernization. The system seems to have functioned efficiently in the past when the demands on common grazing resources were low. As the demand grew with increasing human and animal populations, traditional regulations were weakened, primarily by the development of a strong central government. Inefficiency, in the form of degradation of the collective resource base, resulted from overstocking and intense, season-long grazing, but it cannot be attributed to the failure of traditional institutions that were no longer allowed to function.

The traditional regulatory system has some obvious benefits when efficiency is considered. Since herdsmen are in constant contact with their grazing lands, livestock and each other, and stand to profit most from efficient management, they are potentially the best monitors of any management system. They are also best equipped to detect infractions of exclusionary and operational rules. We can conclude that the information needed to maintain efficient grazing management institutions is available at least cost to the herdsmen themselves. The free flow of that information among decision makers was one of the great strengths of the traditional institutions.

Some weaknesses are equally evident. As the traditional institutions deteriorated, they no longer adequately controlled grazing. That failure is the institutional explanation for the degradation evident today. Another weakness of the traditional system is the lack of any formal means of introducing new technical improvements.

The modern alternative outlined in the 1969 Dahir also has strengths and weaknesses regarding efficiency, and in many ways they complement those of the traditional institutions. The interventions described are based entirely on technical criteria developed outside the indigenous production system. The value of some of the interventions, particularly the insistence on rotational grazing, may be questionable from a technical standpoint.¹⁰ The great potential strength is the degree to which grazing timing, intensity and duration could be controlled if the management institution existed and operated as intended. But that capacity is remote at this juncture. In the 15 years since this legislation was enacted, virtually nothing has been done to put new regulatory institutions in place, but degradation of the collective has become evident as the old institutions grow ever weaker. The fact that the new system would be monitored by outsiders constitutes another weakness.

In terms of efficiency, the current situation is grim. Management of the collective suffers the weaknesses of both the traditional and the proposed modern institutions, and the strengths of neither can be brought to bear. Any institutional change that would enhance the capacity of the Ait Ben Yacoub to collectively control grazing or that would speed implementation of the government's plans and increase its monitoring capability would improve efficiency. In the long term, optimal management institutions would combine the two options, capitalizing on the strengths of both. In the short term, given the relative costs in time, money and manpower, changes of the former sort seem preferable.

Equity

We noted above that Berber society has always been characterized as contentious. It is also characteristically inegalitarian. This study revealed rapid shifts in the fortunes of individuals, families and sub-fractions. The traditional grazing management institutions seem to have provided a number of opportunities for a herdsman to improve his position by conducting his affairs wisely. Other constraints, particularly stronger reciprocal social arrangements and labor efficiency, helped limit the amplitude of fluctuations of wealth in the community; 50 years ago, a poor herdsman had more animals and a rich one many fewer than they have today.¹¹ More recently, a few individuals have been able to secure disproportionately large benefits from the collective and to assure their ability to keep securing those benefits. The shift from collective to individual strategies increased the degree of inequality while limiting the opportunities for the non-elite to better their positions.

The effect of the 1969 legislation on equity is uncertain. It depends entirely on how the restructured use rights are distributed. If they were to be allocated on the basis of the current distribution of wealth, current inequalities might be perpetuated. If use rights were equitably distributed again, then institutional avenues might be opened to allow the old flux of relative benefits to begin again. The legislation does not describe how the issue of equity is to be addressed.

NOTES

1. Carrying capacity, grazing capacity, and related terms are defined and discussed in Heady (1975:114-116).
2. This is one of many technical interventions to be undertaken by the Middle Atlas Project, a cooperative effort of the Food and Agriculture Organization of the United Nations and the World Bank designed in 1979. It is an integrated natural resource project encompassing five adjoining rural communes including Timahdite.
3. The development of pastoral improvement perimeters is legislated in Dahir no. 1-69-171, Décret no. 2-69-312 and Arrêté no. 349-69 of the Code des Investissements Agricoles, a compilation of Moroccan agricultural law.
4. The formation of cooperatives was legislated by Décret no. 2-69-39 of the Code des Investissements Agricoles.
5. Some of the units of collective land used by the Aït Ben Yacoub are legally open to the other fractions of the Aït Arfa du Guigou tribe of the rural commune of Timahdite. However, as these areas are adjacent to Aït Ben Yacoub's private lands and used almost exclusively by this group, they are lumped with the Aït Ben Yacoub collective lands for this analysis.
6. This section presents only a few of the most important pieces of legislation affecting grazing on collective lands. All pertinent legislation has been compiled in La Legislation des Parcours Collectives et Forestières, National School of Agriculture, Meknes.
7. Some of the effects of such organization are described in Halstead (1969). Some mechanisms for such organizations are described in Gellner (1969).

8. The Aït Bouatiya sub-fraction was the last of the four to regularly create an agdal. The last occasion was 1980. Since then, the group has not united in support for the practice.

9. According to a 1963 decision of the Conseil de Tutelle, the Aït Kessou sub-fraction has no right to graze parcel 295, which constitutes the majority of the Aït Ben Yacoub collective. Their collective is in the mountains to the east. Since the sub-fraction has settled among the Aït Ben Yacoub and become powerful--the current sheikh is Aït Kessou--they do use the collective.

10. Some inconsistencies in the findings of grazing research, particularly regarding the benefits of rotational over continuous grazing, are reviewed in Sims et. al. 1982.

11. In the past, herds of over 300 sheep were practically unknown. Currently, a handful of Aït Ben Yacoub own more than 1,000 head, and one more than 4,000.

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Oukaimedene, Morocco: A High Mountain Agdal¹

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INTRODUCTION

About one-fifth of the world's surface is currently threatened by desertification (McGuire 1978). Most of this land is now used for grazing domesticated animals. If wide-scale environmental deterioration is to be prevented, the management of world rangelands must be improved, but to date virtually every attempt to manage Third World rangelands has failed. Setbacks have been so frequent that agencies that fund development programs have begun to consider pastoral development too risky for further investments (Little 1983). In large part, the failure of pastoral development programs can be traced to a failure to understand the complexity of traditional pastoral production systems. Planners often assume that the seemingly "primitive" techniques used by pastoralists were unproductive and poorly adapted to semiarid environments. However, closer examination of these production systems reveals that they are as productive as modern ranching systems in North America and Australia.

The failure of most government-sponsored range management programs and the relative efficiency of traditional pastoral systems suggest that indigenous approaches to pasture management can be used to protect the world's fragile rangelands. One of the few successful government-sponsored pastoral development programs is based on such an

approach (Draz 1983). The Syrian government and the Food and Agriculture Organization (FAO) were able to create pastoral development cooperatives based upon a traditional system of pasture reserves known as the "hema system." While it may not be possible to manage rangelands using the hema system everywhere, the Syrian experience illustrates the importance of understanding traditional range management systems (Eighmy and Ghanem 1982).²

An indigenous system of range management, known as the agdal system, survives in many remote parts of Morocco. An agdal may be defined as a "collective pasture with rigid, fixed opening and closing dates" (Hart 1981), or any grassy area whether collectively or privately owned from which grazing animals are excluded (Geist and Gregg 1984).³ The focus of this paper is the collectively managed agdal with collectively defined opening and closing dates. Such agdals exist at many levels of society--some are shared by members of a single hamlet, others by groups of villages, and still others by whole "tribes." The agdal of Oukaimedene described in this paper is shared by two sedentary tribes--the Ourika and the Rhiraya.

The Oukaimedene agdal is located in the Western High Atlas Mountains about 60 kilometers from Marrakech. A stable institution dating from the 17th century, it is notably free of the high degree of conflict surrounding those in the Central High Atlas such as Talmest, the site of "an annual brawl which occurs as regularly as clockwork, one which neither the French nor the Moroccan government since independence in 1956 has been able to solve...." (Hart 1981:7). The stability of the Oukaimedene agdal gives us an opportunity to identify the elements of an appropriate range management system.

BERBER SOCIAL ORGANIZATION

Before we can discuss the use of Oukaimedene by the Rhiraya and Ourika tribes, it is necessary to have some understanding of the social organization of Berber society, which turns on a notion of segmentation that is associated with ties of solidarity within groups and among allied groups, and also with serious conflict between groups and between alliances (Hammoudi 1974). Kinship (real or mythical) is the organizing principle of segmentary groups.

The basic building block of society is the household (takat), which may include more than 50 members. House-

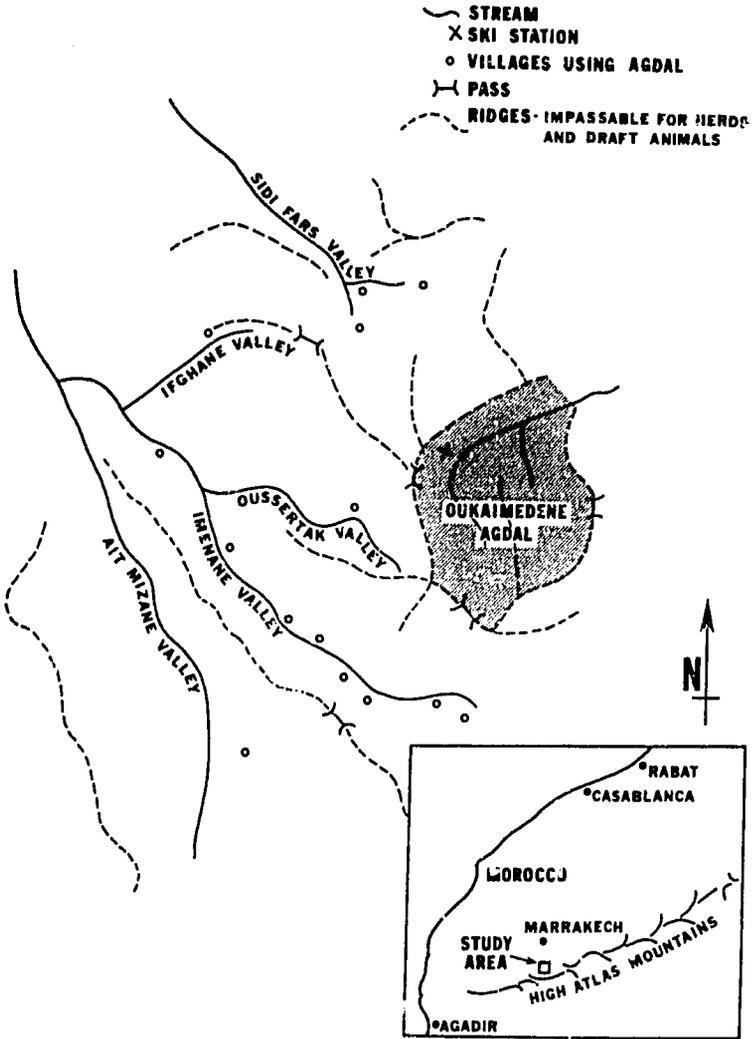


FIGURE 1 Location of the Rhiraya territory and Oukaimedene agdal.

holds in turn belong to lineages, or groups of households with a common ancestor. Villages (douars) might contain more than one lineage, and often share a common ancestor. Lineages belong to fractions. In some cases, the lineages of a fraction share a common ancestor and the fraction is similar to the "clans" in other societies. Other fractions may be confederations of nonrelated lineages that are united by ancient political and military alliances. A tribe is composed of fractions that may share common ancestors or may be long-standing confederations of unrelated fractions. The Rhiraya and the Ourika are confederated groups.

Berber society, particularly in settled areas like the Rhiraya, is also organized on a territorial basis: steep mountain valleys create natural social units. In the past, valleys or groups of valleys were politically united under chieftains. Today, the village is a social unit that controls water and pasture rights. Territorial units may cut across the boundaries of lineages or fractions.

For our purposes, it is important to remember that each unit in a segmentary group can be in conflict with other units at a similar level. Each valley in the Rhiraya ; territory can be viewed as a unit because villages in them share water resources and territory and often have to rely upon each other for mutual protection. At the same time, conflicts over water and pastures within a valley can be quite intense, and villages might form alliances (leffs) with outside groups to protect themselves against their neighbors. Conflict is likely within any unit of Berber society--between households in a lineage, between lineages in a village, between villages in a valley, or between tribes in a confederation. However, subunits in conflict will generally unite to respond to threats from outside groups. This is the classic segmentary pattern.

The Oukaïmedene agdal is used by members of two confederations, the Ourika and Rhiraya, which are organized along both kinship and territorial lines. With the exception of a few watchmen who protect the property in a small ski station located at Oukaïmedene, there is no permanent population on the agdal. Before the French came to ski in the late 1930s, the valley probably had no year-round residents. Although both the Ourika and Rhiraya participate in the opening ceremonies of the agdal, the pasture is clearly divided between the two tribes, and each tribe confines its animals to one of Oukaïmedene's two watersheds. At present, the "Ourika side" of Oukaïmedene

has 115 corrals and shelters, while the "Rhiraya side" has 195. The two tribes belong to different administrative subdivisions. The authors did not have official permission to work among the Ourika, so this paper will concentrate on the Rhiraya and their use of Oukaimedene.

The Rhiraya are agro-pastoralists who have private lands outside the agdal. They cultivate barley and wheat on unirrigated terraces carefully carved out of steep mountain slopes. But they have developed an elaborate system of irrigated terraces that has allowed them to cultivate maize, potatoes, a variety of vegetables, and walnuts; in recent years, orchards of apples and cherries have been added. The stark beauty of the rocky canyons and of the carefully manicured terraces attracts hikers and mountaineers from throughout North Africa and Europe, and one has the impression that every possible resource is being exploited. The reality, however, is that even with extensive terracing, less than 10 percent of the territory can be used for crops: most of it is steeply sloped, and many areas are denuded of vegetation. Nonetheless, the valleys inhabited by the Rhiraya are heavily populated for such a marginal region--the average density is 55 persons per square kilometer (Chami 1982). The population of the Rhiraya is estimated at about 36,000 persons or about 2,800 households (Chami 1982), but only a small proportion of the Rhiraya tribe actually bring their animals to Oukaimedene. While all members of the tribe have some "right" to place their animals on the agdal, the physical and social constraints outlined below prevent most of them from doing so.

PHYSICAL AND TECHNICAL ATTRIBUTES OF THE AGDAL

The agdal of Oukaimedene is located in the highest part of the Western High Atlas mountains about 16 kilometers from Jebel Toubkal, the highest peak in North Africa. Oukaimedene's elevation varies from 2,600 meters at its lower end to 3,260 meters atop Jebel Oukaimedene. Oukaimedene is a treeless valley, 4.5 kilometers long and 4 kilometers wide at its broadest point, divided into two watersheds separated by a low grass-covered mountain. These watersheds meet at the end of the valley at the entrance of a narrow gorge. With the exception of the granite cliffs of Angour and Jebel Oukaimedene, the valley is characterized by steep grass-covered slopes. A strip (1,000 meters long

and 150 meters at its widest point) of naturally subirrigated pastures runs along the valley floor; the peaty soil is rich in organic matter, moistened by underground seepage, and capable of supporting plants that can be cut for hay and reserved for cattle. A number of small permanent springs are scattered throughout the valley; herders have built stone corrals and stone huts or shelters next to these sources of water. Ascending from the valley floor, the mountain slopes have fine-textured soils in their lower reaches and coarse alluvium in higher areas. The rain-fed slopes provide pasture for sheep and goats.

Detailed climatic data on the agdal do not exist. The average minimum winter temperatures for December, January, and February are approximately -3°C. Precipitation is estimated to be 500 to 600 millimeters per year, most of it in winter and early spring, with virtually no rainfall during the months of June and July. The usually heavy snowpack at Oukaimedene precludes grazing during winter months, but is sufficient to permit alpine skiing.

The agdal is only one of the forage resources used by the people of the region. The local population classifies its pastoral resources into five components: (1) the asif or streambanks, (2) the adrar or mountain, (3) l'rabit or forest, (4) the uta or plain, and (5) the agdal or closed reserve. The streambanks are the focus of economic activity, since they provide both the arable land and sources of crop residues, hay, and pasture for cattle. The mountain slopes are common grazing lands (especially for sheep and goats), generally used by people from one village. Although the forest is legally state property from which the state is entitled to exclude people, local groups still manage to exercise their traditional usufruct rights. The plains are the territory of other groups, but many Rhiraya have reciprocal arrangements that permit them to graze their animals on the plains during winter months.

The streambanks and the mountain slopes are the most important forage resources because they comprise the majority of any village's land and they can be used throughout the year. Nonetheless, the agdal's pastures are highly coveted because they provide high-quality forage at a time when grass is in short supply everywhere else.

The use of the agdal is affected by climate, technology, the distance between Oukaimedene and one's village, family size, the size and composition of the family's herd, and the family's eligibility to use an overnight shelter on the agdal. Thus, while a fairly large group of people are

theoretically entitled to the area, the above factors sharply reduce the number of families who can in fact make profitable use of the land. Oukaimedene's elevation prevents it from being a permanent settlement, given traditional technology and housing. The growing season is too short for most subsistence crops, and even though the majority of the agdal's area is desirable pasture for sheep and goats, the winters are too severe to permit year-round pasturing. High elevation and low temperature prevent goats from using the pasture except in the hottest months of the summer, as these animals are more sensitive to cold than are sheep or cattle. Sheep are more resistant to cold, so they can utilize the agdal for several months, but even they are forced to leave when the heavy snows arrive. Forage suitable for cattle is limited to the small subirrigated portions of the agdal, and because so many cattle are taken to the agdal, the area can provide them adequate food for only two to four weeks.

The remoteness of the agdal from village settlements also affects its utilization. Two to three hours are needed to herd animals to the agdal from the nearest villages, and up to two days from more distant hamlets. Only those who have successfully negotiated for the right of transit may cross the territory of other groups that lie between their own village and the agdal. The agdal is too remote to permit herds to move back and forth between pastures and the village on a daily basis, so herders must remain with their animals on the agdal overnight. Considerable amounts of time and labor must be devoted to ferrying supplies between the villages and the agdal, so a family using the agdal must have enough labor to simultaneously maintain households in the village, care for the herd at Oukaimedene, and go back and forth with supplies for the shepherds on the agdal. Finally, in order to maximize the quantity of hay available to the cattle, families find it necessary to harvest hay from the subirrigated areas of the agdal rather than allow the cattle to roam loose and trample their own food. Thus only families with labor to spare are able to make use of the agdal for feeding their cattle. This is a burden for most families, as the average number of animals per household is quite small, yet it is also a necessary one, as virtually all families have cattle and therefore value the agdal's usefulness as a cattle pasture. Nearly every family in the region owns one or two head of cattle, but herds of over five cattle are quite rare. Many families also own goats,

but a substantial minority do not, and even fewer have sheep.

Because of the low nighttime temperatures and the importance of corralling one's herd for the night, Oukaimedene is effectively available only to those who have access to shelters or camps there. And since most shelters are located in the sites favored with a source of water and a hay meadow for cattle, eligibility to use a shelter is also crucial in obtaining access to the agdal's resources. Shelters and corrals are owned by individual families, so someone wishing to use the agdal must belong to a group that regularly uses the agdal and thus exercises its usufruct rights, and must either own his own shelter or enter into a cooperative arrangement with someone who does.

The characteristics of jointness, excludability, and indivisibility described by Oakerson (this volume) apply differently to each part of the agdal and to different groups of users. The hay meadows on the subirrigated portions of the agdal are small enough and valuable enough to make division into individual fields feasible--as with the land at lower elevations--but the isolation of the agdal from human settlements makes the enforcement of private property rights utterly impractical. Families and even villages simply cannot afford to post guards on the meadows year-round to ensure that the proper people and animals are using the proper piece of land. However, a collective agreement to close the agdal completely can be enforced even without such on-the-scene monitors. Grazing animals and intruders can easily be detected--though their identity and precise location cannot be pinpointed--from a distance of several kilometers, and the fact that they are violating the closure of the agdal is instantly apparent. Thus the Rhiraya maintain jointness of use of the hay meadows, as well as the other resources of the agdal, through collective regulation.

The dry uplands of the agdal are extensive, but have a relatively low productive value per unit of area. Individual appropriation of such lands is neither technically feasible nor desirable (Gilles and Jamtgaard 1981). The costs of dividing land among hundreds of co-owners and maintaining so many boundaries would exceed the benefits derived from private pasture ownership, especially given the small number of animals held by each family. Collective ownership is beneficial because it spreads the risks

inherent in extracting resources from a relatively fragile and often-changing ecosystem and also allows individual households to change the size and composition of their herds without worrying about whether their particular private pasture is suited in a particular year for the herd they happen to have that year. Yet the total number of animals brought to the agdal each year could easily destroy its pastures if grazing were uncontrolled, so collective regulation is needed to maintain jointness of use for the tribe as a whole.

The remote location of Oukaïmedene, on the frontier of several rival Berber groups and closer to the territory of the Ourika tribe than of the Rhiraya tribe, also encourages collective management of the agdal. When the Ourika and Rhiraya tribes established the agdal at Oukaïmedene, the possibility of bloody confrontations among users and raids by rivals dictated that herders band together for mutual protection to use the agdal. A group of shepherds from a single village would be too vulnerable to attack, so alliances among villages resulted.

DECISION-MAKING ARRANGEMENTS

The Oukaïmedene agdal is closed to grazing from March 15 until August 10. According to tradition, these dates (and other institutions surrounding the use of Oukaïmedene) were created by a Muslim saint who lived in the late 17th or early 18th century--Sidi Fars, patron saint of the Rhiraya tribe.⁴ The agdal itself is considered to be holy ground "belonging" to Sidi Fars.

A day or two before the August opening date, family members with mule loads of personal effects arrive at the agdal, but herds do not enter the valley until about 7 in the morning of August 10. Some family members precede those driving the herds to repair the rock shelters and corrals where they and their animals will pass the nights. The Rhirayas who use the agdal come from villages in the five valleys of the Rhiraya area that possess corrals and shelters; they are therefore the principal users of the pasture. These valleys, in the order of their distance from Oukaïmedene, are Oussertak, Imnane, Ifghane, Aït Mizane, and Sidi Fars.

Herds from the most distant locations arrive the night of August 9 and camp near the passes that open into the

pasture. In earlier times the regulations concerning order of entry were more complex, specifying the sequence by household. There is still a definite order of entry, with people from Oussertak beginning and those from other valleys following. Cattle enter the agdal first, followed by herds of sheep and goats.

Immediately after the opening, the principal activity is hay cutting in the subirrigated meadows. All members of the family participate: women and children do most of the cutting and men transport the hay to the camps. Among rights holders, hay is cut on a first-come-first-served basis, so that those families with the largest labor force harvest the most hay. Cattle, mules, and horses could be left to graze in the hay meadows, but people prefer to cut as much of the choicest grass as quickly as possible to reserve it for their dairy cows. Rules require that this hay be consumed at Oukaïmedene and not be transported back to the village, preventing anyone from cutting more hay than the animals can consume while they are on the agdal. Cutting the hay by hand produces a larger hay crop than if the animals graze directly and trample part of the grass underfoot, and thus prolongs the period of time that the agdal is useful as pasture. Sheep and goats are not permitted to graze the meadows but instead graze the mountain slopes adjacent to them.

Following the opening of the agdal, groups of women from specific valleys and villages participate in ceremonies at various springs and other sacred spots. On the first Friday after the opening of the agdal, the festival of the spring of Sidi Fars takes place. Young men and women from both the Gurika and Rhiraya groups hold a dance adjacent to the spring, which is protected by a small shelter and is visited by women who want to receive the blessings of Sidi Fars. Money collected at this time is used to compensate one of the herders for an animal that will be sacrificed at the zaouia (shrine of Sidi Fars and lodge of his disciples). Two weeks after the opening of the agdal, another celebration marks the departure of most of the people and animals.

PATTERNS OF INTERACTION

In principle, all members of the Rhiraya group have the right to graze their animals at Oukaïmedene once the pasture is opened, but it is clear that not everyone

exercises this right. To use the aqdal, one needs access to a campsite with a shelter and a corral for the animals, located near a hay meadow and a source of drinking water. Although exact population figures for the Rhiraya are not available, even conservative estimates indicate that no more than 16 percent of the Rhiraya households actually have camps at Oukaimedene. The total number of families using the aqdal is substantially higher than the number of campsites because other families place their animals in the care of a neighbor or relative. In 1983, for example, all of the families residing in the Oussertak valley sent some animals to the aqdal; those without camps of their own added their animals to the herds their relatives took to camps on the aqdal. The campsites used by households from the five valleys of the Rhiraya are shown in Table 1 below by valley of origin, with the closest first.

TABLE 1 Number of Camps by Valley of Origin (percentages are rounded).

Valley	Number of Camps	Percentage of All Camps on <u>Aqdal</u>	Percentage of Households from Each Valley Owning Camps
Oussertak ^a	56	29	66
Imnane	83	43	22
Ifghane ^a	27	14	33
Ayt Mizane	7	4	5
Sidi Fars ^{a, b}	22	11	22 (of households from the 3 villages in the valley that send animals to the <u>aqdal</u>) 10 (of households from all 9 villages in the valley of Sidi Fars)
TOTAL IN RHIRAYA	195	101	16

^aProtectors and retainers of Saint Sidi Fars.

^bDirect descendants of Saint Sidi Fars.

Several points are worth noting about the relative size and distance from the agdal of the various valleys of the Rhiraya tribe. First, families from the relatively nearby valleys of Oussertak and Imnane, with 72 percent of all of the shelters on the agdal, prevail among Rhiraya families who actually maintain corrals and shelters there. This is quite understandable, since such families face the lowest transport costs for using the agdal. Similarly, there seems to be a rough association between proximity to the agdal and the likelihood that a family will go to the trouble of maintaining a shelter there, doubtless also because of transport costs. However, the households from the three villages that send animals to the agdal from the most distant valley of Sidi Fars deviate from this rule somewhat by maintaining a larger presence on the agdal than their distance from the agdal would appear to warrant.

The existence of a convenient modern road traversing part of the distance between the valley of Sidi Fars and Oukaïmedene reduces the effective distance and associated transport costs for families from Sidi Fars. But religious factors also give extra benefits to the Sidi Fars families who use the agdal: the fact that they claim to be the servants of Saint Sidi Fars--and that some of the families from the valley of Sidi Fars also claim direct descent from the saint himself--gives these households, along with those from Oussertak and Ifghane (who also claim to be protectors of Saint Sidi Fars) what we can call senior rights (extended or full rights) to the agdal. As we will see below, they may graze their animals anywhere on the agdal and are entitled to stay longer than the families from Imnane or Aït Mizane. These extra benefits from using the agdal presumably make using the agdal worthwhile even for families who face somewhat higher costs. The claim by some families from the valley of Sidi Fars to direct descent from the saint, as well as their right to command a "gift" (a payment or a tax) from all other Rhiraya households that use the agdal, may also be important in reinforcing their rights of access to the agdal. The Oussertak, who live closest to the agdal and could conceivably exclude all others from the agdal if they chose to, legitimize their own access to the agdal by their affiliation with Sidi Fars. They are therefore in no position to deny similar access to other groups able to claim connections with the saint.

The various ethnic divisions of the Rhiraya have access to different springs and hay meadows. Shelters and corrals

are located in proximity to these resources in campgrounds or clusters known as azibs. There are three main Rhiraya azibs: Dou Fatfira azib (approximately 90 camps), occupied mostly by households from the valleys of Oussertak and Ifghane; Assif n'Aït Irene azib (approximately 70 camps), occupied primarily by families from Imnane and Aït Mizane; and Imine Taghya azib (approximately 20 camps), occupied by herders from Sidi Fars. Within each of these larger areas, there are smaller groups of camps adjacent to particular hay meadows or watering sites, often occupied by people from a single village.

People from the valleys of Oussertak, Ifghane, and Sidi Fars have more extensive rights than those from Imnane and Aït Mizane. Senior rights holders are allowed to cut hay in the large meadow just below the sacred spring of Sidi Fars and to graze their animals in the well-watered areas nearby. Junior rights holders (whose rights are limited but not necessarily any more recent in origin) must put their campsites above the spring and graze their animals in this drier, less-favored, upper zone of the watershed. They also leave Oukaimedene soon after the festival that takes place on the 15th day after the opening of the aqdal, after which time the senior rights holders may then allow their herds to graze the upland areas vacated by the junior rights holders. Shepherds from Oussertak may stay until snowfall or until the pastures are exhausted, and they may also return in late February to pasture their sheep in years when the snowfall is light.

These two classes of users disagree with each other over the rules concerning the exact time of departure from the aqdal. Such disagreements probably reflect fluctuations in the power of various groups. The senior rights holders, claiming to be protectors and descendants of Saint Sidi Fars, argue that the others are required to leave the aqdal after the 15th day--that is, immediately after the closing ceremony--and that the senior rights holders generously allow the others to extend their stay for another few days until the grass supply runs out. In contrast, the junior rights holders argue that there is no difference at all in their rights and that they are not expected to leave on the 15th day, but that within a few days of that time the grass for their herds is exhausted anyway and it makes no sense to stay longer. In fact, once a substantial number of people leave the aqdal, the camaraderie and the temporary traveling marketplace for bread and supplies evaporate, and the attraction of

remaining on the agdal declines even for those who insist that they are entitled to stay. Moreover, the grass supply diminishes and the weather becomes more severe.

Ethnic identity not only creates a hierarchy of rights among users but is also important in extending rights to new users and denying rights to others. Reciprocal arrangements through relatives permit people without camps to use the camps of others or to construct a new corral and shelter adjacent to those of their kinsmen--as long as the kinsmen or others with camps in the same azib do not object. Those with objections can take them to the jmaa, the council of people with corrals in a particular azib. Wherever there is a collective resource, a council composed of one adult male per household that is empowered to enforce the rules and resolve conflicts among users can be established. All members of a council are theoretically equal, although representatives from rich families usually have considerable power. Nonetheless, a learned or articulate representative from a poor family occasionally can be persuasive and influence council decisions. Members of a community normally oppose the effort by an "outsider"--say, a member of a village that has no azib--who attempts to construct a camp. The council is also likely to deny permission to use water points or to build corrals even to other members of the Rhiraya who theoretically have the right to use the agdal.

Rights to a corral and shelter can be maintained only through regular use. In a real sense, the only title one can have to a camp is the historic fact that one's family has always come to Oukaimedene and used its corrals and shelters. We know that villages that do not currently use the agdal used it in the past and possessed corrals and camps there. Informants from the villages of Imlil and Aremd in the Ayt Mizane valley could point out their former corral sites, though no physical evidence remains. If a family fails to use its camp, others slowly pilfer the rocks from the stone walls of the unused corrals. The theft is hardly noticeable at first, but the corrals may literally disappear in a few years' time. Those who build new corrals and encounter no objections can eventually claim that the silent compliance of their fellows confers permission. Thus actual use over the years determines the ebb and flow of rights to the agdal.

Finally, particular and idiosyncratic circumstances have given many people rights to corrals that are not located in the azib "belonging" to their community or

valley. A substantial number of households from the valleys of Sidi Fars and Imnane have corrals and shelters in the Dou Fatfira azib, which is otherwise limited to households from the Oussertak valley. The Dou Fatfira azib is particularly desirable because it is adjacent to the largest hay meadow and is close to a modern ski resort that provides some temporary winter employment. Some families may have acquired rights there when the original sites of their camps were leveled to make way for the ski resort and ski lift. Other people may have constructed shelters to live in while they worked at the resort, expanding these later to include corrals. Still others may have "inherited" rights from in-laws. Recently, however, this proliferation of camps at Dou Fatfira has been stopped. Although the Oussertak insist that they still have the right to construct new corrals there, the Moroccan government has forbidden the construction of new camps.

People from other tribes and from communities not possessing azibs in the agdal may still use it by asking or buying permission from a "friend" to share the friend's corral. Such transactions require approval by the council of users. Many people at Oukaïmedene have been allowed such reciprocal grazing arrangements, but "strangers" are often denied permission and asked to leave. The council determines who is able to construct and occupy the corrals and azibs, and deals with objections raised by users to others' efforts to construct new corrals. The council functions on the basis of consensus, and Moroccan government authorities normally will respect and enforce a consensual decision.

Such councils may levy fines and exclude intruders from the agdal, but the major sanctions against illegal use of the agdal appear to be supernatural. Because Saint Sidi Fars or his spirit supposedly watches over the pasture, those who violate the rules are expected to become the victims of natural disasters and disease. Similarly, the councils at Oukaïmedene cannot easily alter the fundamental rules of use as long as these are believed to be the sacred heritage handed down by Saint Sidi Fars. The opening and closing dates for the agdal, supposedly set over two centuries ago by Sidi Fars, are universally observed and not easily amended. Other rules not as closely associated with Sidi Fars are stretched or their very existence debated.

OUTCOMES AND EQUITY

As a resource management system, the agdal of Oukaimedene is a reasonable success. Even an untrained eye can detect the difference between the quality of pastures at Oukaimedene and pastures beyond the agdal's boundaries. Several desirable forage species that exist at Oukaimedene have disappeared entirely in adjacent valleys. The August opening date appears to ensure that most of the major forage species have time to produce seed before they are grazed.

Resource conservation is probably not the main reason for the creation of Oukaimedene or other agdals. Equity among various user groups was probably the main motivation. Without regulation at Oukaimedene, the people from Ous-sertak could easily use the resources of the whole pasture each year before other groups could get there. Similarly, without regulation of grazing by sheep and goats, the meadows would not produce hay for cattle. Since virtually all families in the tribe own cattle, but the poor generally lack sheep or goats, these constraints on sheep and goats actually favor the poorer families. Similarly, since the race to harvest hay favors families with large amounts of labor relative to the number of cows they possess, the regulations on grazing that maximize hay production also protect the poor families, which have the largest numbers of people and the smallest numbers of cattle.

CONCLUSIONS

If everyone with rights to use Oukaimedene were actually to exercise them, Oukaimedene would be devoid of vegetation. The survival of the agdal is due largely to a combination of technical and social factors. First, the agdal's isolation and distance from villages make its use extremely costly for shepherds from the Aït Mizane and Sidi Fars valleys, so that only large, relatively rich households from these valleys can profitably use the agdal. As a result, a larger proportion of families from nearby valleys use the pasture than do those from distant valleys. In addition to the technical prohibitions on use, there are sociopolitical constraints. A person must either belong to a village that has maintained usufruct rights to corrals and campsites, or have a relative in such a village in order to have access to hay and drinking

water. An individual from a village not possessing an azib will have difficulty establishing a camp. The problems of group membership and the physical characteristics of the agdal serve to limit the number of rights-holders who actually use the pasture.

We studied the Oukaimedene agdal in order to understand this pasture management institution and its implications for resource conservation in Morocco and elsewhere. The closing of the agdal preserves plant cover and protects some desirable forage species. In order to discuss implications of this study for resource management in general, we must first describe some of the differences between Oukaimedene and other agdals.

The first reason for the stability at Oukaimedene is the sacred nature of the agdal as the land of Saint Sidi Fars. Many Moroccan agdals are similarly sacred, but others are primarily secular institutions. In the latter, where the rules are entirely in the hands of the community of users, attempts to change the rules and conflicts over these attempts frequently occur. The poor often try to privatize land suitable for cultivation or hay production, or the groups that live closest to an agdal may reduce the access of more distant users (Bourbouze 1982; Geist and Greg 1984). The councils overseeing the use of agdals are consensual bodies that cease to operate in the context of non-negotiable conflicts, which were traditionally settled by force of arms, but today invite government intervention. In such cases, the state may impose an arbitrary solution that is inevitably unacceptable to some, freezing a conflict in place without permitting the emergence of the new consensus that is essential to the functioning of group decision making.

Another factor that may contribute to the stability of the agdal at Oukaimedene is, oddly enough, the presence of a ski resort. The ski season coincides with the period when it is impossible to use Oukaimedene for pasturing, so in one sense skiing is a complementary resource use. However, conflicts in land use do exist: a ski slope may be an excellent pasture, but stone corrals and shelters are dangerous obstacles to skiers. In addition, there may be conflict over water. Some land that is not now subirrigated has peaty soils, indicating that they were once moist. The large well that serves as the water supply for the ski resort may have altered the hydrology of the lower part of the agdal and thus reduced the size of hay meadows. Thus further expansion of the resort would

threaten the pastoral users of the agdal and would not necessarily benefit any of them.⁵

How then does this potential conflict affect the stability of the agdal? Berber society is segmentary, made up of tribes that are conglomerates of many smaller groups (fractions, sub-fractions, villages, lineages, and extended households), among which conflict is frequent. Traditionally, the various components of society were held together by the need for allies in case of conflict with other groups, but the arrival of the French protectorate at the beginning of the twentieth century reduced intergroup conflict--at least at the inter-tribal level--and thereby reduced the social significance of tribes and similar large groups. Supravillage organizations still have some importance, however, because the boundaries of administrative units in rural areas still largely coincide with the territory of a tribe or a fraction. Conflict at lower levels, among lineages and villages, still continues, so such groups continue to have a high degree of solidarity. In the case of Oukaimedene, the external threat posed by resort development may contribute to the solidarity of those who use the agdal and thus to the agdal's ecological stability.

The Oukaimedene agdal illustrates some management principles for communal pastures. There are many ways to manage a rangeland--through rest, rotation, deferment and control over the timing and intensity of grazing. The case of Oukaimedene suggests that deferment is a desirable approach. If a pasture is visible to users, and if unfavorable weather conditions end the grazing period, it is relatively easy to set opening and closing dates. After a deferment period is set, constant evaluation of pasture quality is not required, and the rights concerning use of the pasture can also be quite flexible. Thus, those without rights may use the pasture occasionally, and likewise the Rhiraya will sometimes graze lands belonging to other groups.

A possible barrier to the extension of these traditional resource management institutions is the fragility of the councils that govern them. These councils are largely consensual bodies that depend on a certain degree of group solidarity. As society changes, Berber groups become increasingly differentiated and it becomes difficult for the councils to operate, particularly when the central government claims a superior right to decide resource use questions. Today, an "injured" minority that objects to a

decision of the council may appeal to government authorities, who will sometimes contravene council decisions that are not accepted by all, and who will even ignore unanimous decisions that interfere with the central government's plans for development. Such intervention can only undermine further the legitimacy of local institutions, already a serious problem because the local councils' decisions have no legal status and are only advisory. The fact that council decisions have no official recognition makes it likely that the councils will be supplanted by the state in regions where economic development is a high priority. If the agdal concept is to be used as the basis for range-land conservation in Morocco, the legal status of the agdal councils must be clarified and strengthened.

NOTES

1. The order of authorship is alphabetical and does not indicate degree of contribution. Field research was begun in the summer of 1983 by Mohamed Mahdi under the direction of Abdellah Hammoudi and Jere Gilles and has continued to the present date. Beginning in June of 1984, Lloyd Mendes joined the team to conduct range and animal husbandry research. Research on the Oukaimedene agdal in was part sponsored by the Small Ruminant Collaborative Research Program, U.S. Agency for International Development Grant No. DSAN/VII-G-0049.
2. Recently, Eighmy and Ghanem (1982) have called into question the utility of the hema system. They imply that the success of efforts in Syria may be due to unique local conditions.
3. The origins of the word agdal are obscure. David Hart defines an "agudal" (plural, "igudlan") as "collective pasture with rigid, fixed opening and closing dates." This is normally what is meant when the word agdal is used in the anthropological literature. Although this is the sense of the word that is most of interest to us here, this is not the only one. Agdal (or agudal) is more often used as a verb to denote the exclusion of grazing animals from a piece of pastureland. Geist and Gregg (1984) note that during the season when pasturing is permitted on an agdal, there is no agdal. A second sense of the word used among traditional agro-pastoralists of the Western and Central High Atlas is that of a meadow or a prairie. In the Rhiraya Valley and in adjacent areas, small private hay meadows are also given the name agdal. Thus the word agdal can be the act of exclusion or a particular place, and its use in everyday speech seems to combine both of these.
4. Muslim holy men played an important role in maintaining the structure of Berber society. Successful ones (saints) founded religious lodges (zaouia) that were houses of

learning and places of mediation for various Berber groups. These lodges were generally located between the territories of tribes or fractions. One way in which land could be made open to two conflicting groups was to make it sacred land "belonging" to a saint--like the Oukaimedene agdal.

5. The only way that those using the agdal might benefit from the expansion of the resort would be if the site of their corrals and shelters could be developed for the construction of a ski chalet.

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Socioecology of Stress: Why Do Common Property Resource Management Projects Fail?

Anil K. Gupta



INTRODUCTION: A SOCIOECOLOGICAL PERSPECTIVE

In a stratified rural society, different classes of landless pastoralists or cultivators-cum-pastoralists can be expected to have varying stakes in protecting the environment. They also have differing expectations of the kinds of assurances (see Runge, this volume) that they should receive from the various institutions that control resource use. These expectations may vary over time depending on the extent to which the availability of the resource is affected by environmental change. However, other factors, separate from the vicissitudes of the environment, also alter expectations: accumulated deficits or surplus in household budgets, mobility patterns, and simultaneous operations in factor and product markets alter the amount of insurance that different classes seek to cover risks in the future supply of common resources. The implication is that "assurance" institutions that serve different classes, and hence that have varying obligations, do not emerge only through changes in factor prices alone. The central question thus is how such assurance was provided in traditional societies and why modern projects frequently fail to provide it.

This paper offers a brief discussion on the socio-ecological perspectives for explaining differential stakes of various classes in environmental management. Then,

using the conference framework, a case study is presented, followed by some tentative policy implications as well as questions for further research. The focus is on agricultural endeavors in drought-prone regions.

The key ecological and institutional characteristics of drought-prone regions are listed below:

- o Low population density
- o High risks inherent in various crop, livestock, craft enterprises
- o Current level of farmers' technology generally geared towards risk minimization rather than profit maximization.
- o Uncertainty of rainfall and lack of local employment opportunities that invariably lead to seasonal (or to some extent permanent) migration with the implication that often the households are managed by the women or the old people
- o The capital absorption capacity is very low with the result that the institutional infrastructure is very poor
- o Social and cultural networks are characteristically different from the irrigated regions, particularly with regard to the extent of traditional forms of cooperation and pooling of resources that exist in such regions to augment the extended family systems.

The key element of the socioecological perspective is that the ecology defines the mix of economic enterprises that different classes of farmers have found to be sustainable in a given environment. Different classes operate different enterprises at varying scales, depending on their respective access to credit, product, and labor markets. Thus, when we find larger farmers owning predominantly high-value grazers, while the poor own browsers (as was the case in our study), it is not difficult to deduce the amount of access and resource use options accorded to each. Not surprisingly, each group had different perceptions of and responses to risks. It appeared thus that different classes of farmers used different measures (i.e., discount rates and time periods) to appraise their returns in various resource markets depending upon their knowledge, skills, resource advantage, and future expectations as well as their current or projected surplus, subsistence, or deficit budget conditions. The cash flows resulting from the risk-return trade-offs might

be more unstable for some than for others; some households accumulated surpluses while others became chronically in debt. The decision-making options of such farmers were obviously different, as were their investments in the level of productivity of the environment.

One of the characteristic responses of different classes to changes in the environment (availability of dry matter from common grazing lands to supplement the fodder from private lands) has been to modify the livestock/space mix, which often exacerbates ecological imbalance. Studies have shown that in the event of drought, farmers-cum-pastoralists tried to dispose of heavy grazers (cattle and buffalo) first and browsers (sheep and goats) last (Gupta 1984a). Consequently, a region that has faced successive droughts may well become biased in favor of browsers instead of grazers, particularly if large-scale population migration is prevented through public investments in drought relief.

When we summarize the important bearing of this approach on the Oakerson framework, the policy implications become richer:

- o The fact that livestock species-mix is class- and eco-specific implies that in any region the technical and physical conditions of resources endowment would be defined differently by different classes. In other words, the catchment area where the dry matter is derived for sustenance of the livestock would vary in a characteristic manner for different classes.

- o In view of the above, the village common lands' vulnerability to degradation would also be different. At the same time, rich and poor may be disinterested in protecting common land for very different reasons. The rich have access to dry fodder from crop residues; in the main, they own grazers that do not migrate widely, hence their dependence on commons is relatively small. The poor, on the other hand, own smaller individual herds biased in favor of browsers that demand extensive labor mobility; their payoff from the increased dry matter supply from the village's commons is therefore not significant. However, in cases where male members migrate from an area and the households are headed by females or older

people (which is quite common in drought-prone regions), the commons may become seriously degraded without much concern from the herders, whose household cash flow is never great and who would require a significantly higher payoff to be induced to change their habits of resource use.

- o The discrepancies in access to commons as well as to such private lands such as fallows (which were generally used as common grazing land in the dry season) require that the Oakerson framework be applied from the perspective of those who are losers in the game, instead of from a holistic or a community perspective.

SHEEP AND PASTURE DEVELOPMENT PLOTS: A CASE STUDY

Under a World Bank project (World Bank 1974) for development of drought-prone areas, 100-hectare sheep and pasture development plots were established in 1974 in the Jodhpur district of Rajasthan state, an area of 222,860 sq. km, and population (in 1971) of 1.152 million. The key objectives were the conversion of lands not used for agriculture, the maximum utilization of rainwater, the prevention of migration of people and animals in famine years and, to achieve all of these, the organization of a cooperative of the weaker sections of sheep breeders. These plots thus were to provide demonstrations of technological alternatives for better rangeland management and possibilities of group action through the organization of sheep growers' cooperatives. In all, 49 plots of 100 hectares each were developed between 1974 and 1984.

Jodhpur district had a livestock population of 1.89 million in 1971. The mean rainfall ranges from 425 mm in the southeast to about 200 mm in the northwest. Traditionally, the private fallow lands were also treated as common land, although this practice is becoming more and more restricted. Cultivators have begun objecting to the use of their fallow lands by other pastoralists, sometimes to the point of violence in many parts of the country.

The pasture plots were to cover only a fraction of the total waste common lands in the district; nonetheless, the expectation was that once local people were convinced of the utility of restricted grazing they might choose to

develop institutional alternatives for conserving the village common land and private wastelands as well. The program was to organize cooperatives that would buy share capital (preferably in kind, i.e., sheep). In general, the most degraded land was selected for initial improvement. It was expected that after the full development of the plots, a maximum of 400 sheep could be maintained on a year-round basis in each plot.

One of the first pasture plots established on degraded auran lands in Bhawad village was selected for detailed analysis. (The word auran is derived from the Sanskrit word aranya, meaning forest. Historically, auran was a traditional institution signifying the concern of the people towards conservation of common lands.) In these lands, grazing was restricted; not even twigs from dead trees were collected for domestic consumption. People were restrained from using auran land for any individual purposes because the land was dedicated to various gods or goddesses respected in the region; the use of any water source was also restricted. In general, the carrying capacity of a plot could never increase beyond 33 adult cattle because of successive droughts.

The soils at the study site are shallow, poorly drained, severely eroded, saline and alkaline in nature, and have very low organic matter. The temperature ranges between 2°C and 45°C, and the rainfall pattern is extremely erratic, with an annual average of around 300 mm. Because of excessive grazing pressure, such coarse grasses as Aristida spp. and other useless herbs (such as Techrosis spp.) had been dominant in the area (Joshi and Jain 1979). Cenchrus ciliaris grass was seeded in the plot.

The plot is located at the intersection of two different ecological units. (The village of Bhawad is situated in ecological unit number one and borders on ecological unit two.) The southern part of the district has a high aridity index, shorter crop sowing season, and low rainfall probability; the result is that the cultivable area is suitable generally for short-duration pulse crops. Longer duration millets could be cultivated in the northern ecological unit. Population density, livestock species-mix, settlement patterns, and institutional arrangements for resource use and conservation were different in each part of the plot. In the region having higher stress, (i.e., ecological unit number two), the settlements were scattered, population density was lower, the proportion of browsers (in particular, goats) was higher, and reliance on non-farm activities, (including

drafts) was also greater. Interestingly, it appeared that zuran had survived more influentially as a mechanism for managing common lands in ecological unit number two.

Other distinctive features of technical and physical attributes of the total plot were as follows:

- o The proportion of goats in the total livestock had increased from 16.6 percent in 1951 to 35.6 percent in 1971; cattle and sheep had declined over the same period from 32.1 percent and 45.0 percent to 22.5 percent and 36.1 percent, respectively (CAZRI 1982).
- o The fodder deficit during the same period was estimated to have increased from 44 percent to 55 percent (Gupta 1984b).
- o The population of cattle, buffalo, sheep, and goats had changed between 1951 and 1971 by 7.96, 17.3, 23.39, and 229.89 percent, respectively. The dynamics of degradation thus were reflected in the changed species-mix of livestock. Goats were much more widely distributed amongst economic classes and ecological regions than were sheep, which were restricted more to the poor in the arid west (Gupta 1984b).

Formal decision-making arrangements were based on complex processes and requirements as described below. A member of a sheep and pasture development project was required to be a resident of the village where the project operated and had to be a sheep breeder. His written application had to be approved by the majority of the management committee, and he should purchase at least one share. No one would be admitted who had been convicted on any criminal charge (per the provision of Rajasthan Cooperative Society Act and Rules). A preference was to be given to small, marginal farmers and agricultural laborers (for example, sheep owners who would like to purchase equity with specified livestock). A guaranteed return of 25 percent was assured to every shareholder. Individual members provided a sheep in lieu of the share capital so that they would have greater attachment to the project. The sheep and wool department of the state government had appointed stockmen at each plot to take care of the health of the animals and to protect against unauthorized intrusions. Although each plot was fenced

with barbed wire, it was not uncommon to find the fence broken.

The president of the management committee of the pasture plot was one of the richest persons in the area. The members of his family owned about 25 percent of the total land and 45 percent of the cultivable land. They also had the most livestock, and a very high proportion of cattle. All of the good tube wells in the village belonged to this family (a total of six). The president of the sheep and pasture development society was also the village head-man, vice president of the dairy cooperative, and exercised influence over almost every other social activity. He belonged to the Rajput caste, which, although not the leading caste in sheep production, dominates the panchayat.

In the beginning, the "advance" team (organized by the department of sheep and wool development) was to try to persuade people (particularly those who owned sheep and goats) of the advantage of developing common land into pastures through cooperative societies. But in the push to launch the project and under political pressure from the Rajputs, the major objective of having the poorest shepherds form societies and nominate their management committee was sacrificed. Moreover, the project failed to consider that access to the common lands differs on the basis of social class. The land closest to the village was selected, although it was not representative of the worst parts of the common lands.

The management group, composed of three government representatives and four members of the society, was supposed to be representative of and accountable to all the members, yet most members could not explain anything about the actual decision-making processes or how they received income from the sale of their grass seed, sheep, and wool.

Many of those who were eligible to become members did not even know about the society when it was started, and others were skeptical about the benefits of participating in such a small project: even if the plot could carry 400 sheep belonging to 34 members, it could only deal with a fraction of the total problem. In fact, the village did not agree to fence the common land through collective decision making. The political dominance of the panchayat by the Rajputs ensured that the plot would be established in spite of opposition.

The plot should have been handed over to the people after four years of operation--that should have been in

1982--but it continued to be managed by the department, who feared the total disintegration of the plot.

The fence had been intact in the earlier years, but had broken down at several places over the life of the project. Several explanations were put forward:

- o Many people in the village were upset because they had not been included in the cooperative society but felt they deserved to be included.
- o The two watchmen posted at the plot could not effectively guard the 100-hectare plots.
- o Since the plot was located just next to the village, the farmers who had their fields on the other side of the plot had to take much longer routes to reach their fields. They felt that they did not gain anything by cooperating and protecting the fence.
- o Some people said that before the plot was fenced everybody grazed their animals on the common lands, but once the plot was developed, the benefits accrued only to the members.

It is difficult to isolate the contribution each factor made to the deterioration of the fence. It is important to note that most of the plots where fences remained intact were located in the ecological unit number two, where environmental stresses were higher.

The pattern of interaction can be studied by first determining the relative importance of livestock and land in the household enterprises of different classes. The households having more land than animals would have different perceptions of the benefits and costs of cooperating to preserve the commons than would those with the opposite situation. The landed class, in view of its access to fodder from private land, did not feel vulnerable even if the commons were degraded. On the other hand, those whose wealth lay in livestock found that the commons provided a very small share of their total grazing requirements. The lack of cooperation to protect the commons thus emerged for different reasons; this is one aspect of the tragedy of the commons that remains understudied.

It is also important to note that successive droughts in this region, coupled with excessive grazing (even if in the short run) have effected changes in the successional

profile of biomass. During monsoon, such species as Tephrosia spp., Indigofera spp., Crotalaria spp., Cyperus spp., and Cenchrus biflorus suppress the development of perennial species. Many of these species are of very low nutritive value, and being annual, leave soil bare and subject to wind erosion for the greater part of the year (Jodhpur Team 1980). The implication is that once the degradation has reached a particular level, mere conservation or restraint would be insufficient to provide the necessary regeneration of perennial and desirable grass species; a technological change--seeding proper species--would be required. Therefore, management of such commons must not merely reinforce controlled grazing but should also devise a strategy for sharing the costs of instituting technological change. Often, these costs have been borne partly or fully by the state. However, in providing these funds, the state failed to assure that (1) alternative sources of fodder and water would be available during the stress period, and (2) the value added through government investment and supply of restraint would be shared equitably among different classes and not merely in proportion to respective stocks as is often done.

In contrast to these formal decision-making arrangements and patterns of interaction, the traditional approaches to managing auran land invoked religion and moral sanctions to effect the desirable collective behavior. These sanctions could not be questioned while the rules of the game were evolving.

Pasture plots unquestionably resulted in increased grass cover and in conservation of water in the underground tanks. But the costs of conservation were very high--the iron fencing was expensive, and the project required a heavy investment of manpower to supervise the arrangement. As a consequence, the project, and hence its benefits, are difficult to replicate.

During the past decade, only a fraction of the total land has been conserved by this arrangement, and wherever management has actually been handed over to the people, the fence has broken down. The basic question of equity--reasonable and fair return to respective contributions--could be answered with a statement from Oakerson (this volume): "Indeed the presence of inequity may lead to the collapse of collective efforts, resulting in inefficiency. Equity problems are exacerbated by asymmetries among users, which create opportunities for some to benefit at others' expense."

The basic purpose of 100-hectare sheep and pasture

plots was "to demonstrate [to] the farmers how the carrying capacity of the existing degraded land could be increased by adopting scientific methods and utilizing the moisture for longer periods, thus increasing the productivity of [the] same lands substantially...[as well as] to demonstrate...[that] adopting sheep husbandry practice [could] increase the income without...any further [investment]" (Jodhpur Team, n.d.)

Indeed, if the purpose of these plots (and other extension measures) was to demonstrate that restricted grazing would lead to increased grass cover, one must acknowledge that the project succeeded admirably well. However, the fact that auran land in many villages was not only better conserved, but still had much denser growth of trees, bushes and grass, should have provided the same demonstration. Thus, the appropriate question for the sheep and wool department to address should have been: "why did traditional decision-making arrangements generate diverse outcomes like protected auran land in some villages and degraded common lands in other villages?" Yet, such a question was neither explicitly raised nor implicitly answered. Instead, it was assumed that people in arid regions did not know the advantage of restricted grazing.

There also remained a case for improving veterinary practice and enhancing the common lands (with better grass seeds), both of which would have reduced sheep mortality. But in a system already as iniquitous as this one, and one that had no mechanism for keeping disparities in check, technological changes that improve returns on existing investments (in this case, sheep) only widen the gap between "haves" and "have nots." The uncertainties leading to individually optimal but collectively suboptimal outcomes were not reduced. The official review of the pasture and sheep development program acknowledged some of these problems:¹

- o "In the village there is a tough competition between cattle versus sheep for grazing. Because of lower socioeconomic status of the sheep breeders, most of the grazing facilities in the community grazing lands are utilized by the cattle breeders for their cattle and buffaloes. Sheep population is forced to the rocky and most unproductive areas and the Gochars and other productive pastures are allotted to them after they have been consumed by the cattle. In such a situation, it is very difficult to teach the whole of the village

people to offer their community grazing land patches...[as] sheep pastures (only for a particular society's livestock)." (Jodhpur Team n.d.)

- o The total production on the 100-hectare plots was very low and could not sustain a large number of animals. Further, because of low rainfall and longer periods of dry spell, the establishment of perennials posed serious problems.
- o In whichever case, the plots had a better grass cover compared with the adjoining community lands, but the fences were broken and frequent conflicts ensued between owners of plots and villagers.
- o As a result of frequent droughts, unpalatable shrubs (like Tephrosia) have come to dominate the plots and further reduced the grazing potential.
- o Because the government was not sure whether it wanted to continue the scheme (or even expand it with modifications), members of the society were reluctant to use their sheep as share capital on the plot.
- o Management problems, already severe, were exacerbated because the village extension workers in charge of the plots were often transferred.

The initial phases of establishing the pasture plots were often marked by resistance from the villages (so much so that in some cases the fencing had to be abandoned even after the pillars were erected), yet no effort was made to study the farmers' response systematically. This project suffered from a typical development problem: technical solutions were offered for what were basically institutional difficulties; not surprisingly, such pilot projects have never been replicated.

Using Oakerson's framework to analyze the lack of congruence between the physical and technical resources and the decision-making arrangements, we can see how counter-productive patterns of interaction led to undesirable outcomes. Even more disturbing is the fact that the national grazing policy (Ministry of Agriculture 1984)

evidences no appreciation for the potential conflicts inherent in any strategy to manage common property.

The report of the Task Force to Study All Aspects of Grazing and Fodder to Evolve a National Grazing Policy includes the familiar recommendations (Ministry of Agriculture 1984):

- o The number of livestock should be reduced and unproductive animals should be replaced with productive animals so that the land use plan could be developed for both community and waste land. In the scarcity-prone areas, arrangements should be made for maintaining fodder banks.
- o Migration of livestock should be stopped; the herdsman should be held responsible for any damage caused to the agricultural fields and various plantations.
- o Nomadic tribes should be permanently settled.
- o People should be encouraged to adopt the system of stall feeding.
- o The panchayats should take responsibility for ensuring rotational grazing on common lands.
- o Regional fodder depots should be established.
- o Critical areas (e.g., the catchments of major rivers) should be closed to grazing.
- o Sheep and goats should be prohibited in the forest areas.
- o Extension programs should be initiated to inculcate public awareness leading to cooperation.

These suggestions do not incorporate any attempt to understand and address conflicts that have arisen from historic inequities in the pattern of resource ownership and their implications for the management of the commons. It has been assumed that the landless communities, faced with the degraded commons, irrationally concentrated on raising sheep and goats because these animals require less fodder than do cattle or buffalo. Yet the landless were also confronted with two other problems: the intensified use of private cultivated lands by the landed communities (which reduced their access to private fallows) and the increasing price of dry fodder. It may be that raising sheep and goats was entirely sensible under the circumstances.

The problem of degradation of commons should not be considered in isolation of changes in private lands or in the variations in the availability of dry fodder. A dry

fodder market has emerged in the few years consequent to the large-scale efforts to encourage livestock development in nontraditional irrigated cash crop regions. As a result, dry fodder has moved from one place to another, thus restricting local supplies, particularly in drought years, and intensifying the pressures on the commons. Recent government efforts to encourage afforestation by closing the roadsides or other areas where moisture retention may be higher has further increased the demand for commons use.

FUTURE OPTIONS

Basically, four parameters influence the extent to which any value-adding cooperative enterprise will generate socially desirable outcomes:

- o The proportion of value addition that is used as dividend, replacement cost, maintenance fund, and most importantly, risk fund to ensure the risks that poor people take when they pool in the enterprise.
- o The share of value addition that is used to diversify the resource management strategy so that the skills or resources of the poor members of the cooperative are used in higher proportion.
- o The extent to which the transfer pricing arrangement is used to reduce the income disparities (by charging, for example, higher prices for the same services--e.g., veterinary services--to wealthy members and lower prices to the poor members). It may be added here that the differential pricing of services is easier than is differentially pricing the various inputs.
- o To the extent to which the pooling is independent of redistribution.

It must be appreciated that in any state intervention, the case for pricing mechanisms that bias the outcomes of the intervention in favor of the poor are justified by constitutional obligations in most developing countries. These obligations are embodied in the socialistic objectives to which many developing countries have subscribed. It must also be noted that market forces will always try to

intensify the inequities in a manner in which the resource-use options would invariably be different for different classes of producers. Finally, if the development of common lands is intended to expand the decision-making horizon of the poor and to constrict or equalize the influence of the wealthy, then one cannot belittle the role of assurance mechanisms as argued by Runge (this volume). Given the class conflict in the rural society, these assurances would work only if different rations of assurance were properly accorded to different sections of the society, and the supply of restraint expected from these classes were specified.

These assurances must take cognizance of the varying levels of risk in different resource markets. The same risk phenomenon is subjectively perceived as being different by different classes of users of a resource depending upon their access to institutions and their historical experiences with the way the state and market forces respond to scarcity. Thus, different classes will require different degrees of assurance before they will invest in a common property resource. Classes that are less vulnerable to deprivations resulting from a degraded commons may need only minimal assurance about their future returns from restrained exploitation. On the other hand, the classes that are more vulnerable will want assurance of alternative means of subsistence in the short run and high degrees of long-term assurance about sustained supply of resources from the common property. It is our contention that the kinds of institutional innovations that would provide these different degrees of assurance likely will not come about through the play of market forces alone; positive state action that draws upon the principles of traditional resource management very likely will be necessary; clearly, the institutional arrangements in this case did not in any way provide disproportionately higher returns to the poor landless shepherds.

Because the reasons for noncooperation by the poor and by the rich are different, it is important that one take into account the implication of these differences for any institutional solution. Using a multi-market socio-ecological framework with proper recognition of historic inequities in resource use might sharpen the Oakerson framework in such a way that new and viable options could be discovered.²

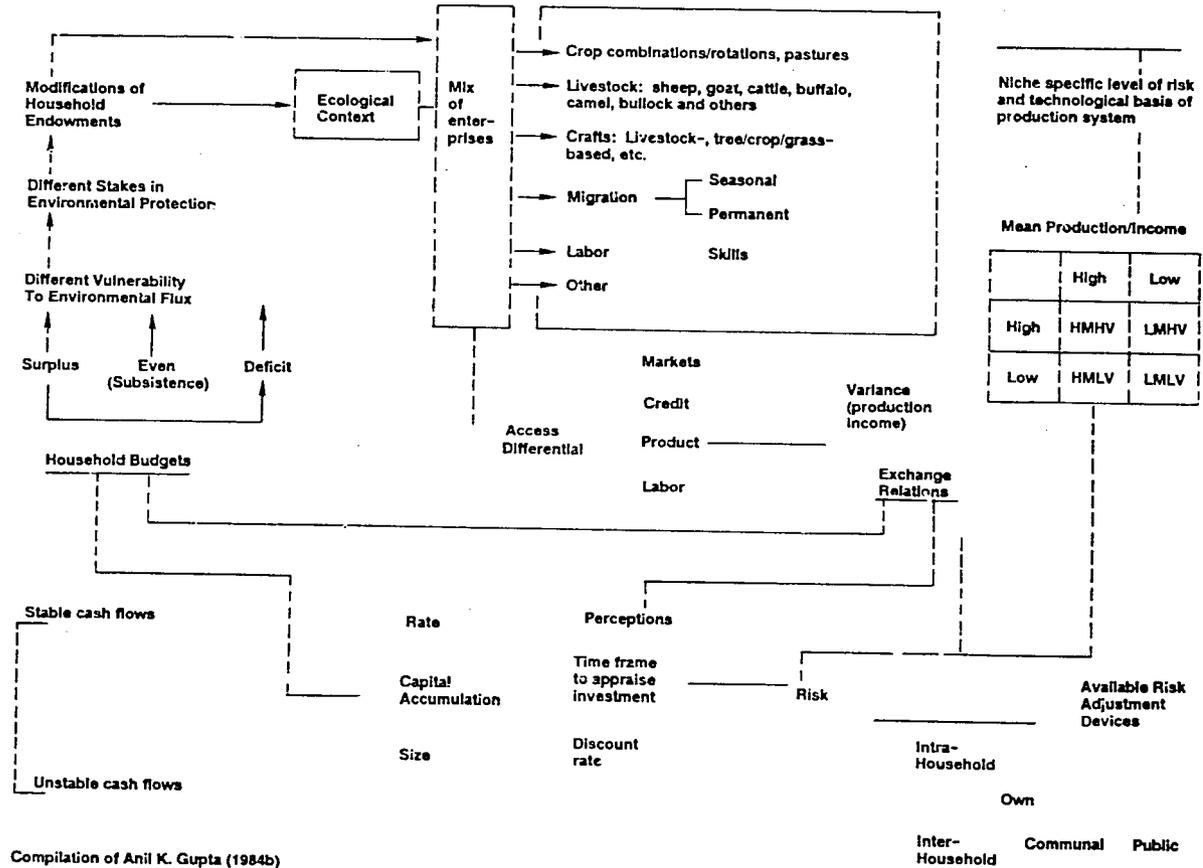


FIGURE 1 Socioecological framework for analyzing household economy.

NOTES

1. It is obvious that the conflict that was finally recognized after 10 years of project operation could have been anticipated from the beginning, yet neither the World Bank report (in 1974) on the subject nor any other evaluation except by the author (Gupta 1981) noticed the conflict so as to modify the project design.
2. The theoretical implications of various aspects of common property management are briefly discussed in a separate paper (Gupta 1985). Managing common properties: some issues in institutional design. The concept of scarcity, role of redundancy in rule making, and the role of state vis-à-vis assurance mechanism are discussed.

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Commonfield Agriculture: The Andes and Medieval England Compared

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INTRODUCTION

Commonfield agriculture is one of the most distinctive and the most intriguing manifestations of common property resource management--distinctive because of its peculiar blend of private and communal endeavors and its complex patterns of decision making and interaction; intriguing because farmland is inherently divisible, there being no technical or physical reason why individual holdings should not be managed on an entirely private basis. That this has not been the case in many parts of the world over remarkably long periods of time is consequently a matter of very considerable interest.

Four key attributes define the core dimensions of commonfield agriculture (Thirsk 1964). First, the holdings of individual cultivators comprise many separate parcels scattered among unenclosed commonfields. Second, after the harvest, and usually during fallow years, these commonfields revert from private farmland to communal pasture ground, as all villagers exercise their customary right to graze their animals on the herbage temporarily available on the arable land. Third, common rights extend beyond mere stubble grazing: in commonfield agrarian regimes, villagers also enjoy the collective right to gather peat, timber, and firewood from common pastures and fallow fields. Finally, regulation and supervision of the

entire system is provided by an "assembly of cultivators."

Any of these features may be found in isolation in other farming systems. Many pastoralists, for instance, graze their stock communally. Village councils rule Himalayan, Swiss, Andean, Japanese, and Vietnamese peasant communities (Rhoades and Thompson 1975; Popkin 1979). The simultaneous occurrence of all four traits, however, is more rare; we see it only in selected parts of Europe, New England, the central Andean highlands, Mesoamerica, India, the Middle East, and West Africa.¹ The two- and three-field system of England is probably the best known of these systems and certainly one of the most systematized and regularized. In its case, historians now believe that the four elements noted above only coalesced after a long gestation period, possibly in the 10th and 11th centuries. Thereafter, the system endured in some parts of the country until well into the 19th century.²

No single definition is likely to capture all the subtleties of an agrarian system found over so wide a geographical area and so long a period of time. Nor is any one theory likely to explain the causal factors responsible for the emergence of such a complex system in so many geographical areas and sociopolitical environments. What this exploratory essay therefore offers is a systematic comparison of the technical and physical attributes, the decision-making arrangements, and the patterns of interaction among users of commonfield systems found in two widely separated parts of the world: the Central Andean highlands and medieval England. This comparison is less far-fetched than might at first appear for, despite vast difference in the material underpinnings of these two commonfield regimes, they manifest striking similarities in their functional attributes, demographic patterns, and evolutionary trajectories.

Current knowledge and understanding of Andean commonfield systems may be deficient, but, as Marc Bloch once remarked, there are times when synthesis, comparisons, and the formulation of interesting problems contributes more to an understanding of cultural phenomena than would further detailed case studies. Accordingly, this essay is offered as a first step in the development of a genuinely cross-cultural understanding of commonfield systems.³ It also serves the more immediate function of helping to frame questions and rank priorities for further research. Above all, in the wider context of the present volume, it furnishes two very illuminating cases of highly developed and successful common property management systems.

HISTORICAL BACKGROUND OF THE TWO SYSTEMS

English and Andean commonfields are far removed from each other in time and in space. In England, commonfield farming is a thing of the past. Today, only a solitary, deliberately preserved, commonfield township survives--at Laxton in Nottinghamshire (Anonymous 1980). In contrast, in Peru and Bolivia, commonfield farming continues to be practiced over an extensive geographical area.

Precisely when and how commonfield farming came into being in England remains a matter of considerable debate. Nevertheless, there is general agreement that the system reached its heyday during the early Middle Ages, from approximately the 10th to the 14th centuries. Throughout that period, commonfields were expanding and developing: by its close, approximately two-thirds of England's population lived in commonfield townships (Baker and Butlin 1973; Dodgshon 1980; Campbell 1981a; Rowley 1981). Thereafter, the prevailing trend, with certain exceptions, involved increasing consolidation and enclosure, so that by the close of the 17th century England had become a country in which farming in severalty (i.e., with land held by an owner in his own right and not jointly or in common with others) predominated (Wordie 1983).⁴

It was at this same time that a fully fledged commonfield system seems to have been crystallizing in the Andes, as native systems of husbandry were transformed under Spanish colonial influence. Almost everything remains to be learned about the history of these commonfields, but fragmentary evidence suggests that it was during the 17th and 18th centuries that the system became most widespread (Chevallier 1953:60; Gade 1970; Custred and Orlove 1974; Malaga Medina 1974; Gade and Escobar 1982). Since then, these commonfields have also begun to succumb to alternative methods of land management.

TECHNICAL AND PHYSICAL ATTRIBUTES OF ENGLISH AND ANDEAN COMMONFIELDS

Entirely different though their respective chronologies of development may be, both commonfield systems share the same fundamental physical attribute: arable fields made up of myriad unenclosed and intermixed parcels. This is the one abiding feature of all commonfield systems and it is from this that associated decision-making arrangements and patterns of interaction spring.

Thus, rights of stubble grazing and the communal regulation of cropping are most satisfactorily interpreted as responses to the problems of farming in subdivided fields. That being said, subdivided fields could exist quite independently of such rights and regulations: the latter were by no means axiomatic upon the former.

In Andean and medieval English commonfields, the degree of subdivision was often extreme. The community of Irpa Chico in Bolivia, for instance, possesses six great fields in which Carter and Mamani (1982:26-27) noted some 11,000 separate parcels. These mostly ranged from 1,200 to 3,000 square meters, with some diminutive plots, and others as large as 24,000 square meters. In England, the size range of plots was narrower, although some diminutive plots did exist. At Martham, in Norfolk, for example, the land held by the peasantry was divided into at least 2,500 separate plots at the end of the 13th century, with an average plot size of 2,000 square meters and a significant number of plots measuring 1,000 square meters and less (Campbell 1980).

There has been much discussion of the reasons for this most distinctive form of field layout. It has recently been suggested that dispersed holdings may represent a strategy of risk minimization. The Andean evidence lends some support to this interpretation, insofar as plot scattering increases with altitude, which is positively linked to higher natural risk factors (McCloskey 1976; Dodgshon 1980:22-25 and 45-46; Figueroa 1982:127, 129, 132; McPherson 1983). Yet, although plot scattering may reduce the risk of wholesale crop failure, there is no unequivocal empirical evidence to show that it was actually undertaken with this express purpose.⁵ Indeed, it may have arisen from entirely different motives. Thus, in England, several studies have demonstrated that piecemeal colonization by groups of cultivators, together with the repeated partitioning of holdings between heirs, and the sale and exchange of portions of land between different cultivators, were all capable, over a period of time and under conditions of population growth, of creating subdivided fields from formerly consolidated holdings (Bishop 1935; Baker 1964; Sheppard 1966; Campbell 1980). When the rules governing the transference of land permitted, population growth was likely to lead at one and the same time to an extension of the cultivated area and the fragmentation of established holdings. As population expanded, so holdings proliferated, individual parcels became smaller, and the degree of scattering increased.

In this context, it is significant that partible inheritance, whose contribution to the formation of subdivided fields in medieval England is now well established, is still practiced in many Andean commonfield communities today. Other things being equal, such inheritances are likely to ensure the persistence of a highly subdivided field layout.⁶

Notwithstanding the high degree of parcellation in both English and Andean commonfields, it would be misleading to represent their physical appearance as at all similar. The shape of the parcels and the way in which they were organized into fields differed due to the contrasting technological and ecological circumstances under which the two systems evolved.

English commonfields were developed for the most part on level or gently undulating terrain and in conjunction with a plow technology and mixed grain and stock economy. Indeed, the plow was arguably the single most formative influence upon the morphology of English commonfields. As Langdon has shown, three main types of plow were in use by the 13th century: the wheeled, foot, and swing varieties (Langdon 1983).

Wheeled plows were more likely to be drawn by horses than were the other varieties (on the lightest soils, a team of only two horses would sometimes suffice), and in distribution were confined to the southeastern counties and parts of East Anglia. This pattern is partly a function of soil conditions, but it also reflects social, economic, and institutional factors, insofar as the adoption of horse traction entails a greater emphasis upon the production of fodder crops, notably oats; this, in turn, is associated with higher labor inputs and the kind of intensive cultivation systems that, at this date, were only found in conjunction with the more loosely regulated commonfield systems.⁷

Elsewhere in the country, swing and foot plows predominated, the ox was the principal plow beast, and plow teams were often large--usually eight animals, but sometimes ten, or even as many as twelve. Again, this is partly because of physical conditions, as large, slow ox teams were a necessity on the heavy clay soils of much of lowland England; but it also correlates with lower population densities and cultivation systems that placed greater emphasis upon fallowing, with a corresponding dependence upon natural rather than produced fodder. These conditions obtained in much of those parts of central and southern England where commonfield farming was most strongly

developed, so there was a general association between foot and swing plows, large ox teams, and regular common-field systems. Finally, it was for the simple but obvious reason that these large teams were cumbersome to manage and awkward to turn that individual parcels within the common-fields acquired their characteristically long, sinuous, and strip-like shape (Eyre 1955).

The prevailing plow technology can also be credited with creating the equally characteristic micro-relief pattern known as ridge and furrow. This resulted from the repeated turning of the sod inwards, towards the center of the strip, which the fixed mold-boards (it was the mold-board that turned the sod) of medieval plows made unavoidable. The boundaries between strips thus became marked by furrows, which had the additional advantage on heavy soils of assisting drainage (Beresford 1940; Kerridge 1951). A buildup of soil also resulted at the end of each strip from the action of turning the plow: the resultant "headlands" often became so massive that they may still be identified from aerial photographs, even where the associated strip pattern has long since been plowed out (Hall 1981).

Land hunger during the 13th century pushed the cultivated area of most commonfield townships to its physical limit, so that property boundaries became clearly demarcated (double furrows, grass balks, and marker stones and posts were all used for that purpose) and property rights--private as well as communal--became jealously guarded.⁸ Odd patches of ground were sometimes left untilled within the commonfields for reasons of shape, accessibility, or soil conditions; these were usually utilized as a valuable supplement to the otherwise meager pasturage resources. For the most part, however, commonfields were very regular and only appeared fragmented and haphazard in areas of broken relief, poor soil, or bad drainage (Elliott 1973). Even then, they still bore little physical resemblance to the commonfields of the Andes.

Andean commonfields occur in high mountains, where the terrain is extremely fractured, and where cattle, and especially plow oxen, have difficulty in adapting to the altitudes. The commonfields are distributed over a very extensive geographical area: they have been found as far north as Huanuco in Peru and as far south as Macha, Department of Potosi, in Bolivia. Within this zone, they lie at 3,000-4,000 meters above sea level on both the eastern and western flanks of the Andes, including the altiplano.

Throughout this area, yoked oxen are employed for plowing only in the lands surrounding Lake Titicaca, and on the flatter patches of the Bolivian plateau. Elsewhere, plow animals are precluded by the rugged topography, easily degradable soils, and risk of hypoxic stress (Guillet 1981). For these reasons, and partly because the principal crops are roots and tubers (notably potatoes), the predominant tool of cultivation is not the plow but the digging stick (chakitaclla), supplemented by picks, shovels, and scythes for planting and harvesting (Gade and Rios 1976). Individual parcels of land are therefore free to assume every conceivable size and shape, a phenomenon that is encouraged by the steep and broken slopes and stony soils.

In consequence, the typical appearance of Andean commonfields is a mosaic of irregular parcels, many of them Lilliputian in scale. The boundaries between these parcels are often vague; they include natural features, untilled land, marginal pasture grounds, and upended sod blocks. The same applies to the commonfields themselves and the boundaries between them, which tend to be zones rather than precise lines and are usually demarcated by small piles of stones (mojones) or natural landmarks (Godoy 1985). This endows commonfield agriculture with an element of flexibility. for cultivation can be expanded or contracted as required according to demographic changes and altered land requirements (Mamani 1973:93). It also produces a different agricultural landscape from the neatly aligned arable strips of lowland England.

DECISION-MAKING ARRANGEMENTS IN ENGLAND AND THE ANDES

Pronounced though outward differences may have been, both English and Andean subdivided fields presented their dependent cultivators with the same basic problem: how were cropping and grazing to be organized in fields that were so parcellated? In particular, how was advantage to be taken of the valuable opportunity that fallow land afforded for feeding livestock and fertilizing soils? In medieval England, the need to utilize the fallow grazings was especially acute, for in many townships (especially in the counties of the East Midlands) the area of arable land had been so expanded that permanent grassland was in very scarce supply (Fox 1984). Yet livestock remained an indispensable adjunct of arable production both for traction and manure. In the plowless Andes, the need was

different. What was important here was the conservation of soil fertility in a mountain environment where soils are deficient in nitrogen, phosphate, and potassium and easily degradable (Crawford et al. 1970; Eckholm 1976; Orlove 1977:119; Ravines 1978a:3-74; Thomas 1979; Brush 1980). Indeed, adequate dunging of the soil (usually by flocks of sheep and llamas), is essential to the successful cultivation of one of the region's main staples, the potato (LaBarre 1947; Winterhaider et al. 1974; Camino et al. 1981; Brownan n.d.).

It is in the context of these ecological requirements that the adoption of communal decision-making arrangements must be interpreted. The precise nature of these arrangements depended upon environmental, technological, demographic, and sociopolitical circumstances, which is why England, for example, contained so many different types of commonfield systems (it remains to be established whether the same applied in the Andes, although this is a priori likely).⁹ These systems differed from one another in both form and function, possessed distinctive geographical distributions, and followed separate chronologies of development. Apart from subdivided fields that were devoid of communal decision-making arrangements, two basic generic types of field systems can be identified: irregular commonfield systems and regular commonfield systems. Within the former category, further distinctions can be drawn among systems in which there was no regulation of cropping, systems in which there was some regulation of cropping, and those where, very occasionally, there was complete regulation of cropping. This last feature was, however, more typical of regular commonfield systems, whose distinctiveness lay in the superimposition of communally enforced rotations upon a regular layout of holdings.¹⁰

Although many different commonfield types existed, it is important to recognize that there have always been some subdivided fields within which individual holdings have been managed without reference to any wider framework of decision making. Thirsk believed that attempts to herd and farm in subdivided fields were so prone to conflict that "the community was drawn together by sheer necessity to cooperate in the control of farming practices" (Thirsk 1964:9). In fact, this was by no means necessarily so, as England and the Andes both demonstrate.

Examples may be found in both countries of intensely subdivided fields with little or no communal regulation of

cropping and herding. This was particularly the case in environmentally favored areas of relatively high population density and intensive agriculture. A high population means that labor is available for the fencing and policing of individual plots and private tethering, herding, and folding of livestock. More to the point, intensive cultivation means that the area left fallow is usually either small or nonexistent.

The husbandry systems where this occurred in medieval England--notably in parts of Sussex, Kent and Norfolk--were characterized by the cultivation of fodder crops and associated stall-feeding of livestock, coupled with labor-intensive methods of fertilizing the land. When fallowing occurred, its sole purpose was to cleanse the land of weed growth by means of multiple plowings, a practice that would have been in direct conflict with any attempt to utilize fallows as a source of forage. Wherever these husbandry methods were employed, rights of common grazing on the arable fields were therefore either restricted to the period immediately after the harvest (the one time in the year when the fields were free from standing crops) or absent altogether (Baker 1973; Campbell 1981c; Campbell 1983)

In the Andes, the counterpart of these intensive grain-producing districts are the areas of irrigated maize production, at lower altitudes than the main area of commonfields, where a warmer and more stable climate and a more benign topography permit a greater intensity of cultivation and correspondingly higher densities of population. Here, too, the organization of cultivation is largely on an individual basis, as communal supervision of grazing is precluded by the intensity of cropping (Donkin 1979:120; Guillet 1981; Platt 1982). Cultivators make their own private arrangements for feeding the plow oxen employed in these areas.

The opposite extreme is represented by the classic commonfield system of the English midlands. Here, demographic, economic, and environmental circumstances were less conducive to the kind of intensification of production outlined above, with the result that there were both greater incentives and fewer obstacles to the adoption of collective controls upon agriculture. In fact, communal management of an integrated system of cropping and grazing was taken further in this system than in any other. What made this possible was an artificially regular layout of holdings, whereby an equal amount of land was held in each of the commonfields of the township. This was essential

since a regular, and communally enforced, rotation of crops was superimposed upon the entire arable area.

The furlong--a bundle of adjacent strips--was the basic unit of cropping, with the result that individual commonfields frequently carried a range of different crops. Nevertheless, when it came to fallowing, the field retained a central place in the whole system of rotation: "Whatever changes in cropping were rung on the furlongs of the sown field or fields, the fallow field remained inviolate." (Fox 1981:74). Under the two- and three-field system, each field was fallowed either every second or third year. The basic rotation was either winter corn (wheat, rye, maslin, winter barley) followed by fallow; or winter corn, spring corn (barley, oats, dredge, legumes), and then fallow. The purpose of the fallow was to rest the soil so that it might recuperate its fertility, to allow the land to be fertilized with the dung of grazing livestock, and, above all, to supply the livestock with forage, which was in such short supply in many of the townships that followed this system. Since the need to find grazing for the livestock was the *raison d'être* of the entire system, there was no question of subjecting the fallow to repeated plowings: on the contrary, it was left to sward over with weeds and grasses and only put back under the plow shortly before it was returned to cultivation.

Andean commonfields share many affinities with these English arrangements, and display the same association with a moderate density of population and intensity of land use. They, too, employ communal controls to rationalize the distribution of sown and unsown plots, thereby facilitating common grazing of the fallows. On the other hand, the crops involved are very different from those grown in medieval England, as are the functions and organization of fallows. These differences ensure that Andean commonfields possess considerable individuality in their decision-making arrangements and attendant patterns of interaction.

Within the Andes commonfield, lands are generally sown for up to four consecutive years. There is no distinction between winter-sown and spring-sown crops and the normal rotational sequence is: first, potatoes fertilized with llama or sheep dung; second, native chenopods (quinua and canahue) and tubers (ocas and ullucus); and then cereals and leguminous crops in the third and fourth years. Having deep roots, the cereals and legumes seek nutrients below the shallow surface layer of the soil, whose

fertility is rapidly depleted during the first two years of cropping (Freeman 1980). Thereafter, soil nutrients are allowed to build up because the fields are allowed to rest for as long as thirty years, but the mean fallow duration is three or four years. The length of fallows is never fixed, but varies according to soil conditions and cropping requirements, and this provides the key to the whole system. The higher the altitude, the longer the fallow period, owing to reduced soil fertility and slower rates of growth (Caballero 1981).

In very few cases are fields sown for more than five consecutive years, or fallows reduced to one year. The exceptions include areas undergoing intensification, or those communities situated on the shores of Lake Titicaca that, owing to a more benign climate and richer soils, plant on what approaches a continuous basis (Carter 1964; Mamani 1973:89, 110; Urioste 1977:43; Lewellen 1978:16, 49; LeBaron 1979; Godoy 1985). It remains to be established how far such intensifications of production have led to modifications in conventional Andean commonfield arrangements and to what extent they have led to irreversible ecological degradation. Nevertheless, that intensification has occurred at all does demonstrate that commonfield systems are nowhere a direct adaptive response to environmental factors--various nonecological considerations have always been important.

Once a field is designated for cropping, the precise pattern and sequence of crops sown is a matter of individual choice. There is thus no Andean equivalent of the furlongs found in medieval England. The range of crops grown within any field is usually quite wide, as cultivators tend to diversify their pattern of planting as a hedge against environmental hazards and the risk of wholesale harvest failure (Brush 1981:71). Nevertheless, as far as the decision-making arrangements of these commonfields are concerned, it is not so much what crops are sown that matters but, rather, which fields are to be left fallow and for how long. Such important decisions are taken at a village level. To accommodate the relatively long fallow period required in this high mountain environment, the arable land of each community will usually be divided into at least seven or eight commonfields, and sometimes as many as fifteen. Whenever any of these fields lie fallow, villagers exercise a customary entitlement to pasture their livestock, collect firewood, and cut turf. At the same time, arrangements are made for the systematic dunging of the land by sheep and llamas

penned in movable folds. This ensures that all the land is adequately manured before it is eventually returned to cultivation: the dung, urine, and treading of the animals are all highly beneficial to these upland soils. Analogous arrangements occurred in certain English commonfield systems on the light soils of East Anglia, where there was likewise a tendency for fallow periods to be of several years' duration (Postgate 1973).

Two aspects of these Andean arrangements require further comment. The first concerns the household's entitlement to common pasturage. In some cases, households have rights to graze only portions of the stubble of the commonfields and when this occurs the location of this grazing ground is often independent of the distribution of parcels making up the holding. Carter has described this distinctive arrangement (Carter 1964:68; Platt 1982; Godoy 1983). According to him, the section of the commonfields reserved to each household as pasture for its flocks is known as an unta, which is a prolongation of the houseplot into the commonfields. This unta privilege (literally meaning "that which one can see") directly overlays the normal rights of cultivation that apply to individual plots in the fields and sometimes applies to such uncultivable land as mountaintops or swamps. Such demarcation of each family's own grazing zone within the village's territory is an Andean peculiarity and reflects a desire for private control of their own animals by individual community members. It finds no counterpart in the more emphatically arable farming commonfield villages of lowland England, with their scarcer pasturage and much smaller flocks and herds.

A second, and much more significant characteristic of Andean arrangements is that a communally determined system of cropping and fallowing coexists with an irregular layout of holdings. Such a state of affairs carries with it the obvious penalty that each year some households will be obliged to leave a disproportionate amount of their land uncultivated. There is thus an inherent inequity within the system, a deficiency that is avoided in the English midland system by the equal distribution of a holding's strips among all the fields of a township.¹¹ Such a regular layout of holdings would be of no practical advantage in the Andean situation where the timing and duration of fallows are, perforce, subject to much flexibility. It is certainly true that (as in those few English instances where there was a similar mismatch between holding layout and rotations) Andean people are sometimes able to use

land held outside the commonfield system to offset the inequities arising within that system. Thus all commonfield holdings include a house plot that is held in severalty and capable of intensive cultivation. Although such plots are occasionally quite substantial, most have been much reduced in size through the application of a custom of male partible inheritance (Carter 1964:65; Heath et al. 1969:177; Rodriguez-Pastor 1969:84-86). For the tenants of these diminutive house plots, the most effective supplements to commonfield land are therefore valley plots. Not only are the latter not subject to communal decisions, they are also environmentally more favored and can consequently be cropped much more intensively than the commonfields (Guillet 1981; Platt 1982).

When house plots, valley lands, and pasture grounds are all taken into account, it transpires that commonfields generally constitute between 20 and 70 percent of total land holdings, the proportion rising with altitude (Figueroa 1982:133). Nevertheless, many individuals remain dependent upon the commonfields for the basic staples of daily life. For them, the only solution when they are temporarily disadvantaged by the system is to come to some kind of reciprocal arrangement with those who are temporarily advantaged. It is upon this kind of social exchange between members of the same agricultural community that the commonfield system ultimately depends for its success.

The nearest equivalent in England was the commonfield system of parts of East Anglia, noted above. A similar coexistence of common rotations was found in this system in the form of flexible cropping shifts, with an irregular layout of holdings. The object of the cropping shifts was likewise to concentrate fallow strips for sheep folding. Since this periodically placed certain individuals at a disadvantage, successful operation of the system, as in the Andes, depended upon the establishment of a satisfactory method of compensation. As control of the system was vested in the manorial lord (who, as principal flockmaster, was also usually the major beneficiary of it), a tenant thus placed might receive part of the lord's crop, temporary use of a portion of the lord's demesne, or financial compensation in the form of a cash handout or rent rebate. Even so, this system was particularly prone to conflict, as is testified by the large number of resultant court cases (Allison 1957; Allison 1958; Simpson 1958; Postgate 1973).

On the whole, both English and Andean commonfield systems made good practical sense in a situation where land was cropped with only moderate intensity, and where population levels were such that substantial dividends were to be derived from pooling scarce labor and organizing basic farming tasks in common. Savings were obviously to be made by eliminating the need for fencing and by appointing a few guards to watch over the fields and stock of all the villagers. Moreover, information and transaction costs were reduced when decisions were taken at a village level as to when and where to plant and pasture.

Such arrangements may also have proved advantageous to subjects faced with heavy labor-tribute liabilities, a relevant point in both a medieval English and an Andean context. In the former, lords were entitled to exact labor services from their tenants through the institution of serfdom; these services characteristically assumed the form of agricultural work on the lord's demesne. In fact, under the conditions of labor scarcity that probably prevailed when serfdom was first instituted, lords would have had a vested interest in promoting the development of a system of husbandry that enabled them to redeploy labor to their own ends. There is certainly a striking coincidence between the areas of strongest lordship and most fully developed commonfield systems.¹²

Likewise in the Andes, the Spanish instituted a system of forced-labor to work the silver and mercury mines of Potosi and Huancavelica. This assumed the form of an annual migration of able-bodied males (the mita) drawn from a very extensive area. At the end of the 16th century, this migration totaled some 13,000 workers per year, some of whom came from so far away that they had to walk for an entire month to reach the mines. As Tandeter has pointed out, a migration on this scale must have had major repercussions for the accumulation and reproduction of the communities that were being exploited, the more so as these heavy labor demands coincided with a prolonged and massive reduction in population (Tandeter 1981).¹³ It seems, therefore, that in the Andes, too, there is a coincidence between the area of heaviest labor-tribute liabilities and the area where commonfield agriculture appears to have attained its most complex form and survived the longest.

PATTERNS OF INTERACTION

The common denominator of all these commonfield systems is a reversion from private use to till the soil to communal rights to graze on the herbage of the fallow fields. This communal arrangement places a premium upon the collective management of resources. For instance, since commonfields remain unfenced, individual householders face incentives to steal crops from adjacent plots and encroach upon neighboring lands. This potential threat fosters collective action, as isolated households by themselves would be less effective in opposing interlopers (Gade 1970:51; Orlove 1976:213; Albo 1977:23; Platt 1982:45). Hence the phenomenon of village-appointed guards and other officials. Furthermore, the movement across time and space of different flocks and herds, and the designation of fields to be sown and fallowed, involve complex scheduling problems affecting all villagers.

These logistical problems are therefore frequently decided upon by village assemblies; it is they who determine the date and place of planting, harvesting, and grazing. In the Andes, these village councils, as noted by McBride, constitute the "de facto government of a community, though its operation is so silent and its deliberation so carefully guarded that its existence is seldom even suspected" (McBride 1921:9). Much the same is true of similar assemblies in England, whose existence is often barely hinted at in the historical record. Yet, although there is a clear association between commonfield agriculture and strongly developed corporate village communities, the precise causal connection between them is enigmatic. At any event, the outward physical expression of the strong corporate character possessed by these commonfield communities in both countries is the nucleated village. In contrast, more dispersed forms of settlement--loosely clustered hamlets, isolated farmsteads, and a mixture of villages and scattered messauges--tend to prevail in non-commonfield areas.¹⁴

The Andean evidence demonstrates that the corporate sense of these commonfield communities is usually sufficiently strong to override even quite substantial inequalities of holding size among cultivators.¹⁵ As is to be expected, the larger landholders do tend to exert a disproportionate influence within village assemblies and dominate the principal village offices. On the other hand, all household heads serve as field guards by yearly turns. This rotational incumbency possibly had colonial origins,

but it still functions (Rasnake 1981).

These officers, known variously as pachacas, campos, muyucamas, arariwas, camayoqs, or regidores de varas, are in charge of supervising fields, preventing animals from straying onto cultivated lands, guarding against crop theft and trespass, punishing and levying fines on miscreant shepherds, and performing rituals to protect crops when hail, drought, and other natural calamities threaten. Their honesty is ensured because they are answerable to the higher level village authority and charged with responsibility for any crops stolen from the fields. In recompense, if the harvest proves successful, they receive the produce of a few furrows from each family, or are allowed to plant in uncultivated plots of the commons.

As Thomas observes, this system of incumbency by yearly turns symbolizes total community involvement in the decision-making process of the entire community (Gado 1970:12; Degregori and Golte 1973:42; Preston 1973; Thomas 1979:161; Fujii and Tomoeda 1981:54). Household heads also sponsor village festivals at one or more times in their life cycle: these festivals confer prestige upon those who sponsor them, but are also essential for validating the individual household's right of access to village assets in the eyes of the community (Platt 1982; Godoy 1983).

The need to establish who belongs to a community and has a stake in its resources is critical: that it is perceived as such is demonstrated by the symbolic reapportionments and public reconfirmations of a household's rights to land that hacienda officials continue to supervise.¹⁶ If anything, the issue of who is entitled to land rights has become more prominent in recent years as expanding populations have brought resources under increasing pressure.

Today, as in the past, a pronounced social stratification is apparent within many of these villages. In Bolivia, the true insiders (originarios) tend to have more parcels within the commonfields than do later arrivals (agregados). Below these two groups lie the kantu runas (people of the margin), peasants who settled in the village during the 19th century and who obtained indirect access to common land in exchange for services rendered to wealthier households (Platt 1982; Godoy 1983).¹⁷ These divisions tend to be perpetuated by rules that proscribe the renting or selling of commonfield land to outsiders, although they permit cultivators to rent or mortgage their parcels to other members of the community (McBride 1921:14; Metraux

1959; Carter 1964:68; Custred 1974:258; Guillet 1979; Fujii and Tomoeda 1981:53; Godoy 1985). Such entry and exit rules are enforced by the village council, which, if need be, employs expulsion as the ultimate sanction against recalcitrant behavior. That village councils should have acquired such powers is a function of the historic weakness of national power structures in the areas of commonfield agriculture.

In medieval England, the administrative structure and patterns of interaction of these commonfield communities are more difficult to ascertain, filtered as they are through the historical record. Most of what is known is provided by the proceedings of manorial courts (the lowest level of courts with legitimate legal jurisdiction). It was in these courts that commonfield bylaws were enacted and enforced, and their proceedings usually record innumerable boundary disputes and prosecutions for trespass and crop theft (Ault 1965). The election of village officials was also usually enrolled in the courts. Some of these officers, like the pinder and hayward, are close equivalents of the Andean field guards. They watched over the livestock feeding on the commons, and when necessary impounded them and assessed the damage done by cattle and trespassers, after which a fine was imposed by the manor court on those responsible. Effective operation of these courts was obviously partly a function of the strength of seignorial authority, but it also depended upon the cooperation of the village community. Although a good deal of friction often existed between the villagers and their lord, they obviously derived considerable benefits from such ready access to a means of resolving local disputes.

The role of the manor court was important in the operation of the commonfield system, but the prerogative of overseeing the regular routine of commonfield husbandry and ensuring that cultivators conformed to its discipline was probably reserved to informal village assemblies.¹⁸ Effectively, all those who owned land in the commonfields had a say in their management and enjoyed an entitlement to the appurtenant common rights usually in proportion to the size of their landholding. The only exceptions were various landless but long-established families within the community who sometimes retained a customary claim upon its resources through retention of the ancient house plot. All those holding such rights were known as commoners.

On the large Worcestershire manor of Halesowen, there were no less than 12 separate commonfield communities, each of which was represented in the central manor court

by two villagers elected by its members, an arrangement that implies that they must each have possessed some kind of well-organized self-governing machinery. As in the Andes, these "assemblies" were almost certainly dominated and run by the richer peasants, for it was they who usually fulfilled the majority of manorial offices. Patterns of social and economic interaction reconstructed by Razi from these court records indicate a high incidence of reciprocity between peasants, its precise nature varying according to socioeconomic status. It is his view that in the late 13th and early 14th centuries the manor of Halesowen was characterized by "a high degree of cohesiveness, cooperation and solidarity as a result of the requirements of an open-field husbandry, a highly developed corporate organization, and a sustained and active resistance to the seignorial regime" (Razi 1981).

Nevertheless, the strong corporate sense manifest by these commonfield communities should not be mistaken for rural egalitarianism. Nor should commonfields be regarded as an expression of such principles.¹⁹ Cooperation, a shared identity, and a sense of common purpose at a village level were perfectly compatible with the existence of sharp inequalities between peasants and marked intragroup rivalry. Moreover, in the long term, these internal divisions were potentially disruptive to the commonfield regime, particularly given any changes in the wider political and/or economic context.

Documentation of the long-entrenched social stratification that existed within these rural communities is now becoming increasingly available (Dewindt 1972; Britton 1977; Smith 1979; Razi 1980). Thus, Halesowen village society may have functioned as a community but it was also highly monetized and competitive. From his reading of the evidence, Razi was in no doubt that the well-to-do villagers were exploiting the needs of their less well-off neighbors to maximize their profits. Equivalent studies of villages in other parts of England have come to much the same conclusion. There was no question of arable land's being periodically reallocated (all attested cases of reallocation relate to meadow land, a common resource, like most other sources of herbage). From at least the middle of the 13th century, it is plain that peasants had attached strong individual ownership rights to their land. According to customary law, even villein land descended according to the prevailing rules of inheritance within the same family: only in default of heirs did it revert to the lord, who might then reallocate

it among his tenants. Moreover, an active market in peasant land was already established by this date in much of lowland England. Its effect was generally to encourage the emergence of socioeconomic differences between individual peasant families (Smith 1984b; Harvey 1984). Moreover, through the observation of certain common-sense safeguards, this land market proved in no way inimical to the effective operation of the commonfields.

CONCLUSIONS

That two commonfield systems with such a strong functional affinity should have developed under such fundamentally different technological conditions is highly significant, for several writers on the origin of English commonfields have placed great stress on the role of technology. Seeböhm (1883) and Orwin and Orwin (1967), for instance, all have attributed the creation of commonfields to the practice of co-aration or joint plowing using a heavy mold-board plow (Dodgshon 1980:30-34). Yet the culture that evolved such similar agricultural arrangements in the Andes was effectively plowless.

Environmentally, too, there was a vast difference in the circumstances under which these two commonfield systems developed. However, despite the obvious physical differences between the high Andes and lowland England, both environments presented cultivators with an analogous problem. In each case, the productivity of the agricultural system rested upon the maintenance of a delicate ecological balance that required the reconciliation, on the same land, of the conflicting requirements of animal and pastoral husbandry. The need to supply forage to the animals and dung to the soil was the link between them. Even so, that the same basic need should have elicited such a similar institutional response says as much about the sociopolitical conditions prevailing when commonfields emerged, as it does about environmental considerations per se.

As has been shown, English and Andean commonfields only make complete sense when viewed in the context of a specific combination of economic, demographic, social, and political circumstances. The connection between cultivation practices at one extreme and sociopolitical institutions at the other may be difficult to demonstrate empirically, but we believe that it was a real and vital link in both of the cases discussed above.²⁰ Such a conclusion is not merely of relevance to students of com-

monfield systems: it also provides a warning against adopting an approach to the whole question of common property resources that is either too environmentally or economically deterministic.

These two cases also demonstrate the capacity of common property resource management systems to take on an existence of their own, independent of the circumstances that may have led to their creation. Commonfield systems were self-perpetuating. This was partly because the system could only be dismantled if the common rights that applied to it were dissolved first, and the dissolution of such rights required a consensus that was particularly difficult to obtain where there were so many vested interests. The process of parliamentary enclosure in England provides a graphic illustration of this and demonstrates that the intervention of a superior legal authority was sometimes required before long-established common rights could be finally extinguished (Tate 1967; Yelling 1977; Turner 1984).

Inertia also derived from the strict adherence to a specific agricultural routine that a commonfield system tended to impose upon a community. It was not that progress was impossible--the system could not have survived for so long had this been the case--but rather that changes were cumbersome to achieve (Havinden 1961; Dahlman 1980:146-199). Communal consent was required before any deviations could take place from established crop rotations, or before alterations could be made in the existing ratio of pasture to tillage. Radical changes in the techniques and intensity of cultivation were consequently to be avoided. For these various reasons, commonfield systems had a bias towards the maintenance of the economic and demographic status quo, and their dependent communities adopted social and cultural values and demographic strategies that actually retarded population growth and technological change (Homans 1941; Howell 1975; Goody et al. 1976). The resultant symbiosis between commonfield regime and sociodemographic behavior sometimes endured for centuries.

Nevertheless, commonfield systems were by no means immutable. Over time they furnish much evidence of adaptation to new technologies and socioeconomic circumstances. Parcels have been altered in shape and size, and fields in layout; new crops have been incorporated into rotations, and increases made in the number of rotational courses; livestock stints have been reassessed; and modifications have been made to the management of fallows.²¹ Provided

that the pace of change has been gradual, it has usually been possible for commonfields to adapt themselves to it.

However, problems have arisen when the pace and nature of change have been more revolutionary. In England, for instance, although economic and technological developments rendered commonfield agriculture increasingly anachronistic from the 15th century onwards, so that enclosure by agreement began to make quiet but steady progress, the final demise of the system did not come until the 19th century. Even then, it took powerful economic forces, combined with the facility of enclosure by act of parliament, before the last bastions of the system fell. During this final period, commonfield agriculture was much castigated by agricultural writers so that it became widely regarded as a moribund and inefficient system: recently compiled statistics show a 24.5 percent advantage in crop yields in enclosed, as compared with unenclosed parishes, suggesting that such views were not without practical foundation.²² This specific historical experience from the last years of an otherwise extremely long-lived institution has tended to color contemporary western attitudes to communally managed resources in general and has been used to support a strong preference for privatized property systems in particular.

Yet in the Andes, the question of enclosure remains very much a live issue. Much privatization of former commonfield land has already taken place, by one means or another, in those areas where agriculture has been most strongly exposed to commercial penetration (Heath et al. 1969:192; Rodriguez-Pastor 1969:86; Mamani 1973:87-88; Preston 1974:247; Mayer 1981:82; Figueroa 1982:133). But away from the influence of the Peruvian coastal cities and the chief towns and mining centers of the Bolivian interior, traditional commonfield agriculture continues largely unaffected. Coincidentally, it is in these same areas that the terrain is most rugged and rural poverty greatest, and this poses a major dilemma for those working in development (Eckholm 1976; Thomas 1979; Guillet 1981; Godoy 1983). Should contemporary Andean commonfields be condemned, like their erstwhile English counterparts, as an obstacle to progress and a cause of rural poverty and backwardness? Or should stress be placed upon the delicate ecological balance that they undoubtedly help to maintain in this high mountain environment, and the sense of corporate identity and solidarity that they nurture in these isolated, materially deprived, and agriculturally dependent communities?

NOTES

1. For the European distribution, see Bloch (1967:69). For the commonfields in New England, see Walcott (1936:218-252) and Bidwell and Falconer (1925). For Andean commonfields, see Godoy and Orlove (forthcoming). Mesoamerican systems are briefly discussed in Wolf (1966:20-21). Indian commonfields are described in Wade (this volume). Middle Eastern systems are discussed in Goodell (1976:60-68) and in Poyck (1962).
2. For an up-to-date review of the literature on English commonfield origins, see Fox (1981:64-111). For a comprehensive treatment of the development of English commonfields, see Baker and Butlin (1973).
3. Pleas for comparative research in commonfield systems have been made by Bloch (1967:70), Thirsk (1966), and McCloskey (1975:91).
4. For the late medieval antecedents of the enclosure movement, see Fox (1975:181-202) and Campbell (1981a).
5. In this context, it should be noted that the main reason that the villagers of Vila Vila, in the north of Potosi, abandoned commonfield tillage was that a frost would kill everyone's potatoes, since all the villagers planted potatoes in the same great commonfield (Mamani 1973:88).
6. The most usual arrangement is for male co-heirs to work a holding as a group: each brother receives the right to work some parcels within each commonfield, and further plot fragmentation is thereby halted (Mamani 1973:91-92).
7. The complex economics of the changeover from natural to produced fodder, and thus from ox- to horse-plowing, are discussed in Boserup (1965:36-39).

8. For agrarian conditions at this time, see Miller and Hatcher (1978).
9. These different British field systems are surveyed in Baker and Butlin (1973).
10. For a fuller specification of the diagnostic features of these different commonfield systems, see Campbell (1981b:112-129).
11. Households will also be faced with a periodic seasonality of agricultural surpluses or deficits, depending upon the amount of land held in the commonfields open to use.
12. This argument is elaborated more fully in Campbell (1981b). On the strength of seigneurial power at the time that European commonfields were crystallizing, see Duby (1974). For an illustration of the coincidence between variations in lordship and variations in field systems, see Harley (1958:8-18) and Roberts (1973:188-231). For the factors that promoted the institutions of serfdom, see Hatcher (1981:3-39).
13. The post-conquest population collapse is discussed in Dobyns (1963:493-515), in Smith (1970:453-464), and in Shea (1976:157-180).
14. For the pattern of rural settlement in Britain, see Roberts (1979).
15. See, for instance, Albo (1977) and Isbell (1978). Earlier echoes of the same theme may be found in the indigenista literature, as in Valcarcel (1925) and Castro-Pozo (1936).
16. These reapportionments seem to date from Inca times, when they were used to ensure that all households had the means of meeting tribute obligations to the kings in Cuzco (Murra 1980a:xv).
The system was adapted by the Spanish to serve a similar purpose (see Rowe 1957:162). This practice survives in fossilized form today. The shift from true reallocation to a system of nominal or symbolic reallocation, wherein households continue to use the same parcels year after year, probably reflects a growing shortage of land and concomitant increased specification of individual

land rights (Carter 1964:69; Buechler 1969:179; Preston 1973:3).

17. For the existence of unequal holdings among commonfield farmers in Peru, see also Mishkin (1946:421-422), Soler (1958:190), Matos Mar (1964:130-142), and Guillet (1981:146).

18. For a recent review of the literature on this subject, see Smith (1984a).

19. The notion that primitive egalitarian principles may have underlain the emergence in England of corporate commonfield communities has had several influential advocates. The relevant literature is admirably reviewed in Dodgshon (1980:1-7; 1981:130-140).

20. With reference to the link between the development of commonfield systems and exploitative seigneurial systems, it should be noted that mature commonfield systems are unknown in simple tribal societies and have tended to decline with the emergence of capitalist societies.

21. For English documentation of some of these developments, see Havinden (1961); Baker and Butlin (1973); McCloskey (1975).

22. The literature on agricultural progress and enclosure in the 18th and 19th centuries is voluminous. The best general introduction nevertheless remains Chambers and Mingay (1966).

The statistics on crop yields in enclosed and commonfield townships come from the 1801 crop returns and are discussed in Turner (1982:489-510).

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Information Problems Involved in Partitioning the Commons for Cultivation in Botswana¹

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INTRODUCTION TO THE PROBLEM

In 1968, Botswana's central government authorities assumed responsibility for a major reform of traditional land and water resource management institutions that had been in operation since the mid-19th century. The new administrative system of land boards established by the Tribal Land Act of 1968 was expected to provide more professional resource management and end discrimination in the allocation of use-rights to resources (Hitchcock 1985; Peters 1983; Roberts 1980). By 1970, twelve main land boards were in operation. They were responsible for managing tribal land² used for cultivation, grazing, family housing and commercial purposes, and for all water resources. Numerous subordinate land boards, which were assigned responsibility for managing land used for village housing and cultivation, were authorized in 1973.

Despite the thoughtful attention devoted to the design of the land board system, substantial conflict continues to surround the management of land in Botswana (Machacha 1981; Roe and Fortmann 1982; Werbner 1980). Disregard for the rules by which cultivation land is supposed to be managed has emerged as a persistent and widespread problem. Farmers have cleared and plowed fields not authorized for such use, illegally extended the boundaries of their existing fields, and altered new boundary markers erected

by land board members. At the same time, land board members are known to have refused allocation requests to protect their own interests or those of relatives in undeveloped land.

Two different explanations could be advanced to explain the existence of the conflict and illegal behavior that followed this institutional reform. One is that the problems that have arisen are the result of confusion created by institutional changes--neither officials nor ordinary citizens understand the intent and substance of the new procedures and rules. A second explanation is that the new rules have had the unintended result of creating situations that offer officials and farmers opportunities to act in perverse ways that generate conflict.

Sorting out which of these explanations is correct is an important problem for policymakers in settings where institutions have been changed.³ The particular conclusion they reach has major implications for further action. Acceptance of the first explanation suggests the need only for additional training and public education. Since this explanation for the continued conflict has been most widely accepted by central ministry officials in Botswana, substantial funds have been spent to improve understanding of new arrangements. Acceptance of the second suggests the need for changes in the design of the institutions in order to restructure incentives.

In this paper, I will use information about land-use patterns and the administrative problems of the residents of the village of Lethakeng, located in the Kweneng District of Botswana, as the basis for my own analysis of this problem. My conclusion differs from that of the special interministerial committee established in 1977 by Botswana's Ministry of Local Government and Lands (the ministry), the central government authority with principal responsibility for the land boards, to diagnose the causes of this illegal behavior. The committee's suggestions to the ministry reflect the conclusion that conflict has developed largely as a result of implementation problems (Botswana Ministry of Local Government and Land 1978).⁴

NATURE OF THE RESOURCE

Land differs in some important respects from other resources that are frequently managed as common properties. In this section, I will identify those characteristics of common lands used for cultivation purposes that pose

particular problems for the design of appropriate management institutions. I will also briefly describe those features of the physical and social environment of the central Kweneng District that largely account for the way grain cultivation is organized in this area. Characteristics of the resource and of the social organization of production strongly influence farmers' strategies in their interaction with other farmers and with land board members. They also constitute the physical and social "givens" to which appropriate land management rules must be fitted.

Nature of a Cultivation Commons

Resources such as underground water basins, fisheries, forests, bridges, and pastures, though highly diverse, demonstrate important analytic similarities that are the basis for their categorization as common-pool resources. All can be thought of as natural or artifactual systems that, over time, generate a finite flow (or pool) of benefits such as water, fish, fuel, crossings, and grazing. Each resource user consumes a portion of this stream of benefits. Consumption of benefits is subtractive. The exclusion of interested users from the pool of benefits is difficult, in most cases, because of the physical characteristics of the resource systems themselves. The difficulty of exclusion, along with the subtractive nature of consumption, means that the productivity of resources in this category may be endangered by inappropriate patterns of use.

The nature of the distribution of property rights in both the resource system and the flow of benefits generated by the system is an artifact of human design created to preserve the productivity of the resource (V. Ostrom 1980). Because of the physical characteristics of these systems, rights in common-pool resource systems are frequently, but not necessarily, held by a group of people "in common" rather than by a single individual. As soon as the demand for benefits produced by the systems exceeds the supply, consumption of the benefit flow must be limited. This is usually achieved by partitioning the flow of benefits and assigning well-specified bundles of rights in a portion of the flow to specific consumption units. These consumption units may be individuals or groups. The bundle of rights assigned to each unit may or may not include the right to independently transfer rights in the system or in the flow to others.

In Botswana, land used for cultivation is held in common. Fertile soil is the natural resource system that produces a stream of "cultivation possibilities" that can be realized in the form of crops. Resource consumption is subtractive in that one portion of fertile land cannot be simultaneously cultivated by two producers. The difficulty of excluding interested users from the resource system derives from the strength of long-standing community norms that state that land belongs to all members of a community and that all who wish to cultivate should have rights to a plot of land. Even those who no longer accept this norm, however, believe that altering long-standing and well-known arrangements for resource consumption would entail high social costs. The more isolated portions of Botswana's population may be unaware of alternative ways of distributing rights in land.

Members of Botswana's land boards function as managers of district land. As such they are authorized to assign rights to individuals to appropriate the crops those individuals produce on a portion of this soil system. The "producers" who cultivate and then consume the benefit stream generated by the soil resource are actually groups of kin who form production teams. Land board members are also responsible for assisting the users of each existing field to exclude others from the portion of this resource system already assigned to them.

Common land used for cultivation purposes is an unusual common-pool resource in that it requires the partitioning and the assignment of consumption rights regardless of the level of demand for the benefit flow. This is because the application of human labor is necessary to realize the cultivation possibilities inherent in fertile land. Use of land for cultivation, unlike the use of land for grazing or the open sea for fishing, requires the actual physical division of land into separate plots. Otherwise, producers--whether these be individuals, groups, or an entire community--would have difficulty in appropriating the benefits generated by their work on the resource system. Land cannot be used for cultivation in the absence of rules that assign the production teams rights to the flow of crops from their plots. Fertile land that is being cultivated is, thus, always managed in some sense.

The inappropriate use of common lands for cultivation can lead to an outcome similar to that which follows from the inappropriate use of a commonly held pasture or fishery. The overutilization of a grazing commons not

only depletes the existing pool of benefits but also adversely affects edible plants' ability to regenerate. The mismanagement of a cultivation commons decreases the soil's capacity to generate cultivation possibilities; this happens when users are able to mine fertile soil and then move on to other areas.

Poor management of a cultivation commons is often less threatening to the resource system than to the net value to production teams of the crop yields. Recurrent conflict over rights to land is attended by increased costs as more labor is devoted to the surveillance and negotiation needed to prevent incursion or the destruction of crops planted on contested plots. The efficiency of crop production is reduced by virtue of increased costs for equal or reduced levels of agricultural output. Conflict over land may also heighten tension in a community and reduce the possibility of collective agreement on other issues of common concern. Reciprocal hostility can eventually lead to generalized warfare. Land then goes unutilized despite high levels of demand for the crops that the fertile soil could produce.

The Cultivation Commons in Letlhakeng

Characteristics of the natural and social environments in which Letlhakeng residents find themselves have influenced the organization of their agricultural production activities. In turn, the way agricultural production is organized crucially affects the general pattern of demand for land in this area where, in the past, the supply of fertile land has not been a limiting factor. The management authority's operational rules for the commons determine the pattern of supply. The degree of congruence between patterns of demand and supply has had an important impact on the attitudes of villagers toward land management authorities.

The Natural and Social Environments of Central Kweneng

Letlhakeng is the largest settlement located in an extraordinary network of fossil river valleys in central Kweneng District. The fertility of the black soil, the dense vegetation, and the numerous points at which underground water can be tapped with pit wells and boreholes in these valleys contrasts sharply with the sandy soils of

the surrounding grass and Acacia brush savanna that contains no perennial water sources.

The harsh climate of the region in which these rich valleys are set, however, makes grain production unreliable. The local, average annual rainfall level of approximately 350 to 400 mm is just sufficient for the rain-fed sorghum cultivation practiced in the area, and then only if the rainfall is not interrupted for lengthy periods during the growing season. The variability of rainfall levels, however, is high. Nighttime winter temperatures low enough for frost bring the single growing season to a very distinct end. The timeliness of plowing is thus a crucial determinant of the size of grain harvests in good rainfall years.

In this arid, tsetse-free region, keeping cattle is the preferred economic activity. Herd owners attempt to keep herd growth rates high by selling off young male animals to buy female calves. Cattle are seldom eaten, however, and, due to the uncertainty of rainfall, grain production has never provided a dependable source of food. Since the 1920s, men from the area have depended upon employment opportunities in the mines of what is now the Republic of South Africa and in Botswana's towns to supplement their grain production activities.

The settlement of Letlhakeng was formed in 1942 when protectorate district administrators asked seven small, scattered communities (makgotla) to move to a central location. These makgotla (singular: lekgotla) are composed largely of fragments of one of three distantly related patrilineages--the Babolaongwe, the Bakgwatheng, and the Bashaga--known collectively as Bakgalagadi (people of the desert). Before 1970, adult males secured rights to land primarily through their membership in a lekgotla. Bashaga-baga-Sekgalo are the only exception, having always cultivated land given originally to the leader of the Baga-Motsoto lekgotla. Fields are still cleared and plowed by men for wives who are responsible for cultivation. Upon her death, a woman's youngest daughter has first claim to her field. Household wealth, held primarily in the form of cattle, continues to be controlled by the head until his death. The inheritance rule for livestock, which once approximated primogeniture, has been gradually abandoned in favor of greater equality of distribution among male and occasionally female heirs.

The inheritance rule has been changed in part in response to the increased financial independence of young men made possible by wage labor opportunities. The

prospect of a larger inheritance serves as an incentive for younger sons to forego the higher personal income they could derive from continuous wage employment in order to contribute their labor to their family's cultivation and cattle-raising enterprise. A household owning some cattle whose members live to old age and that is well-endowed with male children who cooperate fully in operating the household enterprise can maintain cultivation simultaneously with cattle raising and wage labor (Henderson 1980). Many households, however, lack one or more of these elements. Survey data show that even married women must frequently rely on members of the extended family for assistance in plowing and supervising livestock.⁵

New wage labor opportunities for men have raised the value of men's labor relative to that of women's and contributed to the decline in polygyny. Social pressure to observe monogamy, accompanied by continued high fertility rates and male preference for younger wives, have produced a "surplus" of women. Some women now produce children but never marry. The divorce rate has also risen. As a result, male household heads today find themselves, for varying periods of time, responsible for several adult women who are not married to them. The productivity of these unmarried, divorced, or widowed women is largely a function of the degree to which a male household head successfully integrates them into his production activity. The improvement of educational facilities in the village has aggravated the agricultural labor problem particularly in those cases where household fields and cattle are located far from the village school (Chernichovsky 1981; Mueller 1981; Froya 1983).

The Organization of Cultivation and Common Features of the Local Demand for Land

The greater reliability of income from wage labor and from cattle raising in this uncertain environment has drawn adult male labor away from cultivation activity. Young men face substantial short-term opportunity costs in foregoing wage labor opportunities in order to help with household agricultural activities. Households also face high opportunity costs in foregoing the exchange of male for female calves in order to maintain a plowing team of four to six oxen. This has meant that the supply of adult male labor and draft oxen are the scarce inputs into grain production.⁶ In view of these constraints, one would

predict that cultivation land, which has been the relatively abundant input in this area, would be developed by villagers in ways that economize on the use of the two scarcest inputs.

The pattern of cultivation in this area is consistent with this prediction. The cultivation of larger fields with the aid of the plow dates from the 1930s when diminishing local supplies of game animals could no longer support the expanding population. Sons cleared fields for their wives near their mother's field so they could make use of the oxen team controlled by their father until his death. Even after a father's death, brothers often kept the herd together and maintained contiguous grain fields. This enabled several brothers to share a single plowing team, thereby reducing the number of male animals that they had to maintain in their collective cattle holding, while still plowing all their fields in a timely fashion. Further, only one son was needed to plow the widowed mother's field and those of his wife and sisters-in-law while his brothers worked outside the village.

Earlier patterns of land allocation practiced in the area were well fitted to this way of organizing production. Grants of use-rights to cultivation land in the Letlhakeng area were of varying sizes, but all grants were blocks of land larger than the size of the single field initially developed. These blocks of land were allocated to individual heads of households in anticipation of the later development of additional fields for a second or third wife and for the wives of sons and grandsons. Buffers of land between blocks served as a grazing area for cattle kept near the fields in the growing season. Rights in land were retained even though the holder did not or could not cultivate a field for many years because of absence from the village, illness, or drought.

In the 1950s and 1960s, the size of new allocations decreased in the more intensely developed plowing areas. The general pattern of earlier land development, however, remains popular today. A survey of current land use practices indicates that the fields of sons are often developed in close proximity to those of their father, as are the fields of dependent, adult female relatives (see Wynne, forthcoming). The clustered-fields pattern in current use closely resembles the clustering of fields belonging to the wives and daughters-in-law of one man that was characteristic of earlier times. Clustering fields continues to simplify and expedite plowing in those cases in which one oxen team is used to plow several fields.

As relative scarcity in the plowing areas has become more severe, the value of undeveloped land surrounding the fields of established farmers has assumed even greater value to household heads who resume responsibility for a widowed or divorced daughter, sister, or sister-in-law. Fields earlier abandoned may acquire new value for similar reasons. New means of providing cultivation opportunities for unskilled female labor have also developed in recent years. A person who has not yet cleared his/her own field may borrow a field belonging to a relative who owns a plowing team. Some widows borrow land for long periods of time. Some also hire plowing services from owners of oxen teams. A partnership owning one of the two tractors in the village is eager to sell plowing services. While these services are as yet above the means of many middle income families in the area, they open up the possibility of substituting capital for labor in plowing in the future.

The absence of adult males, in conjunction with a greater appreciation for the advantages of education, has meant that the supply of labor for day-to-day herd management has been reduced. Survey data indicate that most households owning small- to medium-sized herds keep their animals in or near their cultivation area for much of the year (see Wynne, forthcoming). Even households that graze large herds at distant boreholes may keep plowing oxen and milk cows near their fields.

DECISION-MAKING ARRANGEMENTS

Rules, in combination with the characteristics of the natural and social environments of central Kweneng, shape the context in which land board members and farmers devise strategies of interaction with resources and with each other. In this effort to explain conflict over land in this area, two types of rules have been selected for careful attention out of the dense network of rules that order life in Letlhakeng: (1) authority rules define the structure of the land board system (including the ministry and other institutions of local government) that constitutes the arena in which decisions about operational rules for the cultivation commons are made; and (2) partitioning rules, a subset of operational rules for the cultivation commons, are used by land board members to determine the size and spacing of new field site allocations. Although rules always work in configurations (E. Ostrom 1986), partitioning rules are emphasized here because they are

particularly important in affecting the strategies of farmers and because they are difficult to design for cultivation commons. These rules were also substantially changed when the land board system of allocation began operation.

The Use of Partitioning Rules

The potential of a cultivation commons cannot be fully realized in the absence of rules that effectively bound, determine access to, and divide the common land. Boundary rules are used to define the physical limits of the soil surfaces that may be used for cultivation. Entry rules determine which persons or groups qualify for cultivation rights within the bounded area. In the case of common land used for cultivation, partitioning rules direct the physical division of a soil surface into fields with attendant streams of cultivation possibilities. Dividing fertile soil into fields indirectly partitions the future flow of crops.

Partitioning rules for cultivation commons are especially difficult to devise because individuals can be expected to have strong preferences for the use of a specific portion of the commons. Partitioning rules for a common pasture, in contrast, need make few provisions for the location of actual consumption. Although the location of the commons itself in relation to other facilities may be important for livestock owners, the owners are likely to be indifferent to where their animals actually graze within the pasture.

As a consequence of the particular partitioning rule being applied, each plot assigned to a production team acquires specific dimensions and spatial relations to fields owned by others as well as to water sources, grazing pastures, roads, etc. Access to specific locations within the boundaries of the cultivation commons itself can assume significance because of differences in soil fertility and in the ease of achieving cooperation among producers. In societies where cooperation in stages of cultivation is widespread, the location of land is as important as access to land itself.

Partitioning the Cultivation Commons in Letlhakeng

The land boards replaced a land management system in Kweneng that had been in operation since about 1855. For

the purposes of day-to-day management, chiefdom land had been divided among the leaders of the three major sections of the dominant social group, the Bakwena. Each section leader had further distributed responsibility for large areas to leaders of subordinate makgotla within his section and to leaders of Bakgalagadi makgotla (which were attached at that time to his section as subject people). Leaders of Bakgalagadi makgotla that was settled near Letlhakeng chose overseers who organized the development of each cultivation area as it was established.

Subordinate officials in this system were required to carry out the policies of the Bakwena chief and section leaders. In practice, however, Bakgalagadi managed land and water resources with considerable independence. Because population densities were very low and the cost of moving from one small settlement of kin to another in western Kweneng was also low, Bakgalagadi authorities were considerate of the preferences of others in their cultivation areas. Allocation decisions by overseers could be appealed up the hierarchy of authority to the lekgotla headman, the Bakwena section leader, and finally the Bakwena chief. Most land disputes were, however, settled locally.

By the late 1950s, population densities had increased considerably. Makgotla overseers and headmen began refusing more frequently to allocate new fields; this they did to keep troublesome people out of an area, to preserve access to undeveloped land in the area for the authority or his neighbors, or to punish people for purely personal reasons. Authorities were especially likely to refuse allocations to people from other makgotla. Efforts to reform land management in the late 1960s were intended to reduce discrimination in access to land.

and Administration Reform

In accordance with the Tribal Land Act of 1968, a single land board began operation in each of Botswana's administrative districts in 1970. By 1973, five subordinate land boards had been established in Kweneng to allocate rights to new housing and field sites. The district board retained authority over all rights to commercial business sites and water sources. Dramatic changes were made in land management jurisdictions and personnel. The six lekgotla headmen and their numerous overseers who had managed the cultivation and grazing land near Letlhakeng

were replaced by the four members of the new subordinate land board for central Kweneng whose office was established in Letlhakeng.⁷ This board's jurisdiction covers an area of approximately 7,000 square kilometers. Its members manage four to five times as much land area as did their predecessors.⁸

The Ministry of Local Government and Lands, the Kweneng District Council, the Kweneng District Land Board, and a meeting of headmen of all villages within the jurisdiction each appoints one member of each subordinate land board in Kweneng. Members are usually selected so that four different villages in the jurisdiction are represented. Their five-year term of office runs concurrently with the terms of office of all national and district-level elected officials in Botswana. Members may be reappointed to their positions. The board convenes every other month for a week or two to process applications and to make physical demarcations. The members' sitting allowances are paid out of the district council budget. The permanent administrative staff members of all boards belong to the nationwide civil service organization for district-level personnel, which is administered as part of the Ministry of Local Government and Lands.

Although the district land board is considered the principal land management authority in each district, the minister can veto regulations issued by the district boards. He is also authorized to issue his own regulations to direct the work of all land boards. Subordinate land board members are required to apply rules contained in statutes, ministry regulations, and district land board instructions. The administrative secretary of each district land board is responsible for explaining policy directives to and monitoring the work of the members of the district and subordinate boards.

The representative bodies at the sub-national level--the district councils and village development committees--have no rule-making authority over land management. The Tribal Land Act requires that district land boards consult with district councils regarding policies. The ministry also expects members of subordinate land boards to consult with the relevant village development committees regarding allocations, although these bodies have no veto powers. At the time of the trouble case, only sporadic consultation took place between the Letlhakeng subordinate land board and the rather inactive village development committee.

New Partitioning Rules

Before 1970, land in the Letlhakeng area was managed by makgotla leaders with significant independence as six makgotla commons.⁹ Under the authority of the overseers, production teams cultivating in each plowing area organized their own affairs with considerable autonomy. Different partitioning rules were used in the various cultivation areas before to 1975, due partly to discrimination but also to differing conditions. In older, more extensively developed areas, it was no longer possible, for example, for individuals to obtain rights to large blocks of land that were available in the newer areas. In an effort to end discrimination in land allocation, the partitioning rules applied by the subordinate board after 1975 have been much more uniform.

Each district land board is authorized, subject to possible veto by the minister, to determine the size of housing and cultivation sites. Subordinate land boards may adjust these guidelines to take account of circumstances in their jurisdictions. The first Letlhakeng subordinate board members used dimensions for its allocations that had been suggested by the district land board. They would allocate plots of either 30 or 40 square meters for housing sites; cultivation sites were allocated in one of three plots: 400 by 400, 400 by 484, or 484 by 484 meters. Some space had to be left between fields, but this was space designed to be used as a roadway.

Now, individuals may have only one legally registered field. That field can be enlarged with authorized extensions without limit, provided the area is regularly cultivated.¹⁰ If no good reason can be given for a field's remaining uncultivated for five years or longer, rights to the field can be confiscated and regranted by the subordinate boards. With some guidance from the district land board, subordinate board members decide what constitutes a "good" reason.

Rules determining who qualifies for rights to cultivate land are closely associated with partitioning rules. In principle, entry rules used in the Letlhakeng area did not change with the introduction of the land boards. Anyone could request land anywhere. Although most people who cultivated or herded within each of the six makgotla commons belonged to the lekgotla managing the area, many cultivation areas today are worked by people from other makgotla in Letlhakeng and surrounding villages. Some individuals from Thamaga and Molepolole who

are married into Letlhakeng makgotla also cultivate in these areas. The prospect that Bakwena or others not related to Letlhakeng residents will secure allocations in cultivation areas in Letlhakeng is, however, a source of considerable anxiety to villagers.

PATTERNS OF INTERACTION

Demand for cultivation land in the Letlhakeng area has been increasing at a moderate but steady rate for decades as the population of the village has grown. Although abundant supplies of such land are still available at some distance from the village, the amount of undeveloped fertile land located nearby is declining. Rising levels of conflict over access to increasingly scarce land was one of the reasons for the reform of land administration. It was presumed that a more modern administrative management system would help to reduce earlier inequities and would reduce conflict levels. The establishment of a new land management authority in the Letlhakeng area has, however, been associated with more rather than less conflict over land in densely developed areas. Inadequate information is an unexpected but important problem for the new land authorities.

The Information Variable

Members of subordinate land boards have both executive and judicial responsibilities that frequently require the application and interpretation of partition rules. Acting as executives, subordinate board members are responsible for the final decision to allocate a new use right, for physically demarcating new housing and cultivation sites, and for making a permanent record of the right. Responsibility for all investigations prior to an allocation falls upon the lekgotla headman who was the former manager of the area where a new use right is sought. His signature on an application form purportedly certifies that he believes that no one currently holds a recognizable right to the site that is sought and that neighboring cultivators have been consulted about the possibility of a new field's being created in the area.

Acting as judicial officers, subordinate land board members serve as a court of first instance for all disputes over land rights in their jurisdiction.

Judgments reached at this level can be appealed first to the main district land board, then to the ministry, and then, in some cases, to the high court. At issue in most of the disputes heard by subordinate board members is the validity under current law of claims to land that conflict with new allocations of use rights by the boards.

Villagers' compliance with partitioning rules can be achieved with low enforcement costs only if the rules are appropriate (Oakerson 1978, 1984; Taylor 1966) and can, in fact, be applied fairly. Partitioning rules are considered appropriate by a community of resource users if their application allows that community to maintain an array of values simultaneously, including efficiency and equity, within an acceptable range. Subordinate land board members have the difficult task of defining, within the bounds of their discretion, partitioning rules that are uniquely fitted to the circumstances of a farmer's situation. These rules must also be consistent with provisions of the general law (contained in constitutional and national statute law) that define the basic property rights of citizens. The application of partition rules is fair if similar situations are treated similarly. Determining the facts of an allocation situation is a prerequisite for the fair treatment of disputants.

Achievement of all these tasks depends crucially upon information. The types of information that subordinate land board members need to partition the cultivation commons appropriately within their jurisdiction are listed in Table 1. The rules that guide the land boards in tailoring and applying partition rules and in determining the validity of contending claims to land are contained in the Tribal Land Act, ministry regulations, and in district land board guidelines. Board members must know the substance as well as the intent of these rules. In order to apply rules emanating from these sources and to exercise their own discretion appropriately, land board officials must also know the preference for partitioning rules of a community of farmers and be familiar with the general character of land and water resources within their jurisdiction and how people use these resources in production. In order to locate new fields without interfering with the rights of other farmers, members must know the boundaries of legitimate land claims.

Because undeveloped fertile land is still available, a piece of land is now given to the first applicant. After all fertile land has been allocated, board members will be required to determine who among competing applicants

"should" get a field that comes vacant. Such decisions will require that board members determine, among other things, the value that access to the land will have for each applicant.

Increased levels of public spending to assist board members in their decision making within the present land board structure could improve members' access to the first three types of information listed in Table 1. Improved

TABLE 1 Types of Information Needed by Subordinate Land Board Members in Partitioning Common Land for Cultivation.

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- T1 Information regarding the provisions of the national constitution, relevant statutes, ministry regulations, and main land board guidelines regarding partitioning rules and the intent of these provisions.
 - T2 Information regarding the extent of subordinate land board discretion over the establishment and the application of partitioning rules.
 - T3 Information regarding the boundaries of use rights in land established by previous land board decisions.
 - T4 Information regarding the character of land and water resources within their jurisdictions and how, in general, these resources are used as production inputs.
 - T5 Information regarding the boundaries of use rights in land established by the earlier land administrators.
 - T6 Information regarding the preferences for partitioning rules of a community of farmers.
 - T7 Information regarding the value of use rights to a particular field site to a given applicant.
-

training programs and the attachment of legal specialists to the boards could provide T1 and T2 information. The addition of technically trained surveyors and cartographers could improve the recordkeeping of the boards and provide T3 information to future boards. The selection of board members from among long-term residents of a given jurisdiction should ensure that members have T4 information.

The ministry has assumed that T5 information is available from the present makgotla headmen if land board members and headmen will only respect and cooperate with each other. The village development committees are expected to provide the T6 information to subordinate board members. No need has yet developed for T7-type information in central Kweneng. The facts of the trouble case underscore the critical importance of T5 and T6 information for partitioning decisions and cast doubt on whether these types of information are available to subordinate board members.

Farmers' Strategies

Most cases heard by the Letlhakeng land board involve decisions about the legitimacy of claims to land under current law. Land board members are told to expect makgotla leaders and established farmers to attempt to hoard land, and thus find themselves with access to very little "disinterested" information about previous allocations of rights. Many villagers now consider land board members as incompetents who intentionally or unwittingly sow trouble. They do not like the new partitioning rules, and they are therefore not very cooperative. Makgotla headmen attempt to quietly protect themselves and other makgotla members from new allocations. They try to avoid uncompensated effort and guilt by association with land board allocations over which they have no veto. Conscientious board members are frustrated by such a situation but are determined to uphold the authority of the board to take control of land affairs.

The absence of authoritative information regarding the history of allocations in this area creates opportunities for farmers to pursue two undesirable courses of action: (1) to advance a spurious claim to land where there is some opportunity to sow doubt about the legitimacy of another person's claim to it and (2) to collude with neighbors in a cultivation area to challenge the rightful claim of another person in order to preserve access to the

land for oneself. Since there are no fees collected by the land boards for applications, demarcations, or adjudication of disputes, no out-of-pocket cost is associated with either strategy. The winner gets access to well-suited land--a prize well worth the effort of asserting a claim. Without information about prior allocations from uninvolved parties, the land board members can rely only upon their own assessment of the validity of the conflicting claims.

AGGREGATE OUTCOMES

The land boards are still recognized by villagers as a symbol of the efforts to end the petty discrimination of the earlier land administrators. Nonetheless, the operations of the subordinate land board, in concert with unpopular actions by the Kweneng District Land Board, have also increased the villagers' levels of anxiety about land rights. While there are a few examples of clear and intentional abuse of authority on the part of a few members of this board, villagers appear to most fear the unwitting harm members might do out of ignorance or carelessness. No one wants to be associated with land board decisions. The hostile reactions of farmers reinforce the beliefs of some board members that the land boards are the only champions of the landless.

In the next section, I will examine the wider social impact of land management by the land boards. These outcomes are evaluated using the criteria of equity and efficiency. In addition, I will consider the extent to which this administration system is likely to contribute to the development of the citizenship capabilities of villagers as well as to the maintenance and extension of patterns of reciprocity among residents of the settlement.

Equity

The designers of the land boards did not intend that all Botswana would have rights to an equal quantity of land at some point in the future. Central government ministry planners expect many cultivators to continue to operate near subsistence levels in the short term while some expand the scale of their cultivation to become "commercial" producers of food crops. Given climatic constraints, planners believe that agriculture has a

limited capacity to absorb Botswana's rapidly growing population. The development of rural industrial enterprises is being strongly encouraged (Botswana Ministry of Finance and Development Planning 1985). This type of development would also reduce the pressure on cultivation land generated by population growth. Progress in this direction has been slow, however.

A principal objective of those who undertook the design of the reformed administrative system was to enhance the equality of opportunity to acquire cultivation land while protecting the security of existing claims in land. Like previous land authorities, however, land board members and their relatives are in a better position to protect claims in land and to get access to the land they want. They can better protect themselves and their relatives from illegal encroachment by persons simply because they know the history of allocations in these cases. With little unbiased information about prior allocations in other cases, their judgments in dispute cases must be largely subjective. More aggressive individuals may well be rewarded disproportionately. Board members can also preserve access for their own purposes to contiguous undeveloped land. This is usually done by stalling decisions on allocation requests for the piece of land until applicants give up and request an alternative site.

Those persons who had no claim to land were the subject of the special concern of the designers of the land board system. Few people in Letlhakeng lack claims in land, although some can claim rights only in land that they consider "useless" because it is infertile or overgrown by Cynodon dactylon (motlhwa), a grass with an extensive root system. However, these people are not helped if they are given access to land surrounded by the fields of people who hate them enough to sabotage their crops. Partitioning rules that ignore the value of access to contiguous land for some producers do the greatest disservice to poor households that suffer the most from shortages of labor and draught power (Henderson 1980).

Efficiency

The further development of strategies of aggression threatens individual producer efficiency as well as the efficiency of land administration. Producer efficiency can be reduced in several ways. Land board allocations using existing partitioning rules, regardless of whether

they are based on accurate information about prior allocations, may reduce the producer efficiency of family production teams already established in cultivation areas if they make it difficult to group the fields belonging to female relatives. Given the particular constraints on agriculture in this area, the location of cultivation areas is as important to many households as is the absolute size of the holdings. In a situation that rewards aggression, individual land holders incur greater time and effort costs in protecting their claims from encroachments and in securing land board judgments that establish their claim. Individuals who cannot cultivate a contested field until a case has been settled also lose the output from that field.

Aggression also diminishes the efficiency of land administration. The ease with which the land board can exclude illegal claimants from a given field is reduced as uncertainty about the facts in conflict cases rises. At present, land board officials must inquire into the facts of each conflict case even though they have little alternative but to issue highly subjective decisions in the more complicated cases. Land board members can always lower decision-making costs in adjudication by issuing arbitrary judgments based on no knowledge at all of the facts of the case. Such judgments, however, create serious deprivations for litigants and further undermine conscientious board members' efforts to win the respect and cooperation of villagers.

Development of Citizenship Capabilities

The theme of self-help pervades the ministry's public education efforts, but it has been strikingly absent from public discussions of the land boards. Botswana's political leadership is generally eager to have the citizens take greater initiative in identifying and overcoming local problems through voluntary organizations. The Tribal Land Act, however, requires no direct citizen involvement in land management. The land board operating in central Kweneng has not encouraged groups of citizens to become involved in its decision making. The greatest part of their business is with individual applicants. While the involvement of headmen in making new allocations is required by law, board members suspect that information provided by headmen may be biased toward continuing discrimination. Central ministry officials believe that citizens will be intimidated by "greedy" headmen and

therefore cannot be relied upon to support the management of land in an even-handed manner.

The creation of the land board system is the last in a long line of important institutional changes that have reduced the number of arenas in which makgotla members could organize important joint undertakings. The pattern of response by central government leaders to problems of governance has been to remove authority from makgotla and villages and give it to authorities at the village, district, or national level. As the level of conflict over land increased, ministry officials preempted the necessary reform of land management institutions in order to ensure that reform was carried out properly.

As a result, public discussion of the problem of partitioning and allocating use-rights to common land did not take place in many villages in Botswana until political leaders appeared to introduce the land boards. Villagers in Letlhakeng were pleased that someone was doing something about discrimination, and that they did not have to struggle with designing the changes. Villagers and headmen alike in Letlhakeng have thus felt free to criticize the land board system without much thought about how conflict generated by the increasing scarcity of land could be reduced. They have not tried to reach a collective decision about what kind of partitioning rules should be used. Now, however, villagers are faced with a reformed system that is producing outcomes they do not like. The considerable self-governing skills, which these people developed in response to their isolation in the western desert areas over the past 150 years, are now being put to use principally by small groups of farmers who organize ways of outmaneuvering board members to advance their own interests.

Maintaining and Extending Reciprocity

The levels of conflict between land board members and villagers in some regions of Botswana, which prompted the creation of the Interministerial Commission on Land Board Operations, have not been reached in central Kweneng due in part to lower population density. The more thoughtful villagers are anxious, however, about the growing conflict over land--a new phenomenon for people who have treated land as an abundant good. Although the land boards were created to reduce conflict over land, they have become part of a structure creating incentives to break the

peace. Because bonds of reciprocity are weakest across makgotla in the village, growing conflict will increase rather than decrease the potential for destructive "tribalism."

The maintenance of reciprocity among villagers depends crucially upon the ability of citizens to call fellow citizens and officials alike to account for behavior that violates the climate of trust that is still strong within makgotla. Proper institutional design structures incentives for officials and citizens so that they do what is expected of them. The current management institution is perverse in that it all too often forces officials to reward predatory behavior.

CONCLUSIONS

Peaceful and productive management of cultivation land in the Letlhakeng area is not possible under the existing land management institution. With no means of determining local preferences for partitioning rules and little access to disinterested information about past allocations, the land boards can do little else in extensively developed areas but antagonize people and provide opportunities for some to profit from breaking faith from their fellow citizens. Access to local time and place information is crucial to the appropriate organization of land for cultivation (Hayek 1945). What kinds of considerations bear upon accomplishing this?

The ministry has accepted the recommendation of the Interministerial Commission on Land Board Operations that, in the future, disputes regarding land and water be adjudicated by the traditional court system.¹¹ This, it is argued, would remove land board members as judges in their own causes. It would also give the responsibility for adjudication to those who presumably know most about the local history of land rights. The separation of judicial and executive functions is vital but this change would not alter villagers' unhappiness with the partitioning rules being used by the land board members. The popular election of nominees for some positions on the boards, which was introduced in 1984, also fails to provide a means of determining community preferences for partitioning rules.

Residents of Letlhakeng do not trust the leaders of the existing village development committee, which is a purely voluntary organization. Members of each lekgotla

fear other makgotla will free ride on any contributions they make to joint projects. A new assembly with authority to determine local rules for resource management would provide a context in which to aggregate community preferences for operating rules for local common land. The assembly probably would have little difficulty devising operating rules for newly developed cultivation areas and their associated commons grazing areas. It could well have serious difficulty, however, reaching agreement on partitioning rules for the extensively developed cultivation areas.

While the situation in these areas is complicated, the appropriate management of these areas (which are usually located near the village) is of greatest import for poorer households. Smaller groups of people--makgotla or new associations of people who cultivate these areas--would have the best chance of reaching agreement about rules for these areas. Existing households of cultivators could use undeveloped portions on a rotating basis, keep it as a commons from which to gather wood, thatching grass, etc., or divide it into equal shares.

The reallocation of taxing and spending authority in Botswana to village communities would also likely change the distribution of primary schools. The concentration of these schools in villages in accordance with present district government policy compounds crowding problems in the cultivation areas surrounding the schools. This concentration unnecessarily raises the cost to those who would like to develop fields in new cultivation areas.

Flexibility is an important quality of any management system for cultivation land. Households now can expand unexpectedly with the return of widowed or divorced women; the practice of borrowing land helps cope with these unanticipated needs for more land, but the introduction of rights to exchange in land would also help. Market prices for land in this particular area would not increase enormously because plenty of undeveloped land is available, but exchange rights would have the effect of encouraging the development of new cultivation areas and thus relieving congestion. At this time, virtually all households hold rights to some land. Even land considered unusable could become valuable when the advantage of fertilizers is recognized. The introduction of some market mechanisms now would have fewer undesirable equity effects than such a change would have in the future when land scarcity has increased. Authorizing individuals to sell claims in fields would not necessarily mean the end of group

management of cultivation areas and attached grazing commons nor group development of new cultivation areas.

Movement in Botswana toward the creation of a widely accepted written record of rights in agricultural land is bound to produce conflict regardless of the structure in which it occurs. The central government has a vital role to play in providing judicial appeal mechanisms that protect basic civil and property rights. The performance of this function is not inconsistent with the empowerment of local resource management groups (Wynne 1980).

NOTES

1. I gratefully acknowledge the many discussions with Ronald Oakerson, Elinor Ostrom, and Vincent Ostrom; they have helped me understand the underlying causes of the conflict I witnessed in Letlhakeng. My field research was funded by the Fulbright-Hays Doctoral Dissertation Research Abroad Program. Extensive subsequent support has been provided by the Workshop in Political Theory and Policy Analysis, Indiana University. Preparation of this chapter has been partially funded by the United States Agency for International Development (USAID) through grant number DAN-5433-GSS-4052. The views expressed are those of the author and not those of USAID or the United States government.

2. There are three categories of land in Botswana: tribal land is administered by the land board system, and represents 71 percent of the total; state land, which is administered by the Ministry of Local Government and Lands, is 23 percent of the total; the remaining 6 percent is held by individuals as freehold land.

3. I am particularly indebted to Ronald Oakerson for pointing out the nature of this diagnostic problem.

4. The commission did suggest one important institutional reform. It recommended that jurisdiction over land and water conflict cases be transferred from the land boards to the traditional court system. Consideration was also given to increasing the control of the popularly elected district councils over land board policy.

5. Data supporting the description of social organization and the organization of sorghum production provided here could not be included because of space limitations. They are presented in my forthcoming dissertation.

6. Commercial fertilizers are not used in this area and little conscious effort is made to encourage manuring of the fields by cattle. Since damage to a borrowed plow is more easily recognized by the owner than is injury to an animal, it is much easier to borrow a plow than to borrow plowing oxen. Animals are normally lent only to persons trusted by the lender.

7. The Establishment of Subordinate Land Boards Order, 1973, indicates that each subordinate land board shall consist of five members. The fifth member of these boards has never been appointed. This member was originally intended to be a district-level employee of the Ministry of Agriculture. Reference is made here to six makgotla commons rather than seven. Members of the Baga-Sekgalo lekgotla in Letlhakeng were not given any land of their own in this area. They have always cultivated land controlled by the Baga-Motsoto.

8. The area of the jurisdiction of the Letlhakeng Subordinate Land Board, which is approximately 7,000 sq. km., is actually more than five times as large as the area earlier controlled by Letlhakeng makgotla, which was approximately 1,200 sq. km. Portions of this area are uninhabited or used for grazing, however, and so add nothing to the work load of management authorities with authority over cultivation land.

9. There were actually more than six local land authorities in the Letlhakeng area. The Bakgwathen lekgotla, Goo-Moiphisi, originally controlled the largest section of land in the area. Authority equal to that of the lekgotla headman over two sub-units of this section was given by the lekgotla to four kinsmen, two of whom remained in the immediate area. This lekgotla thus had three land authorities. Because of their close kinship relationship to the headmen, the other two authorities were sensitive to the preferences of the headmen regarding allocations. They were thus not totally independent of his authority.

10. No limit now exists on the size to which a field can be extended, provided that contiguous land is available. The ministry is planning, however, to place an upper limit on the size of fields used for "subsistence" cultivation purposes. Eventually, a yearly rent will be charged to users whose fields exceed a specified size. It is presumed that these larger fields will be used for commercial-scale

agricultural production.

11. Botswana has two judicial systems. The customary court system, which hears probably 90 percent of the cases processed in Botswana, is staffed by chiefs and elected headmen who are part of the tribal administration (still so-called) for each district. These courts rely on unwritten customary law and on statutory law. Magistrates courts staffed by law school graduates have jurisdiction over serious criminal cases and civil cases brought to it. The procedures used in this court system, introduced in the colonial era, are similar to those used in British civil and criminal courts.

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Institutional Dynamics: The Evolution and Dissolution of Common Property Resource Management¹

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INTRODUCTION

Institutional arrangements for the management of common-pool resources are created and evolve as responses to certain combinations of circumstances. A full understanding of the evolution and survival of such arrangements thus requires dynamic analysis of case studies. The framework presented by Oakerson (this volume) may be applied recursively to examine dynamic sequences of change. Thus, responses to exogenous shocks in one period become part of the existing set of institutional arrangements in the next, affecting the subsequent path of evolution in institutional arrangements.

The dynamic sequences of change in the management of forest resources in Niger (1884-1984) and land resources in Thailand (1850-1980) are the themes of the paper. By applying the model in Oakerson (this volume) iteratively, changes in both individual strategies and decision-making arrangements may be treated as if they were endogenous. The approach is applied at both the local and supra-local levels.

In both Niger and Thailand, exogenous changes in population and market opportunities combined to make the common pool resource more valuable. The response to growing scarcity was the search for new arrangements to manage the resource more effectively.

In each case, the behavior of the state was important in affecting the choice of new arrangements. In Niger, especially in the colonial period, the lack of accountability of the government to constituencies of resource users meant that new socially inefficient arrangements could be gradually imposed. In Thailand, in spite of the general lack of democratic forms of government, indigenous regimes provided new arrangements that better served the interests of the resource users. However, the key difference between the two cases is not merely the type of regime and degree of its accountability to those whom it governed: elite Thai decision makers shared in the gains created by the provision of the new property relations, and consequently their interests affected the innovation possibilities.

Given the existing constitutional structures in each case, basic changes in institutional arrangements relevant to resource management required that the central government take some action. The local arena is, however, also important in shaping the interpretation, enforcement, and operational meaning of the new and existing arrangements. In the Zinder (Niger) woodstock case, arrangements that were extra-legal by national standards, but increasingly legitimate in local eyes, have become relevant as well. In the Thai case, traditional patterns of the exploitation of land resources were retained in spite of the lack of official sanction, and eventually legal compromises were introduced that served to officially recognize actual practices. Formerly extra-legal arrangements were officially sanctioned.

The changes in institutional arrangements occurred within and were linked to the ongoing evolution in the system of resource exploitation. The evolution of each system will be briefly described.

The Zinder Woodstock Case

During the first half century of relative abundance (1884-1935), Zinder's woodstock was subdivided on a de facto basis into three parts: (1) a series of small local common properties around settled areas; (2) an undifferentiated common property resource composed of all remaining undeveloped bushland; and, (3) a de jure state-wide commons for one tree, Acacia albida. This species is widely valued and protected for its agroforestry properties (Pélissier 1980; Weber and Hoskins 1983:2-5).

At the beginning of the 40-year period of relative equilibrium (1935-1974), colonial legislation imposed a *de jure* common property status on the 15 most valuable tree species (including Acacia albida). Management authority was centralized for the protected species at the colony level. Colonial foresters created a small force of forest guards, assisted by local informers, to enforce these rules in rural areas. But enforcers were so few as to be virtually ineffective in those places they did patrol. In other areas, the forest service simply did not make its presence felt. Nonprotected (rough) species remained a common property resource, whose management was left to evolve in light of local concerns. Given extensive undeveloped bushland in the immediate vicinity, few residents of the Zinder area perceived any real scarcity of wood, or any real reason for woodstock management.

In the final 10-year stage of relative scarcity (1974-1984), the 15-species common property trees remained a state concern and off limits to unauthorized users. In consequence, rough species were nearly destroyed, and pressure was generated by the demands of a growing population to lift bans on protected species. An attempt to organize common property village woodlots failed because the technical forestry package was inadequate, commons regulations remained inchoate, and rules governing management were never specified. Though it is fair to suppose more elaborate common woodstock management regulations might have arisen as local people perceived wood shortages, such rules were not developed because the post-independence state maintained the preemption and centralization of management authority. One result has been the recent emergence of individual attempts by peasants to assert personal rights to the trees growing on their own land.

The Thai Land Rights Case

The development of a reliable market for surplus paddy production in the 19th century made land valuable. As a result, disputes over commons land ownership became endemic, inducing a series of innovations in institutional arrangements that resulted in the privatization of arable land in Thailand. Ultimately, in the early 20th century, a cadastral survey land titling system was established through national legislation. This law was the culmination of successive attempts to reduce or resolve land disputes.

For land rights in Thailand, neither jointness nor excludability posed prohibitive problems, given the fixed, immovable character of land and the technology available for excluding others, as well as for exploiting it. Divisibility posed no theoretical problem, but as rice cultivation spread in response to world market demand, it became the heart of the issue in efforts to firm up land titles to parts of the original commons.

Institutional Innovation

Pressure for privatization was the result in both the Zinder and the Thai cases. It should be stressed, however, that in the Zinder woodstock case, privatization by peasants is far from a foregone conclusion. Effective subdivision of the woodstock commons into discrete, individually controlled units remains legally impossible and highly problematic today. In the Thai case, continued management of land as a common property resource was improbable, given the combination of factors at work. The world market impact on the local economy during the 19th century stimulated the replacement of usufruct cultivation with intensive exploitation of private arable land.

In addition to examining each of the case studies within the Oakerson framework, the Thai case is explicitly (and the Zinder case is implicitly) analyzed in a simple supply-and-demand model of institutional change.

In the supply-and-demand model, the demand for institutional change arises when some gain cannot be captured under existing institutional arrangements.² Changes in relative factor or product prices, changes in the size of markets, changes in technology, and changes in the fundamental decision rules of government are among the important variables that create disequilibrium in the existing institutional arrangements. Whether the demand for change will be met, however, depends on the supply of institutional change--the willingness and capability of the fundamental institutions of government to provide and/or permit and/or prevent new arrangements. The capability depends in part on the cost of institutional innovation, which in turn depends in part on the stock of existing knowledge about the design and operation of institutions. The willingness to provide new arrangements also importantly depends on the private benefits and costs of providing change to the agents who are in a position to do so: the elite decision makers of government. Thus, the

existing set of institutions and initial distribution of power will have an important impact on the kinds of new institutional arrangements that are supplied.

Institutional change then arises through the interactions of the demand for and supply of change in dynamic sequences. The institutional response in one period becomes part of the initial conditions in the next, thus affecting the subsequent path of change.

Institutional innovations in both Zinder and Thailand contrast with those reported by McKean (this volume) in her analysis of Japanese woodlots. In Zinder, the French colonial state sought to impose a commons management. Because management was so ineffective, peasants have recently attempted informal privatization. In Thailand, by contrast, the state, major landholders, and peasants all pressured for privatization. In the Japanese case, local village decision-making authority and tradition facilitated the continuation of effective local management of the village's common woodlot, despite changing circumstances, for more than three centuries. New rules to exclude potential users of the resource were officially adopted (Thailand) or attempted on a *de facto* basis (Zinder), whereas in Japan the rules governing inclusion in the group of those who had rights to use the commons were instead retained and refined.

WOODSTOCK MANAGEMENT IN THE SAHEL

In the arid West African Sahel, around Zinder, Niger, changing patterns of woodstock management illustrate several rounds of institutional evolution as population pressure mounted, supplies of wood as a renewable resource eroded in the face of growing demand, and various actors attempted to deal with the problem.

Before woodstock abundance gave way to scarcity in the Zinder area, trees were managed "passively": people simply allowed natural regeneration to reclaim fallowed fields. Though their usefulness was recognized, trees were generally taken for granted because supplies more than met demand. Trees on village lands (typically one to two square miles in all) were apparently dealt with as a common property resource, but access and use rules were probably very loose, given the abundance of wood at that time.

As colonial foresters perceived wood scarcities elsewhere in the French West African empire, colonial

government fiat declared an important part of the woodstock to be a common property resource, subject to management at the colony level. This imposed management system has since proven to be largely ineffective, and woodstock capital is under increasingly serious threat.

As a consequence of institutional stalemates within the forest service and the national government, some peasants are now moving, often illegally, to privatize parts of the woodstock. For them, this now appears to be the cheapest option to preserve their own dwindling wood supplies against complete destruction.

On the basis of woodstock supply and demand relations, the century can be divided into three distinct periods: (1) 1884-1935: relative abundance; (2) 1935-1974: equilibrium; (3) 1974-1984: increasing scarcity.

Relative Abundance, 1884-1935

Resource Attributes

The physical attributes of the resource and techniques for controlling and exploiting it remained roughly constant throughout the three periods. The full description provided here will thus not be repeated for the two later periods. The local woodstock is clearly a renewable resource, composed of all the woody vegetation in the area (Thomson 1983:167-71). It can be exploited on a sustained-yield basis by various users for different purposes, so long as demand does not cut into woodstock capital and impair the process of efficient renewal. The limiting condition here on joint use is set by the productive capacity of a given woodstock. This capacity may be gradually enriched; it may also be impaired by overcutting.

Unless patrols are mounted (which they have not been), exclusion is feasible only within an area that can be enclosed by traditional fences. Such areas will usually be of limited size (gardens and residential components) because thorn fences require substantial investment of labor. Fields are not generally enclosed. However, the Bugaje agro-silvo-pastoral communities were exceptional in this regard: they collectively fenced their lands. Each community was subdivided into a variable number of quarters or sections, organized over time as new groups arrived in a village and took up land. Within each quarter, families resided on their own fields, which were laid out in long, contiguous, parallel strips. Each family

managed its land as a separate enterprise. But the residents of each quarter jointly maintained a common fencing system that both enclosed each quarter field and separated all the quarter's fields from its fallows (Nicolas 1962; Thomson 1976:261-64).

Decision-Making Arrangements

Rules and institutions governing woodstock use during this initial period of excess supply were appropriately simple. People planted and owned privately at least two tree species, the baobab (Adansonia digitata) and the date palm (Phoenix dactylifera), because they produced valued foods. A third species, Acacia albida (Hausa: gawo, pl. gawuna) was protected by the fiat ruling of Tenimun, sultan of Damagaram from 1851-1885. This tree has long been prized and selectively cultured in many Sahelian arable areas. It fertilizes the soil, recycling leached nutrients. It also fixes nitrogen and facilitates cereal crop uptake of phosphorus (National Research Council 1983: 13). Sultan Tenimun reportedly ordered the execution of those who cut the gawo (Salifou 1971:7).

All other tree species formed an open access resource that anyone could freely exploit. Trees were relatively plentiful during this 50-year period (Thomson 1983:169-171). People viewed them more as a nuisance to cultivation than as a valuable good, even though they recognized that leaf litter and wood ashes sharply improved soil fertility.

The woodstock could have been subdivided by allocating discrete portions to individual owners of land where trees grow, but this was never done. This would have modified traditional rules, which instead separated land tenure from tree tenure, and permitted overlapping property rights and different systems of effective control of land and woodstock resources within the same piece of real property. As noted, some peasants are now trying, a century later, to effect this change. During the period of relative abundance, however, divisibility remained a moot point because wood was freely available and off-field supplies more than met demand.

Interactions

There were few conflicts as a result of the imposed rules because different demands for the wood were not yet

competitive (supply exceeded demand). Indeed, the only time when use rules might have resulted in conflict involved the Zinder sultan's fiat ruling against cutting Acacia albida. It is not clear from available data whether people generally accepted the sultan's assertion of authority in this matter as legitimate. At the end of the period, which came midway through the colonial era (1899-1960), wood was still plentiful. Much unexploited bushland still existed in the Zinder area. People continued to found new hamlets in unsettled regions.

Outcomes

Interactions changed little between 1884 and 1935. The dynamics of wood production and consumption appear to have varied only slightly during the entire period. We have no information about the extent to which cutting of gawo seedlings was policed and punished under the precolonial regime. Under the early colonial government, presumably little would have been done along those lines. The impact of consistent population growth was yet to be felt. In this case, the supply of forest products generated by passive management of the Zinder-area woodstock (supplemented by large areas of uncultivated bush) covered demand. The need for active management of a renewable resource was not yet perceived by local residents.

Equilibrium, 1935-1974

Attributes of the Resource

During the first half of this 40-year period, woodstock users still did not interfere with each other in exploiting the common property. Demand could still be satisfied. Nor did exclusion conditions change: barbed wire appeared in the area only after 1960, and then only in small amounts financed by foreign donors. The woodstock was potentially divisible, but economic considerations militated against division. Demand for wood did not yet justify the investment in fencing or in patrols to enforce exclusion. In most of the Zinder hinterland, wood was not sold until well into the 1960s.

Decision-Making Arrangements

Existing legal (forestry code rules) and political constraints, which might have hindered subdivision by individuals, were not tested during this period. Somewhat larger units, based on either quarters or villages, might have served as appropriate levels at which to devise common resource management efforts when scarcity became apparent toward the end of the period, if state-imposed rules emasculating local organization had been relaxed. As it happened, most villages had lost their power of independent activity as the result of efforts of both the colonial and independent regimes to establish controls over major forms of organization in rural areas. Villages (or quarters within them) had no authority to enforce sanctions against violators of locally devised use rules. In practice, few such rules appear to have been made.

The French West Africa forest service was established in 1935 and charged with overall responsibility for managing the woodstock. A few French tropical foresters had concluded that deforestation trends that were then becoming apparent would threaten and perhaps destroy the resource if unchecked. Metropolitan French forestry tradition granted the forestry department relatively extensive controls over the exploitation of the woodstock outside national domain lands; accordingly, the colonial legislation simply arrogated authority to the colonial regime to regulate wood use in the colonies. Because colonial subjects--the vast majority of the population in the Sahelian colonies--had at the time no effective political or legal recourse against these centralizing initiatives, and little power to force colonial officials to take account of local conditions, individual rules included in the French West African imperial forestry code reflected precious little sense of the realities of local agricultural production and woodstock management systems. Small forestry agencies were set up by French administrators in each colony to implement central policies elaborated through a bureaucratic process and imposed through the colonial administrative hierarchy.

This legislation defined far-reaching changes in the regulation of woodstock use. First, it provided for creation of state forests, subject to exclusive forest service control concerning woodstock and land use. Second, and much more important, this legislation centralized the forestry service's authority to regulate the exploitation of the 15 most valuable species of trees outside, as well

as inside, the state forests. New regulations prohibited cutting live specimens, or lopping branches above the height of 10 feet without an authorization (provided free by the forestry service if trees were destined for personal use) or a cutting permit (sold to the holder if the wood was to be harvested for sale). Other provisions of the forestry code left intact local customary rights to exploit nonprotected species.

This restructuring of controls on woodstock exploitation amounted, on one level, to a simple broadening of the prerogative to protect valuable trees first asserted in the area by the pre-colonial Sultan Tenimun. Those who wrote the code provisions clearly foresaw the day when wood would become a scarce and valued commodity. They sought to set up rules to reduce consumption, or at least shift demand from valuable to rough tree species.

On another level, however, the French West African imperial forestry code formalized control over the commons; it removed or drastically restricted what had hitherto been fairly broad local-level discretion in dealing with woodstock management. Because wood was plentiful, little, if anything, had been done along these lines before 1935, but the option of developing local management solutions presumably existed before forestry code legislation eliminated the prerogative. As a result of the forestry code, devising new local political solutions to management problems became a much more difficult and expensive process. While most regulations outlined above were enforced sporadically at best, villagers recognized foresters' authority to control woodstock use, and made few (if any) attempts to establish alternative controls on access and use. The independent state of Niger inherited and maintained the common property framework institutionalized in the forestry code imposed by the French.

Interactions

With the creation of the forestry code, and the formalized, colony-level commons, a new series of interactions gradually arose. Nothing changed until the forestry service managed to patrol an area. Once it did, and forest guards began to impose fines, new patterns of behavior arose. As a result, peasants may have left more trees on fields than they otherwise would have. However, aware that they would not subsequently be allowed to cut protected species without special forester-issued

authorizations, they may have done a more systematic job of surreptitiously destroying seedlings.

Enforcement pressure mounted. Foresters regularly blamed and fined landowners for any trees illegally felled on their field. Those who feared fines for harvesting live trees on their own land cut the wood they needed in remaining areas of bush. Some cut surreptitiously on others' land. Eventually, in the early years after independence, some landowners began to discourage cutting on their property when they found people in the act. Some simply told cutters to stop; others said they would reveal violators' names to the forest guards if the guards threatened the landowners with fines for the code violation. But few landowners ever complained to forest guards about illegal cutting, or asked their help in controlling it.

To assist with identification of code violators, foresters hired local informants. Often these men were traditional policemen attached to canton chiefs. Peasants soon realized they could bribe the informants to steer a touring forester away from a fresh stump. A number of people adopted this strategy, calculating that it would in most cases be far cheaper to bribe than to pay the fine.

A new interaction may be noted: peasants who were caught by a forest guard did what they could to reduce the fine. Local people saw this as a process of bribe bargaining. Because almost all were illiterate, few knew details of the forestry code, and few knew what actually became of the money. In any case, receipts were rarely issued by enforcing officers (Thomson 1977:64-71); most forest guards probably did profit illegally from their power to fine forestry code violators.

Because they perceived no need, people planted very few trees until at least the mid-1960s. At most, some planted shade trees in courtyards, or fruit trees--mangoes, guavas, and date palms--in gardens where they could be protected against animal and human damage. But none planted trees in fields or did very much to preserve natural-regeneration seedlings there. What fieldowners planted or protected might be cut by others without permission, so investments in future woodstock supply made little sense. The potential still existed for investments to renew the woodstock once available wood supplies no longer met demand, or perhaps even earlier, when shortages began to appear. But the new rules of the game made investments in augmenting the stock of trees much more problematic.

This is particularly unfortunate when silvo-agriculturalists would willingly preserve certain seedlings on their fields to fertilize soils and improve harvests if they felt confident they could trim, lop, or cut trees as needed. Such is not the case, however. Farmers are unwilling to risk trees' eventually overshadowing their crops or attracting birds that would destroy ripening millet and sorghum, so they will simply eradicate seedlings rather than leave themselves with no recourse if they end up with too many "untouchable" trees on their fields.

Limited questionnaire data from the area (Thomson 1982) and in-depth interviews during 1971-72 strongly suggest that most landowners accepted the proposition that foresters control the use of trees on lands villagers own and farm. This division of authority over the two resources, which reflects traditional land and tree property rules in some African areas, means that they will not often be managed as an integrated renewable unit.

Outcomes

Neither equity nor distribution terms seemed disrupted until the very end of this intermediate period of relative equilibrium between the supply and demand for woodstock products. The patterns of resource exploitation and mismanagement that flowed from the structure of decision-making arrangements had little direct effect on peoples' lives in the Zinder area. The price of wood did begin to rise slowly in Zinder, the regional center, and a firewood market developed in some rural settings, supplementing the existing markets in building poles. But shortages did not really appear in the rural area surrounding Zinder. Furthermore, people did not really see the cause-and-effect relationship between their actions and the destruction of the woodstock, whether through direct cutting of mature trees, or deliberate destruction of seedlings.

Relative Scarcity, 1974-1984

The landscape has changed somewhat since the early 1960s, but few places are totally cleared of trees. Instead, one still finds rather impressive stands of Acacia albidia, in particular, and other protected and rough species in scattered, interspersed sites. The

scrub bushes Guira senegalensis and Combretum micranthum appear everywhere, apparently indestructible and forever a part of cultivated fields.

Resource Attributes

In general, the limits of jointness have been reached throughout the Zinder area. Few indeed are the places where all can find the wood they need. Instead, each person's harvesting reduces the amount available for other people, increases the time they spend harvesting, and adds to the general over-exploitation of the woodstock.

Exclusion through fencing remains largely impossible, because neither foreign nor adequate local fencing materials are available at reasonable cost. Those who use branches from protected thorn trees (Acacia albida, Acacia senegal, Acacia nilotica, etc.) risk fines at the hands of roving forest guards.

The resource can in fact be subdivided in a few special situations, e.g., through garden and compound enclosures. Such plantings have increased recently. Fenced village woodlots have also been created in some communities since 1974, as a matter of state policy, through foreign-financed projects.

Decision-Making Arrangements

The central government and donor organizations introduced common property village woodlots on a trial basis, beginning in 1974 in the Zinder area. This ever so slightly changed the character of rules governing woodstock exploitation. The new system involved creation of a new set of formal and working rules for the small (one-to-four hectare) plots fenced with barbed wire financed by foreign assistance. The land for woodlots was "donated" by villagers. Often the burden for "donations" fell on the village headman, the individual who possessed the most land, and thus was best able to bear the loss of cropland or fallow "for the common good."

Formal rules specified by foresters who supervised the implementation of these projects were minimal: within the project context, village volunteers, in exchange for token wage payments (equivalent to about half the daily rate for field labor), were to clear land, fence the plot, excavate planting holes and plant seedlings (mainly exotic neem and

eucalyptus, poorly adapted to plantation forestry under local arid conditions). They were then to cultivate peanuts or other leguminous food crops (to ensure that weeds would not smother the newly planted tree seedlings) and generally watch over the plot.

No formal agreement defined the system of distribution. Forest guards who supervised creation of the woodlots asserted that the lots were "for the villagers" and the wood produced there "belongs to the villagers." Villagers remained skeptical. Many assumed that the woodlots really belonged to the government or to the forest service, which they feared would claim the wood at will and without further compensation for villagers' efforts (Thomson 1980).

As far as the rest of the woodstock was concerned, common property rules remain unchanged. The forestry code, as interpreted by local forest guards, still provides for centralized control over use of protected species. Remaining rough species are exploited subject to local use regulations, often highly informal in nature.

Interactions

Because villagers conclude that the new woodlots will benefit the government, not them, they try to minimize their inputs. In most cases, they kill off seedlings by benign neglect: when the fence collapses, or when animals break through it, they do nothing to protect trees. Most trees die quickly, if not from overbrowsing, then from drought. As for protected species, little has changed from earlier periods, although illegal use of wood growing on others' fields may have increased in some villages. In any case, many villagers are beginning to perceive the growing wood shortage.

Some react as usual, allowing the cutting to occur because they feel that the trees do not belong to them. Other landowners, frightened about fines, try either to stop illegal cutting on their land or to identify responsible parties so they can escape paying unjust fines by naming the real violators. Finally, some individuals have begun to defend the trees on their fields when they have the chance; they chase off would-be cutters, asserting a personal right to the trees by virtue of ownership of the land on which the trees grow.³

This smaller group of individuals is intent on changing the previously accepted local working rules of wood use, so some take their disputes to village moots, or

before canton chiefs. Others, in an effort to prevent destruction of trees on their fields, stand up to cutters authorized by the forestry service to harvest wood for commercial use. In neighboring areas, individual field owners have begun to take authorized woodcutters before the arrondissement forester, to inquire why the latter allow cutters to chop down trees on their fields. The foresters generally reply that they never authorize cutting trees on fields, but only in the bush. But for all practical purposes, the bush has been destroyed throughout the Zinder area.

Around Zinder, some field owners have begun during this period to make use of the Qur'an, considered for this purpose to be a magical fetish, in order to identify timber poachers and wood stealers, and force return of their property. A few even go so far as to place a future Qur'anic prohibition on all unauthorized harvesting of wood on their fields by other individuals, despite the fact that this conflicts with recent national-level prohibitions on such use of the Qur'an.

The village woodlots, as currently organized, are a fatally flawed experiment in commons management. Those who established them failed to address the most fundamental concerns of putative producer/users: they gave no effective guarantees of property rights to the latter, nor did they provide any information about distribution of trees or wood produced. Users legitimately concluded they would derive little or no benefit.

Attempts by individuals to police wood on fields, and thus in effect to establish private property rights over those trees, represent efforts to parcel out the commons. It is not yet clear what, if anything, these efforts will produce by way of code changes.

Outcomes

State-organized attempts to reforest through a program of village woodlots have demonstrated once again to Zinder-area villagers that such efforts will not help them, at least not as these programs are currently operated. They remain highly suspicious of both the technical feasibility of woodlots and eventual distribution of any wood produced. Villagers find collective woodlots to be a losing proposition unless they receive pay equivalent to or better than the going rate for field labor for the time they put in.

As for the rest of the woodstock, investment possibilities are stalemated. This leaves everyone worse off, because reduction of the woodstock increases the risk of soil erosion and reduces the likelihood that soil fertility will be reconstituted through natural regeneration. As people press relentlessly on the remaining trees, the costs of fuel and building materials rise rapidly. At the same time, women use more and more animal droppings and crop residues for cooking fuel, so the supply of organic matter available to restore soil fertility has dropped off sharply. Failure to increase wood supplies to keep pace with rising demand in turn translates into a significant lowering of living standards in Zinder's rural areas.

DEVELOPMENT OF PROPERTY RIGHTS IN LAND IN THAILAND

Among the Western developed nations there is a centuries-old tradition of well-defined and enforceable private property rights in land that allow the owner to exclude others from using the land, pass it on to his/her heirs, pledge it as security against financial liabilities, and, within limits (set for instance by zoning regulations), use the land as he sees fit. That system of property rights took centuries to develop and is still evolving.

Comparable systems are usually of more recent origin in many of the less developed world. During much of the 19th century (and more recently in some cases), the rights to land in many countries were usufruct rights. With the rise of commercial agriculture, this system of property rights often proved inadequate. Some of the inadequacies were a consequence of the common property nature of the usufruct land rights. In a usufruct system, land rights were use rights and did not apply to the stock; the individual user therefore planned for the flow of services from the use of the renewable resource over a shorter planning horizon than he would if his property rights extended to the stock, the ownership of the resource itself. Because of the temporal insecurity of land rights, cultivators had an incentive to overuse the resource because if they took into account the effects on the future resource service flow, they could not be sure that they would be able to capture the gains from stinting.

Commercial agriculture and more profitable opportunities for the sale of the produce from farming the land

were generally associated with a rise in the value of land and an increase in the rate of return on land clearing and development activities. Because of the development of a reliable market for output in excess of subsistence production, clearing additional land and investments in leveling, draining, and otherwise developing the land became more attractive. To fully capture the gains from the investments as well as the capital gains from the appreciation in relative land values, the land developer needed a mechanism whereby he could exclude others from using or taking possession of the land. Under a usufruct rights system, the ability to exclude was contingent on nearly continuous use. Such use conflicted in some cases with the fallow-rotation system employed to maintain soil fertility.⁴ The developer might also want to capture some of the gains by using his land as collateral--an unattractive option to a creditor wanting security if the ownership rights were conditional on continued use by the debtor. Land often became open-access property once it was left idle for a period of time, so the common property aspect of the system created disincentives for the socially optimal level of investments in land development during a period in which, setting aside the prevailing property rights system, the economic returns on those investments were in fact increasing.

The generalized case described above applies to a number of Asian and African countries during the 19th and 20th centuries. The specific changes in the decision-making arrangements and interactions among the parties that occurred in Thailand will now be described as a case study.

Economic Change

In Thailand, the opening of the economy to increased participation in international trade, population growth, and generally favorable terms of trade for agricultural export products led to an appreciation in land prices (see Table 1). Numerous accounts of the 19th century period indicate that the expansion of the rice-export economy was accompanied by an appreciation in real land rents and prices (see Feeny 1982). For the 20th century period, the qualitative and fragmentary quantitative evidence is supplemented by data on land prices derived from mortgage transactions. The data again document the overall appreciation in real land prices and reveal a pattern in which

TABLE 1 Economic Change in Thailand, 1860 to 1942.

Average Annual Percent Rate of Change									
<u>Period</u>	<u>Terms of Trade</u>		<u>Period</u>	<u>Real Land Price</u>	<u>Period</u>	<u>Rice Exports</u>		<u>Period</u>	<u>Population</u>
	(1) ^a	(2) ^b				<u>Quantity</u>	<u>Value</u>		
			(3) ^c		(4)	(5)		(6)	
1865-67 to 1912	1.41	1.55			1864-1910	4.43	5.64	1860-1910	0.85
1912-1925	-3.39	-1.92	1915-1925	-0.31	1910-1925	1.78	4.14	1910-1942	2.08
1925-1940	6.31	6.69	1925-1940	2.58	1925-1940	-0.85	-3.80		
1865-67 to 1940	1.52	1.95	1915-1940	1.41	1864-1940	2.84	3.41	1860-1942	1.33

^aExport price of rice divided by import price of white shirting.

^bExport price of rice divided by import price of grey shirting.

^cLand price deflated by price of rice; similar trends are revealed when the land price is deflated by the price of manufactured goods.

Source: Feeny (1982), pages 17, 20, 21, 33, 127-131.

appreciations in the terms of trade are accompanied by an upward trend in real land prices (for a discussion of a simple general equilibrium model that generates this prediction, see Feeny 1982). The increasing value of land in turn led to disputes over land ownership, and these induced changes in the property rights system, ultimately culminating in the privatization of land rights. The major changes in the system of land rights are summarized in Table 2.

Changes in Land Rights through 1954

Under early 19th century monarchy, the system of property rights in land in Thailand was essentially one of usufruct rights. As long as the cultivator continued to use the land, he (or she) had the right to sell it, to pass it on to heirs, to exclude others from using it, or to use it as collateral to obtain a loan.⁵ The maintenance of the rights depended on the payment of land taxes. In addition, if the land were not cultivated for more than three consecutive years, rights were forfeited. Operational rules thus provided for serial jointness.

The provisions created temporal uncertainty in the security of the usufruct land rights in Thailand. Homesteaders were particularly concerned by the insecurity of long-term rights: they wanted to be sure that they could reap the gains of having cleared the land for cultivation. In a monsoonal rain-fed agricultural system, land use was not always predictable, and any lapse in its use could make it fair game for acquisitive neighbors and officials.

The first half of the 19th century saw a gradual increase in the degree of commercialization of the Thai economy.⁶ As a consequence, jointness became more problematic. During the fourth reign (1851 to 1868), land rights were made more formal through a change in operational rules: the issuance of title deeds was based on paddy land tax receipts. In 1867 and 1868, titles for paddy land were introduced that based the tax on the area harvested. By 1882/1883, this had been reversed in some major Central Plain rice-producing provinces: titles were based on the area owned rather than harvested. Thus, by paying taxes on land not currently in use, farmers could maintain ownership rights. They could obtain titles by presenting officials with the tax receipts for the previous 10 years. Documents were also available to give cultivators of newly cleared areas the rights to exclude others

TABLE 2 Major Changes in the Thai System of Property Rights in Land, 1850-1954.

Period	Institutional Change
Early Nineteenth Century	Usufruct rights, existing system
1867-1868	Title deeds issued based on the area harvested
1882-1883	Title deeds issued based on the area owned
1880s	Standardized forms and procedures prescribed in an effort to reduce land disputes
1892	Comprehensive land law enacted with provision for title deeds and use of land as collateral
1901	Torrens system of land registration instituted and cadastral surveys conducted
1936	1901 law amended to allow for ownership based on registration with the Land Department of claims on unsurveyed lands
1954	New land law enacted providing for a variety of documents and levels of security of land rights

Source: Feeny 1984.

from developing the land for three years, at which time rights were forfeited if the area had not been developed.

As land prices continued to appreciate, inadequacies in the property rights system became apparent. Frequent land disputes occurred. Conflicts over ownership of the same piece of land became endemic. During the 1880s, the government responded by issuing standard forms and prescribing standardized procedures. Although the administrative changes represented improvements, the lack of a central place for land records meant that more than one set of titles could be issued for the same piece of land. With increased commercialization, disputes became increasingly frequent.

The response was another change in operational rules, the passage of a more comprehensive land law in 1892. It created nine types of land, including land held by religious institutions, royal land, residential land, agricultural land, land used for mining, forest and jungle land, and waterway land. The agricultural land category included three types of orchards and gardens, upland land, and two types of paddy land. Provisions were made for transferable title deeds that could be used as collateral, and there were documents and procedures for the registration of such transactions. Homesteading provisions were included as well as procedures for converting old documents into the newly created ones. The 1892 land law replaced the earlier rather ad hoc system with a more comprehensive one.

However, major deficiencies in the legislation and its administration remained. The continued lack of central land title offices and precise descriptions of the boundaries of the land in question meant that disputes over ownership could not be easily resolved and land could not be unambiguously identified. These problems became very conspicuous in the Rangsit area (to the northeast of Bangkok, a major commercial rice exporting region in the Central Plain) during the boom of the 1890s when a number of very bitter land disputes arose. Conflictual interactions dominated once the limits of jointness had been reached. As a result, the Royal Survey Department was diverted from its work on mapping and in 1896 began cadastral surveys, initially concentrating on the Rangsit area but later expanding into most of the major rice exporting areas in the Central Plain.

New operational rules were formally introduced in 1901; the Torrens systems of land titling with central provincial land record offices and cadastral surveys was formally adopted. From 1901 to 1909, 11 land record

offices were established. In the Central Plain, 593,059 title deeds had been issued by 1910 (637,001 for the whole kingdom), and the area surveyed was 1,605,000 ha (1,671,000 ha for the whole kingdom). The work was carried out by European experts (mainly on loan from the Indian Civil Service) who, in addition to conducting the survey work, also provided training to the Thai staff.⁷

The system was not fully realized. A lack of diligent record keeping and administration reduced the benefits. Not all farmers obtained or were able to obtain the proper documents for land that they held. Cadastral surveys in areas outside the Central Plain were particularly incomplete.⁸

In 1936, the 1901 law was amended to allow for the registration of claims on unsurveyed land (see Engel 1978:156; Yano 1968:853 and 856). While claims on apparently unclaimed lands were traditionally registered with the village headman, the 1936 law required registration at the Land Department. The 1936 law represented a compromise between the elaborate European cadastral survey system of the 1901 law and the incomplete implementation of that system. The compromise was extended in 1954 when a new comprehensive land law was enacted. The 1954 code remains the basis of the current system of land rights in Thailand. It provides for a variety of land documents that give different levels of security of land rights. Occupation certificates are issued by village headman and commune leaders and allow the holder to temporarily exclude others from using land as long as it is being developed. Reserve licenses issued by district officers also give rights for temporary occupation subject to utilization. Exploitation testimonials (again issued by district officers) confirm that utilization of previously reserved land has taken place and confer rights that are transferable and inheritable. Finally, full title deeds based on cadastral survey provide for the recording of land transactions; they are issued by officials in the provincial capital. Greater security in land rights thus comes at the expense of higher transaction cost (both formal and informal). The 1954 code is the basis of the current system of land rights in Thailand.

The Land Rights Situation Since 1954

Even within the parameters of the compromise embodied in the 1954 code, the system is still incomplete. Ingram

(1971) reports estimates for the late 1960s of the area covered by three types of land documents. Only 12 percent of the area had full title deeds, 4 percent had reserve licenses, 18 percent had exploitation testimonials, and 65 percent had no formal legal documentation at all.⁹

The incomplete realization of the system of private property rights in Thailand, especially in upland areas, is creating disincentives that hinder efforts to intensify cultivation in the face of a rapidly shrinking land frontier. Recent World Bank reports have pointed to situations in which socially profitable investments in land development are being underexploited in favor of continued extensive cultivation systems (such as swidden agriculture). The reason for the lack of intensification is often that farmers lack the means to obtain secure property rights, not that they are unaware of the higher rates of return on more intensive land development. Thus they make investments in land clearing that have only marginal returns and in the process contribute to soil erosion. These investments have a certain short-term appeal, however, since during the first few years the marginal returns exceed those initially available with more intensive modes of cultivation (that require larger investments in land development). In the long run, the outcome is clearly suboptimal from an efficiency point of view, and because these farmers are generally members of the lower income group in Thailand, equity is also not well served.

Disputes over conflicting claims to the same piece of land played an important role in stimulating the government to develop more systematic and elaborate systems of private land rights in Thailand. The creation and actual operation of that system also had distributional consequences. In general, the pre-existing rights of cultivators and homesteaders were formally recognized under the new system; but differential access to formal procedures and the ability of powerful government officials to manipulate land records did allow elites in some cases to obtain ownership of land that, under the traditional system, would have been controlled by homesteading cultivators. A striking example of this occurred when the Siam Canals Land and Irrigation Company successfully evicted 29 previous occupants in an area along the east bank of the Nakorn Nayok River to the northeast of the company's Rangsit development scheme. In 1916, Prince Rabi, then the Minister of Agriculture (and formerly the Minister of Justice), reviewed the records of the dispute and concluded that the courts had incorrectly found in favor of

the company and its powerful investors. The previous occupants had first taken their grievances before local administrative officials, but after obtaining no satisfaction took their case before the provincial court. They provided various certificates of occupancy and land tax receipts as evidence of their prior rights. The company had, however, been able to use its superior access to government officials and procedures to have the titles for the land issued in the company's name.¹⁰ Given the high level of political connections of the company and its allies, little could be done in this case to protect the original occupants.

Although the outcome was in this case somewhat atypical, the process by which external arrangements and third-party dispute settlement were brought to bear was not. Initially, disputants typically approached local administrative officials who attempted to resolve the dispute. As mentioned above, their ability to do so often depended upon the precision and accuracy of the land records; thus the evolution of more precise documentation and record-keeping systems. When disputes could not be settled at the district level because the parties were intractable or the records were incomplete or inaccurate (whether through deliberate manipulation, carelessness, or negligence), the provincial courts were then employed to resolve the dispute.

Today, intrafamilial manipulation of the system has allowed some heirs to gain at the expense of others (Engel 1978). The traditional system of equal inheritance by all surviving children is frequently subverted by more literate and knowledgeable siblings, resulting in a clash between the use of the modern system and traditional inheritance practices. Through its provincial courts, the central government has become increasingly involved in the adjudication of local disputes that in former times would have been settled by local officials.

The trend has two important implications. First, common people can use the court system to inhibit arbitrary behavior on the part of officials. This advantage, however, comes at the expense of a higher level of transaction cost than in the traditional system.

Conflicts in frontier areas today share many characteristics with those of the earlier period. First, conflicts have served to focus the attention of the Thai government on providing cadastral surveys. A recent World Bank project in Thailand is specifically aimed at extending the cadastral survey. Second, differential access of claimants

in land disputes to the Thai bureaucracy, the imperfectly competitive political arena, has distributional consequences. We have already seen that in the early 20th century period elites were sometimes able to successfully manipulate the system. Similarly, today, especially along the mountain slopes in northern Thailand, ethnic Thais are often able to obtain legal claim to lands previously cleared and occupied by non-Thai minorities (Kunstadter et al. 1978).

Institutional Change

In the Thai case, the appreciation of land prices led to an increase in the demand for more systematic procedures for defining property rights in land. The government in fact responded to the demands and a new system of property rights gradually evolved. What factors contributed to the willingness and capability of the government to supply the institutional change?

In part, the new system evolved as a practical solution to the land disputes that became so common as land became more valuable.¹¹ The cost of supplying a new set of institutions was lowered by the availability of European systems and officials--by the existence of a stock of knowledge and practice on the organization of property rights in land. Over time, that system was increasingly appropriated by Thai institutions. The feasibility of creating private property rights in land in Thailand was enhanced by the concomitant development of a provincial court system; this process began in 1892 when the Ministry of Justice was created; the Law of Provincial Courts was promulgated in 1896, and in 1908, the Law of Courts of Justice transferred control of the provincial court system from the Ministry of Interior to the Ministry of Justice (Engel 1978:24-29). Both Thai officials and foreign experts were engaged in drafting modern civil and criminal codes. Although it has never been vigorously exploited in Thailand, a better cadastral system also gave the government an enhanced land tax revenue base. Finally, private and social interests coincided. Members of the elite, primarily government officials, participated in the land boom and benefited from the more secure system of property rights in land. They had an incentive to supply the new system because they too would share in the gains.

In the case study, one can see that, given the initial common property nature of usufruct land rights and the growing incentive to exploit land resources for commercial

agriculture, the existing set of decision-making arrangements generated sub-optimal outcomes. The existence of the unexploited gains and resulting land disputes fed back into the system and produced a series of reasonable administrative changes. Simple and inexpensive remedies were tried first, but when the outcomes were still far from satisfactory, more elaborate and expensive solutions were attempted. A new system of property rights evolved and is still evolving. In this case, a system of private property rights (even if less than ideally implemented) was the solution to the common property resource management problem. Manipulation of the property rights system by elites for their private gain occurred and continues to occur, but in the majority of cases the new system provided more secure rights in arable land to the party who actually cleared and cultivated it. Ownership rights that did not depend on continued use and that were more precisely defined provided cultivators with the assurances necessary to make investments in land development privately profitable. In short, the new system of property rights reduced the divergence between the private and social rates of return on land development.

The discussion may be briefly summarized in the framework provided in Oakerson (this volume).

Resource Attributes

Arable crop land lends itself to excludability; thus the creation of boundaries marking areas for exclusive private use was not prohibitively expensive. Arable land is also divisible. Finally, at low levels of population density, much arable land may be left idle. Jointness may be maintained sequentially.

Decision-Making Arrangements

From the mid-19th century on, land rights and disputes were adjudicated under operational and legislative rules imposed by the Thai government on existing usufruct rights. Both local administration officials and the national government were involved in specifying and enforcing the rules governing land use. Over time, local customary rules increasingly conformed to the national laws as interpreted through the provincial court system. The national laws, however, were also formally modified to

reflect the lack of a complete cadastral survey and the long-standing Thai tradition of homesteading on unoccupied lands.

Interactions

Under the traditional usufruct system and in the environment of a largely subsistence economy with a low population density, there was limited competition in land use--in the interactions among cultivators. The usufruct system allowed the cultivator to exclude others from land currently in use. But given the abundance of land and limited outlets for surplus production, there was full jointness and/or little rivalry in the use of waste land.

As the property rights system gradually evolved, individuals made use of the new government-established institutional arrangements to enhance the security and precision of their land rights. Many people, influential and otherwise, shared in the gains. However, differential access to the use of the institutional arrangements did affect the outcomes in terms of who obtained land rights to various tracts of land in a minority of important cases.

Outcomes

The development of more secure property rights in land signalled increased intensification in land use, greater investments in land development (the bunding and leveling of fields to promote the use of transplant varieties instead of the broadcast planting of paddy), and the increased use of land as collateral.

At another level, that of the system as a whole, the result was an evolution of institutional arrangements--changes in the rules through which individuals interacted. The outcome of the efforts of the landowners to more securely define their rights in land was a gradual evolution of new legislative rules and operational regulations resulting in the privatization of rights in arable land.

CONCLUSIONS

From the two case studies, several propositions concerning the dynamics of common property management emerge. As Oakerson (this volume) stresses, understanding

the dynamics of institutional change involves assessing the opportunities for individuals to learn from the consequences of their actions. The recursive nature of the evolution of systems is evident in both cases. An understanding of change also requires an examination of the ways in which existing institutional arrangements constrain or enhance individuals' abilities to make adjustments in the decision-making arrangements. In both the Thai and the Zinder cases, existing constitutional structures required action by central government if innovations in institutional arrangements were to be made that would ameliorate common pool resource management problems. In both cases, peasant farmers in general have limited access and influence in the political system and few instrumentalities of local government or local association. Nevertheless, in the Thai case, the demands of landowners for innovations in the property rights system were largely met, apparently because elite and peasant interests largely overlapped on the issue of land rights.

In both cases, privatization of a common property resource makes sense for a number of reasons:

- o First, the costs of organizing collective management are extremely high and collective management creates problems. Privatization does, however, risk inequality at the subdivision stage when control over the resource itself is allotted to particular individuals. If this is a one-time allocation, with no easy mechanisms to rectify maldistribution, inequities can pose a serious problem. It should be noted that maintaining common property institutions in no way avoids equity problems. They are simply pushed back a step, and reappear when annual or other increments of production from the resource are harvested and distributed to users. Distribution rules specify who gets what, when, and how. The potential for inequity inherent in such regulations and practices is substantial.
- o Second, commons management of any sort depends on a situation of perceived scarcity; on the legal possibility (that is, legal authority) to manage a resource (or at least the lack of a legal prohibition on local efforts to manage it); and on the perception of some comparative advantage to sustaining common property status for the resource

rather than privatizing it (e.g., prohibitively expensive fencing that makes it reasonable to jointly hire a few guards to protect the resource for everyone). Therefore, it follows that effective commons management depends on: (1) local capacity* to experiment with joint management forms as production-consumption relations deteriorate and resource shortages appear; and (2) low political and economic costs of collective organization to manage the commons.

Zinder-area villages have no authority for, and little tradition of, collective management of any kind of resource. The ethnic Hausa who inhabit this region tend to be highly individualistic, and show little interest in state-organized groups. Collective action groups that could be readily altered to manage a commons effectively simply do not exist. Given the existing institutional arrangements and cultural norms, the transaction costs associated with collective management in this setting are high. Much the same can be said for Thailand, where highly individualistic behavior also generally prevails. In such settings, privatization may minimize transaction costs.

- o Third, population pressure, world or local market opportunities, and changing production technologies will influence the type of management structure local people will prefer. These trends shape the demand for new institutional arrangements.
- o Finally, effective decision makers must perceive that organizing the management enterprise is worthwhile, i.e., that it will benefit them in a personal manner, either directly or indirectly. Incentive compatibility--the congruence of the interests of the individual decision maker and of those affected by his decision--appears to be essential.

*In the woodstock case, the state forester lives so far away from most users that they do not consider him a reasonable source of authorization. The national system of common woodstock management thus failed and still fails to function. In Zinder, then, illegal privatization efforts appear critical as indicators of a fundamental change in user perspective. From being producers for their own consumption only, the users in these cases have begun to become producers of wood for sale as well.

NOTES

1. The authors acknowledge the helpful comments of Jere Gilles, Margaret McKean, Elinor Ostrom, Pauline Peters, and C. Ford Runge.
2. The specific model employed here is described in more detail in Feeny (1982, 1984); see also Ruttan and Hayami (1984) and Hayami and Ruttan (1985).
3. It should be noted that there is a long tradition in West Africa of a distinction between property rights in land and in the trees that grow on that land. In part, the distinction may be a result of the fact that property rights in land were acquired through the investment of the labor necessary to clear the land and bring it under cultivation. Thus, by analogy, the person who invested his labor in cutting a tree had acquired ownership in the wood, even if he did not own the land on which it was grown.
4. Furnivall (1909) provides an example of the conflict between fallow-rotation systems and usufruct rights in lower Burma in the 19th century.
5. In a usufruct system of land rights, the act of selling land transfers the use rights from the original user to a new party; in the process, this new party obtains the original holder's right to exclude third parties. In many instances, it is the investments in clearing the land that are being "sold." Thus, the purchase price compensates the original owner for improvements in the land.
6. The trends in commercialization in the Thai economy over the 19th and 20th centuries are discussed in Ingram (1971) and Feeny (1982). Developments in the Thai property rights system are discussed in Feeny (1982, 1984).
7. After 1909, the Royal Survey Department was transferred back to its original mapping duties and the rate of

increase in the surveyed area plunged. The number of title deeds on file (primarily in the Central Plain) did, however, continue to increase; the rate of increase of title deeds on file for the whole kingdom was 4.69 percent per year over the 1905 to 1941 period.

8. After 1909, a number of minor changes were made in the system. Administrative procedures were changed and fees were instituted on land transfers. Restrictions were placed on the sale of public lands in 1916 and 1919 with the intent of curbing land speculation. Finally, in 1938 and 1939, a new schedule of agricultural land taxes was established.

9. Ingram (1971:266); see also Feeny (1982), Johnson (1969), Hooker (1975), Gisselquist (1976), Engel (1978), Kemp (1981), Yano (1968), and Chalermrath (1972). Reasons for the incomplete coverage include the lack of a complete cadastral survey as well as the unwillingness or inability of farmers to obtain formal documentation of their land rights. The overwhelming constraint appears to have been the incomplete coverage of the cadastral survey supplied by the government.

10. Primary documents relevant to this case are found in the Thai National Archives, Sixth Reign, Ministry of Agriculture Documents 5/1 to 5/12; see also Feeny (1982).

11. Unfortunately, archival and other records provide little evidence on the individual strategies employed among the competing parties involved in disputes over land use. Some of the limited available evidence is discussed in Engel (1978) and Feeny (1982); see also Kemp (1981), Chalermrath (1972), and Yano (1968).

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Collective Management of Hill Forests in Nepal: The Community Forestry Development Project

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INTRODUCTION

Forests and forest products have always been of central importance to life in the middle hills of Nepal, a region where villagers are unusually isolated, even today, by the terrain. Fuel and timber, fodder supplies, and tree litter for composting are but the most important products of the forests. The forest has supplied these and other smaller inputs to the household and rural economy, and helped to prevent widespread soil erosion, flooding and damage. But the expanding population has put increasing pressures on the land, with the consequence that forested land is diminishing and with it both the products it has supplied and the protection it has afforded to the ecological balance in the area.

Early attempts by the central government to halt this deteriorating trend were based on measures to bring all forest land under government control. In the late 1970s, however, these measures were reversed in a vigorous new initiative designed to enable, encourage, and support local control, management, and creation of forest resources. In doing so, the government hoped to be able to build upon the tradition of communal management of forests, and of other resources and activities, among the people of the middle hills.

In some areas, this new approach to forest management is being pursued through existing integrated area develop-

ment projects. In the rest of the hills and mountainous region, about one half of it, the new approach is being developed through a project of the Community Forestry Afforestation Division of the Forest Department in the Ministry of Forests--the Community Forestry Development Project (CFDP).

This paper reports on progress made in initiating and institutionalizing communal forestry in the hill areas through the CFDP, which is supported by technical assistance from the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Development Programme (UNDP) and by a loan from the World Bank's International Development Administration (IDA). During the initial phase covered here, the project has been operating in 400 panchayats in 29 administrative districts, spread throughout the middle hill areas of the four regions of the country (see Figure 1). (A panchayat is the lowest political and administrative unit.)

This study encompasses an initiative by a government to provide a widely applicable framework for developing productive local forest management systems suited to current needs, and that would build upon local traditions and practices for forest resource management. Thus, the concern here is not with a single group or collection of groups, but rather with a policy.

The newness of the CFDP initiative needs to be underscored. The project became operational less than five years ago, and its early years were devoted to evolving and setting in place the necessary institutional and physical infrastructures. Transfer of forests to local control only began to take place on a substantial scale in 1983/84. What is reported here is thus necessarily confined to the experience gained in the formative stage of this potentially very large and far-reaching attempt to establish a sound, sustainable system of common property resource management.

HISTORICAL BACKGROUND

The Forest Resource

The hill areas of Nepal contain an unusually wide variety of forest types, reflecting both the wide variations in altitude, climate and terrain, and the fact that the botanic zones of the eastern and western Himalayas meet and merge within the country. Stainton (1972)

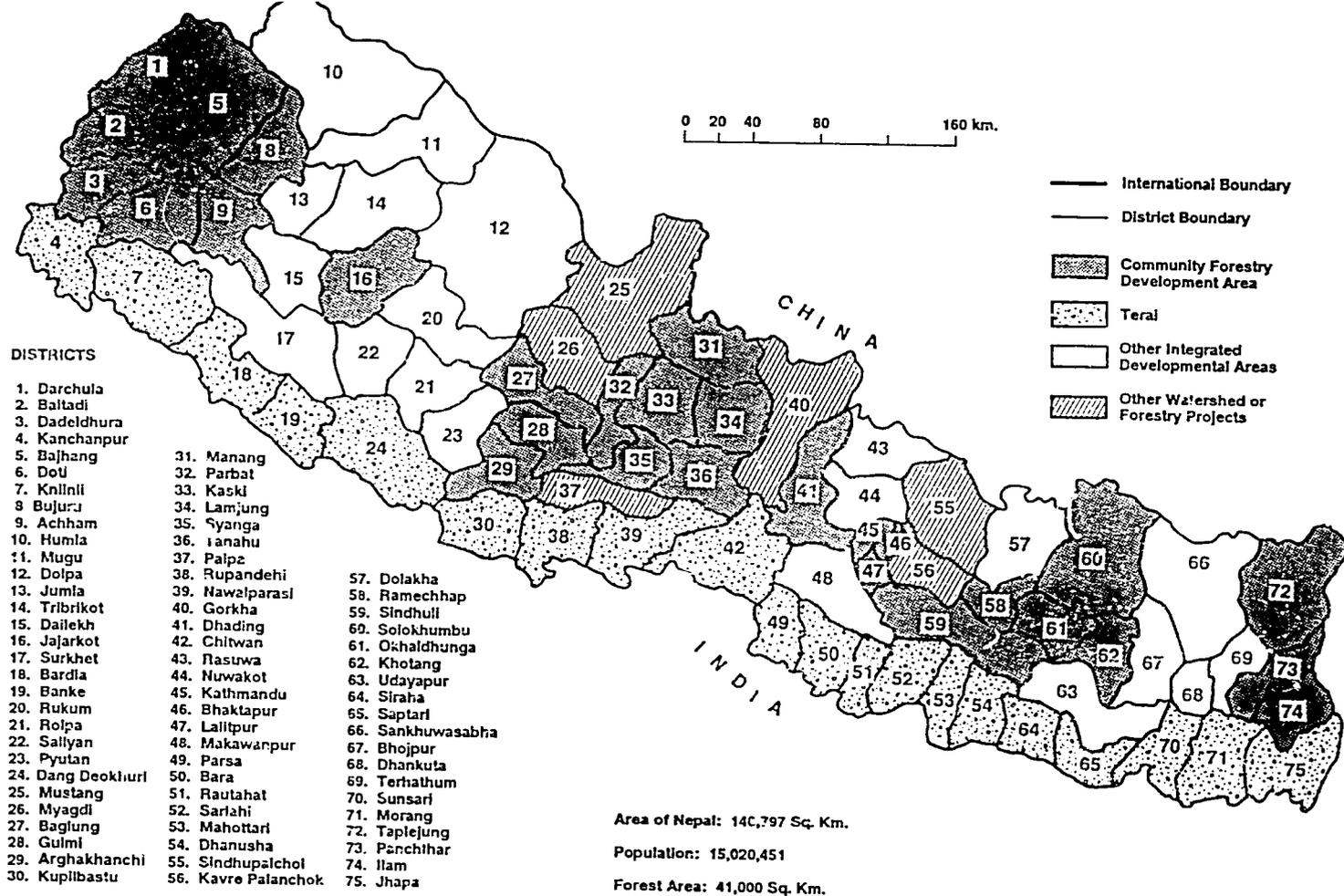


FIGURE 1 Community Forestry Development Program, Nepal.

identifies 6 zones, 13 sub-zones, and 77 forest types. In general, within the populated range of altitudes, fir and oak predominate at higher elevations, gradually giving way to chir pine (Pinus roxburghii), species of Prunus, Castanopsis, Schima and Alnus at medium elevations, and sal (Shorea robusta) at lower elevations.

The natural diversity of the forests has been further modified by prolonged and often heavy local human intervention--which varies considerably both in intensity and purpose from one area of the hills to another. In the east, for example, pressures on the forest have been heavier than in the west. Different mixes of products drawn from the forest reflect variations in such factors as the role and management of animal husbandry, type of house construction, and individual or village preferences.

Changing Patterns of Use of the Forests

Nepal's agricultural economy has always depended on the farmers' use of several complex economic strategies to exploit the available natural resources. The principal source of income has always been crop production from arable land. But farmers have always supplemented their incomes through the sale of livestock and livestock products, and have fulfilled their own needs for manure and draft animals by raising livestock. Thus, farmers have always depended heavily on forest and pasture land resources to supply fodder for livestock and such forest products as fuelwood, compost materials, construction, cottage industry, food, and ritual materials. Indeed, these resources have traditionally been an indispensable component of the subsistence systems used by Nepalese farmers to maintain their livelihood.

So long as there was (and in many parts of Nepal there still is) a relative abundance of these natural resources, the traditional methods of exploiting them did not pose a severe problem. The management systems controlling their use were primarily concerned with rights of ownership and the protection and distribution of benefits.

Many villages of Nepal had systems in which forests and pasture lands were considered community property (such as the kipat system in eastern Nepal) that could only be used by noncommunity members through payment of fees or other commodities. Likewise, many villages (such as in the far west) had, and continue to have, communal systems of gathering and harvesting that ensured fairly equal

distribution of and ease of access to such products as fodder and composting materials. Some communities, like the Sherpas in Khumbu, even had strict rationing systems to control the use of construction timber, since trees regenerated so slowly in their high altitude ecosystem. In addition, a tradition of temple and monastery forests ensured that trees growing near religious structures were cut only for religious purposes. However, for most of the Nepalese hills, the main factor that limited the amount of deforestation was the relatively small population and the lack of any commercial exploitation. In these demographic conditions, it was labor and not resources that limited agricultural productivity (Campbell 1978).

Given the high intensity of labor required to terrace fields, build irrigation channels, and transport manure composts, a farmer could intensively cultivate only a few fields. This meant that where possible the average farmer supplemented his main production with labor-efficient methods such as slash-and-burn agriculture in forest lands. Similarly, cattle and sheep were extensively herded in forest and alpine areas. So long as the population was small and resources exceeded the amount of labor available to exploit them, this kind of extensive agriculture and grazing did not produce severe ecological repercussions; the fields could be left fallow to regenerate naturally, and the carrying capacity for grazing was not exceeded.

As population dramatically increased from 1850 to the present, the resources-to-labor equation reversed: land rather than labor has now become the limiting factor throughout most of Nepal. This has resulted in a shift to more intensive farming in which most cultivation is carried out on terraced fields. It has also resulted in a reduction in the number of livestock per family, and a shift from cattle to buffalo, and from sheep to goats. While these agricultural trends are ecologically beneficial, the benefits are unfortunately offset by the increasing use of marginal lands for cultivation without sufficient fallow, and by a continuing pattern of forest and pasture use that considerably exceeds the carrying capacity of the environment.

Heavy pressures on the resource base are thus of relatively recent origin, and there are still important exceptions and enormous variations in the rate of degradation. People are only now seeing the consequences of these pressures on a scale sufficient to persuade them to

evolve new methods of resource conservation on common lands.

Forest Legislation

In the face of growing demands for fuel and fodder and other forest products, the government nationalized all nonregistered forest and waste land in 1957, in an attempt to curb the process of deforestation and forest degradation and increase productivity by putting forests under more active management. Later, under the Forest Act of 1961, the definition of forest land was extended to include all land adjoining forest areas and left fallow for two years (Manandhar 1982).

The desirable objectives of this new policy proved very difficult to achieve. Effective government supervision of thousands of patches of forest scattered through remote hill terrain, accessible only with extreme difficulty, proved impossible. For example, one regulation required people to obtain permits from forest rangers to collect each load of firewood. Another required written agreement from a distant forest office (at times, more than a days' walk) for house timber. Obviously, these were difficult for households to obey and nearly impossible for the authorities to enforce. Consequently, people in most places unavoidably resorted to illegal collection of forest produce.

At the same time, nationalization initially had the unforeseen effect of further weakening existing forest conservation and management. Whereas communities previously had sought to protect local forest resources against exploitation by outsiders through their traditional management systems, they now had no legal authority to do so. Furthermore, they now tended to view the forests as government property rather than their own, an attitude that seriously eroded motivation to protect local forest resources. Thus, nationalization apparently inadvertently "hastened the process of deforestation" (Manandhar 1982). Ironically, this alienation of official control also led some communities to intensify protection of their forests from the depredation of outsiders--including, occasionally, the forest department itself.

The forest legislation also tended to obscure the understanding of hill forestry as a component of hill agricultural systems. For example, a regulation that specified that any field left fallow for two years could

be appropriated by the state had the effect of discouraging following.

In recognition of these negative consequences, the government took a radically different initiative in 1978 by promulgating new regulations to enable substantial amounts of public forest land to be handed over to local communities to control and manage. Under these regulations, the forest department could enter into agreements to transfer forest to village panchayats. The village panchayat, the lowest level of political and administrative organization, comprises nine wards, usually encompassing several villages with a total population of 2,000 to 4,000 persons. The elected representatives from the constituent wards in turn elect a chairman, the pradhan panch. The village panchayat is the principal institution through which local development activities and funds are channeled.

The 1978 Panchayat Forest and Panchayat Protected Forest (PPF) Rules (as amended in 1980) define the categories of forest that could be transferred to local community control as follows:

- o Panchayat Forest: "Any governmental forest area or any part thereof, which has been rendered waste or contains only stumps, may be entrusted by His Majesty's Government to any village Panchayat on prescribed terms and conditions for reforestation in the interest of the village community, and such forests shall be called Panchayat Forests."
- o Panchayat Protected Forests: "Governmental forests in any area or part thereof may be entrusted by His Majesty's Government to any local Panchayat on prescribed terms and conditions for the purpose of protection and proper management, and such forests shall be called Panchayat Protected Forests."

The new law also made provision for the establishment of Religious Forests to be managed by temple trusts, and for Contract Forests, which could be awarded to either individuals or groups.

As many as 125 hectares of bare land could be handed over to each panchayat for afforestation to create a Panchayat Forest, and approximately 500 hectares of existing forest could be turned over to the panchayat as a Panchayat Protected Forest. It has been estimated that, provided that sufficient forest land is available in each panchayat, a theoretical maximum 1,835,000 hectares could

fall under panchayat control, amounting to almost 45 percent of the existing state forest area (Manandhar 1982).

NATURE OF THE RESOURCE: PEOPLE-FOREST RELATIONSHIPS

Early in 1982, a wide ranging survey was conducted to provide information that would be used in the design and implementation of the Community Forestry Development Project. The information documented prevailing patterns of forest resource use, particularly fuelwood and fodder, in relation to local farming systems in different regions of the country. Information was collected from a sample of 900 households and 180 ward leaders, with the random sample stratified equally among the four regions in which the project is operated, and further subdivided by the length of time the panchayats had participated in the program. Important features of the people-forest relationship that emerged are summarized as below (from Campbell and Bhattarai 1983).

Dependence on Supplies from Public Forests

Fuelwood. Mean annual fuelwood consumption was found to be 640 kg per capita, varying considerably by region and source: the consumption level of the central region was only half that in the east, while use in the other two regions lay somewhere in the middle (Table 1). Cost was an important determinant of consumption. In the east, only one-third of the fuelwood came from public forests, while this source accounted for over three-quarters of supply in the far west. On average, public forests provided just over half of total fuelwood supplies (360 kg of per capita consumption). With growing fuelwood shortages, more agricultural residues (except dung) were burned for fuel, although dung was used in the Kathmandu Valley and the Terai. Kerosene was reserved almost exclusively for lighting, and was thus not an alternative to fuelwood.

Fodder. Livestock feed was reported to be insufficient throughout Nepal; the average of four months of shortage peaked in March-April. Of the roughly 60 percent of the households that owned large animals, three-quarters grazed their cattle for much of the year while two-fifths grazed their female buffalo; stall feeding accounted for the rest

TABLE 1 Fuelwood Consumption by Source of Supply.

<u>Variable</u>	<u>Value</u>	<u>East</u>	<u>Center</u>	<u>West</u>	<u>Par West</u>	<u>Project</u>	<u>Hill Nepal</u>
Kg/household	mean	4,966	3,198	4,472	3,926	4,126	4,074
	median	4,329	2,600	3,900	2,808	3,444	3,355
Kg/per capita	mean	829	484	743	548	656	640
Kg/public forest	mean	273	234	377	436	327	328
	-percentage	mean	33	48	51	80	51
Kg/private	mean	205	62	113	27	103	97
	-percentage	mean	25	13	15	5	15
Kg/twigs and bushes	mean	298	129	251	64	195	181
	-percentage	mean	36	27	34	12	29
Kg/purchased	mean	54	58	2	19	31	33
	-percentage	mean	7	12	0	4	5

SOURCE: Campbell and Bhattarai (1983).

of the feed supplies. Of the hand-harvested feed, which was the main source for most households, 17 percent was tree fodder. Of this, less than 25 percent was reported to come from public forest; only one-third of all households used public forest for tree fodder at all.

Other products. Timber and poles for building (and bamboo in the east), and grass for fodder were important additional forest products, followed by green matter for livestock bedding and compost. Overall, the use of such products as forest vegetables, fruits, and herbs was very low, although the proportion of households using some amount was probably quite high.

Thirty-six percent of the ward leaders reported the existence of some form of collective system for protecting an area (or areas) of local public forest. More than half of these collectives had come into existence after the 1957 nationalization of forests, indicating a strong continuing interest in communal solutions to forest-related issues, despite nationalization.

It appears that management systems have developed in areas where small shortages of fuel and fodder had emerged, but not where the shortages had become so severe that they could no longer be remedied by using the remaining resource, even if it were more effectively managed. Commitment to management was found to be much greater where villagers had access to forests that were rich in desired species, such as sal (Shorea robusta) or oak. Where the forest contained species that were prized for fuel and fodder, e.g., chir pine (Pinus roxburghii), villagers were much less willing to adopt the harvesting restrictions necessary to preserve it.

Private Tree Growing

The finding that most fodder does not come from public forests contrasts with earlier assessments, and makes it more difficult to explain past trends largely in terms of the use of tree fodder. However, it is consistent with two other findings from the survey--that livestock numbers are decreasing in the majority of villages, and that private sources for tree fodder are increasingly important. When villages were asked what method they would suggest to overcome fodder shortages, they most frequently proposed private planting of fodder trees (by contrast, only 7 percent proposed planting fodder trees on public land). Apparently, as public sources of fodder have diminished over the last half century, there has been a major shift to stall feeding and private fodder trees (Campbell and Bhattarai 1983).

Each household was found to own an average of 28 trees of various kinds, and 31 seedlings under 5 years of age. Ownership was highest in the western and eastern regions. Three-quarters of all households own some fodder or fuel timber trees. Although, as is shown in Table 2, the numbers of both types of trees are roughly equal, the greater importance of fodder trees is reflected by their wider distribution (65 percent of households compared with 36 percent with fuel/timber trees), and by their prominence (along with fruit trees) in people's preferences for additional trees.

TABLE 2 Percentage of Private Tree Ownership by Region.

<u>Type</u>	<u>East</u>	<u>Center</u>	<u>West</u>	<u>Far West</u>	<u>Hill Nepal</u>
Fodder	13.5	9.4	16.7	8.6	12.1
Fuel/timber	12.8	9.2	17.8	7.4	11.9
Fruit	2.2	2.2	1.6	3.9	2.4
Bamboo clumps	5.3	.9	1.3	.03	1.7
Total Trees	33.8	21.7	37.4	20.0	<u>28.1</u>
Total Seedlings	53.0	27.0	36.0	15.0	<u>30.8</u>

SOURCE: Campbell and Bhattarai (1983)

Natural regeneration accounts for most fuel/timber seedlings and half of fodder seedlings. Villagers acquire most of the rest by transplanting naturally occurring seedlings either from elsewhere on their land or from the forest. The study found that nurseries had begun to contribute to supplies, particularly of fruit, bamboo, and particular fodder species that could not be readily obtained from natural regeneration. On average, households expressed a wish for an additional 30 trees, with clear preferences for certain species, although preferences ranged across a large variety of species depending on the region and use.

The 1982 survey thus disclosed a number of factors of considerable importance to the design and implementation of a program to encourage and support collective management of local forest resources. Private trees are an important source of supplies of forest products--the predominant source for some outputs, notably tree fodder. Public forests remain the main source of other products, such as timber, and overall continue to be the mainstay of forest-based activities. Despite the earlier nationalization of the forests, there continues to be widespread interest and willingness to take collective action to maintain--and to extend--remaining forest resources. Eighty-five percent of those surveyed were prepared to make common grazing lands available for tree planting. The basis for strengthened local forest management thus appears to remain very much alive in the existing systems.

DECISION-MAKING ARRANGEMENTS

Pre-Existing Local Forest Management Systems²

The size and geographical proximity of the user group are very important determinants of successful cooperation in forest management. Common forest use by adjoining villages and households was found to create strong group cohesion, even where groups are multicaste in composition. In all the forest management systems surveyed, areas of forest are managed by a group comprising only those households that traditionally use the area for fuel, fodder, or composting material. The management entity is thus almost always much smaller than the panchayat, and sometimes cuts across panchayat boundaries.

Group rules governing management of the forest differ considerably among groups. The bases for group rules used in various traditional management systems are listed in Table 3. In general, the use of forests is controlled by restricting access to certain times of the year, thus permitting protection and regeneration during the rest of the year. The length of time during which the forest is open to member villagers for specified product collection, the number of times in the year when collection is permitted, and the timing of the periods of access all vary across groups. These differences reflect the villagers' perception of the extent to which the forest can be safely subjected to cutting and collection. As has been noted, effective management systems are to be found only where enough accessible forest remains to enable villagers to meet their fuel or fodder needs by harvesting only in limited periods of the year.

Systems of spatial control have also been adopted in some traditional management situations. Within these systems, areas are delineated that can be harvested at a specified period. Sometimes these systems cover the whole resource over the period of one season, and their main function is to ensure that all members of the community have equal ease of access to both the nearby and more distant areas. In other cases, a rotational system is used that allows a particular resource, such as fuelwood, to grow again before it is again harvested.

In most of the villages with effective management systems, the user group employs forest watchers to discourage breaches of the management rules. These watchers are paid in grain by every household except the most poor. The effectiveness of the forest watchers

TABLE 3 Control Systems Used in Traditional Forest Management.

<u>Basis of Group Rules</u>	<u>Examples</u>
1. Harvesting only selected products and species	<ul style="list-style-type: none">- Trees: timber, fuelwood, food (fruit, nuts, seeds, honey), leaf fodder, fibre, leaf mulch, other minor forest products (gums, resins, dyes, liquor, plate leaves, etc.)- Grass: fodder, thatching, rope- Other wild plants: medicinal herbs, food (tubers, etc.), bamboos, etc.- Other cultivated plants: upland crops (maize, millet, wheat, potatoes, vegetables), fruit, etc.- Wildlife: animals, birds, bees, other insects, etc.
2. Harvesting according to condition of product	<ul style="list-style-type: none">- Stage of growth, maturity, alive or dead- Size, shape- Plant density, spacing- Season (flowering, leaves fallen, etc.)- Part: branch, stem, shoot, flower
3. Limiting amount of product	<ul style="list-style-type: none">- By time: by season, by days, by year, by several years- By quantity: number of trees, headloads, baskets, number of animals- By tool: sickles, saws, axes- By area: zoning, blocks, types of terrain, altitude- By payment: cash, kind, food or liquor to watchers or village, manure- By agency: women, children, hired labor, contractor, type of animal
4. Using social means for protecting area	<ul style="list-style-type: none">- By watcher: paid in grains or cash- By rotational guard duty- By voluntary group action- By making use of herders mandatory

varies with the strength of social sanctions against forest encroachment, although each village has some system of fines for villagers who enter the forest illegally. Generally, villagers were quite willing to pay the forest watchers with household grain, but they expressed reservations about increasing the number of watchers, and hence the burden on households, should the area of communal forest be increased.

Most traditional management systems tend to be very conservative, allowing access only to a few products. If the amount of a resource is too small to be adequately shared, or if it may be difficult to control an open harvest, communities prefer to stop collection of the resource altogether. In an oak forest managed for leaf litter, for example, all fuelwood cutting will be banned, even though some trees are overmature or unproductive.

Strong leadership in the locality was found to be important in starting management systems, but the villagers' willingness to participate in cooperative forest management appears to be motivated by perceived shortages of fuel, fodder, and composting material as forest resources diminish. Awareness of the problems created by deforestation is widespread and well understood. However, there is considerable variation in villagers' conviction that remedial action could be successful.

Local factionalism impedes successful cooperation in forest management when opposing factions seek to extend their power base by discrediting an opposing faction's forest management initiative. Where factions compete to be seen as more progressive in their approach to forestry, the reverse could be the case.

Proximity to markets for forest fuel products also tends to undermine forest management: where firewood can be sold nearby at high prices, it is hard to prevent poaching in panchayats near market centers.

Conflicts between livestock and forest management are perhaps the most common constraint. Meeting fodder requirements is a main objective of traditional forest management, but since grazing prevents natural regeneration, it is one of the principal causes of forest degradation. The most effective systems of forest management were found to be in areas where animals are largely stall-fed or under the supervision of herders throughout the year.

In addition, access to forest resources was found to differ markedly with location, which is in turn linked to

income. Poorer members of the village tend to live in higher and more remote parts of the village, and consequently are likely to depend more on forest grazing and slash-and-burn agriculture to survive.

Existing forest management systems, varying as widely as they do in their form and effectiveness, are not in themselves adapted to the more intensive management now needed. However, they can provide important information about needs and particular constraints that should be accommodated. As has been noted elsewhere,

[T]he most important lessons to be learned from traditional management systems are that community management of forest resources is possible if the right social unit is self-selected, the objectives are widely understood, and the benefits equitably distributed. In addition, the principles of social control and product distribution encoded in these traditional systems can be successfully incorporated in expanded management programmes. (Pelinck and Campbell n.d.)

The Community Forestry Development Project

The project was established to help the Ministry of Forests, through the Community Forestry Afforestation Division of its forest department, to support the three main elements of local management of forest resources: managed Panchayat Protected Forests (PPFs), planting of Panchayat Forests (PFs), and production of seedlings for private planting. In addition, the project was to develop and distribute more efficient wood fuel stoves for people who were short of fuelwood.

Forest nurseries were to be established in all participating panchayats. Financing and training were to be provided for locally recruited panchayat forest foremen to run the nurseries and panchayat forest watchers to help protect the plantations and managed forests on behalf of the panchayat (in keeping with the tradition of forest watchers in many existing local forest management systems). Finally, a new cadre of forestry staff, community forestry assistants (CFAs), were to provide technical assistance and advice at the panchayat and village level. The CFAs were to help panchayats carry out the preparatory work needed before public lands could be handed over as PFs and PPFs.

The project also sought to help build up the necessary institutional base to service and support this infrastructure. Components included training for forest service field staff and panchayat workers, a system of information and extension materials for communication and training at the village level, a system of field trials to provide basic technical information on choice of species and forest management prescriptions, and a monitoring and evaluation network to provide information about performance of such project activities as nursery production and plantation establishment and about people's needs for project inputs and responses to the project.

During its first five years (1980-85), the project was to extend its operations to 340 panchayats in 29 hill districts. Physical progress has been generally on schedule. By July 1984, the project was working in 381 panchayats and had 430 operational nurseries. Over 8,000 hectares of PF had been planted, more than 1.5 million seedlings distributed for private planting, and 227 PFs and PPFs had been handed over from the government to the panchayat.

The performance of individual components and areas within these aggregates has of course varied. Farmers' uptake of seedlings for private planting far outstripped expectations. In contrast, the transfer of existing forests to PPFs, and the development of collaborative management plans, has lagged behind the ambitious initial targets. Although almost half of the panchayats now participating in the project were given PPFs, few such transfers are protected by legal agreements for management and harvesting. Moreover, of the 227 PFs and PPFs that had been transferred by July 1984, 197 were transferred in the last 12 months.

In the remainder of the paper, we examine the PPF experience with regard to the main issues that have had to be tackled to strengthen collaborative forest management in the hill areas of Nepal.

Establishing Panchayat Protected Forests

The process of establishing and operationalizing a PPF involves three principal components. The first is the procedure whereby the panchayat requests that the government hand over an area as PPF and the government effects the transfer. The second is the establishment and early functioning of the Panchayat Forest Committee, which will

be responsible for managing the PPF. The third is drawing up the management plan--the legal agreement between the government, the panchayat and the people within the panchayat who comprise the user group or groups involved.

Within the forest department, the district forest controller is responsible for assisting the panchayats in preparing an application and for carrying out the necessary enquiries and management plan preparation, although the controller generally entrusts most of the on-the-ground work to the community forestry assistant. Authority to approve the handover of a PPF is vested in the regional director within whose territory the district and panchayat fall.

The Panchayat Forest Committee, in addition to its general supervisory and supporting role towards all community forestry activities, also must ensure equitable distribution of products from the PFs and PPFs to all households in the beneficiary group. The following guidelines³ were prepared to encourage participation by all sections of the user group in the committee and to specify the committee's duties:

- o Users' Group--The committee must represent the primary group of people who use or will use the forest area--the people who call the present grazing land or PPF forest their own. Where appropriate, the formation of subcommittees of users' groups, or even separate committees within the panchayat.
- o Nonpartisan--The committee must represent different social and political groups within the local area. The life of a forest is longer than political terms in office. This important common resource must have stable long-term management. Committees are encouraged to elect as chairman someone other than the pradhan panch of the panchayat to represent the users' group and strengthen the nonpartisan character of the committee.
- o Flexible Membership--The composition of the committee and the number of members to be included must remain somewhat flexible to adapt to different circumstances. There should be a minimum of 10 persons, one of which includes the local ward leader, and a maximum of 25 as determined by the villagers concerned.

- o Equitable--Although the villagers should be allowed to form their own committee, the CFA should try and assure that it is representative of all communities involved, as well as of both sexes, so that women are also included. He should remind the villagers that women are usually the primary collectors of forest products, and so must be included.
- o Democratic--The formation of the committee should take place by election of the full panchayat assembly held in users' wards. A decision can only be taken if the quorum constitutes a majority of the total members.

The CFA is responsible for developing procedures for agreeing upon management plans for the areas of PPF and for an appraisal of the resources within the PPF. The CFA is therefore involved in a continual dialogue with the users, panchayat officials, and forest committee to arrive at a management system that best meets their needs through application of sound, practical silvicultural and harvesting practices.

The great diversity of forest types encountered throughout the hill region makes it difficult establish straightforward management prescriptions that can be widely followed. Fortunately, natural productivity is usually good, and most of the desirable species are hardy, capable of regenerating vigorously as coppice shoots, and able to survive heavy and sustained cutting and grazing pressure. Possible choices for management of each are summarized in Table 4. In contrast to the single (timber) product focus of traditional forest management systems, the emphasis in Nepal is on sustained production of multiple outputs.

PATTERNS OF INTERACTION

Implementation by the Forest Department

The release of state forest resources for local community management represents a radical departure from traditions of government forest management taught to all forest officers in Nepal (as well as in most other countries). Relinquishing exclusive control of such a large natural resource--albeit actual field control over

TABLE 4 Possible Choices for Management of Selected Community Forest Types.

	<u>Forest Types</u>	<u>Timber</u>	<u>Poles</u>	<u>Fuel</u>	<u>Tree Fodder</u>	<u>Grazing</u>	<u>Compost</u>	<u>Other</u>
1.	Scattered mature <u>sal</u> forest	xxx	xx	x	x	x	x	
2.	Heavily lopped small size <u>sal</u> forest		xxx	xx	xx		xx	Plate making
3.	Katus-Chilaune coppice bush	x	xx	xxx		x		Roofing
4.	Scattered Chilaune	xxx	xx	xx		x		
5.	Scattered pine forest	xxx	x	x		x	x	Resin tapping
6.	Scattered oak forest	x		xxx	xxx	x	x	
7.	Dense lopped oak forest	xxx		xx	xxx		x	

LEGEND: xxx Best choice
 xx Good choice
 x Possible choice

SOURCE: P.K. Tyystjarvi (1983).

the scattered and degraded forests has been more nominal than real--has not come easily to officers charged with the conservation and exploitation of this resource. Despite notable exceptions, there was substantial resistance to authorizing the large-scale transfer of this resource during the early years. Government officers explained this caution as growing from fears that the local population would destroy the resource once government controls were lessened.

Significantly, not even one such incident has yet taken place. In the rare instances where PF plantations have been destroyed, investigation has always shown that when the area was surveyed the local community did not know that the purpose of the survey was to transfer the area to the community. On the contrary, the community believed that the government intended to usurp their forest.* Thus, the experience has so far been positive, and has helped to create a climate of opinion favorable to increasing the rate of PPF establishment.

Beyond initial resistance from some forest officers, the major causes for a slow start on this activity can also be traced to its innovativeness and the difficulty of adapting traditional working procedures to a completely new framework. Modern forest management principles used by professional foresters stress the need for proper scientific inventories of the existing forest resource and the application of yield tables to determine harvesting schedules to meet commercial objectives. In contrast, the development of PPF management systems rests on jointly conducting an assessment of the resource with the forest committee, and jointly arriving at management prescriptions based on meeting locally perceived needs. Harvesting plans must almost always attempt to meet multiple objectives on an annual basis rather than optimize the production of a single product over the long run. Plans have a better chance of working when they are based on sound socioeconomic principles (as illustrated by the traditional management systems) than when they follow textbook procedures. Yield tables for managing scrub forests for branchwood, fodder, leaf litter, leaf plates, poles, and other products do not exist.

*"Demarcation," a word that has been incorporated in its English form into the local vocabulary, denotes the assertion of government rights over areas the villagers previously considered their own.

The CFAs responsible for the actual field preparation of the plans have found it difficult to meet the silvicultural demands of their superiors and the social demands of the community. Despite training in extension methods and the provision of extensive supporting materials, the youthful and inexperienced CFAs have initially found the task of community organization and collaboration difficult. Existing requirements for scientific inventories, though greatly reduced from those demanded for government forests, are complicated and physically strenuous, and the commensurate rewards are few. For these reasons, the project has continued to examine ways to simplify the management agreement (Troensegaard 1984), and the CFAs have been retained accordingly. Since this kind of forest management is new to all parties involved, experimentation and learning continues, and the CFAs' level of confidence has been steadily increasing.

The bureaucratic procedures involved in processing and approving applications are proving to be an additional impediment to rapid implementation. In the terrain characteristic of most of the hill region of Nepal, even the district forest office can be several days distant from any given panchayat, and regional offices even more remote--up to one week's walk away. Consequently, processing documentation can be very time consuming; field visits to check on queries often must be delayed for long periods. Possibilities for simplifying transfer procedures are therefore also being investigated.

User Group Motivation and Organization

The greatest barrier to community participation during the project's early years was the lack of widespread public knowledge of the details of managing a PPF. Until a community has actually gone through the process of drawing up a plan in a public meeting, villagers remain ignorant of the precise benefits and costs to them individually (Bhattarai and Campbell 1983). Their previous experience with the forest department usually was limited to situations that increased their individual costs by requiring, for example, payments for cutting wood, withdrawal of land previously available for slash-and-burn agriculture, and closure of land for grazing. Demarcation had never been perceived as being beneficial to the community. Villagers sometimes perceive that their panchayat leaders realize some personal gain by forming an

alliance with government authorities. Initially, the project had to overcome the villagers' widespread suspicion that it was just another way of abrogating their customary rights.

Project staff early on learned the importance of widespread public discussion of exactly what the establishment of a PPF involved. Extension messages informing all members of a community of the provisions of the law regarding, for example, panchayat-government revenue sharing, proved insufficient. However, it was remarkable how quickly group consensus on the value of establishing a PPF usually materialized when the actual provisions of specific management plans (spelling out group rules for protection, harvesting, and benefit sharing) were brought under group discussion. In annual district meetings held by the project for pradhan panchas, forest committee chairmen, and other leaders, it has often been found that suspicions voiced by panchayats not yet participating in the project were completely overcome by the enthusiastic response of villagers from panchayats where the details had been already worked out. Almost every meeting recommended that similar large public meetings should be held within the individual panchayats.

The establishment of acceptable PPFs also required dealing with the central issues involved in upgrading traditional management systems. Principal among these were concerns with defining the boundaries of the beneficiary group, improving protection systems, changing grazing patterns, regulating cutting and harvesting, dealing with offenses, and managing any cash income.

Since the laws governing PPF establishment are written in terms of panchayats as a whole, many user groups feared that their local forest resource would be "nationalized" by the panchayat. Reaching consensus on a PPF thus usually required carefully delineating the boundaries of the user group by specific product. In many cases, the group of people who collected specific products (such as bamboo or fuelwood) were willing to acknowledge the right to other products (such as timber for house construction) to the panchayat as a whole so long as the specific products they previously collected would remain theirs. It thus became crucial to the success of the program to specify benefits and responsibilities by product and beneficiary. To allow PPF plans to build on traditional management systems, an "Existing Forest Management Survey" to determine current usages was developed by the project to replace the earlier survey of needs. This survey,

conducted in a group session, forced communities to make explicit a number of more or less implicit group management rules, which were then incorporated into a legal agreement.

Resource Protection

Several key issues arise around the problems of protecting the resource--particularly from grazing livestock. The most important silvicultural treatment required by most community forests, including those under explicit traditional management, is some form of closure of areas to grazing long enough to allow natural regeneration. The initial problem has been to obtain consensus on how much to close and how to enforce compliance. Since no fencing is used, closure rests on willing consent of all herders to keep their cattle and goats out of the specified areas. This requires more intensive guarding than does protection from cutting and a consequent additional cost (for more guards) that communities found difficult to bear. Furthermore, most communities felt that the government should appoint a guard to supplement the local security service, and have frequently requested financial support to hire local watchers; the project has recommended that this issue be considered for the next project phase.

Enrichment planting in PPFs with adequate stocking for natural regeneration has also contributed to solving problems of protection. Initially, this planting was done to assure that yield goals would be met, and so that the project could finance a guard (money for a guard was available only if planting had taken place). Subsequently, it has been found that enrichment planting serves an important symbolic function: when a small number of highly desirable or visible seedlings are planted in a forest area, the need to restrict grazing until the seedlings are established is apparent to all the villagers in the area. Once planted, the existing natural forest is transformed from an area that did not depend on humans for its reproduction to a "cultivated" area needing protection from livestock, and management becomes meaningful to people who for generations were accustomed to alternative land use patterns. Furthermore, by agreeing on a phased introduction of plants and rotational grazing areas, people who were initially suspicious of the loss of their grazing lands were convinced of the value of cooperative action.

Cutting Regimes

From the perspective of local communities, the most difficult technical issue has been to introduce cutting regimes. The limited number of plans completed to date (86) have tended to be conservative and restrictive in their production prescriptions (de Pater 1984), which evidently reflects the conservative approach of most traditional forest management, an approach whose fundamental tenet is that the only way to prevent abuse and overharvesting by individuals is to ban all cutting of products not specifically controlled by the various methods outlined earlier. This was reinforced by the fact that communities did not previously have legal title to the forests and could not easily institutionalize a system that was vulnerable to government sanction. With the removal of the possibility of government sanction, communities are now theoretically free to design systems based, for example, on selective cutting of diseased and dying trees.

On the basis of extensive discussions with villagers, the following "management systems" appear to be easiest to implement considering local control capabilities and traditional forest management systems:

- o Rotation: some villages conduct product collection (such as branch lopping, grass cutting, grazing) on a rotational basis to control illegal use and ensure regeneration of the area.
- o Limited time period: some forests are opened for only one or two weeks for the collection of particular products so that uncontrolled cutting at other times of the year can be detected and stopped and distribution can be controlled.
- o Equal distribution: to distribute the products, whether hand cut grass, thatch or fuelwood, many villages conduct group harvesting; all users go to the same harvesting area at the same time and obtain roughly equal amounts per household.

However, many communities still opt for avoiding any cutting that would be difficult to control, and sometimes have suggested closing the forest to all product collection. For this reason, rotational cutting of individual areas during prescribed time limits is frequently the

method of choice for the local community. This conservative approach to common resource management typically evolves when local communities have been provided with the legal structure and tenural rights within which to take up more active regulation of their existing forests. Because they are extremely aware of the dangers of uncontrolled access, they are cautious about adopting any system of cutting that would be difficult to enforce.

The lesson here is that management prescriptions must answer social requirements first if they are to be widely adopted by the community. But perhaps the more important lesson is that communities themselves will take the responsibility for devising methods for solving the common property problem if they are given sufficient authority, information, and assistance in doing so.

OUTCOMES

Distribution of Benefits

So far, the project has left the exact mode of distribution within the beneficiary groups largely up to the panchayats and user groups involved. The result has been that a number of different systems have emerged that are suited to the size and type of the resource and the communities involved. While fuelwood is usually equally distributed per user household, fodder may be sold on contract or made accessible to a more restricted group during certain periods of the year. Depending on the quantities available, timber may be reserved only for those households who require it for house construction after receiving the permission of the forest committee. While some communities have strong opinions on the mode of disposal, often based on their traditional usage, others have little tradition to draw upon and are open to suggestions from CFAs or village leaders. In this latter case, experience from traditional management systems in other villages has been applied to the setting.

Cash benefits accruing to the user group or panchayat have presented a special problem because of the difficulties arising from the legislation. The 1978 Panchayat Protected Forest Rules are still subject to the provisions of the underlying Forest Act of 1960. The latter requires that harvesting of timber be authorized in advance by the district forest controller. The practical difficulties

and delays entailed in trying to observe this requirement discourage local groups from including significant timber production in the management prescriptions.

More important, the Panchayat Protected Forest Regulations themselves mandate that income from timber sales be shared between government and users, and specify a mechanism for handling the funds. This system is proving cumbersome and slow, and is impeding progress at the panchayat level. Twenty-five percent of the income from sales goes to the government and thirty-five percent to the panchayat. Initially, however, the full proceeds of sales accrue to government, and the panchayat's share is supposed to be returned to in due course. Often, a great deal of time elapses before the panchayats receive their repayment, which discourages panchayats and engenders suspicion that the process of PPFs and management plans is intended to generate income for the government, not the user group members.

As a consequence of these difficulties, most established management systems have attempted to avoid cash income from forest products (such as timber) that fall under the forest products sales act and for which the income should go directly to the forest department before being returned. In addition, ambiguities regarding whether or not permits for these products should still be issued by the forest department after a plan has been approved have also inhibited the distribution of these products. The project has recognized that modifications to the legislation, and the establishment of accounting procedures acceptable to all involved, is a priority for improving the program further.

Future Prospects

In April, 1985, 381 panchayats were participating in this project to strengthen collaborative local forest management--and private tree management--in the hill areas of Nepal. Over the next 5 years, 375 panchayats are expected to join the project. If they do, and if the demand to join the project remains strong, the project's coverage will extend over more than half of all the panchayats in the 29 districts that it serves. A continuation of the present momentum could therefore extend the new approaches to common forest management to a significant portion of the hill population.

As has been indicated in this paper, the experience to date, although limited, is nonetheless quite encouraging. Although some of the bureaucratic procedures are seen to be too rigid or poorly adapted to current needs, there do not seem to be insuperable impediments to instituting the necessary changes. For example, experience to date suggests that more may need to be done in some panchayats to ensure that more women participate in the forest committees, that committee leadership is separate from panchayat leadership, that the committee has the proper number of members, and that operating rules are established that permit a quorum of the committee to make decisions. The existence of a committee secretary with some relevant training is also seen to be desirable, as is provision for the committee to directly participate in monitoring and evaluating their panchayat's activities.

At the present time, the key to future success appears to be the management plan, which embodies both the agreement between the government and the community, and the prescriptions to enable the community to make more effective use of its forest resource. Consequently, priority is now being given to resolving those issues that are impeding the process of producing, adopting, and implementing workable and acceptable management plans.

NOTES

1. J. E. M. Arnold was Chief of the Forestry Policy and Planning Service of the Food and Agriculture Organization of the United Nations (FAO), and headed FAO's Forestry for Local Community Development Programme. He is currently associated with the Oxford Forestry Institute at the University of Oxford. J. Gabriel Campbell was FAO's socioeconomic adviser with the Nepal Community Forestry Development Project from 1980 through 1984, and is now a consultant to the World Bank and FAO on social aspects of community forestry in South Asia.

2. In addition to the survey already cited, this section draws on the report of an enquiry carried out for the project by A. Molnar (1981).

3. Paraphrased from: Guidelines for the Preparation of Management Plan for Panchayat Forests and and Panchayat Protected Forests (Working draft, August 1983 revision), HMB/UNDP/FAO Community Forestry Development Project, Nepal, as modified by: Report of Fifth Annual Meeting of Regional Directors, District Forest Controllers, Associate Experts, Volunteers and CFAD Staff Associated with HMG/WB/UNDP/FAO Community Forestry Development Project. Kathmandu, September 1984.

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People and Resources in Nepal: Customary Resource Management Systems of the Upper Kali Gandaki

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INTRODUCTION

Anthropological interest in indigenous systems of resource management is rising in every part of the world. In the Nepal Himalayas, applied social science and development researchers recently have begun to examine traditional forms of resource management with some care. They have documented forest management systems (the largest share), as well as systems of irrigation and drinking water control, appropriate energy development, and pasture management. The intent of these investigations has been to better understand how and why traditional systems of forest management work. Some experimentation has been conducted to incorporate traditional systems (usually modified to reflect changed or contemporary circumstances) into ongoing renewable resource projects. While results are tentative, the work appears promising (see, for example, Arnold and Campbell, this volume; Martin and Yoder 1983; Messerschmidt 1981, 1983, 1985; Messerschmidt et al. 1984; Williamson 1983).

This paper presents data and analysis of traditional community resource management systems located in two districts along the upper Kali Gandaki river watershed in north central Nepal. Examples of both forest and irrigation water systems are presented side by side--reflecting the local perception that there are great similarities in

their control and management. The discussion focuses on a 60 km transect through the Himalayas from the town of Beni at 792 m (2,600 ft) in the middle hill district of Myagdi, north to the sacred pilgrimage site of Muktinath at 3,802 m (12,475 ft) in the mountainous district of Mustang. The area is bisected by peaks of the Annapurna and Dhaulagiri Himalayan massifs.

The climate ranges from monsoonal/subtropical in the southern Myagdi District, to arid/alpine in northern Mustang. The area of these two districts is approximately 5,493 km² (2,121 mi²), of which 65 percent is high mountain, barren, or under perpetual snow. Of the remaining portion, 22 percent is forested (75 percent of which is found in Myagdi), 10 percent is cultivated (90 percent in Myagdi), and 3 percent is natural open rangelands (73 percent in Mustang; Bosken et al. 1977). The higher ridges, descending from the snow-capped peaks on both sides of the valley, are forested. The only habitable and arable land is along the Kali Gandaki river and its tributaries, where the villagers pursue subsistence farming, herding, and trading.

The people of the Myagdi District are primarily peasant farmers, raising upland crops of corn, millet, barley, and buckwheat. Some also practice transhumant pastoralism, moving their herds of sheep and goats seasonally between Myagdi and Mustang along the mountain flanks.

The people of Mustang are agro-pastoralists, raising mostly wheat and buckwheat under austere oasis-like conditions along the Kali Gandaki riverside. Their success in farming is dependent upon extensive irrigation works. Yak, sheep, and goat herding is also important on high pasture lands. In addition, a large proportion of Mustang people engage in seasonal long-distance trade, much of it in support of trek tourism. Recently, some entrepreneurial residents of the Mustang District have begun catering to trek tourism by operating and/or supplying trailside inns.

The people of both districts fall into several distinct ethnic and caste groups with contrasting social and cultural traditions. The Myagdi District, with a 1981 population of 96,904, is inhabited predominantly by Magar ethnic people, with minority Brahmin, Chhetri, and Hindu artisan caste groups and several communities of ethnic Thakali. The Magar and Thakali are indigenous to the region, and their ethos is usually characterized as egalitarian. They are related linguistically and culturally to other middle hill and upland groups of central Nepal and more distantly to the ethnic Bhotia (Tibetan border people)

of the north. These ethnic groups have acculturated in varying degrees to the more hierarchically structured caste system of the Brahmin and Chhetri people around them.

The Mustang District, with a 1981 population of 12,930, is dominated in its southern part by Thakali people and a minority of ethnic Magar and artisan castes. The central and northern parts are inhabited by various Bhotia ethnic groups. The Bhotia maintain close affinities in language, religion, and material culture with Tibet. They are only distantly related to the upland ethnic groups of the middle hills of Nepal to their south. While most ethnic groups, however isolated, have been influenced to some degree by the Hindus of lower Nepal, the Thakali and Bhotia of Mustang have historically been able to maintain a strong sense of independence in social, cultural, and even political activity; this independence distinguishes their forms of common property management from other forms elsewhere in Nepal.

Common Property Resource Management

The history of resource management in Nepal reflects the impact of two sets of recent legislative activity: (1) the Village Panchayat Act of 1962 and Decentralization Act of 1982, and (2) the Private Forests Nationalization Act of 1957 and National Forest Law of 1976 (and amendments).²

Introduction of the panchayat system was part of an attempt to unify the Kingdom of Nepal under one multi-layered form of representative government. The panchayat is based on earlier concepts of leadership by caste councils dating far back in the history of South Asia. Today, the panchayat system operates on three levels--village, district, and national. The panchayat system is the focal point of development planning and administration.³

The 1982 decentralization legislation builds on the existing panchayat system, while attempting to relocate some administrative responsibility at the local district and village panchayat levels. While much can be said of the impacts of the panchayat system over two decades, assessment of decentralization is still premature.

In the 1960s, one immediate result of the new panchayat system on the ethnic populations of the hills was the superimposition of a new and essentially alien political system over pre-existing forms of local and

ethnic (i.e., non-caste) communal governance. It was especially disruptive in traditional non-caste oriented communities where other modes of village leadership existed. In some, for example, leadership was traditionally based on the hereditary principle of primogeniture (as among the Magar) or on acquired respect, wisdom, influence, and consensus (as among Thakali and Bhotia).

Also in the early 1960s, and simultaneous with the introduction of the new panchayat system, the Nepal government (with international donor assistance) began investing its modernization energies in rural development. While the focus at first was largely in the agriculture sector, by the 1970s there was increasing interest in natural resource oriented projects, especially in the forestry sector.

The modern history of Nepalese forestry dates only slightly earlier, to 1957, when the government in Kathmandu enacted the Private Forests Nationalization Act. While this law was designed ostensibly "to protect, manage, and conserve the forest for the benefit of the entire country" it became, in fact, a highly disruptive factor in the overall well-being of the hill forests and related resources (Bajracharya 1983:233; see also Arnold and Campbell, this volume). Partly because of this law, pre-existing and traditional practices of communal resource management in the form of group control over local forests was upset, and existing local political structures in which communal control was embedded, with their customary rights and duties, became irrelevant (Bromley and Chapagain 1984; Chapagain 1984).

It took 19 years and the enactment of the National Forest Act of 1976 for the government of Nepal to formally begin to redress the effects of forest nationalization. The act of 1976 was quickly followed by rules and amendments encouraging panchayat-based forestry, ostensibly designed to return some forms of communal management over forests and related resources to the local people.

It is now widely believed and well-substantiated that during the decades of the 1960s and 1970s Nepalese villagers began free riding--systematically overexploiting their forest resources on a large scale. The usual explanations for this free riding are that the villagers felt they had lost control of their forests, and they were distrustful of government officials and national resource policy (particularly forest policy). The forest problem seems to have been especially acute in Nepal's Terai lowlands, where marketing of forest products in India is

relatively easy. But similar behavior occurred in the hill and mountain regions, albeit with less intensity. Irrigation water resource management and other common resources suffered from neglect. Much of the blame rests on the disruptive changes in patterns of local government imposed by the central government, resulting in the abandonment of traditional communal systems of resource control and allocation.

In some (if not all) locales, the negative effects of exploitative behavior have been compounded by at least three other simultaneous events or circumstances. One is Nepal's rapidly rising population, which places increasing pressure on the natural resource base. Another is a dramatic increase in tourism, especially since the 1970s; the demands that trekkers (and local entrepreneurs catering to trekkers) place on natural resources are especially severe. A third came in the form of massive development aid beginning in the 1960s; much development is aimed at the rural villages where it is often initially greeted by euphoria, soon followed, however, by feelings of dependency and disillusionment. All three trends encouraged the devaluation of traditional solutions and independent local group or individual initiative vis-à-vis resource management (forest and water resources in particular).

In the mid-1970s, Hans Rieger observed in Nepal what he called a pervasive "tragedy of the hills" (following closely the theme of Garrett Hardin's [1968] "tragedy of the commons"). Rieger (1978/79:179) determined that the people of the middle hills of Nepal held a negative "social image," this image being the collective knowledge, beliefs, attitudes, and taboos that affect their view of themselves and of the natural environment. The predominant social image of the people of upland Nepal, he wrote, was one in which many seemingly counterproductive practices of resource management prevailed. The alarm that he sounded still echoes among developers and national planners.

In recent years, however, evidence has emerged to show that, contrary to a totally negative and pervasive resource tragedy, rational and conservative resource management practices have remained strong in some locales. In some instances, newly organized local systems of management have sprung up, and in others, older, pre-existing systems have been rejuvenated or strengthened despite nationalization and similar disruptive circumstances. The following examples, three from forestry and two from irrigation, provide supportive cases. Local

perspectives on the two resources--forest and water--are highlighted side by side because of the inherent similarity in the contexts of their management, each being seriously affected by exogenous conditions and decisions imposed by the central government of Nepal. The analysis of common property resource management issues that concludes the paper is based on the case studies from five village panchayats (see note 3).

EXAMPLES OF COMMON PROPERTY RESOURCE MANAGEMENT

Case 1: Community Forest Protection in Ghatan Panchayat (Myagdi)

The "Big Pine Forest" of Ghatan Panchayat is situated in the south of the Myagdi District, a community predominated by the Chhetri caste. Villagers date the origin of their forest protection system back three generations, to a folk hero and visionary named Bala Badra Baniya Chhetri. Following fires that destroyed earlier natural forests in the area, this man rallied his neighbors to preserve approximately 75 hectares of land that had little agricultural value so it could regenerate naturally back to pine forest. In time, the renewed forest was opened to controlled cutting of dead and fallen trees; villagers paid a small fee. The fees plus small donations of grain from neighboring households paid for a watchman to keep the forest paths clear of pine litter and to watch for fires.

Under the 1950s nationalization legislation, the Ghatan forest was designated government forest, but traditional management was maintained until the 1970s. Then, the divisional forest officer (now district forest controller) came under pressure to sell timber-cutting permits to builders in the nearby district headquarters town of Beni. At that point, local control and customary management collapsed. More recently, local leaders, forest officers, and United States Peace Corps Volunteers have begun working to establish panchayat protected forest (PPF) management plans incorporating elements of the traditional system.

Case 2: Community Forest Management in Piple and Rakhu-Bhagwati Panchayats (Myagdi)

Four small local forests in these two panchayats (near Ghatan) are each managed by traditional "forest management

committees." The inhabitants are predominantly from the Chhetri, Brahmin, and artisan castes. The members of each user group work together to plant and fence the forests and employ a forest watchman. Each watchman is chosen from among the poorer families; his duties are to patrol the forest and control access for firewood, fodder, and building material collection or cutting, and for livestock grazing (sheep, goat, cattle, and water buffalo) according to rules set by the user group committee.

Typically, the rules allow for collecting fodder during winter, harvesting roof thatch during fall, and cutting wood for house construction as needed. Only those households that are paid-up members of the village forest protection committee are allowed to use the forest. Fines are levied in the event of rule violations. Each user household donates grain in a specified amount annually to pay the watchman.

Case 3: Forest Protection Committee in Lete Panchayat
(Mustang)

The Thakali villagers of Ghasa in Lete Panchayat, southern Mustang, recognized in the 1960s that their local Ramjung Pine Forest was rapidly being depleted by over-cutting, indiscriminate grazing, and general abuse. They closed off approximately five hectares to allow regeneration. Access is controlled and the forest is patrolled by members of a panchayat forest committee. While the committee functions within the modern panchayat system, it is of an old style dating to pre-panchayat times (pre-1960s) when the Thakali exercised much more self-control over local affairs. The forest is also home for a tutelary deity, worshipped in an annual ceremony by the Ghasa villagers.

Since 1974, forest access to sheep and goats has been strictly forbidden, although cattle, water buffalo, horses, and pack mules are allowed to graze. Cutting fuelwood and building materials by individuals is prohibited, although cutting poles and timber for public use (school construction, bridge repair) is permitted on request. Fines are levied for illegal entry or fuelwood cutting. The district forest controller's staff regulates permits for thinning the forest, and cutting large timber by permit will be allowed with second growth maturity.

Every winter, each Ghasa household is required to collect debris and litter within the forest. Two persons from each of approximately 50 user households harvest up to

5 large basketloads of pine needles and litter daily, over a 9- or 10-day period. This reduces the risk of forest fires, and the litter provides bedding for cattle stalls and compost for fields.

In the early 1980s, forest officers recommended that a management plan be prepared and that Ramjung forest be designated a PPF. Villagers expressed reluctance, however, in the belief that by changing current management practices, they would lose all local control. As of 1984, no action had been taken.

Case 4: Irrigation Management System in Marpha Village (Mustang)

The traditional irrigation control and allocation system at Marpha, a Thakali ethnic village in Marpha Panchayat, is an example of the sort of well-organized cooperation and resource management found widely among the Thakali and Bhotia of the Mustang District. Marpha is a highly nucleated settlement situated in the rainshadow of Dhaulagiri Himal. It is subject to the cold, dry climate of the Tibetan (Xizang) Plateau. Irrigation is essential for farming, and in the past irrigation management was closely tied to Marpha's traditional form of government by clan representatives, a system similar to that of Ghasa in Lete Panchayat (above) and the of Muktinath-Jhong panchayats (below). Irrigation management in Marpha was closely linked with forest management, and operated under local custom for many generations before the panchayat system was introduced.

By long-established custom, the management of all of Marpha's resources was the business of a committee of 10 workers. Besides controlling the flow and distribution of irrigation water, the workers also maintained the public drinking water system and water-powered grinding mills, and served as forest watchmen and town criers. They were compensated from mill use fees, fines levied for abuse of irrigation and forest regulations, and by a small share of the annual profits from each farmer's irrigated barley crop.

The workers were appointed from the four clans of the village and were responsible to the headman and his executive and treasury committees. The headman, described as "the best man in the village" (i.e., the most honest and influential), was customarily selected for a three-year period from among the four clans. His executive committee was composed of four men, one appointed from each clan for one-year terms.

Marpha's cultivated fields are divided into two sectors--north and south. The communal workers were responsible only for the northern sector.

Marpha has two agricultural seasons, one for barley (planted in winter and harvested in summer), and one for buckwheat (planted in summer and harvested in fall). Each crop receives three major waterings during its growing season.

For barley, the workmen were responsible only for the first two waterings, and for buckwheat, only the first. Thereafter, the individual farmer handled his own watering. To make distribution equitable for all farmers over the course of the year, the barley crop was watered from the top of the north fields downward; that is, the fields closest to the head received first water. Then, for buckwheat, the order was reversed so that the tail-end fields were watered first. This traditional rule was remembered in a Thakali rhyme: kar yaalaa, nhaa mhalaa, meaning "barley from the top, buckwheat from the bottom."

Beginning about 1963, two events led to a reordering of Marpha's age-old form of village government, economic life, and overall resource management. The first was the introduction of the panchayat system. In Marpha, this meant that a new kind of leader--a panchayat chairman--replaced the old headman. The new chairman is assisted by a council representing the nine newly and arbitrarily designated wards. The clan basis of selection is gone.

The second event was the realization of economic opportunities outside of Mustang District that attracted the more entrepreneurial Thakali farmers away from Marpha. As they left, home farms were placed under tenancy with Bhotia immigrants, non-Thakalis, and the old system of irrigation was replaced by a lottery. The Bhotia farmers and a few remaining Thakali farmers began looking after water distribution on their own. Nowadays, watering order is determined by lot and is publicly announced at periodic meetings quite independent of traditional social custom.

Case 5: Irrigation Management in Muktinath and Jhong Panchayats (Mustang)

The survival of the mountain Bhotia villagers is critically dependent on the consensual leadership of the traditional headman and the full and unequivocal cooperation of all adult villagers in managing common properties

in the harsh, arid environment of the northern Mustang District.

In both Muktinath and Jhong panchayats (and in other Bhotia villages throughout Mustang), all irrigation canals are communally constructed and maintained, and water is distributed according to simple, well-respected, and customary rules. Forest protection and access are similarly managed by committee. Periodic public meetings are called to discuss irrigation management and other communal resource issues. The head of each household must attend. Annual irrigation ditch cleaning is a village-wide responsibility: every able-bodied resident between the ages of 15 and 56 is required to participate. Absenteeism is controlled by fines, and frequent refusal to participate is countered by social ostracism.

The key to social control among the Bhotia is their willingness and ability to retain a strong, traditional system of community governance. Each villager has a part to play in the daily management of common assets--e.g., irrigation water and ditches, forest resources, pastures, and drinking water systems. But the ultimate responsibility for their management lies with the traditional village headman. Community members choose this man from among the most influential in the village, by the consensus of all household heads.

Over the past few decades, these ethnic Bhotia communities have succeeded in preserving the ancient and customary role of headman despite imposition of the caste-based panchayat system. The Bhotia consider the panchayat to be a foreign concept, but pay lip service to its requirements. They elect a chairman and a panchayat council, but beneath this façade the village headman remains in charge. He manages by consensus and is backed by strong tradition. His decisions are based on public consensus. Contrary to the power of many panchayat leaders elsewhere in the villages of Nepal, the Bhotia headman cannot act without full support and agreement among his constituent households.

In the words of one Nepali researcher, a fundamental fact must be understood by any outsiders who propose to work here: "The traditional system is the underlying strength of the communities; the panchayat system serves [only] as the community mouthpiece to the outside" (Devkota et al. 1983).

ANALYSIS

I turn now to the Oakerson framework (this volume) for an analysis of common property issues. A major strength of the framework is its common and unifying structure, around which unique case studies can be examined and within which a multitude of issues can be explored, and to a large extent, explained. A weakness of the model is a tendency to ignore or de-emphasize the cultural context of local understanding and decision making. And while it can be argued that cultural considerations are in the hands of the user, the model should, nonetheless, refer to cultural relevance and cultural context as universally importable variables.

It is the local villagers' definitions of the resource that I seek to elucidate first. Their perceptions and their control and management of common properties and natural resources are best understood in the context of culture. "Culture" is herein defined as acquired knowledge that people use to interpret experience and to generate social behavior (Spradley and McCurdy 1980:2; emphasis theirs).

Physical and Technical Attributes

Jointness

Oakerson defines "jointness" to mean "that no single beneficiary of some good subtracts from the ability of others to derive benefits" (Oakerson, this volume). In other words, jointness exists to the extent that various uses are compatible or even complementary; disjointness reflects incompatible and therefore subtractive uses. Relative jointness/disjointness, in turn, is a function of cultural perspective or definition, i.e., the meaningfulness (hence usefulness) of a resource in the context of the lives, needs, and wants of the various publics who use it. Meaning, or use, may be as multiple and variable as the many and various publics who perceive a resource as a "good" and who demand access to it. When meanings/uses conflict with one another, as they tend to do in the face-off between local and national control of forests in Nepal, for example, then disjointness occurs.

The anthropologist, in determining what a resource means, and to what use(s) it may be put, whether conflicting or complementary, tends to pose certain fundamental

questions: Who uses the resources? Under what conditions? How are they managed? By whom? To what end? These questions are designed to consider the fundamental definition(s) of the resource among the various individuals and collectivities involved. In short, we ask, "What is -- ?" (a single tree, a forest, irrigation water, drinking water). We expect to hear different answers from each category of user or public whom we ask.

For example, to the question "What is a forest?", we expect that portion of the relevant public called "scientists" to answer in terms of cover type, species, soil, aspect, and slope. "Resource managers" and "developers" might refer to forests in terms of watershed protection, microclimate amelioration, or soil erosion. "Policy planners" would probably consider ownership, local, regional, or national needs, and development priorities. "Economists" would talk of access rights and allocation, and of supply and demand (marketing the resource). Conflict is inevitable to the extent that these perceptions of "forest" reflect, for example, a national or regional perspective as opposed to a local one, or a scientific perspective as opposed to an indigenous one based on folk wisdom, or use of the resource for cash production as opposed to subsistence. But, alternative definitions, like these, can also be complementary.⁴

The local village public, those who have traditionally kept control of local forest resources for themselves (whose lives and daily household subsistence economies may depend on the quality, quantity, accessibility, and utility of forest products), will answer our question "What is a forest?" in ways qualitatively distinct from the others. From Nepalese villagers in the five locations described above, we can expect to hear answers with at least three parts. One part concerns the forest's natural products (e.g., fuelwood, building material, water source, pasture land, etc.), and the physical and technical attributes thereof. Another concerns certain supernatural attributes (e.g., the forest as an abode of certain deities and/or spirits), and beliefs and practices associated with them. And, while not an attribute of the forest per se, villagers will also typically describe certain social and political behaviors associated with those who use and/or control the forest. Few, however, distinguish clearly among these seemingly discrete categories of information. They are all part of the perceptions and knowledge about, or the definition of "forest" in the local cultural context. And that, in turn, generates or determines

resource use and management strategies and associated behaviors (according to our definition of culture).

Furthermore, we tend to find that within each Nepalese community or social group, the natural attributes vary considerably by resource type--each is used in distinct and discrete ways, according to its unique technical and physical characteristics, in a given cultural context. In cases 1, 2, and 3 above, for example, local use of the forest varies among local demand for fuelwood, for litter to use in composting and stall bedding, and for grass as fodder in stall feeding or for grazing herds of livestock. Where extra-local demands have been introduced, e.g., the demand for construction timbers to supply a booming government town, definitions of "forest" and "tree" tend to change and come into conflict, reflecting other needs and uses complementary to national growth and progress but contradictory to local custom and understanding.⁵

Traditional Nepalese villagers' definitions of "fuelwood," an important local forest product, provide a case in point. By convention, most Nepalese distinguish two types of fuelwood according to certain physical and technical characteristics, correlated with cultural and social activities by season. One type, called jikra, includes old fencing and agricultural residue (stalks, cobs, etc.) found around households and villagers. The other, daura, consists of fresh (wet or green) wood and dead wood (dry twigs and branches) collected directly from the forest. Usually, dead wood is free for the taking from private lands or from the forest commons, but the cutting of fresh wood on public land is more often carefully controlled. Jikra is generally collected any time of the year, but most often in summer and autumn. Daura collection commences in early winter, when fieldwork is at a minimum and farmers and householders have more time (Bajracharya 1983; Fox 1983).

Recent developments in the Myagdi District (case 1), however, have greatly increased fuelwood demand, just as they have for building materials from the forest. The demand comes particularly from new residents (mostly government civil servants) in the booming district town of Beni. As their demand rises, local tradition and informal rules of management and access by season become blurred. The result is disjointness and "tragedy," in Hardin's sense, as outsiders begin cutting wood, or buying it from indiscriminate and uncaring (or unknowing) others, including locals who have abandoned traditional management custom. The complementarity between physical and technical

attributes and cultural context and seasonal conditions is lost, especially on outsiders who quite differently define the product, their use of it, and even the concepts of time and work associated with it.

A similar case can be made for water resources. As changes in perspective on the land and on water usage occurred at Marpha (case 4) with the outmigration of local Thakali farmers, and as Bhotia farmers arrived to take over the Thakali lands as tenant farmers, the understanding and compatibility of pre-existing social customs of local government and resource management diminished. The old Thakali management style for the distribution and control of water was dropped. Likewise, other characteristics associated with water resources also changed with the new Bhotia cultural perspectives, and although water is still assigned to similar categories of use (drinking, bathing, powering mills, cooking) to the newcomers, the traditional and culturally distinctively Thakali responses no longer hold.

The physical and technical attributes of the socio-political behaviors associated with particular resources may vary with the imposition of exogenous changes, but there is a nearly universal belief in Nepal that certain resources have supernatural characteristics (uses). These beliefs tend to appear quite similar despite differences in ethnic or caste identity, environmental variations, or religious predilections.⁶

For example, various gods and godlings (local and regional and of fertility, tutelary, gustatory, or other definition) are commonly believed to dwell in or be otherwise closely associated with water sources, forests, pasture sites, and other resources or natural objects. In case 2, the residents of Ghasa believe that the Thakali guardian spirit dwells in the Ramjung forest and that the people must go there periodically to worship. Similarly, there are sacred attributes associated with every forest and water system described in this paper.

At Muktinath (case 5), for example, the springs that serve as a principal source of irrigation and drinking water are elaborately enshrined near the source within a sacred forest of considerable antiquity. This water and forest place is, furthermore, considered a source of spiritual power and authority throughout Nepal and Asia as a major pilgrimage center for Hindus and Buddhists alike. Such universal reactions toward the supernatural aspects of forest or water sources are just as much a form of controlled "use" of such resource as are logging timber,

collecting fuelwood, cutting fodder, grazing meadows, or diverting water into fields.

Belief systems in which nature is sanctified often function to hold resource abuse in check through some combination of respect and fear that disturbance or neglect of the supernatural may cause more harm than good to the resource and to the people associated with it. At various levels, these beliefs serve to remind people of the miraculous (hence fragile) nature of the resource and of the people's own responsibilities to manage it for the sustained public good.

Sociopolitical solutions to resource management needs by the local villagers of the upper Kali Gandaki, and elsewhere across Nepal, also tend to be quite similar. In all cases described, where local traditions have not been totally disrupted by exogenous changes, management actions have been designed by local user groups along egalitarian and participatory lines (although certain historic conditions and styles of communal association vary from place to place). Likewise, rules concerning resource use or abuse tend to be quite similar--fines are charged for misuse, monetary fees or in-kind contributions are collected to pay watchmen, and social ostracism befalls those who neglect communal duties vis-à-vis the resource or who habitually neglect or debase the resource.

In short, these various beliefs and perspectives (meanings and uses), and the rules associated with particular resources all aid in retaining the relative jointness of those resources, all else being equal. When these systems are disrupted by exogenous forces, such as by nationalization and centralization in Nepal, and when other contending definitions are imposed, the result is disjointness.

Indivisibility

The forest and water resources of the upper Kali Gandaki watershed are intrinsically indivisible on physical grounds. But, as noted, a full understanding of indivisibility must take into account both the natural (physical) boundaries of each resource and other meanings/uses in cultural context. While it is conceivable that the forest can be divided into as many units as there are trees, it is not perceived in that manner by its users. Conversely, private trees may grow on private lands, but those trees are not considered as "forest" per se, either by local

farmers or by government forest officers. To villagers, the forest is a natural unit belonging to the community-- and deviation from that norm results in negative social sanctions, or (it is widely believed) resource failure (which some blame on the supernatural).

In the case of irrigation water, divisibility is more problematic. Farmers perceive water in terms of divisible time and quantity necessary to serve crop needs. The farmer cannot subtract water units from the total reserve in the same manner that one can clandestinely remove single trees from the forest. Rather, communal control, reflecting broader styles of local governance, is the norm. One reason that the old irrigation system in Marpha broke down was that without the full complement of Thakali villagers to maintain earlier tradition, the amount of irrigation time and consequently the quantity of water any single farmer received was not assured. Local definitions, hence uses, of the resource changed with the people. The new lottery system of control operates not on age-old rules of common and equal access, but on chance in a system fraught with uncertainties imposed from outside. The lottery is quite compatible, however, with the cultural traditions of the Bhotia tenants now operating the Marpha farms.

Decision-Making Arrangements

Two trends appear in the Nepal data--the first, from about 1957, toward more national control of resources, or centralization, and the other, more recent, toward decentralization.

Centralization is evidenced in an increased level of control over decision-making by the national government. In the case of forests, the nationalization legislation of the 1950s is the prime example of central level policy planning. In terms of both forestry and irrigation (cases 3, 4, and 5), the imposition of the panchayat system of local government has provided a centrally defined new structure of local government, one that has effectively undermined customary structures and made them irrelevant.

Nationalization, and other related government actions leading to increased centralization of authority in Nepal, led quickly to the decline or collapse of local initiatives for resource management in many communities. One point of this present discussion, however, is to show that traditional structures do continue to exist, not only in the

upper Kali Gandaki (as the five cases describe) but in other communities across the country. As Molnar has noted (based on a sample of forest management systems throughout the middle hills of Nepal): "Traditional management systems do exist. Where they do..., they should be incorporated in the management plans and built upon where it is feasible" (1981:24).

Decentralization of decision-making authority has become, in the 1980s, an important goal of the government, particularly as it relates to the development and maintenance of communal resources. On the one hand, there is a trend toward strengthening local authority and accountability in communities that have reasserted or have held tenaciously to "ownership" (in the sense of management control) over local resources despite nationalization (cases 3, 4, and 5). On the other hand, both recent reform legislation in forestry and national development policy indicate a trend toward more formal control of some resources (both natural and political). The National Forest Act of 1976 (and amendments that provide the mechanism for panchayat-based community forestry), and the Decentralization Act of 1982 (ostensibly giving more governing jurisdiction to local district and village panchayats) are the two principal actions of the national government toward decentralization.

In the Nepal scene, and I predict elsewhere, the basic conflict between national and local is (perhaps oversimply stated) one between formal and customary law. Both nationalization and "panchayat-ization" are essentially processes of supplanting preexisting informal and customary rules based on close interpersonal and largely oral tradition and social control with formal laws or rules that are based, in part, on the Western tradition of constitutional law and judicial process and in part on traditional caste law and governance. The two systems are not likely to be compatible in any large measure.

The process of decentralization in Nepal implies (it is not yet well-tested) returning administrative control to local jurisdiction with, perhaps, tacit allowance for reinstating some forms of customary resource management. The difference is that under centralization, formal national law is brought downward from the center to the village where it substitutes, in full or in part, for traditional customary law. The formal law is translated and transmitted into the rural hinterlands through government offices in district headquarters towns such as Beni in Myagdi and Jomsom in Mustang.⁷ Ostensibly, under the

new legal structure of forest management, formal law and centralized authority will remain, but some aspects of customary law and local participation will be encouraged by a process of selectively melding them with the formal system. As a development strategy, this has some merit, giving both systems--national and local, formal and customary--credibility and acceptability in the eyes of the rural people.

It is apparent in the data that the farther removed a resource (or a community) is from the center of power, the more diminished are the formal, centralized controls over it. In the most isolated panchayats of the upper Kali Gandaki watershed, for example, we find greater strength in customary law (cases 3, 4, 5).⁸ The result of close proximity to the center is clear in the case of Ghatan (case 1), where the pine forest is controlled from the district offices in Beni; indeed, the pine forest is clearly visible from the streets of this government town. (That Beni is a boom town is also a factor, and gives credence to the hypothesis that demand, itself, is a deciding factor in who controls access, for what purpose, and under what set of rules).⁹

Patterns of Interaction

At root, the behavior of the typical resource user, with the possible exceptions of contemporary Ghatan (case 1) and Marpha (case 4), is based on a sense of reasonably balanced sharing, or reciprocity. Each user has relatively equal access to the resource, sometimes calculated according to means or need, sharing it with his or her neighbor users. Each participating individual is expected to provide assistance and support in managing the system. Even leadership roles are shared over the long term by the most qualified individuals (as locally defined). In short, access to resources, and the social relations that grow up around them are developed through a collection of reciprocal rights, duties, and privileges.

The reciprocal ethic is most clearly demonstrated among the ethnic groups (e.g., Thakali and Bhotia, in cases 3, 4, and 5), but also exists more loosely, less formally, among the castes (cases 1 and 2). Reciprocity in the form of a relatively egalitarian approach to social and economic interactions prevails so long as the local people feel a measure of local control. In Marpha (case 4), local control was diminished by migration and by a new

form of governance imposed from the central government. In Ghatan (case 1), local control was usurped by district forest officials under the aegis of nationalization. These are only a few examples of the changes in interaction imposed by national authorities. As often happens in such instances, disenchanted locals begin to spread rumors maligning the integrity of certain officials and even some of their local leaders. It is not uncommon to hear unsupported allegations about local leaders involved in such fraudulent activities as special timber permit sales with financial kickbacks or with direct benefits to their own business enterprises. Such talk, and such beliefs, effectively undermine or cancel the reciprocity upon which a well-functioning traditional system depends.

Outcomes

A principal outcome in the Nepal case is a dynamic tension between local and national interest, particularly evident in the management of critical natural resources. While the evidence so far is unclear, it can be reasonably speculated that the more that local management systems or customary controls are accommodated in the development of resource management policy, the more efficient and equitable will be the result; likewise, the health of the resource will improve. Several development agencies and resource projects in Nepal recently have been attracted by the potential opportunities of this assumption (see Arnold and Campbell, this volume).

But, even where reciprocity and equity do not appear strong (as in some instances of hierarchically based Hindu caste communities), it remains clear that local tradition "survives" in some form, regardless. It is the strength of those local systems, their familiarity, their source in "tradition," and not necessarily their equity, efficiency, or economy in Western terms, that give them survivability--even in the face of forces to formalize, nationalize, or "panchayat-ize" them.

As has been pointed out before, there is a prevailing assumption among Western observers, at least, that equality in communal and cooperative systems is somehow a precondition to success. For a country like Nepal, however, this expectation may be unrealistic (Messerschmidt 1981, after Bennett 1979). Rather, cultural diversity and a diversity of form, function, meaning and use provide a key to understanding how and why communal systems of

common resource management survive and thrive in the world. If no other understanding is gained from the Nepal data, this one should stand--that there are many ways for communities to organize in dealing with common property and resource management problems. Each must be studied, understood, and appreciated in context. Each works well under its own unique conditions, but none provides a single model that is applicable to all.¹⁰

NOTES

1. The author is a development anthropologist with extensive experience in the Nepal Himalayas since 1963. The data were collected between 1981-1984 on the USAID-supported Resource Conservation and Utilization Project (RCUP). The RCUP was designed to improve forest, soil, and water resources and their management; its social science component sought conjunction between development inputs (of appropriate technology and financial assistance) and local systems of organization for natural resource management. Some of the material in this paper was first developed in a study prepared for the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu (Messerschmidt 1985). The author is indebted to the directors of the RCUP and the ICIMOD and to their staff for assistance. Further elaboration may also be found in Messerschmidt (1986).

2. Sweeping land reform legislation in the mid-1960s has also had a great effect on the concepts and practice of private and communal resource control and management, particularly in relation to such land-related resources as trees and water. Land reform is not discussed in this paper, primarily because it is not well-documented in Nepal. It is clearly an important topic for future study.

3. A village panchayat comprises a population of approximately 2,500 to 3,000 people in one or several villages. It is headed by an elected chairman and vice chairman and a representative council of nine individuals selected from each of nine wards. A group of village panchayats articulates together within an administrative district, of which there are 75 in Nepal.

4. I am reminded of the contradictory definition of bamboo as a forest product espoused by an American advisor I knew in Nepal. In editing an FAO forest survey form to fit the

needs of the resource development project on which he was engaged, he eliminated a whole section on bamboo. Bamboo, however, is a product of the forest of immense importance to Nepalese villagers who put it to an incredibly wide variety of uses. When the advisor was asked why he had dropped the questions concerning bamboo, he said: "because it is not a 'tree'; it is a 'grass'!"

Similarly, a definitional debate--hence a policy debate concerning access and appropriate use--rages between those who consider the village forest to be a "national" resource, subject to centralized management and marketing decisions, or a "local" resource subject to customary village controls and used in the local subsistence economy. How a resource is defined has very definite effects on how it is used (or abused), as well as on its relative jointness or disjointness in any one place or time.

5. Donovan (1981) has identified 13 "minor forest products" including food products, oils, medicinal herbs, resins and dyes, incense, and such other miscellaneous products as leaves for smoking, broom material, wicker, structural bamboo, and beeswax.

6. Furthermore, knowledge about resources is, itself, frequently held sacred, guarded and preserved by certain people such as shamans, sorcerers, or diviners and by other specialists, such as artisans (especially blacksmiths) in Nepal. These various human repositories of sacred and profane knowledge sometimes have enviable stores of environmental information at their disposal. Quite often such lore is considered as a secret and highly valued personal resource, propounded and passed along (usually by oral tradition) only to the initiates or inheritors of the lore. Often the knowledge is enveloped in semi-secret ritual, myth, or legend, which functions to keep it relatively intact and safe. And, in a very real sense, this lore and folk knowledge is, itself, a communal resource--entrusted to the specialists to keep secure for the wider village public. In short, the ritualization of environmental knowledge serves the distinctly important purpose of nurturing and preserving knowledge itself as a communal resource.

7. The question of precisely how to ameliorate the problems of "formal" versus "informal" and "central" versus "local" control over forest management, however, is beyond

the scope and prescribed length of this paper. The reader is encouraged to read Arnold and Campbell (this volume) for an analysis of one apparently successful attempt to reinvigorate local communal participation in forest management under a centralized national forest authority (see also Messerschmidt 1986).

8. The historic trend towards local independence from outside or central government control in the Mustang District is well-documented (see Bista 1971; von Fürer-Haimendorf 1966).

9. It is interesting to note that there are several similar forest tracts in the Myagdi District, but in those farther removed from (literally, out of sight of) Beni headquarters, local leaders have been better able to maintain customary controls on resource allocation.

10. Similar conclusions have recently been drawn by Thompson and Warburton (1985a, 1985b).

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The Management and Use of Common Property Resources in Tamil Nadu, India

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INTRODUCTION

Tamil Nadu is the state at the southeastern tip of the Indian peninsula. It is traversed from the higher west to the coast by several major river valleys where the cultivation of irrigated rice predominates. The intervening plateaus also have some irrigated agriculture, dependent upon water stored in surface reservoirs and groundwater, as well as dry cultivation of millets, sorghum, pulses, and oilseeds. Both the valleys and the plateaus have been relatively intensively cultivated over a long historical period. Common property resources play some part in agricultural systems throughout the state, the most important of them being surface water and groundwater for irrigation. These have been the object of some other recent studies, however, and our research¹ has been focused rather upon land-based resources: principally fuel, fodder, and grazing, but also construction timber, green manure, and a variety of minor forest products with domestic, craft, or sometimes industrial uses.

All of these products may be obtained, subject to environmental conditions, from one or another of the types of publicly owned lands that are defined by the systems of land and forest administration, and sometimes from private land (see Figure 1). The system of land administration has its roots in the precolonial period but was further devel-

oped as a major instrument of British rule, with the objective of maximizing the appropriation of land revenue. The "commons" of Tamil Nadu are now those lands defined under this system as: (a) poromboke: "lands incapable of cultivation or set apart for public or communal purposes," (including, sometimes, public grazing lands) that are not generally liable for revenue; (b) "waste," which may be either "assessed waste" ("cultivable lands which have been left uncultivated, lands relinquished by cultivators, and lands bought in by government in revenue sales") or "unassessed waste" ("lands to which no classification or assessment has been assigned because they are considered unfit for cultivation")²; and in addition, (c) areas designated under the terms of the forest act as either reserve forest or revenue forest.

Poromboke and assessed and unassessed waste land fall within village boundaries and are nominally "village lands," while forests are usually outside village limits. None of the lands covered by these official categories should be encroached upon for settlement or cultivation; if they are, then official penalties may be applied. Fuel, fodder, and other products available on poromboke and waste lands may be freely collected, except in the case of designated trees or bushes (such as palmyra palms or tamarind trees), the rights to which are in the control of the local administration and are usually auctioned annually. These products may also be available from designated forests, when rights to collect or cut are under the control of the forest department of the state government. In addition, fuel and fodder may sometimes be obtained quite freely from private land, where there are generally accepted common rights, for example, to dig up the stumps and roots of harvested plants for fuel, to graze animals after harvest, or to cut grass from field edges.

There is a problem in clear labeling of the various resources available and the exact property rights attached to each. Poromboke and waste land, for example, are designated as village land and, as such, would seem to be land on which the resources are common property. However, in many cases, poromboke and waste land are used by persons outside the village too, particularly when they are in large tracts and/or abut roads or other settlements--in which case they are "open access" resources. However, in the majority of cases, users of the poromboke and waste lands close by a village tend to be the villagers themselves. Also, within any one territory, a variety of property rights are attached to specific resources, as

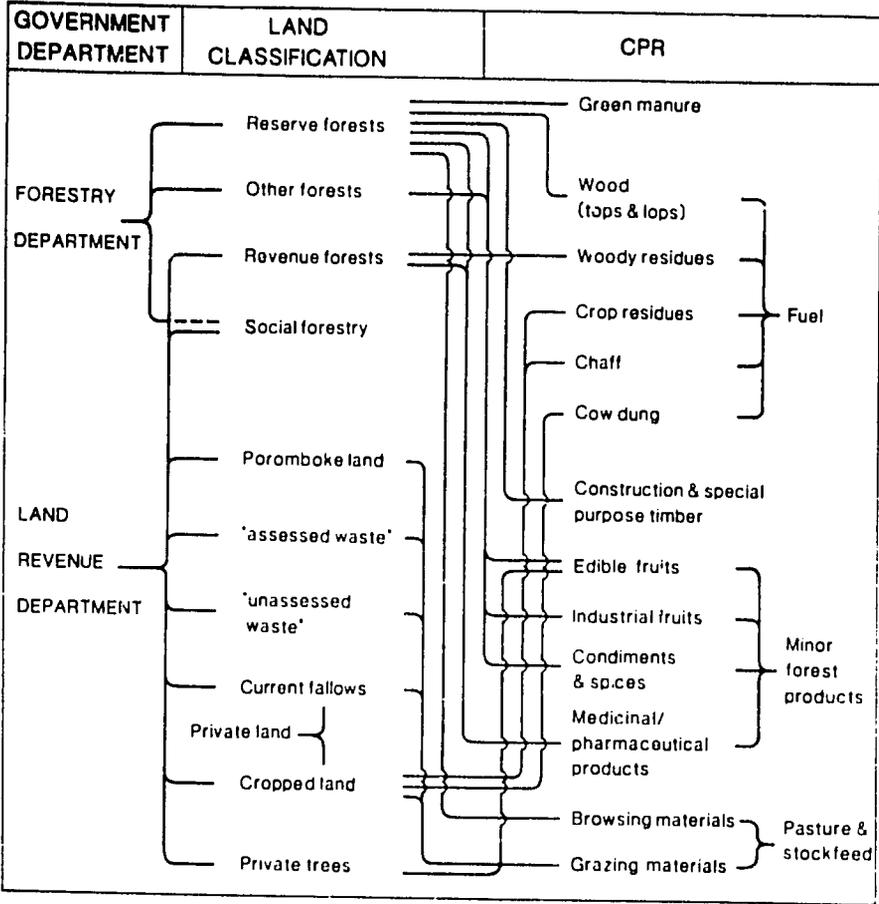


FIGURE 1 Common property resources studied in this paper.

Figure 1 makes plain. For example, a sandalwood tree in a reserved forest is treated as state property, while the grass around it is a common property resource for

which users pay the state. The unambiguous label is threatened by "illegal" use. At what point does poaching turn state property into an open access resource?

Official data on the areas of land covered by these official categories give us a measure, though an imprecise one, of the availability of commons in different parts of the state, and of the extent to which they are being depleted. The official land utilization data, shown in Table 1, gives only an imprecise measure because the categories employed may lump together both public and private land. It is fair to assume, however, that the major share of the areas of "forest," "culturable waste" (the sum of assessed and unassessed waste) and of "permanent pasture" shown in the data is under public ownership, and that any changes in extent that are recorded are likely to include changes in this "public" area. These figures suggest that while the forest area has remained constant over the last 21 years, the areas of culturable waste and of permanent pasture have undergone a general, steady decline.

TABLE 1 Tamil Nadu--Changes in Land Use Patterns Relevant to CPRs 1961/62, 1969/70, and 1981/82 (percentage geographical area).

	Forest			Culturable Waste			Permanent Pasture		
Year:	61/62	69/70	81/82	61/62	69/70	81/82	61/62	69/70	81/82
Percentage:	14.5	15.5	15.6	5.3	4.1	2.6	2.8	1.7	1.2

SOURCE: Season and Crop Reports.

Field investigations at the village level show that there is a good deal of diversity in the importance of common property resources (CPRs) in the economy. But it seems that we may broadly distinguish in terms of both area and potential benefits between "CPR-limited" and "CPR-dependent" villages. In villages in areas of old, established, and quite intensive cultivation, CPRs may in fact be of rather marginal importance, where there is no frontier of "waste" land that can be encroached upon for cultivation--apart perhaps from limited areas of tank foreshores; cattle are largely stall-fed with crop residues and even purchased feeds, and grazing on public or common lands is of secondary importance; fuel includes dung cakes

made from the manure of privately owned cattle, thorn bush twigs cut on privately owned land, and even purchased firewood (only very poor people collect fuel on poromboke land). Soil fertility depends upon purchased inorganic fertilizers, and even organic manures are purchased from outside; few, if any, minor products supply food or raw materials, apart from the roots of some cacti that provide famine food. These can be termed "CPR-limited" villages.

In contrast with these circumstances are those of villages in more marginal environments such as the hilly areas of Dharmapuri and Salem districts and in the western areas of the state. Here, a "frontier" of waste still exists and offers livelihood possibilities even for poor people. Fuel and fodder are extensively obtained from the "commons" by all classes of people, and soil fertility may be closely bound up with the numbers of livestock that can be maintained. These CPR-dependent villages are often situated in the west of the state where forest still covers a significant percentage of the land area.

TECHNICAL AND PHYSICAL ATTRIBUTES

Tamil Nadu has a wide range of vegetative formations reflecting a diversity of rainfall regimes. This vegetation provides the productive base for CPRs. Although the area of natural vegetation has decreased both quantitatively and qualitatively, the government of Tamil Nadu had listed 1,219 species in the area in 1983, the majority of which are used for one purpose or another (for a detailed list, see Blaikie, Harriss, and Pain 1985).

The technical and physical qualities of these CPRs can be considered in terms of their jointness of supply, excludability and indivisibility (Oakerson, this volume). We will discuss them under the two broad headings of timber and fuel and grazing resources (although for many purposes there is no need to distinguish between them). With regard to jointness of supply of these CPRs, clearly they all can be used by a number of people simultaneously, and that use can subtract from the per capita benefit. However, there are important methodological issues here, since use is not necessarily harmful to productivity: there is evidence that under certain circumstances limited degradation of, for example, climax to secondary vegetation can actually lead to enhancement of productivity. Indeed, continued use of many biological resources is the key to sustained productivity.

Data on the production and productivity of CPRs is very scarce. For example, livestock obtain fodder supplies from crop residues, grazing on village common lands (poromboke and tank foreshores) and from browsing in reserved forests. The relative importance of these various sources is quite variable over space and time, and the intensification of rice production has evidently alleviated problems of fodder supply in some areas. Nevertheless, fodder or browse resources from forests constitute a major source of supply for cattle in western Tamil Nadu, but (as with fuel species) data on natural browse species, on actual and potential productivity, and on carrying capacity of browse areas are almost entirely absent. Thus, precise statements on actual or potential supply and benefits cannot be made. If we knew the sustainable yield of browse species, we could make a determination of what the grazing limits could be. However, one would have to accept a trade-off between fodder and fuel supplies, since maximizing the one would reduce production of the other.

The excludability of CPRs is an issue that is constantly at the centre of contradiction between the rural population and government departments. It is physically feasible to fence off forests, but very expensive. It is estimated that fencing social forestry plantations doubles the costs of establishment (Karnataka State Forestry Department, personal communication). In addition, fences are difficult to guard and are easily cut. It is extremely difficult to guard and to exclude users from small forests entirely surrounded by rural populations. For poromboke land and other major grazing resources, exclusion of non-locals (those from outside the village) might be quite easy through recognition. In practice, little effort is made to exclude outsiders from village poromboke. If a village decided to stint on the poromboke land, it would be fairly easy for people to identify free riders--although not necessarily to exclude them, since effective exclusion is a matter of political power as well as of the physical characteristics of the CPR itself. This point underlines the difficulties of clearly labeling the type of property rights attaching to each resource.

There is another aspect of excludability that depends upon the location of the CPR relative to potential users. The friction of distance derives from relative location and not from the technical attributes of the CPR, but it is an important aspect. Development of the road system even to the remote parts of Tamil Nadu has opened up many forest products to commercial pressures. Pappanaickenpatti

(a village in Salem District) has developed a substantial local export industry in green manure for paddy and curry leaves from the curry leaf plant (Murraya koenigii); the former is transported to the Salem district, the latter to the markets of Madras over 100 miles away. The new road to the village laid in the last decade has made this business possible, and has made most CPRs in Tamil Nadu accessible to commercial exploitation.

The physical attributes of CPRs in Tamil Nadu can be summarized, therefore, as broadly accessible and non-excludable, subject to relatively high subtractibility and divisibility, and with a clear set of boundaries.

DECISION-MAKING ARRANGEMENTS

Decision-making arrangements regulating the use of CPRs in Tamil Nadu have these characteristics: first, the development of institutions for collective choice within the groups involved with these "commons" is very restricted indeed; second, there is extensive bureaucratic control under rules that are partial and often unclear, and that leave a great deal to the discretion of field officers in matters of enforcement; and third, following from these features, the arrangements are highly susceptible to manipulation by those with local power.

Conditions of Collective Choice

Few local institutions regulate choices over the use of CPRs in Tamil Nadu. In some instances, purely local, community level councils/committees/informal groups act to regulate surface irrigation, such as those in North Arcot District described by Chambers (1977). A tradition of kudi-naramut, or locally organized collective work in the maintenance of irrigation structures, also can be found to a limited extent in some parts (Harriss 1982: 72-76). But these instances are exceptional and they relate to irrigation water. We know of no such institutions or arrangements for the management of the resources of poromboke and designated waste lands or of forests.

Tamil Nadu, as elsewhere in India, has a history of local institutions (panchayats) with juridical powers (for the resolution of disputes) and executive authority (for certain decisions in the public realm, such as over temple affairs and village religious ceremonies). (We refer here

to village and caste panchayats rather than to the officially constituted panchayat, the lowest level of organization in the system of democratic local government adopted in India in the 1950s and 1960s.) The panchayats still exist (see Harriss 1982:227-233), but there is little, if any, evidence that they have been instruments for the management of resources such as waste land and forest, at least over the last 200 years. They may be used, however, to resolve disputes such as those arising from quarrels over grazing.

The effectiveness of such local dispute resolution and decision making depends upon local power structures, in which the extent of the dominance that is exercised by a particular caste group, and the capacity of that caste group for taking collective action, are factors of crucial importance. In circumstances where dominance is disputed among different groups and/or where the dominant caste group is itself divided by strong factional rivalries, collective action may be compromised. Djurfeldt and Lindberg (1975:125) record an instance of effective action by locally dominant cultivators to prevent encroachment on poromboke lands used for grazing, while Hill (1982:131) documents a case where common grazing lands have been encroached by richer households. What happens to common lands in a particular village area is likely to depend upon the specific interests and politics of richer and more powerful people. Such effective choice as exists with regard to CPRs in the highly stratified rural society of Tamil Nadu is unlikely to involve the entire village population. It will involve the richer, more powerful households and will usually reflect their interests. The mass of rural people may or may not derive some benefit from their action.³

The official panchayats have assumed some responsibility for the management of some CPRs. Palmyra and tamarind trees, growing on tank bunds or at roadsides (respectively), thorn bushes used as fuel, and certain green manure plants all are treated as public property. Rights to the use of these plants were handed over to the village panchayats, which in turn auctioned them, and put the money earned into panchayat funds. Though the village panchayats have been in abeyance in Tamil Nadu since 1975, it is still said by villagers and by officials that the panchayat controls the use of these resources. At present, in practice, use rights are auctioned by a local official and the proceeds go into official coffers. It is significant, though, that the panchayat should still be referred

to: there is a strong belief in the power and endurance of popular institutions of local self-government even when these institutions no longer exist. This belief perhaps helps to legitimize state interventions. Under both the village panchayats and under the current arrangements, there is evidence that relatively wealthy or powerful people have been able to obtain rights to CPR produce at very low rates in auctions, and to sell this produce for a substantial profit.

In sum, the use of CPRs of fuel, fodder, and other produce from poromboke, waste and forest lands is subject to a high degree of personal discretion (individuals are generally able to act on the basis of personal discretion in matters of common concern). This discretion, however, is limited mainly by bureaucratically enforced controls that can be manipulated, to one degree or another, by each individual who encounters them. Fieldwork showed a number of corroborated accounts of bribery: bribes are considered necessary when users want to gain access to resources to which the state laid claim, or when they need to extricate themselves from the consequences of being caught. There were reported to be considerable variations between individual officials at all levels, however, as well as between the way in which the administration operated at the village, district, and state levels.

Individuals adversely affected by others may turn to local, unofficial panchayats to adjudicate disputes or they may find remedies through the law and the local bureaucracy. All these institutions are susceptible to influence by those holding local power. In any event, the extent to which collective decisions are taken at all is very restricted, and both this and the degree to which such decisions are binding depends upon the local power structure, and especially on the politics of the dominant caste. Powerful individuals both in the village and in the bureaucracy have extensive powers of veto.

Operational Rules

In circumstances such as those just described, the operational rules affecting CPR use exist on two levels. On the one hand, bureaucratic rules regulate access to and use of poromboke and waste lands and their products; these are enforced by the revenue department; rules regarding officially designated forests are enforced by the forest department. The former include a scale of fines that

should be levied in cases of cultivation of poromboke; the latter, such rules as giving rights to collect fallen wood, but not to cut standing trees.

On the other hand, informal rules arise from the nature of the local power structure and the interactions of people with the bureaucracy. Thus the revenue and the forest departments are empowered to enforce rules that, in principle, prevent partitioning of CPRs and establish strong boundary lines. Local officials of the revenue department should prevent encroachment upon the poromboke lands and regulate the use of designated waste, and forest officers control access to the forests. In practice, these rules can be bent systematically in favor of the relatively rich and powerful, for whom the fines imposed by the bureaucracy and/or the bribes paid to local officials for turning a blind eye on infringements may be treated as acceptable "costs of production." For the officials concerned, on the other hand, these payments are part of a kind of bureaucratic rent.

External Arrangements

Our account thus far has emphasized the crucial importance of external arrangements in decision making over CPRs in Tamil Nadu. The commons are actually defined by bureaucratic categorization of land as poromboke, or as "waste", or as "forest" (which is then really "state" land and not local "commons"); their boundaries are bureaucratically defined and may or may not correspond to a division based upon vegetational zoning. Rules about access and use are laid down in the standing orders of the departments concerned.

The arrangements in force are mainly bureaucratic, with both highly centralized rule making and, in practice, a great deal of field officer discretion, given the extreme difficulty of supervising their activity very closely. Petty corruption is endemic. But there are also arrangements at other levels, as, for example, with the recent establishment of village social forestry committees that supposedly encourage participation in the management of social forestry plantations. These committees are of such recent origin that it is difficult to assess them. The limited information we have suggests that they are often "paper" organizations characterized by indifference and ignorance on the part of the majority of their members. There is no reason to suppose that they will be any more

effective as instruments of participation and collective decision making than are the village panchayats. Their power to make rules is seriously limited. The forestry department can and does coerce villagers to accept social forestry projects on their foreshores (Centre for Research, Extension and IRD 1984). The village level social forestry worker is responsible to the forestry department and not the village; the department selects the species to be planted and the dates when cutting is permitted, and the produce is auctioned off at its wish. Thus, the villagers cannot choose who will use the CPRs or decide upon how the products will be utilized.

Conclusion

In this sphere, as in others in south Indian villages, it seems that the long-standing attempt by the state to exercise close supervision over land use has actively discouraged collective choice and action at the local level (on this in general, see Washbrook 1976). Utilization of CPRs (fodder, fuel, etc.) is extensively controlled in principle by the local officials of several government departments. In practice, the system is subject to manipulation by those with local power and generally works in their favor.

PATTERNS OF INTERACTION

The account of decision-making arrangements for the management of CPRs implies that the consequent patterns of interaction are of two types--those between people and the state with its various functionaries, and those among people themselves who use the CPRs in the village. Since collective choice in the management of CPRs has been reduced to a minimum, the dominant set of interactions concerns the direct users and the state, or more specifically, the state land revenue and forestry departments.

Although these two sets of interactions are distinct, they are often closely related in the way CPRs are actually used. Any group of would-be users of CPRs is heterogeneous in its economic, social, and political resources. Users usually compete for CPRs, and competition among individual households for CPRs is encouraged by the lack of institutions at the local level (or at any other level) to manage the commons in a cooperative way. Each house-

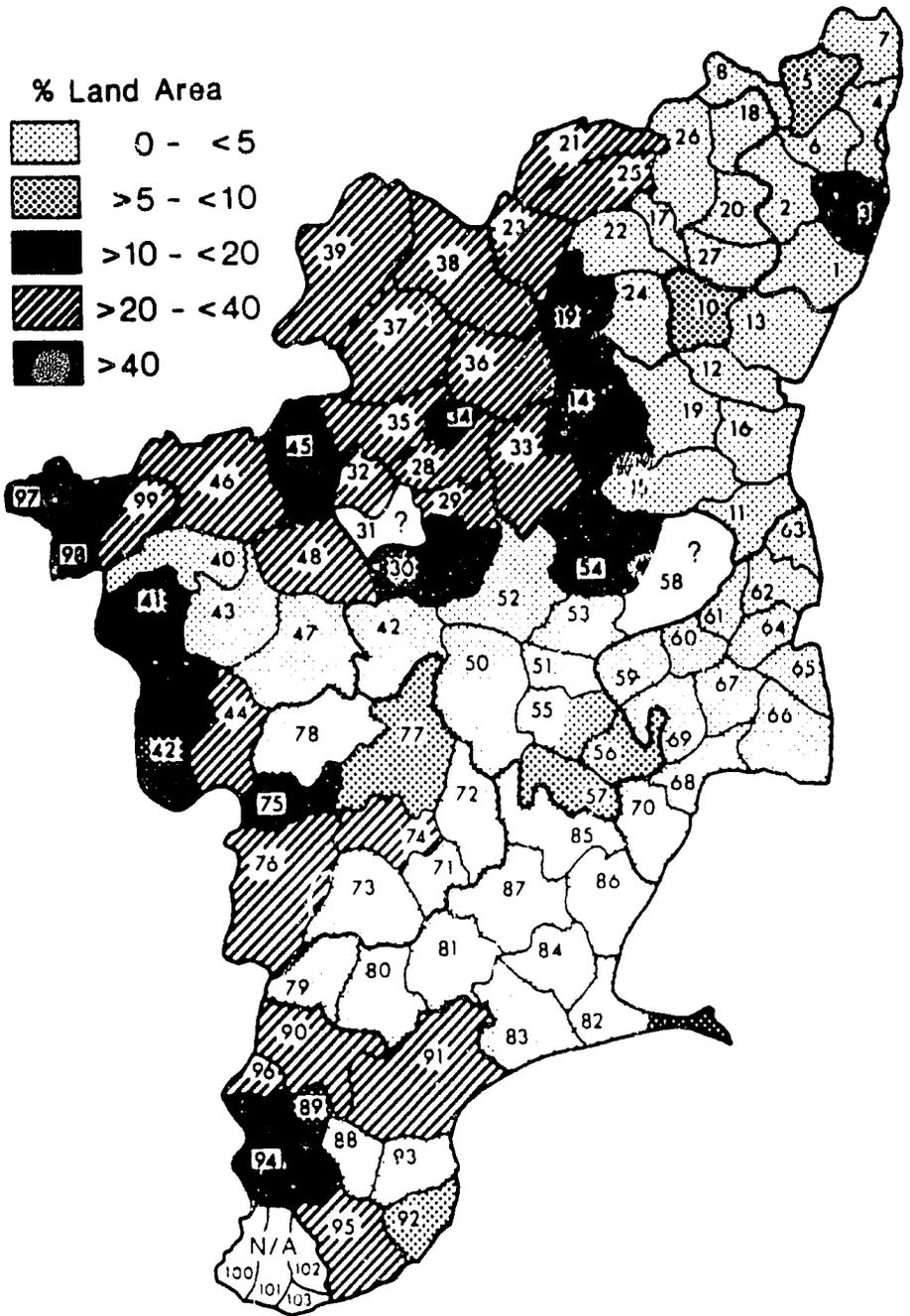


FIGURE 2 Forest cover in Tamil Nadu, 1981-1982.

hold thus competes against the others and against the state, and in this interaction the notion of access is crucial.

Access to CPRs has many dimensions. It implies that the would-be user has sufficient labor to use the resource (this is particularly important for fuel collection and grazing). It also implies that the potential user has spatial proximity to the resource and either the funds to purchase access from state officials (the payment of bureaucratic rent) or sufficient political power and coercion to gain access without paying the fee. Such power usually is the result of land ownership and facilitates dealings with official regulations over CPRs and with other competing households who are also direct users of the CPR. Thus the access position of the user largely determines the choice of strategy to obtain CPRs, and therefore the pattern of interactions among users themselves, and between users and the state.

The first and most common interaction between users and the state is the "legitimate" use of CPRs. This involves the removal of dead wood from both revenue and reserved forests, which is permitted by official regulations for certain forests. In addition, tribal peoples are given special dispensation to graze sheep and cattle (but not goats) in reserved forests. Others pay grazing fees, and there is no restriction on the number of cattle to be grazed. Stock may graze on waste and poromboke lands. As we shall see in the next section, the outcome of legitimate use of CPRs alone (leaving aside "illegitimate" use to be discussed below) has led to extreme pressure on some CPRs, notably grazing land and in some places fuel and construction timber (on the situation in India generally with regard to this point, refer to Government of India 1984). It is not the central contention of this paper that the illegal use of CPRs is necessarily the main culprit in the physical decline of many CPRs, although illegal action certainly is an additional use of CPRs and, as such, contributes to overuse. Illegal use also highlights the contradiction between would-be users and the state (which makes most of the rules).

Patterns of interaction involving illegal use of CPRs are of two major types: (1) instances when the illegal use constitutes overuse or overextraction by an individual of a common resource over and above the limits set by the state, and (2) cases when the illegal use involves a theft of state property (such as sandalwood). The two major resources that are most often overextracted are fuelwood

and grazing land for goats, both of which are found on revenue and reserved forests. Those who collect fodder and fuelwood are frequently caught by forest guards; if the wood they have collected is found to have been cut green, the guards will impound their sickles. A fine of Rs. 5/- is common in such circumstances.

The case of theft of state property of timbers (such as sandalwood) is of a different order, since it is so valuable (up to about \$10 per kilo of grade 1 timber) that it has long since ceased to be a CPR; rather, it is a much-prized commodity to which the state has laid claim. A few private individuals, often backed by considerable capital and equipment, do mount raids on these trees. The revenue collected by the forest department from this source is so much greater than from all others in certain forest divisions in western Tamil Nadu that much of the resources of staff and transport are committed to protect and harvest sandalwood. This undoubtedly diverts personnel from guarding less valuable resources such as small wood for fuel and other species used for construction purposes.

Bamboo is not such a severe case, although it is commercially valuable enough to provide the forest department with considerable revenue. It is also used by local artisans for weaving winnowing fans and mats, and forest guards often fine artisans not only at the site, but also when the artisans attempt to sell the finished product at the market.

It is difficult to assess how much of the fines levied by forest guards find their way to the official revenues of the department, and how much is appropriated by employees as "bureaucratic rent," but widely corroborated accounts of bribery abound. Villagers informally arrange an annual bribe to local forest guards to facilitate the grazing of goats, for example (by a capitation "fee" of about Rs. 5/- per goat-owning family, which, in one village, provided a sum of some Rs. 600/- [\$50] handed over annually).

Similarly, artisans using bamboo arrange an annual bribe. In one vil-

lage, the collection of green manure from the more productive reserve forests attracts a standardized charge of Rs. 80/-, of which Rs. 36/- is an unreceipted fine to forest guards. The forest guards (and perhaps forest rangers, too) have an informal organization for dividing this rent amongst themselves and for collecting it in a variety of ways. One tribal village, well-endowed with reserve forest, has forest guards who arrive two or three times a year with a lorry, make a spot-check on fuelwood stocks of households, and confiscate and remove any timber that they believe was cut green. The value of a lorryload is estimated to be at least Rs. 1,000/-.

The other main type of interaction between state and user is the privatization of CPRs through encroachment. Successful encroachment of poromboke lands and other common lands (such as uncultivated waste lands) depends upon the access position of the individual encroacher, both with regard to other villagers and to the bureaucracy of the land revenue department. Individuals of widely differing access positions encroach upon poromboke land. Landless and near-landless households are perhaps the most numerous, but their position is threatened by powerful "big-men" and speculators from outside the village who employ strong-arm tactics to evict less powerful people, and who sometimes use the law to have them removed--and then evade the law themselves through bribery to take over the land and register it in their own names (as in the case of Pappanaikenpatti, where the village munsif acquired patta--i.e., land to which an individual has title--right over land from which he had evicted tribal encroachers). There is therefore a long, drawn out process of de facto occupation of poromboke land, annual fines for illegal privatization that may go on for many years, and finally change of revenue classification to patta land. Revenue records, therefore, inevitably lag behind the true extent of encroachment. Encroachment clearly has been going on for a very long time, so that opportunities for further encroachment are generally limited. Local revenue records show that most of the encroachment takes place on land designated as poromboke, cultivable waste, permanent pastures and other grazing lands, and only to a very limited extent onto land under the jurisdiction of the forest department.

Turning to the interactions among individuals in the use of CPRs, it will by now be plain that there is very little cooperation among individuals in the management of commons that have been taken over by the state. Competition is the dominant relationship in CPR use, rather than free riding. The intensity of competition among users is a function of the supply of CPRs and the demand for them, and of the lack of legitimacy of the rules governing the resources. The state makes the rules but enforces them arbitrarily (from the local users' point of view), and their legitimacy is low.

To summarize the principal patterns of interaction, the chief actors are users and the functionaries of the state, backed by the law that, in official terms, clearly demarcates and sanctions categories of rights and restrictions. The arena of local management and interaction is

thereby drastically limited, and is characterized by individualistic patterns of use and competition among users who have differing qualifications for gaining access.

OUTCOMES

Political Economy

The outcomes of the political economy can be summarized by seven major points discussed below.

It will already be clear that the state has taken control of virtually all lands on which common property resources are to be found. The social forestry program, as it is currently conceived, is merely an extension of the state's control and a further restriction upon the use of common property resources. At the local level, too, no institutions take a major part in managing these resources. In sum:

- (1) The state seeks to regulate most CPRs in Tamil Nadu.

The outcome of CPR management in Tamil Nadu cannot be analyzed properly without reference to changes in the ownership and productivity of private property resources (PPRs). Here there has been a steady reduction in the average size of landholdings and a considerable degree of differentiation among rural households has existed for a long time. Some farmers have managed to increase both the size and productivity of their farms; others have been reduced to the status of either landless laborers or sub-marginal farmers, and have been pushed onto the economic fringes of cultivation. This sometimes finds spatial expression in that they illegally squat on poromboke land and barren wastes, and may be forced to cut and sell firewood to eke out a living. These people are also marginalized in the sense that they cannot usually invest in productive assets and tend to lose land to more adventurous, unscrupulous, and wealthy people. For the most part, encroachment is the result of population pressure within a society with a highly skewed distribution of power. The exception is encroached land that is irrigable and attracts speculative purchase by wealthier people.

Other changes in PPRs also affect the use of CPRs; these come about as a result of irrigation. When an extra one or two crops a year are produced, crop residues for

feeding livestock and for fuel are more plentiful. In Tamil Nadu, the double-cropped area has generally increased, especially as a result of the expansion of groundwater irrigation (data in Kurien 1980). At the same time, paddy cultivation may create a demand for green manure, which is usually obtained from forests where these are accessible. Thus:

(2) Marginalization of poorer rural people has led to increased use of CPRs and their encroachment through illegal squatting.

(3) Increases in irrigated area have tended to ease the shortage of pastures on common land, but may also have increased the demand for green manure, particularly near forests.

Greatly increased pressure on CPRs has led to rising costs to users whose travel and collection time have increased; users may also be paying more for bribes and fines.

In the areas of Tamil Nadu that were studied, there is a notable exception to encroachment patterns that seem widespread throughout India--namely the unauthorized collection of fuelwood. There is little evidence of a serious shortage of fuel in Tamil Nadu. There are a number of reasons for this. First, there are a fair number of woody residues from tree crops (for example palmyra and coconut palm), and annual crops (such as cotton, cassava, and sorghum) that are not readily recyclable through the agricultural system via composting, but that are still suitable for burning as fuel. Second, there is not an appreciable cold season (as in central or northern India). Third, opportunistic thorn bushes (such as Lantana spp.) grow rapidly and freely on poromboke land on roadsides, tank foreshores, and elsewhere, and provide an adequate source of fuel in many areas. In eastern districts, Prosopis juliflora provides fuel, since it is rarely browsed by goats, and it coppices well and grows fast. This finding is different from that of Jodha (forthcoming), who found quite acute shortages of fuel in the drier areas of western India where dung is burned as a substitute for wood. In Tamil Nadu, dung is burned in areas far from any available forest, but it is not universal. Thus, we may summarize our fourth outcome:

(4) There is not yet a widespread nor severe shortage of combustibile fuel.

Increased pressure on grazing is undoubtedly severe, however, and is reflected in reduced numbers of live-stock:

TABLE 2 Changes in Livestock Population in Tamil Nadu, 1961-1982.

	1961	1974	1982	% change 1961-1982
Buffalo	2,594,271	2,853,252	3,212,224	+ 23
Bovines	13,420,174	10,572,378	10,365,500	- 23
Sheep	7,159,956	6,392,821	5,536,514	- 23
Goats	3,428,847	3,954,477	5,246,192	+ 53
TOTAL	26,603,248	23,772,928	24,360,430	+ 8

The views of individual owners of cattle, buffalo, and small stock also support this view. The extension of government-sponsored social forestry onto tank foreshores clearly exacerbates the pressure on remaining land. Thus:

(5) There is severe pressure on grazing land, and this is partly associated with a decline in the numbers of cattle.

Other forest products both for commercial exploitation and for subsistence have also become scarce or unavailable altogether. Exploitation of those that have commercial possibilities (such as gall nuts and curry leaves) have increasingly been organized by contractors who have successfully bid for the rights that are sold by the forestry department or the land revenue department. Medicinal herbs, wild roots, honey, and relishes have long since disappeared from both the forests and minds of those who use the forest (curry leaves are the one exception here). Thus:

(6) Most minor forest products have ceased to be CPRs either because they have been overused to the point of extinction or because they have been commercialized and taken out of the realm of CPRs for local use.

Turning now to the overall extent of land on which CPRs are or were exploited, encroachment into poromboke land and unassessed and assessed waste land has reduced the area of common land to a very small proportion of the whole (see Table 1). While the remaining poromboke and waste land is dwarfed by land held in reserve and revenue forests, it remains the only land that could conceivably be managed by a committee of users. Thus:

(7) The area of village lands from which CPRs are obtained has been diminishing over a long period, and has left very little common land under the control of the village.

Environment

It is difficult to be precise about the efficiency of use of CPRs in Tamil Nadu because of the general dearth of accurate physical information on their potential and actual levels of productivity. Further, if one considers the interactions among different CPR products obtained from the same common lands, such as browse or grazing and fuel, data on how productivity of the one will affect productivity of the other does not exist. Statements of biological efficiency that concern themselves solely with aggregate productivity or vegetative material are meaningless without recourse to exact information on human needs and whether in fact fuel or grazing products are or should be more significant. Of course, this is not to suggest that there is no compatibility of use among different CPR products, but one must recognize the limitations of simply using physical data in a vacuum.

Verbal reports and some physical evidence do suggest that overall usage rates of CPRs has led to a depletion of resources. Productivity has actually increased in one case where tank foreshores were planted with Acacia nilotica (babul) under social forestry schemes; however, this has not necessarily enhanced common benefits.

There are differences among villages in the higher west of Tamil Nadu and those on the eastern plain. The Kalrayan hills in Salem district surrounding the village of Pappanaickenpatti still support a diversity of flora in a well-structured community, which hardly indicates severe environmental pressure (see detailed analysis in Blaikie et al. 1985). In the neighboring district of Dharmapuri on the common lands of Arakasanahalli, this vegetation

cover is largely gone and the lands are covered by the opportunistic Lantana spp. and thickets of heavily coppiced Albizia amara. But despite the fact that the vegetation is degraded, the village does not suffer from problems of fuel supply. On the other hand, in Dusi, a predominantly paddy village in North Arcot, the remaining 21.56 acres of common grazing lands support no standing timber, and although there is full grass cover, the species composition is such that productivity is low and little benefit is derived by anyone using these lands for grazing. But the fuel situation in Dusi has actually improved over the last decade with the spread of the thorn bush Prosopis juliflora, and the village is almost self-sufficient in its fuel requirements.

In general, production from village grazing lands is minimal, but this has probably been the case for some decades. There is no doubt that many of the forests and their various products are degraded or exploited beyond their natural rate of sustainability, and the overexploitation of bamboo has been well documented.

Livelihoods

CPRs are of varying importance as sources of food, fodder, fuel, manure, and minor products; these products, in turn, are the basis for livelihoods in villages in different parts of Tamil Nadu (see our earlier remarks on "CPR-limited" and "CPR-dependent" villages). The bureaucratic regulation of CPRs is of particular concern in CPR-dependent villages, for this regulation is often subject to manipulation by local power to the disadvantage of poorer people.

But in both CPR-dependent and CPR-limited village economies, CPRs present livelihood opportunities that are either not pursued or that are inefficiently pursued from the point of view of poor peoples' welfare. In the latter category, we would include the current use of tank beds and foreshores for so-called "social" forestry projects; there is often no benefit at all to local people and particularly none to the rural poor, given that they find neither employment nor resources of use to them in the social forestry plantations. In the former category, we would include the possible uses of marginal lands (classified as waste) for forestry conducted by poor people for their own benefit. Clearly the mobilization of opportunities like these is subject to difficulties that should not

be underestimated in circumstances where the powerful and wealthy have been able to systematically take advantage of the confusing layering of rights and enforcement, so that considerable inequalities in access to common resources has resulted. Any fresh interventions by the state are likely to be susceptible to manipulation by local power holders. The point is that opportunities for the production of livelihoods do still exist and that the means for exploring them are not available under the current system of management by a bureaucracy imbued with an ethic of regulation and control.

NOTES

1. The research on which this paper is based was essentially of an exploratory kind. The authors undertook field research together in the state of Tamil Nadu in September 1984, when they collected secondary data and made studies of six villages, three of them in an area of intensive irrigated agriculture in the North Arcot District. Thereafter, Adam Pain undertook an additional six weeks of field work, including some ecological analysis, in the same villages.

2. Definitions quoted from: Sundararaja Iyengar. 1933.

3. Wade makes this point with regard to some villages in Andhra Pradesh that display an unusual degree of corporateness (Wade, forthcoming). The councils in these villages, with their common funds (that are used to pay the field guards and common irrigators whom they employ), are essentially institutions of the dominant Reddy caste community. It may be in this case that low-caste, landless people do derive benefits from the existence of these institutions because of the higher levels of economic activity that they are instrumental in bringing about. But poor and low-ranking people are not participants in the institutions. Wade's study describes institutions concerned with collective choice that are certainly unusual in India, and his account in the end emphasizes just how exceptional the circumstances are that seem to explain the existence of corporate activity in this case.

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Minor Forest Products as Common Property Resources in East Kalimantan, Indonesia¹

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INTRODUCTION

One way to study the use of biological resources in a diverse ecological setting (such as a forest or fishery) is to consider simultaneously all the exploited species. This is typified by "ecosystem" or "resource system" analyses. Another approach, also holistic but in a different way, is to focus on one or a few resources and their connections to a variety of ecological and economic factors. We take this second approach in our case study of tropical forest resources in the province of East Kalimantan in Indonesian Borneo. We focus on a few so-called "minor" (non-timber) forest products to show how problems of their exploitation are related to: (1) biological and technical characteristics of the exploited species; (2) rules and other formalities of resource use; and (3) interactions among resource users and other relevant actors.

The model for the analysis of common property problems (Oakerson, this volume) is meant to enable us to conduct this analysis in a way that facilitates comparison among case studies. However, we believe Oakerson's identification of problems and the criteria for success or failure of resource management are too narrow in scope. Oakerson discusses one problem said to confront all users of common resources: "how to...attain an optimal rate of production

or consumption for the whole community" (Oakerson, this volume). This focus on "the" problem of coordination and the (supposed) community goal of optimal use leads him to adopt the criteria of efficiency and equity (which are closely linked in the notion of Pareto optimality) to evaluate the outcomes of user interactions.²

An absence of efficiency and equity may indeed pose problems for some people in some instances of managing a resource, but we do not see that the concepts necessarily help to identify other sorts of problems, especially those whose scope extends beyond any particular group of users. One can envisage, for example, situations in which a resource is exploited equitably and efficiently until it is exhausted, at which time users can switch to another resource. No user in the group is harmed (Pareto's criterion of efficiency) by depletion of the resource in this case, because an alternate resource is subsequently available. (Conversely, if all users suffered harm to the same degree, would that not also be equitable?)

An example of such deplete-and-switch behavior is seen in the colonization of new land in East Kalimantan by Bugis pepper farmers from Sulawesi (Vayda and Sahur 1985), some of whom have abandoned their old farms as productivity falls in order to exploit opportunities to pioneer in new areas of forest. To an economist interested principally in such aspects of coordination as efficiency and equity within a group of users, there may be no manifest "problem" in this case. However, others concerned with the conservation or sustainable use of forests will see in this instance a real problem of resource depletion and environmental degradation. Oakerson says the evaluation of outcomes is value-laden and dependent on the prior selection of criteria. We would add that the same is true of the identification of problems (cf. Vayda and McCay 1977).

We shall be explicit, therefore, in stating that our concern is with environmental problems of resource depletion and forest degradation. By "depletion" we mean the reduction of a resource to such a low level of abundance that its renewability is seriously threatened. By "degradation" we mean a decline in the quality of the resource. We are also interested in how people attempt to sustain their use of resources despite fluctuations in the circumstances of their availability and exploitation. In these respects, our criteria for successful management converge with those of Bromley (this volume), who urges scholars to "regard the social system and the ecosystem as equally important and then search for use regimes that...allow both

components to survive, if not prosper."

We differ with Bromley (this volume) and some others in that we do not assume the existence of quasi-autonomous social and ecological systems. By adopting a more integral and nonsystemic approach to the study of resource use, one avoids significant difficulties, both theoretical and practical, in defining and identifying the boundaries and goals of such systems. It is possible instead to focus directly on human actors, their interactions with particular aspects of their environments, and the consequences or outcomes of those actions (Vayda 1983).

Our case study is from the province of East Kalimantan, where we have done human ecological research as part of a U.S.-Indonesian project in the Man and the Biosphere (MAB) Program from 1979 to 1982. The purpose of our research was to investigate the environmental effects of people's forest-related activities (such as shifting cultivation and the collection of forest products) and to identify the contexts in which people engage in or alter these activities.

East Kalimantan was chosen as a site for MAB research because of the rapid social and environmental changes that have accompanied the recent timber boom there, changes that, on the one hand, were believed to seriously threaten forests and, on the other hand, were poorly understood by scientists and development planners (Kartawinata and Vayda 1984). Despite a small population (1,214,604 in 1980, less than 1 percent of Indonesia's total, and a mean density of 5.7 people per sq km [Zimmermann 1982:33]), East Kalimantan had become Indonesia's wealthiest province by the 1970s. Its natural resources--mainly timber and oil, but also rattan and other minor forest products--accounted for almost 25 percent of Indonesia's export earnings in 1976. (The research was conducted before the devastating drought and fire of 1982-83, which particularly affected the middle and lower Mahakam areas and has probably had indirect effects on minor forest products elsewhere in the province.)

MINOR FOREST PRODUCTS

Most useful species in tropical forests provide products other than timber. Though overshadowed in recent times by large-scale commercial logging, products now called "minor"--such as rattan, dammar (resins used in making varnishes and lacquers), and edible birds' nests--have been traded since antiquity and, until World War II,

were comparable in importance to timber. They still contribute more than does timber to the incomes of people living in or near forests.

Most collectors of forest products in Borneo are peasant farmers, whose repertoire of economic activities also includes shifting cultivation; hunting, fishing, and gathering of wild plants for food and materials; production of rubber, pepper, fruit, and other perennial cash crops; and occasional wage labor, e.g., as loggers (Dove 1985; Dransfield 1981; Miles 1976; Jessup 1981; Padoch and Vayda 1983). Other forest-product collectors in East Kalimantan are migrant laborers who flocked to the province during the manual logging boom (1967-1971) and turned to collecting minor forest products when the government restricted logging practices in the 1970s. Among the peasant farmers, the number of forest species collected for subsistence and trade, like the diversity of collectors' economic activities, is substantial.³

Indigenous forest product collectors in East Kalimantan, whose forest-related activities are the primary focus of this paper, do not use all available resources or engage in all possible economic activities at any given time. Rather, they switch from one to another or vary the degree of their involvement in response to changing opportunities and problems, including fluctuations in commodity prices and employment as well as environmental variations. Nevertheless, many commercial forest products are over-exploited, often to the point of depletion.

Three circumstances surrounding the overexploitation of forest products may be ascribed to the "modern" economic context of collecting: (1) the concentration of international trade in minor forest products in a relatively small number of species, commonly for luxury uses, with prices (and therefore incentives to collect) rising as the stocks decline; (2) the closing of opportunities to practice some "traditional" activities, such as shifting cultivation, by the designation of large tracts of forest land as logging concessions; and (3) a decline in local employment opportunities in logging with the change from manual to mechanized methods in the 1970s. The combined result of these factors is the specialization of some forest-dwelling people (such as those in Rukun Damai, discussed below) in the collection of a few species.

These observations suggest that the modern commercial context is one of decreasing economic diversity. Yet we do not assume that so-called "traditional" forest-dwelling people were necessarily more conservative users of

resources before the modern boom in tropical forest exploitation. Other circumstances in the past, including warfare, demographic changes, and fluctuations in the long-established trade in minor forest products, may have led people to deplete certain resources and switch to others; the switch was not necessarily made at a point that would conserve the resources.

The most important of East Kalimantan's minor forest products are rattan, aloes wood, edible birds' nests, dammar, illipe nuts, beeswax, and reptile skins (Table 1). We will focus on the first three of these products.⁴

TABLE 1. Export of Forest Products from East Kalimantan, by Value, as Officially Reported (in Thousands of US dollars). (Note Rise in Timber Exports in Early 1970s and in Rattan Exports in Late 1970s.)

Year	Timber	Rattan	Birds' nests	Resin	Illipe nuts	Aloes wood	Beeswax	Reptile skins
1967	600	-	-	-	-	-	-	-
1968	4,000	-	-	-	-	-	-	-
1969	15,000	-	-	-	-	-	-	-
1970	53,000	100	26	1	258	2	-	-
1971	86,000	89	10	8	-	2	-	-
1972	111,000	93	8	12	-	-	1	-
1973	276,000	142	6	6	1	2	2	-
1974	365,000	262	9	19	66	-	-	-
1975	258,000	128	2	8	-	-	-	24
1976	402,000	160	12	2	-	-	-	-
1977	493,000	539	11	7	-	-	0.5	-
1978	525,000	1,313	18	9	-	-	3	-
1979	-	2,312	14	14	3.5	-	-	-
1980	-	2,882	-	6	-	-	-	22

Hyphen indicates no data in source tables.

SOURCES: Daroesman (1979:46) for timber (given to nearest \$1 million); Zimmermann (1982:80-81, 288-289) for minor forest products.

Rattan and aloes wood are typically held as common property within village territories, which is the general pattern of local control over forest resources in Borneo. Birds' nests, in contrast, are often controlled as private property by individuals or families. We shall consider some possible reasons for this difference.

Rattans are a diverse group of climbing palms, highly versatile in their uses. The stems of slender rattans are used in woven mats, baskets, and wickerwork, while large species provide cane for making furniture and other articles. Indonesia produces about 90 percent of the world's rattan, and East Kalimantan is one of the main sources.

Aloes wood, a resinous heartwood found in certain diseased trees, is a component of various Chinese and Malay medicines. Lower grades of the wood are used as incense in the Middle East. Demand for Borneo aloes wood rose sharply around 1977, possibly because the supply from Cambodia and Vietnam had been curtailed (Paul Chai, personal communication). This led to a flurry of collecting in parts of East Kalimantan.

Edible birds' nests, made by cave-dwelling swifts, are the principal ingredient in birds' nest soup and various tonics that are prized in China and parts of Southeast Asia for their supposed restorative and invigorating properties. Birds' nests are the most valuable, per unit of weight, of all Borneo's forest products. One kilogram (about 100 nests) of high quality nests were valued at between U.S. \$200 and \$400 in 1979 on the Upper Mahakam River in East Kalimantan; the lowest grade sold for about \$10. In Singapore, the price was about \$1,000 (Peluso 1981).

By comparison, in early 1980 the best grade of aloes wood was bought by upriver traders in the Apo Kayan for \$20 per kg and was resold to urban buyers for about \$100. Rattan prices are even lower on a per-weight basis: for Calamus caesius, stems of good quality sell for less than \$1 per kg on the Upper Mahakam in 1980 and still under \$2 at the point of export.⁵

Tables 1 and 2 show forest product exports from East Kalimantan by value from 1967 until 1980 and prices for rattan and birds' nests from 1969 until 1978, the years and products for which we have data. The price trends for birds' nests show substantial increases even as the reported quantities declined. Rattan exports increased in quantity as well as price. (We have more confidence in the trends shown by the data than in the actual value.

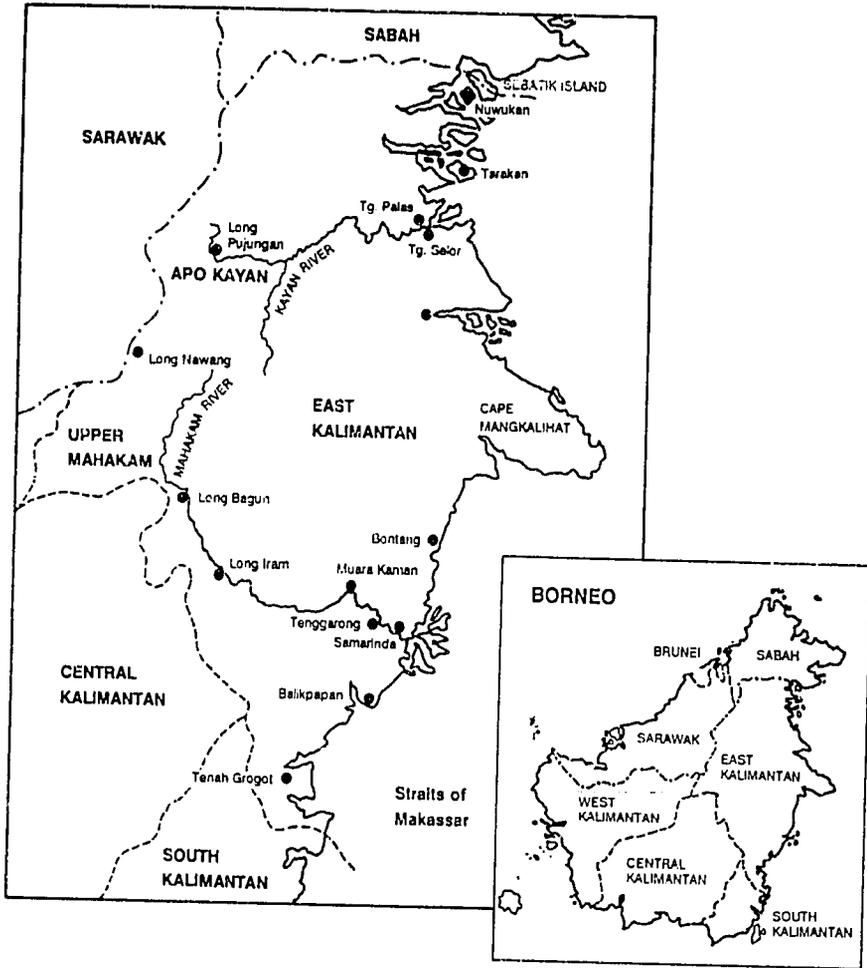


FIGURE 1 Province of East Kalimantan.

TABLE 2 Export Prices of Rattan and Birds' Nests from East Kalimantan, 1970-1978.*

YEAR	RATTAN			BIRDS' NESTS		
	Export Volume [Tonnes]	Export Earnings ('000 US\$)	Price (US\$/Kg)	Export Volume (Tonnes)	Export Earnings ('000 US\$)	Price (US\$/Kg)
1970	2,979	100	33.57	11.5	26	2.35
1971	3,602	89	24.71	12.9	10	.77
1972	3,703	93	25.11	6.6	8	1.21
1973	5,136	142	27.65	7.0	6	.86
1974	4,634	262	56.54	6.9	9	1.30
1975	2,021	128	63.33	1.0	2	2.00
1976	2,780	160	57.55	5.8	12	2.07
1977	4,787	539	112.59	1.6	11	6.88
1978	3,105	1,310	422.87	1.5	18	12.00

*Official sources often differ on volume and value of exports. For example, the Kutai District Government (1974) reported exports of birds' nests in 1970, 1971, and 1972 as 13.8, 8.9, and 7.8 tonnes, respectively. Birds' nest prices are purposely undervalued, even by government officials, to provide an advantage to Indonesian traders, but the reported price per kilogram provides a crude indicator of relative value.

SOURCE: Muttaqin (1980).

The true value and quantities of forest products traded are notoriously under-reported, due to tax incentives given to exporters and smuggling.)

Peluso investigated the collection and trade of rattan and birds' nests in the area of the Upper Mahakam River, while Jessup did research in the Apo Kayan (see map), where aloes wood is the most important commercial forest product. Peluso also visited the Apo Kayan to study the trade in aloes wood there. The two areas are similar in many ways, including the kinds of forest products used locally (such as rattan and dammar), the practice of shifting cultivation, the ethnic affiliations of the inhabitants (Kenyah and related Dayak tribes), and the interior location of both areas. However, they differ in the greater isolation of the Apo Kayan, the proximity of commercial logging to the Upper Mahakam, and the commercial importance of particular forest products. Birds' nests are important in the Upper Mahakam, and aloes wood in the Apo Kayan, apparently because each product is available only in one area or the other. Rattan occurs in both places but it is not much traded in the Apo Kayan because of the difficulty of transporting the bulky stems through the rugged terrain there.

CHARACTERISTICS OF TROPICAL FOREST RESOURCES

We now consider the biological and technical characteristics of tropical forest resources in general and of rattan, aloes wood, and birds' nests in particular. A general characteristic of tropical forests is their great diversity of species. Since the number of species in a given area is high, the number of individuals of any one species in the area tends to be low. Most are dispersed throughout the habitats in which they occur rather than being concentrated in a few locations. Collectors of these dispersed resources, which include rattan and aloes wood, must forage widely in search of suitable products.

Another characteristic of rattan and aloes wood (and of some other forest products, including timber) is that the valuable resources are in the stems, rather than in more easily regenerated parts such as fruit, leaves, or exudates (gums and resins). The growth of resprouting stems is relatively slow, if it occurs at all. Some species only reproduce from seed and, as we have noted, seed sources (i.e., mature plants) tend to be widely

dispersed. For these reasons, the precise location of collectible rattan and aloes wood is shifting and unpredictable.

In contrast to the pattern just described, edible birds' nests are a highly concentrated and rapidly renewable resource. They are produced by cave-dwelling swifts, which nest year after year in the same locations if the caves have not been seriously disturbed by human predators. These differences in the ecological patterns of forest resources have consequences for the way people manage them (i.e., as common or private property). A more detailed description of the characteristics of each of these resources is presented briefly below.

Rattan

Rattans are spiny, climbing palms, comprising nearly 600 species with their center of abundance in Borneo (c. 150 species) and Malaya. Some rattan is cultivated but most is collected from wild forest stocks. Rattans occur throughout Southeast Asia, mainly in lowland rain forests. The climbing plants reach to the top of the forest canopy, commonly 45-60 m above the ground. Their coiling, sagging stems are often 60-90 m long and some weigh enough to snap tree branches. Pulling down the larger species is arduous work, and most commercial collecting is done by able-bodied men. Most of the thick-stemmed species must be boiled in diesel oil (to remove natural gums and resins) soon after collection, or the cane will spoil. Slender rattans must be dried, before or after they are split into strips and cores, and are usually treated with sulfur to protect them from insects.

Rattan species with multiple stems regenerate after cutting, but single-stemmed ("solitary") species do not. The solitary Calamus manan, a valuable cane species, has consequently suffered badly from overcutting. On the other hand, the slender, multiple-stemmed C. caesius and C. trachycoleus resprout readily, a characteristic that not only makes wild populations somewhat more resilient, but that has also facilitated their cultivation.⁶ Even in these species, however, seedling mortality in the forest is high and only a small proportion ever reaches the canopy. Many rattans only grow when seedlings are "released" by light from nearby tree-fall gaps, yet some species cannot survive in large gaps. All these factors contribute to the unpredictability--and vulnerability--of the resource.

Aloes Wood

Aloes wood is a diseased, fragrant heartwood produced by trees of the genus Aquilaria, which comprises altogether about 15 species, 5 in Malaya.⁷ Only one, A. malacensis, is widespread, and apparently it is this species that yields the best grade of aloes wood. The heartwood is soft, often oily, and lightweight. Once found, it is easily collected and transported, requires little preparation, and can be stored for long periods. Little is known about the biology of these species or the pathogens that produce aloes wood in them. The data we have suggest they are restricted to certain localities or habitats, at least in some areas such as the Apo Kayan.⁸ Furthermore, the diseased wood occurs sporadically; it is not always found in every tree in a species that can produce aloes wood. The amount of aloes wood collected from a tree, or even from many trees during a collecting expedition, is highly variable. Collectors (and traders seeking to induce people to collect) tell tales of single trees yielding many kilograms of high-grade wood worth hundreds of dollars. Some people in the Apo Kayan have indeed found a kilogram or more in a single day, but typically a collector gets less than that from dozens of trees examined during an expedition of a week or so. Thus, aloes wood is also a very unpredictable resource.

Birds' Nests

Edible birds' nests are made by cave-dwelling "swiftlets" belonging to three genera in the Apodidae, or swift family. Five species occur in Borneo, of which two-- Aerodramus maximus and A. fuciphagus--produce edible nests.⁹ The birds nest in colonies, mainly in limestone caves, some of which are very large.¹⁰ Swiftlets tend to breed each year in a fairly regular season, which makes their nests a temporarily as well as spatially predictable resource.¹¹ Swiftlets of the two commercially valuable species require at least 35 days to build a nest and lay one egg, and some take more than 100 days to complete their nests. Incubation takes about 25 days and fledging another 43 to 59 days. If nests are taken before fledging, the parent birds will build another nest.

The birds make their nests and attach them to the cave walls with a mucin-like protein secreted from their salivary glands. This protein, commonly called

"nest-cement," is the edible part of the nests. The "white" nests of Aerodramus fuciphagus, which are made purely of nest-cement, fetch the highest prices. "Black" nests, made by A. maximus, contain feathers as an additional structural component and hence are inferior in quality and price. Any nests soiled by feces and other extraneous material, and any that have been allowed to deteriorate with age before being collected, are much reduced in value. Thus, there is a strong incentive for collectors to take nests early in the breeding season while they are still clean and fresh. Collectors studied by Peluso collect nests every forty days, knocking them down with a bamboo pole. A torch or flashlight is needed to find the nests; homemade torches doused with kerosene leave odors and residue on the cave walls, which informants said prevent the birds' returning to the same caves in the next cycle (Peluso 1981). Some East Kalimantan collectors purposely leave the highest nests in a cave to ensure (or so they believe) that a few birds will breed successfully and return later to make new nests. Inaccessible portions of some large caves provide nesting birds with natural refuges from collectors.

Jointness, Exclusion, and Divisibility of Forest Resources

Jointness of use of the resources that we are considering decreases at higher rates of exploitation, not only as a consequence of competition among collectors but also because the intensification of collecting tends to retard or disrupt the reproduction of exploited species. At moderate levels of collection, swiftlets are probably more resilient in this respect than either rattans or Aquilaria. The birds can replace collected nests and still breed in the same year, whereas rattans and Aquilaria require decades to regenerate from seed or (in some rattan species) years to reach commercial size after resprouting.

The spatial distribution and predictability of a resource affect the ease with which users can effectively exclude other potential users. Exclusion is more easily accomplished for a concentrated resource than for a dispersed one as long as the effort required to monitor and guard the resource is proportional to the area, perimeter, or number of entry points that must be covered.¹² This is so for the forest products we have considered; birds' nest caves are more easily watched and guarded than

are the scattered forest populations of rattan and Aquilaria.

The forest resources we have been discussing are all inherently divisible, but the scattered distribution of rattan and aloes wood makes them difficult to privatize. Only birds' nests occur within discrete natural boundaries (that is, in caves) and so can easily be apportioned to private owners.

PROPERTY RIGHTS AND THE REGULATION OF FOREST PRODUCTS

Village and Household Property Rights

Throughout the interior of Borneo, shifting cultivators (such as the Kenyah of the Apo Kayan and Upper Mahakam) inhabit village territories, within which residents of each community are entitled to use most forest products as the common property of the village. In addition, households may have more exclusive rights to certain forest products or certain uses of forest land within their village's territory. Territorial boundaries were formerly established and defended in some instances by force (warfare and head-hunting), in others by negotiation and the sale of rights between neighboring groups. These "boundary rules" (to use Oakerson's terminology) were sometimes enforced by third parties, such as the paramount chiefs in the Apo Kayan during the latter part of the 19th century. More recently, arbitrators' roles have been divided between traditional leaders and government officials.

Weinstock (1979) found village territoriality to be a common principle of land and forest tenure among all groups of shifting cultivators in Borneo, but he recognized two types of individual or household land tenure (partitioning rules) within villages: one in which permanent rights to reclear and cultivate a site are established by the individual or household that first clears primary forest (i.e., old-growth or "virgin" forest) from that site; the other in which the cultivators' land-use rights lapse after the crops are harvested, and the fallow land reverts to the village commons. Permanent rights of the first type are inherited, and they can be loaned between households. Similar rights to use trees and tree-products (such as fruit or resin) are found among at least some of the groups that we or Weinstock (1979) and Appell (n.d.) have studied. Tree rights are established either by

planting a tree or by marking and tending a wild one. The types of resources (land, fruit-trees, etc.) that can be claimed and owned by households seem to be those that are, like birds' nests, more predictable than most in their locations and temporal availability. (In the case of land under shifting cultivation, there is generally a preferred or minimum fallow period that, though it may vary with site conditions, is fairly predictable to farmers.)

Kinship is an important factor underlying the property rights outlined above. Ethnic groups and villages tend to be identified with more or less inclusive kin groups. Residence in a village, with the rights to common property that it confers, is established by birth or marriage, and so, too, is membership in a household with its more private rights of tenure (whether permanent or temporary). Conversely, property rights are forfeited by a person who permanently leaves a village. These are the "entry and exit" rules of the village community.

Inheritance is also according to kinship. In the so-called "cognatic" societies that predominate in Borneo, male and female descendants share equally in the inheritance of rights to land, trees, and other property. This rule of bilateral inheritance, together with the multiplication of descendants' households as they marry and have children, requires that there be arrangements to distribute property, if necessary, among several eligible claimants. This is done for land by alternating the use of sites among households according to various rules of priority--notably by the degree of relatedness to the original owner--and for fruit trees by dividing their products. Because inherited rights to property may be distributed over a number of related individuals in several households, this type of property is not strictly "private" but only relatively so in comparison with village-wide rights to common property. In fact, "private" household property lies at the focus of a hierarchy of potential users ordered by degrees of kinship.

It is important to recognize that traditional property arrangements are not stagnant and unchanging, and that adaptations to local circumstances can shift them in unexpected ways. We illustrate this point with two examples of change in the use of forested land for shifting cultivation, though similar changes with respect to minor forest products have doubtless occurred as well. The first example is taken from the work of Padoch (1982), who showed how, in some communities of Iban shifting cultivators (in Sarawak), where the formal rules of

land-use are those of permanent household tenure, land scarcity led to frequent borrowing of land between households. Although an ideology of relatively private, circumscribed rights of tenure was maintained, in practice land was treated more as common property than was the case in some other, more land-abundant Iban villages.

This is not to say that only land shortages are correlated with more "common" types of land use. Jessup (1983, 1984) found that many farm sites in secondary (previously cut) forest in the Apo Kayan were left unclaimed when their former owners moved away during a time of heavy emigration. These sites came to be treated as common village property under the subsequent conditions of abundant arable land. Thus, two very different demographic situations led to similar transitions towards a more common use of a resource. Notice, in these examples, that the actual coordination of resource use among a group of users can change considerably even though the formal rules remain the same.

Ownership of Birds' Nest Caves

Many birds' nest caves are more privately controlled than are other forest products. Historically, birds' nests have been more closely regulated than other forest products, partly because of their great value but also, we believe, because they are a concentrated and predictable resource and therefore more easily controlled. What Oakerson calls "external arrangements," both bureaucratic and market-oriented, have long been important in East Kalimantan. During the 19th century, birds' nest caves along the Mahakam River were owned by the Sultan of Kutai, whose officials supervised the collection, sale, and export of nests. Now, the provincial and district governments regulate these activities. In the Kutai district of East Kalimantan, which includes the Upper Mahakam area, there are two stages or levels of access rights to nests. The first is the right to harvest nests in a particular cave, based on a registered or locally recognized claim of ownership. The owner of a cave is usually the person who found and subsequently guarded a previously unclaimed cave, or an heir of the original owner. The second stage is the right to buy and export nests from the subdistrict in which they were collected. This right is granted by the district government to authorized buyers (faktar) at an annual auction. A buyer may obtain rights to nests in

more than one subdistrict, but he must pay a tax on the nests taken from each subdistrict.

INTERACTIONS AMONG USERS AND OTHER ACTORS

The basic Agrarian Law of Indonesia, passed in 1960, made no provision for traditional, village-based control of forest products. Ownership of all forest land was claimed by the national government. Although the constitution does recognize the local authority of "customary law" (adat) in some matters, traditional village rights to forest land and products were excluded by the 1960 law (Vargas 1985; Weinstock 1979). In fact, traditional property laws are still important to local people in many areas, particularly in regard to land tenure, inheritance, and the collection of forest products. Conflicts often occur, however, where established residents must compete with more recent settlers, itinerant collectors, and timber companies for the use of forest resources.

Effects of Timber Concessions on Forest Product Collection

In the early 1970s, the Indonesian government granted timber concessions in East Kalimantan to a large number of foreign and national companies. This had a number of detrimental effects on local communities in or near the concessions, such as the village of Rukun Damai in the Upper Mahakam area. Villagers are permitted, by law, to collect minor forest products within nearby timber concessions, but the practice of shifting cultivation there is strictly prohibited, a rule that is enforced (in this case) by timber company personnel. Because the infertile soils of the region are not suited to permanent-field agriculture, the restriction on shifting cultivation has severely curtailed villagers' ability to produce sufficient rice for their own needs, let alone to expand their production of cash crops. Faced with this externally imposed "cost," villagers have turned increasingly to the collection and sale of rattan as a source of income or goods on credit from traders. There are few other opportunities for employment in the area; timber companies are reluctant to hire local men because of conflicting demands at home for their labor.

The people of Rukun Damai began to collect large quantities of rattan close by their village in 1978, when

prices were rising rapidly. (See Tables 1 and 2.) By the end of 1979, however, the nearby sources had been depleted, and collectors already had to travel for three to six hours upriver by motorized canoe, then walk for another three hours into the forest from the river's edge. Rattan in those distant areas, far from any village, is an open access resource. A group of collectors is entitled to exclude other groups from the locale in which they are harvesting rattan, but only for the duration of a particular expedition.

Despite their legal right to collect minor forest products within timber concessions, villagers have at times been denied entry to those areas, and timber company personnel have otherwise infringed on the rights of local residents. Collectors and traders in various parts of the province complained to Peluso of timber company guards who confiscated rattan from collectors, of loggers who raided caves and sold the stolen birds' nests to unauthorized buyers, and of timber companies that illegally cut Borneo ironwood (Eusideroxylon zwagerii), a species reserved for local use. Some confrontations between loggers and collectors have led to violence, although other conflicts have been settled within the framework of customary law or by ad hoc agreements (Vargas 1985).

An Attempt to Locally Control Aloes Wood in the Apo Kayan

Outsiders can seek permission to collect forest products within a village territory. For example, in the 19th century, traders in upriver areas of East Kalimantan paid fees to village headmen in return for the right to obtain forest products. More recently, new settlers in some relatively densely populated lowland areas have had to pay to collect rattan or hunt within the territories of already established villages. We were able to see how outside collectors of aloes wood were treated in the village of Sungai Barang, in the Apo Kayan, soon after the local collecting boom began in the late 1970s.

Collectors were attracted to Sungai Barang's forests by the availability of high-grade aloes wood there. They used the village as a base from which to travel into the forest on expeditions of a week or more. Virtually all the outside collectors were members of various Kenyah sub-tribes and were considered kin, in some degree or other, of people living in Sungai Barang. Many could also claim a certain amount of reciprocal "generosity," in addition

to the somewhat indefinite obligations of kinship, in return for past help given Sungai Barang people (for example, the provision of food, shelter, and other assistance to men on trade expeditions). Indeed, the outsiders were not excluded from collecting in the Sungai Barang territory, but they were required (after much deliberation within the village) (1) to sell the aloes wood they collected to a local "contractor" (trader's agent) in Sungai Barang, and (2) to pay a fee (about 10 percent of the sales value) to the village treasury. The contractor at the time was a resident of considerable local influence, who obviously stood to gain personally from the first rule. The second rule, at least, applied to village residents as well as outsiders. Most of the aloes wood collected by residents was, in fact, sold to the local contractor, but some was taken by collectors to downriver markets in an attempt to get a better price.

This attempt to control the sale of aloes wood was disappointing for the community, as the regulations were largely unenforceable. Apparently, there was a good deal of smuggling of wood out of the village by the outside collectors. They were encouraged to do so by contractors in neighboring villages who offered, at least initially, higher prices in order to attract sellers and so gain entry into the market. Peluso (1983a) saw a similar pattern of competition among rattan traders on the Mahakam River. New traders not only offered higher initial prices in cash (especially attractive to indebted collectors), but also bought immature and inferior grades of rattan in order to increase their share of the market. They could afford to do so, first, because they recouped some of their losses by selling important trade goods back to the collectors, often on credit; second, because they would later lower the price paid to collectors once the latter were in debt to the traders.

Illegal Collection and Trade of Birds' Nests

Owners of birds' nest caves often post guards at the entrances, especially at the more productive and accessible caves. In the past, supernatural sanctions against intruders were also invoked. Nevertheless, not all caves can be adequately guarded all the time, and some nests are stolen. Raiding caves has become more common in the Upper Mahakam as the number of outsiders (loggers, immigrants, and itinerant traders) has increased in recent years and

as the threat of magical protection has become less of a deterrent to thieves.

The exclusion of unauthorized nest buyers from a sub-district is even more difficult to enforce than is the exclusion of thieves from caves. Illegal purchasing and smuggling of birds' nests is common. The incentive for traders is to avoid the tax on nests, while for collectors it is the higher prices offered by unauthorized traders. In general, the high price of birds' nests attracts many casual and short-term collectors and traders who have little interest in the sustained productivity of the caves.

While interactions among collectors or traders in a given locale are often highly competitive, those between collectors and traders are characterized by reciprocity if both parties expect to maintain a long-term trade relationship. Furthermore, reciprocity, loyalty, and "good reputation" are important, not only within small groups as suggested by Runge (this volume), but also in the maintenance of long-distance trade networks. The links in such networks are personal interactions between collectors and upriver traders, between those traders and downriver exporters, and between exporters and overseas buyers of forest products. Information and credit flowing through trade networks can have as great an influence on forest exploitation as do localized interactions within a "user's group" of collectors.

OUTCOMES OF FOREST EXPLOITATION

Commercially valuable forest products in East Kalimantan--and Southeast Asia generally--are rapidly dwindling in abundance and quality as a direct result of exploitation, even as the area of forest in which these species can grow is diminished by logging, shifting cultivation, and other types of conversion (Table 2). Wild populations of rattan seem to have been exhausted in many areas, and others are now disappearing. Until the 1960s, about 20 "elite" Southeast Asian species comprised the bulk of the commercial trade, with six species reported traded in East Kalimantan. (Many more species are used locally, but only in small quantities.) However, as world demand for rattan increased, and natural stocks of the elite species declined, collectors and traders took other, inferior species as well. As Dransfield (1981:184) comments: "It appears now that no species can be classed as useless--a worrying fact for the rattan conservationist."

Collectors also took more immature rattans as the supply of adult plants declined, thus threatening the natural sources of regeneration. Peluso found that traders attempting to enter the highly competitive rattan business offered relatively good prices for inferior grades of rattan and accepted bundles containing a mixture of mature and immature rattan, thereby exacerbating the tendency to overcollect.

So little is known about the ecology of aloes wood that we can only speculate about the outcome of its exploitation. Burkill (1935) suggested that the sporadic occurrence of Aquilaria in some parts of its range reflects overharvesting in the past. In the vicinity of Sungai Barang, we have seen the wood depleted in areas of forest otherwise apparently little disturbed by human activities, a pattern of exploitation that fits Burkill's scenario. Aloes wood may soon be found only in the most remote and inaccessible places.

Bird's nests are commonly overharvested in East Kalimantan, contrary to existing laws. Only where biologically sound regulations are strictly enforced, as in some government-owned caves in Malaysian Borneo, has conservation been effective. The great value of nests is, on the one hand, an incentive to owners to manage their caves for long-term sustained yields, but, on the other hand, short-term price fluctuations encourage overharvesting. Thievery and smuggling are also problems for cave owners and government regulators.

Thus, despite differences in the biology and property status of minor forest products, the outcome of commercial exploitation in each of the three cases we have considered has been overharvesting and a decline in quality of the resource.

SUMMARY AND CONCLUSIONS

We have followed the model for the analysis of common property problems in explicating our case study of three commercially important minor forest products in East Kalimantan. We argue that certain biological and technical characteristics of rattan and aloes wood make them more dispersed and less predictable resources than birds' nests. This difference in ecological patterns is reflected in different property rights and controls over the two types of resources in the context of local communities. Villagers' rights to clear forest land and harvest

forest products have been restricted since timber concessions have been granted to a few large companies. This policy changed the traditional common property status of many forest resources and increased stresses on local economies and the environment. In addition, commercial incentives to collect forest products and interactions between established villagers and other actors, such as traders, timber company personnel, and recent immigrants, have led to the unfortunate outcomes described above.

Local common property users' organizations cannot by themselves manage forest resources in East Kalimantan, where so many external influences affect forest exploitation. However, traditional village groups and cooperatives can be incorporated into programs of forest conservation and forestry development. For example, in the case of rattan, there are opportunities for rattan processing in upriver collection areas, which might be linked both to locally managed rattan cultivation and to forest reserves as a source of seed for cultivation and cane from noncultivated species (Dransfield 1981; Peluso 1983a). Government can act at the local level, both to assist in the development of such programs and to legitimize and enforce rules of access or exclusion, as appropriate and feasible. One of the greatest difficulties in designing and implementing a policy of "conserving the commons" for minor forest products is to relate the actions and decisions of collectors in a particular locale to the wider context of forest exploitation, trade, and the eventual use of forest products around the world.

NOTES

1. We would like to thank A. P. Vayda, Charles Geisler, John Cordell, Margaret McKean, James Thomson, and David Feeny for their comments, criticism, and encouragement. Our research in East Kalimantan was undertaken in cooperation with the Indonesian Institute of Sciences (LIPI) and Mulawarman University. It was funded by the U.S. Forest Service through the East-West Center as part of a U.S.-Indonesian Man and the Biosphere Program research project.
2. Oakerson does not say that coordination is the only problem faced by users of a commons. However, by asserting that it is a universal one, and by omitting discussion of other actual or potential problems, he implies that the "problem" of coordination is always important, in all situations, even if only as a possibility to be guarded against. Part of our disagreement with Oakerson is in what constitutes a problem to which people must and do respond, a point treated at length by Vayda and McCay (1977).
3. Burkill (1935) lists about 2,432 useful species of plants and animals in Malaya alone. Nearly half of these are native flowering plants with uses other than for timber, comprising about 16 percent of the indigenous flora (Jacobs 1982).
4. Our main sources of information about Southeast Asian forests and forest products are the following: Burkill (1935); Corner (1952, 1966); Cranbrook (1984); Dransfield (1979, 1981); Dunn (1975); Jacobs (1982); Jessup et al. (1982); Medway (1960, 1969); Peluso (1983a, 1983b); Whitmore (1973a, 1973b, 1984). Other references are cited in the text.
5. Rattan is not sold simply by weight, but rather by weighted volume. The initial price of the rattan is determined by its weight, which decreases at each stage of

sale until it is finally dried completely and treated with sulfur by the exporter. However, the cost of shipping rattan overseas depends on its volume and adds considerably to the final price. Volume is not a factor in the shipping cost of birds' nests and aloes wood.

6. These species of rattan have been cultivated for at least a century in Central Kalimantan and for 50 years or more in South and East Kalimantan.

7. The number of Aquilaria species in Borneo is not known, but we suppose it is similar to that in Malaya.

8. The ecology of Aquilaria has received little attention. We summarize here what Jessup learned from Kenyah collectors and his own observations, with the caveat that the data are not from controlled studies and may not be typical of Aquilaria elsewhere. Botanical specimens collected in the Apo Kayan by Jessup and Herwasono Soedjito were identified at the Herbarium Bogoriense (part of the Indonesian National Biological Institute) as A. beccariana, a small to medium-sized tree less widespread than A. malaccensis. Other species may also occur in the area.

9. The genera Aerodramus, Hydrochous, and Collocalia were formerly classified together as Collocalia (Cranbrook 1984).

10. The floor of Niah Cave in Sarawak, one of Borneo's largest, covers 25 acres. Medway (1960) estimated the combined populations of three species living in that cave to be about 2,000,000.

11. Breeding has been disrupted by collection in some areas, however. (See section on "Outcomes.")

12. The possibility of exclusion depends also on the ability of users to defend a resource or to exploit products not easily accessible to other people, such as those in remote or difficult terrain. The latter "strategy" is attributed by Hoffman (1983) to nomadic Punan groups in Borneo.

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Management of Traditional Common Lands (*Iriaichi*) in Japan¹

Margaret A. McKean



The centuries-old common lands of traditional Japanese villages are particularly worthy of inclusion in our comparative study of common property for several reasons. First, they fall squarely into our most pristine definition of common property--they are common lands with identifiable communities of co-owners, as opposed to being vast open-access public areas used by all and in essence owned by no one, a very different circumstance posing different problems. Second, Japanese villages developed elaborate regulations, even written codes, for their commons; the information available from even a tiny fraction of the many thousands of traditional villages ("classical" or "true" villages, before the amalgamations of the 19th century)² offers ample variety on most variables of interest. Third, the documentation and historical records are sufficiently rich to allow us to inquire not only into formal rules but also into their operation and enforcement, thus offering more data than we have in other cases of common property institutions. Fourth, Japanese villages employed threats of ostracism and banishment to control social behavior and as ultimate penalties for abusing the commons; we therefore find a fascinating resemblance between the sanctions they employed and the concept of exclusion that is so important in the public goods theory used in the study of common property.³ Fifth, from the mid-17th to the mid-19th century, Japan closed its ports

to trade with a formal policy of isolation (sakoku); as a result, Japanese society spent two centuries in a conveniently isolated "test tube," uncontaminated by the world economy and living within the limitations imposed by nature and local technology. Thus, the sources of those technological and socioeconomic changes that did occur (which we are gradually discovering to have been substantial) were internal. This fact may limit the applicability of the Japanese experience to less developed nations today, but it also helps us "control" the phenomena we want to examine so that we can more accurately decipher what the lessons of that experience might be. Finally, although economic development and the commercialization of agriculture threatened the Japanese commons as they have elsewhere--causing many villages to abandon traditional self-sufficiency in favor of commercial production and even to privatize the commons--thousands of other Japanese villages developed management techniques to protect their common lands for centuries without experiencing the tragedy of the commons.

Since the political change (known as the Meiji restoration) in 1868, there has been steady attrition of common lands.⁴ In some cases, the newly modernizing Japanese government managed to declare that inadequately documented common land was government property (to be converted into military bases or national forests). More recently, many villages have realized handsome profits by selling their common land for conversion into golf courses, tourist hotels, shopping centers and other 20th century monuments. But as late as the 1950s, there were many expanses of common land in Japan still being managed collectively without ecological destruction. Thus, this case offers, in our terms, a successful outcome within the rubric of common property (that is, without privatization) It may tell us much about how the assurance problem (Runge 1981; this volume) can be solved so that cooperation among co-owners of a commons is sustained not merely for decades but for centuries, and thus how tragedies of the commons may be averted.

Common lands evolved gradually over a period of several centuries in tandem with other transformations in land holdings. The slow and steady evolution of these lands is described below to demonstrate why we can be certain that the traditional commons in Japan was not simply uninhabited space claimed by none and used by all--as may often be the case elsewhere--but rather involved increasingly formalized use rights. The brief history also describes some of the

conditions external to each village that impinged upon its decisions about the management of the commons. (Japanese terms for particular institutions are provided for the benefit of readers who might want to examine this history of land transformation in more detail at a later time.)

EMERGENCE OF THE COMMONS

The common lands that we can trace today came into being gradually during the breakdown of the estate (shōen) system and the civil wars that followed--essentially between the 13th and 16th centuries--though the tradition of the commons may well have begun more than a thousand years earlier.⁵ All land was officially nationalized (made part of the imperial or public domain) in the 7th century. Only a century or so later, however, the imperial court at Kyoto began to decline, and it acknowledged the rise of vast estates, granting individual court nobles, Shinto shrines, and Buddhist temples some immunity from taxation and from the intrusion of police powers. By the 13th century, many nobles and temples retained only titular possession of the estates; they had lost real control over both their own estate managers and the land stewards (jitō) who had been appointed by the Kamakura shogunate (the first military or feudal government that arose from the emergence of the warrior class) in an attempt to assert the shogunate's powers over the land.

With the decline of the Kamakura shogunate in the 14th century, the same process that had allowed imperial land to devolve into estates recurred within the estates. Shogunate-appointed military governors (shugo), and particularly the estate managers and land stewards on the estates, began appropriating land rights for themselves; they encroached upon the proprietary rights of the absentee estate holders, and even gathered military bands to defend these rights as public order deteriorated. With each outbreak of civil war and each decline in central control over the provinces, real political power slipped away from the shogunate (controlled by the Ashikaga family from the 14th to mid-16th century) into the hands of warlords (often former shugo) or warrior-proprietors (kokujin) (some of whom descended from Kamakura ji). These new proprietors "owned" their land by physically occupying it; they sometimes acquired additional land in battle and awarded it as fiefs to their followers, henceforth their vassals.

This was a period of enormous social upheaval, with

much buying, selling, and outright confiscation of proprietary rights as the fortunes of different military families and coalitions rose and fell. By the 16th century, a bitter competition for national leadership was raging; victors absorbed the domains of the losers, consolidated power, and made and dismantled coalitions until three national figures emerged in succession: Oda Nobunaga, Toyotomi Hideyoshi, and finally, Tokugawa Ieyasu.⁶ During this era of transition, the imperial land grant estates that had been managed by centrally appointed stewards were replaced by fief and feudal lords (sengoku daimyō during the 16th century, and finally, kinsei daimyō after reunification) who had full and independent powers of taxation over the people living in their domains.

Two important features of the evolution in landholdings during this "feudal" period must be noted: first, the development of sophisticated notions of property rights, and second, the eventual assertion of village autonomy in governing property. The evolution of shiki--multilayered proprietary rights--in the medieval period and the variety of ways in which they could be separated, repackaged, commended, bequeathed, and sold is a very complex matter that historians are only just beginning to unravel.

During this period, both tenants (e.g., genin, nago, sakunin) and people who otherwise seemed to be peasant freeholders (myoshu, hyakusho, dogō) were working land that was also "owned" by another proprietor or "landlord" (ryōshu) or by an enfeoffed warrior (jizamurai, zaichi ryōshu). Conversely, peasants sometimes held long-term rights to cultivate land even after the right to tax/rent that land had been traded among different proprietors. The fact that Japan developed such a complex system of property rights, along with a legal system to resolve disputes and thus assure owners of various shiki that their rights were secure, implies that the Japanese conception of property was not limited to the simple notion of packaging together all rights to a piece of land in a privately owned bundle. Actual experience with other arrangements, coupled with a legal system to solve "assurance problems," provided a solid foundation for later experimentation with common property institutions.

The devolution in land holdings and land rights from imperial court to land stewards to locally based warriors that had already taken place proceeded during the years of disorder finally to the level of the village; this transformation applied both to the arable land that would eventually become the private property of peasant culti-

vators and to uncultivated land that would eventually become the commons. Peasant-cultivators' property rights developed very slowly as the estate system declined, and may not have been secure until after the national cadastral surveys (taikō kenchi) that were conducted by Toyotomi Hideyoshi in the late 16th century. These surveys swept away the complex system of shiki, assigned most of the rights that we today consider to be "ownership" to arable land to peasants who lived on and cultivated that land, and initiated the process of converting warrior-proprietors into salaried officials, thereby removing the samurai from the land and validating the claims of villagers to control their own lands (Ishii 1980:61-63). (The details of this transition are still a matter of intense debate: How rapid was the change? How much credit should be given to Hideyoshi's surveys for simplifying matters? How progressive was this land reform in terms of its economic impact on lower layers of the peasantry? [Nagahara 1975; Yamamura 1975; Ishii 1980:59-79; Berry 1982:23-34, 106-126; Wakita 1982; Hall 1983].)

Traditional agriculture in Japan relied heavily on the availability of fertilizer, fodder, timber, and other products from the uncultivated land in cultivating arable land. Thus, there was a need to manage uncultivated lands and eventually to define property rights to them as well as to the cultivated areas. Estate proprietors, land stewards, and eventually the feudal magnates who ended up with the estates therefore appointed prominent peasants as their officers and agents in each village, empowering them to regulate access to uncultivated forests and grasslands, to summon corvée labor, and to govern the irrigation system upon which wet-rice agriculture depended. At the outset, these rights were presumed to reside in the proprietor, manager, or lord, and all the villagers had to petition him through his agent for the right to enter the uncultivated lands. As public order deteriorated, villagers became very concerned with communal solidarity to protect themselves from the ravages of war.⁷

The military class obviously became more dependent on cooperation from the peasants in their areas, and villagers became more assertive about their right to enter the uncultivated land. Villagers who once paid water charges to the proprietors or managers of the estates and who entered the lands only with the proprietor's blessings now received fees from the proprietors or estate managers for the use of the same kinds of facilities, and villages wrote their own codes (complete with penalties for violations) to govern

common lands, irrigation, and corvée labor. Nagahara documents this transformation in one village where the estate proprietor refused to pay a water charge demanded by the village. The village retaliated effectively by absconding from the land and refusing to pay rent/taxes to the proprietor (Nagahara and Yamamura 1974:116-118). Similar changes occurred with respect to uncultivated areas, with peasants aggressively asserting their rights to these lands in some regions as early as the 15th century (Nagahara 1977:108-110). By 1600, when the third of the great unifiers, Tokugawa Ieyasu, established a military dictatorship that would control Japan until 1867, most villages had acquired clear use rights (perpetual usufruct) to large expanses of uncultivated land, held in common and shared by all the villagers.

THE PHYSICAL ATTRIBUTES OF THE COMMONS

Two-thirds of Japan is still occupied by forests and uncultivated mountain plains (about 25 million hectares), and approximately half of this land was held and managed in common by rural villages during the Tokugawa period. (The other half was imperial, Tokugawa, daimyō, or private land.) Even though about three-fourths of that common land has been redesignated or sold as public or private property, more than 3 million hectares of common land remain in Japan today (Watanabe and Nakao 1975:45-48; Kawashima 1979).⁸ Japan now has one of the highest per capita incomes in the world, and many Japanese farmers today practice agriculture only on Sundays, relying on weekday jobs in nearby industries to supply the income with which they purchase color televisions, cars, expensive vacations, and elegant houses. Obviously, such farmers no longer depend on products or income from the commons; but the infusion of industrial wealth into rural Japan is a very recent development, and in many parts of Japan the commons remained a vital part of the rural economy until economic recovery (in the 1950s) from the Second World War.

Communities that retained their common land after the Meiji restoration in 1868 continued to use their land in the traditional way, but also developed other methods as their needs changed, especially as subsistence agriculture increasingly gave way to cash crop agriculture and light industry. We may group the methods of using the commons into four rough categories, which are described below.

The classic type of commons use. This type, of course, prevailed during the Tokugawa period and was restricted to activities that left the commons essentially in its natural state. It involved an investment of labor to harvest natural products that were very important in daily life: thatch for roofs, fodder for animals, multi-purpose bamboo, firewood, charcoal, underbrush and fallen leaves, compost, wood for furniture and tools, medicinal herbs, fowl and game to supplement the otherwise vegetarian diet of the mountains, and edible wild plants that could not be cultivated but that were much treasured (matsutake, warabi, and other mountain vegetables [sansai]). Those with access rights (whom I shall call co-owners of the commons) could enter the commons to obtain these items either as individuals, or by households, or in groups, and either freely or at designated times only, depending on the particular set of rules devised by that particular village.

Direct group control of the commons. This prohibited access by individuals, and was used when the commons was harvested for cash income. The income earned was either distributed among co-owners or plowed back into the next investment in the commons, or some other village project, as needed. For instance, a village might develop rice paddies, dry fields, or fruit orchards on the commons and sell the crop for village income. Some commons were converted into rock quarries. Many meadows and plains (perhaps denuded by daimyō during the deforestation of the 16th and 17th centuries before becoming village commons) have been converted since 1868 into cultivated forests with the encouragement of the modernizing Japanese government; the villagers harvest the timber and distribute the income collectively. Direct group control of the commons as a source of cash income for the village was used throughout the last hundred years to supplement village budgets, especially when compulsory mass education was adopted but local communities were expected to build the schools.

Divided use of the commons. Common land is actually divided into pieces for individual co-owners to use as they see fit. This is akin to privatizing the commons, except that co-owners do not own their allotments--they must abide by certain limits in their use of the commons (they may not build structures on the land, for instance), and they are not free to sell their pieces to anyone else.⁹ Pieces are usually assigned by lot, and reassignments are conducted every two or three years to ensure fairness and to prevent the commons from

degenerating into private property. This method has obvious appeal for a community in which the collective decision making required in classic or direct group control of the land has become cumbersome or time-consuming, or where individual co-owners of the commons have widely differing needs for timber, cash income, extra paddy land, private vegetable gardens, or natural products. Direct group control and divided use of the commons are known to have appeared occasionally in the management of Tokugawa and even earlier commons in some regions, but these methods of management were probably not widespread until the Meiji period.¹⁰

Contracted use. The most modern innovation in common land use involves contracts that are written when villages want to hold onto their common land but cannot come up with the labor to maintain it, so they grant an exploitation lease to another party. This is particularly true with forest land--the village leases timber rights to a municipal body or a forestry firm and earns a percentage of the proceeds as rent.

Most communities that still possess common land combine these methods depending on the activity--the classic method for gathering wild plants and compost, direct group control for forestry or large-scale farming, divided use for forest or garden plots, and contracted use for forestry, quarrying, or large-scale farming. In certain areas of Japan, the classic method has persisted until very recently--particularly in impoverished areas that did not attract industry--where the common lands, often substantial in size and ecological diversity, provided a large share of the local livelihood.

The summary of management techniques given below is drawn from studies of three such villages (Yamanaka, Hirano, and Nagaike, located on the poor volcanic soils north of Mount Fuji in Yamanashi Prefecture) that used the classic method until after World War II.¹¹ I have begun my survey of the traditional commons in Japan with these villages not because they are typical--I will not know what is typical until I examine the management of the commons in many other villages as well--but because they are by far the most carefully studied and can therefore serve as a solid starting point for further research, and because they vary in ways that are likely to prove interesting and significant in building hypotheses about successful management of the commons.

Studies of Tokugawa documents from these villages indicate that the use of the commons changed hardly at all

between the 18th century and the early 20th century. (In fact, in view of pre-Tokugawa records available for some localities, there is little reason to believe that the management of the commons changed much from the 14th century on, with the possible exception of the annual burning of meadowlands [noyaki] explained below that may have developed in the early Tokugawa period.) Yamanaka, Hirano, and Nagaike have diverse common lands:¹² forest and grasslands, large and small expanses of commons, and rich productive lands and relatively poor lands. Moreover, each of these villages possesses some common land of its own, some common land shared with one or both of the other villages, and access rights to the very large expanse of land on Mt. Fuji's north slope (Kitafuji) that are shared among a total of 11 villages.¹³

The villages themselves also vary. Hirano is old and wealthy, nestled against verdant mountains, hierarchical in social structure, inegalitarian in income distribution, crusty in traditional values, and intensely concerned with family and reputation. Nagaike is a younger (late Tokugawa), smaller, poorer offshoot of Hirano with very little difference in social standing or wealth among its households. Yamanaka is the largest and most impoverished of the three, located adjacent to the largest but least productive of the commons (the Kitafuji slope), a large village in which horizontal organizations known as kumi are as important a focus of loyalty as is family. In addition to using the rich social science literature about these villages, I was able to interview old-timers whose memories of the commons went back to the 1920s.¹⁴

The ecological richness of different parcels of common land in Japan varied enormously, but presumably much of the land was fragile and vulnerable to degradation if not well managed: forests could be stripped, and some grass lands could have been denuded even without the introduction of grazing animals. Japanese villages obviously altered the commons from its natural state (with such customs as annual burning and occasional clear-cutting), but they also clearly operated their commons according to the principle of sustained yield so as not to degrade the commons as a productive resource. In Oakerson's sense, then, they preserved jointness (Oakerson, this volume).

As for the physical and technical possibilities of exclusion, Japanese society during the Tokugawa period relied so heavily on natural materials, and lived at such a generally low standard, that fencing was economically impossible. Fences were used mostly in urban areas,

immediately surrounding buildings, as if to deter burglars who might want man-made objects of special value. The only large expanses of fenced land were the grounds of castles and Buddhist temples (the latter, one must remember, were fully comparable in both wealth and political power in some periods to the great military families). The large estates, part of which consisted of common land, often comprised many scattered small parcels of land in any case, and could not have been fenced very cheaply, no matter how inexpensive and readily available the fencing materials might have been. The topography of rural Japan--undulating mountains for the most part--would also have made fencing a miserable chore. To this day, cultivated land is not fenced in Japan; irrigation dikes in between the rice paddies serve as boundaries, but there are no barriers to trespassers. Thus we can be fairly comfortable in asserting that fencing off the commons would have been inconceivably expensive to villagers who could not afford to fence off their private land either. In Oakerson's sense, then, it was not really possible to exclude the ineligible from the commons with physical barriers. Instead, as we shall see, Japanese villages had to substitute rules for physical barriers."

In the same way, just as it was impractical to fence off land for purposes of exclusion, so private ownership of the commons was unimaginable in traditional villages as long as agricultural practices depended so heavily on the products of the commons. These products were not evenly distributed throughout the common land, and different expanses of land were of many grades and sizes and were used for purposes as varied as timbering and rock quarrying. Given the heterogeneity of the commons, it could not have been divided equitably. Moreover, a potential private purchaser of common land would presumably be interested in buying "prime" land within the commons--precisely the kind of land that the village governing body overseeing the commons would be least willing to sell.

As Runge (1981) notes, common property can provide all its co-owners entitlement to all the resources of the commons and thus offer some insurance against hard times. As long as the traditional agricultural economy prevailed (that is, as long as participants believed that their investment in maintaining the commons and its rules was a worthwhile use of time and resources to obtain the products of the commons), the commons were a sensible and inexpensive form of insurance. Thus we find little privatization of common land until the rise of commercial agriculture in

the 19th century. Even then, it often happened that villagers simply stopped using the land (as opposed to selling it); rising agricultural labor costs, levels of technology, and agricultural productivity made farmers unwilling to devote long hours to maintaining and collecting resources from the commons when they could substitute commercial inputs for the products of the commons. They did not sell the land to private owners (whether villagers or outsiders) until and unless nonagricultural uses of the land became profitable.

In the three villages involved in this study, most of the common land is still held as a collective asset saleable in the future, and most villagers have abandoned farming and instead work in the hotels and leisure facilities that have bought land from the farmers' private holdings. Nagaike is an exception: faced with a tempting offer, it sold a portion of its commons to a developer who constructed leisure condominiums with a perfect view of Mt. Fuji.

DECISION-MAKING ARRANGEMENTS AFFECTING THE COMMONS

External Constraints

Our chronological account of the evolution of the commons in Japan has taken us to 1600, when Tokugawa Ieyasu established himself as the nation's leader by winning the battle of Sekigahara. His talents were not limited to military strategy or political alliances: he established an effective military dictatorship and complex administrative structure that gave Japan peace for over 250 years.¹⁵

Japan was divided into 250 to 300 (the number varied) administrative units or domains, each governed by a lord (daimyō). Although these lords had a fairly free hand within their own domains, they were subject to strict constraints designed to prevent the emergence of regional power. These lords also functioned at times as administrative officers of the center and were expected to enforce a body of elaborate laws and decrees from the center within their own domains. The central administration imposed a four-layered class structure and all manner of sumptuary laws to regulate morality, spending habits, and the behavior of the four classes. It also mandated universal registration of all individuals in the country (to track down illegal Christians) and devised complex

requirements for licenses and official permission to engage in commerce and even to travel from one domain to another. All of these were enforced by a nationwide network of police, spies, and inspection stations at domain borders. A system of magistrates and domainal and/or shogunal courts handled disputes not resolved by conciliation at lower levels.

There is understandable confusion and great controversy among historians over the relationship between this complex, nearly totalitarian administrative structure created by the Tokugawa and the newly assertive self-governing villages below it.¹⁶ For the most part, this controversy does not affect the governing of common lands, which were clearly in the hands of the villages and managed freely and independently by them. But three important developments in the Tokugawa period did influence the management of the commons.

First, an administrative innovation of the Tokugawa regime played a role in enforcing the rules villages devised to govern their common lands: the notorious goningumi (literally, five-man groups, but in fact groups of five to ten households) system of collective responsibility, much like the pao chia system in China (Yanagida 1957; Smith 1959; Chambliss 1965:109-112; Henderson 1965, 1975; Befu 1968:301-314). Villages almost certainly developed this system of collective responsibility much earlier than the 1600s (perhaps centuries earlier), and refined it themselves during the era of civil war when they had to provide their own law and order and needed internal spies. Toyotomi Hideyoshi and later Tokugawa Ieyasu adapted the system for keeping track of Christians, rōnin (warriors without vassal ties, who often became mercenaries and sometimes bandits), and tax evaders.

The Tokugawa shogunate and the domains then formalized this preexisting institution to serve their purposes of tax collection and social control. This they did by issuing model five-man registers especially for the peasantry that consisted of lists of rules governing all sorts of behavior: from the proper decorum to be shown to visiting officials (including the stipulation that they not be given gifts or lavish entertainment that might influence their judgment), to admonitions about filial piety, and extending to fair use of the commons and obedience to all other civil and criminal laws. All individuals were members of a five-man group and all were equally responsible and liable for payment of taxes, obedience to the law, and transgressions by fellow

members. The heads of all households in a village had to affix their seals to the five-man registers to indicate their comprehension of the rules and to guarantee their own compliance and cooperation with the village officers, who would be considered personally responsible as well for any misdeeds of the villagers.

We know not only from the circulation of the signed registers but also from the appearance of cases higher up in the Tokugawa courts that village chiefs were indeed held responsible for the behavior of all of the villagers. The village itself was a juridical body that could sue or be sued, make contracts, and be held collectively responsible for misbehavior of its members, whether in tax payment or in crime. Thus the five-man group system of collective responsibility created an enormous internal incentive for villagers to solve their problems and beg, cajole, bribe, or coerce internal miscreants within the village into conformity. By almost any standard, this is a very unpleasant, unjust, but efficient way of frightening people into policing each other, and it seems to produce compliance even when people do not view the laws or codes they are expected to obey as legitimate. There is little doubt that this fairly totalitarian device enhanced the communities' ability to enforce rules governing the commons.

The second important development was that with the Pax Tokugawa, the new daimyō who had not already done so tried to acquire more direct control over both their domains and their vassals by replacing fiefs with stipends of rice drawn from their own revenues. (We will recall that the daimyō had originally acquired their positions of power within the warrior hierarchy through military conquest of the land and through the award of fiefs to their vassals.) This process converted landed vassals into salaried bureaucrats and moved them from the lands that had been their fiefs into the cities. This freed the villages from direct interference by a local fief-holder and increased their freedom and independence in the use of all property, including commons. Moreover, it created a system in which private individuals and villages had not only usufruct but ownership in all but the final formal sense, and daimyō had taxation rights but not ownership.¹⁷ Thus it became possible to distinguish between land belonging to the daimyō and other lands within their domains that belonged to peasant freeholders or to other landlords. In this way, many villages held common land that was not considered daimyō property, and thus operated their commons quite independently.

The third noteworthy change was a consequence of the devastation of widespread civil war in the 16th century. This was followed by peace and the rapid construction of cities and castles throughout Japan in the 17th century, which created a tremendous demand for timber and caused considerable deforestation (Totman 1982a, 1982b, 1983a, 1983b, 1984; Osako 1983). The problem was initially most severe in forests owned directly by the Tokugawa family and the various daimyō engaged in the work of reconstruction. Their appetite for timber induced the daimyō to acquire direct control over all prime forests in their domains, so that the best of the existing timbered commons passed from villages to the daimyō to become ohayashi, the lord's forest, thus threatening ever-widening areas of Japan with deforestation. Eventually, of course, the daimyō recognized that there was only a finite supply of timber available, and they began experimenting with conservation. They focused first (and perhaps inappropriately) on peasants to whom they had granted access rights to daimyō-owned forests (these rights are separate from and additional to villagers' perpetual usufruct on lands not claimed by the daimyō since 1600). They began regulating these rights more strictly, and along with the Tokugawa shogunate created forest magistrates to patrol the daimyō forests, looking for outright theft as well as for violations of rules governing regulated access to these forests. The daimyō often granted exclusive access rights on a long-term basis to particular villages, in exchange for the villages' assurance that they would supervise the forests and keep others out. In effect, then, the daimyō granted these villages increasingly formal entitlement to still more common lands (this is in addition to the substantial commons already in existence before the Tokugawa period and no longer claimed by daimyō at all); this compensated somewhat for the daimyō's confiscation of prime forests from village common lands. When the daimyō finally realized that peasant demand for timber was stable and occasional, and that the daimyō themselves were the prime culprits in increasing the demand for timber, they began to develop principles of management that would not only sustain their own prime forests but contribute to the reforestation of Japan during the 18th and 19th centuries. The daimyō's efforts at regulation may have been misdirected, but they did at least provide the villages with knowledge and experience in designing their own regulations and institutional arrangements, thus lowering the cost of institutional design later.

Part of the problem was a conflict of interest between daimyō and peasant as to what type of forest growth to encourage: the daimyō preferred slow-growing conifers for timber, while the peasants preferred broad-leafed deciduous hardwoods because these hardwoods laid down annual additions to a rich underlayer of leaf mold that could be harvested as fertilizer and that offered excellent fuel when the trees were finally cut down. Peasants entitled to use the daimyō forests had little interest in protecting the seedlings of trees prized by the daimyō until land-leasing (nenkiyama) and yield-sharing (buwakebayashi) arrangements were devised to give all of those involved a mutual interest in nurturing slow-growing timber until maturity.

Land-leasing was the advance sale of a stand of timber with final payment on delivery years later. Yield-sharing was a long-term contract to divide the proceeds of a sale of timber as far as 50 years into the future. These arrangements were adopted variously for all kinds of land--daimyō forest, communal village forest, and private small holdings--and served not only to promote the notion of "multiple use" but also to encourage afforestation during the 18th and 19th centuries (Totman 1982a, 1983a, 1984). We might note that these systems of profit-sharing suggest that separation of land rights from tree rights need not be disastrous at all.¹⁸ Rather, the critical factors seem to be whether the rewards for each party create a mutual interest in nurturing a particular kind of tree growth, and whether there is a legal system that will make a 50-year contract enforceable (the assurance problem). In Japan, this tradition did exist, thanks to the development of customary and codified law and methods of adjudication from a very early period.¹⁹

The deforestation crisis of the 17th century was not limited to privately owned land; it quite understandably increased environmental pressure on remaining common lands as daimyō commandeered some communal forests and tightened restrictions on lawful use by nearby villagers of daimyō forests. It is very important to note that at this juncture, when theory might predict a tragedy of the commons, neither total environmental destruction nor dissipation of the commons into private hands occurred. To be sure, some commons were seriously degraded, and in fact this encounter with environmental degradation may be the reason that so much common land today turns out to be grassland and meadow--this land was probably prime forest before the 17th century. Similarly, some privatization of

commons did occur. It is apparently much easier to maintain the environmental quality of commons than it is to upgrade that quality because the latter requires so much additional investment of labor and money from co-owners of the commons. When daimyō wanted to convert meadows to forests or where villages themselves wanted prime timber to market later, they (the daimyō or the villages) did sometimes arrange to divide the commons into private parcels that were sold to families who then reforested the land and profited accordingly years later at the harvest.

On the other hand, "de-privatization" also occurred. Henderson provides information about a village that decided to create a commonly owned forest from privately owned grassland by buying the land from one of its own residents. Troost (pers. com. 1984) finds the same sorts of conversions of private land into commons in the villages of Imabori and Suganoura on Lake Biwa before the Tokugawa period (also Henderson 1975:76-79).

We also know that frequently the impetus for dividing the commons into private parcels (an event known as wariyama or "dividing the mountain") grew from difficulties of managing conflict among co-owners of the commons, and not necessarily from the threat of environmental destruction. Wariyama was not always perpetual, and use rights were not always comprehensive; villages sometimes tried to maintain a future hold on the land or have it revert to the village commons after it was afforested. By and large, the commons that were divided and sold to become privately owned land in perpetuity were shared by more than one village, and it was conflict among different villages rather than among residents of a single village that proved unmanageable. In effect, the transaction costs involved were too high with respect to the benefits from the commons to sustain collective management in this situation. During the Tokugawa period, there was a clear trend for the multi-village commons to give way to the single-village commons (Harada 1969).²⁰ This suggests that whereas one Tokugawa-sized village might have been small enough to manage a commons, several villages were too large, had too many irreconcilable wishes about how to use their resources (conflicts between poor mountain villages and richer lowland villages attempting to share a commons were especially frequent), and shared no overweening common goals or communal ethic. Such a finding is consistent with the theoretical prediction that normative beliefs or ideology will be crucial in preventing cheating against the commons (McKean 1979; North 1981).

For our purposes, the significance of this episode of deforestation during the 17th century is threefold: visible deforestation seems to have made villagers aware of the very real risks of overuse and enabled them to develop and enforce stricter rules for conservation on their own initiative to save their forests and commons from the same fate. Rather than destroying the commons, deforestation resulted in increased institutionalization of village rights to common land. And it promoted the development of literally thousands of highly codified sets of regulations for the conservation of forests and the use of all commons.

Conditions of Collective Choice

Our next task is to examine the circumstances surrounding the development of operational rules for managing the commons; these rules comprise the "constitution" that governed day-to-day decision making on the commons. This requires a look at the structure of the traditional village in Japan.²¹ The historical evolution of villages and landholding described earlier gave each village a sturdy internal structure and a strong sense of identity by the early Tokugawa period. Cadastral surveys identified particular households with specific pieces of land; tax records identified property owners; and the family register (shūmon aratame, intended for purposes of social control) attached individuals and families to certain villages. Everyone "belonged" to a particular place, and mobility from place to place was tightly controlled--indeed, lodging an out-of-town guest in one's home or travelling to another village overnight had to be cleared in advance with the village head (shoya or nanushi), who then had to seek permission from domain authorities.

The household, not the individual, was the smallest unit of accounting, not just for managing the commons but for all purposes; the household head's name was recorded in documents to represent the entire household. A village consisted of a certain number of households, and villages were governed by an assembly (yoriai) of representatives (almost always the family head) from each household that had political rights. This could be variously defined as households with cultivation rights in land (the hyakushu class), or perhaps ownership rights in land as determined by 16th and 17th century cadastres (such people might be

called jinushi, which translates as "landlord"), or perhaps those with taxpaying obligations (honbyakusho). These three categories were not coterminous, and each village had its own rules for participation.

In one case, a document concerning the creation of a commons to be shared by two adjoining villages was signed not only by representatives of the landowning households in both villages but also by representatives of the tenant families in both villages (Henderson 1975:66-67). Thus, some villages gave more political rights to tenant families than did others. In the village of Chiaraijima, rights to the commons tended to be associated with wealth in private holdings, but wealth did not guarantee access. While only 2 of the 16 poorest families had rights to the commons, only 6 of the 10 richest families also had such access rights (Chambliss 1965:44-45). As more documents come to light, we may eventually acquire a comprehensive picture of what proportion of the Tokugawa peasantry lacked such political rights by virtue of belonging to a headless household or one without any land rights, or falling into such low-status categories as household servants (genin) or outcaste groups (eta and hinin, literally "nonhumans"). When we are able to find multiple records that allow cross-checking, we see that villages displayed great variety. In some, the great majority of households had something akin to ownership rights in land and political representation in the village, but in others the proportion of disenfranchised tenants, household servants, and outcastes might exceed 50 percent of the total population. Tenant families who themselves had no political rights or access to the commons might nonetheless use the commons via their landlord's rights (Smith 1959:24-25, 1968a:273-274). We also know that as the Tokugawa period progressed, the tax burden on the peasantry as a whole grew lighter but that inequalities of wealth within villages increased over time (Smith 1968b, 1977:41-46).

Villages were usually subdivided into intermediate groupings called kumi (literally, "group"), each composed of several households. The kumi was a very important unit of accounting and distribution of responsibilities and benefits connected with the commons. In addition, many other organizations within a village performed collective functions: they not only managed the commons and the irrigation canals, but also occasionally built public works like bridges and roads, took care of the local shrine, held annual festivals, functioned as a mutual aid society for destitute villagers, helped at funerals, thatched roofs, organized the collective labor (yui) for

transplanting rice (an enormously laborious chore that must be done quickly and has always involved cooperation even for private paddyland). Dore (1959:352-353) gives a modern-day example of a village with 401 households and 177 organizations.

On paper, villages were democracies in which each household that was accorded full participation rights was equal to any other, and office-holders were either elected or selected by some principle of rotation. Obviously, the traditional village assembly was a decision-making unit with some democratic potential, and there is of course a raging debate over whether this potential was ever realized in fact. The conventional view is that the traditional village has always been a bastion of hierarchy, elitism, and authoritarianism. Recently, however, scholars espousing the ideas and research methods of folklorist Yanagida Kunio have argued that, before and perhaps during the Tokugawa period, Japanese villages may have operated as idyllic communal democracies in which horizontal bonds were more important than vertical ones, and in which the young men's association often became a focal point for challenges to village elders.²² It is quite possible that in villages where the distribution of wealth was fairly egalitarian (such as Nagaike, described below), each household was nearly equal in power. But the most common circumstance was that a few families held far more land than any of the others, and it is almost certain that the poor deferred to the rich, that the elders (toshiyori) tended to make decisions on behalf of the assembly most of the time, and that they themselves came only from the wealthiest "major" families. (Hirano used the term "meimon" to identify these families, and the term may indicate descent from those who once possessed land rights that were called myō in the medieval period.) Similarly, wherever the group of villagers in charge of maintaining the local shrine (miyaza) had broad jurisdiction, the miyaza turned out to be an elitist decision-making group and reflected a very unequal and hierarchical arrangement of power in the village.

That households and not individuals were the unit of accounting, and that villages possessed the power to determine which households were eligible to participate in politics (and to extend rights of access to the commons only to such households) are facts of great significance. First, large households had no advantage over small ones--they had no extra votes in decisions, no extra representation, no enlarged share of benefits from the

commons; indeed, their household benefits were the same size as the smaller households, but had to be apportioned among a larger number of family members. Large households could not obtain advantages by splitting into several households; permission to form a branch household (bunke) from the main household (honke) had to be obtained from village authorities, who recognized that creating an additional household would enlarge the number of claimants on the commons without enlarging the commons, and so were reluctant to create a new bunke. Smith reports that creating a branch household was actually viewed as a honke's selfish attempt to increase its power over the commons (Smith 1959:82-183). New households sometimes were grudgingly accommodated and were awarded incomplete political rights--for example, no entitlement to hold village office, or less than one regular household's share of benefits.

Of course, households were also constrained from forming a bunke because they would then have to split up their private property and thus dissipate the family's wealth. This fact no doubt played a part in the early emergence of family planning (through birth control, abortion, and infanticide) in Tokugawa Japan that permitted steady increases in per capita income during the latter half of the period.²³ Recent scholarship takes this argument one step further and suggests that this combination of low aggregate population growth over an extended period (only 0.025 percent per year between 1721 and 1846) with rising per capita income permitted much more capital accumulation in Tokugawa Japan than has been acknowledged in the past, and thus set the conditions for industrial take-off in Meiji Japan.²⁴

Thus, users of the commons did not try to increase their numbers in order to increase their share of the commons, nor did anyone count on the benefits from the commons to bail them out after a period of irresponsible procreation. Villages and total population did grow during the Tokugawa period, to be sure, but slow judicious growth was the rule. It seems eminently clear, not only from these indirect kinds of evidence but also from the contents of village and domain legal codes, that everyone was conscious of a sense of "limits." Records from some villages show that after a certain point--about midway through the Tokugawa period--no new arable land was brought into cultivation and the number of formally constituted (politically participant) households did not increase, because no new households were permitted unless an old one died

out for lack of heirs. There is every reason to believe that these villages had "filled up" their legal and topological boundaries and consciously concluded that, given the level of available technology, it simply was not worth trying to bring new lands into cultivation. The commons could produce fertilizer and equipment for cultivating only a certain amount of land, and turning some uncultivated commons into cultivated land would violate that sacred ratio and be useless anyway.

One final source of information about the unwritten "constitution" governing decision making in the villages is the village codes (sompō) from the Tokugawa period, studied by Maeda Masaharu and further analyzed by Harumi Befu (1968:307-310). These were generated from within the village, and, in contrast with shogunate codes and exhortations that emphasized maximizing production, they focused on resolving disputes. Some codes clearly protected the interest of a village elite, but most provided that the assembly as a whole rather than the village head was empowered to enforce the rules. The village codes were streamlined, brief, and clearly based on centuries of knowledge and experience at maximizing the collective good by keeping internal conflict to a minimum. We will now turn to a consideration of the specific rules for managing the commons that were used in Hirano, Nagaike, and Yamanaka to defuse conflict and prevent abuse of the commons.

Rules Governing Rights of Access to the Commons

The villages of Hirano, Nagaike, and Yamanaka relied on the commons as a source of several products. Kaya is a grass grown to produce thatch for roofs. When it is still young, it is good as horse fodder and for weaving into containers for charcoal and other household items. After it has fruited, it is good for thatch. After winter, when only the dried stalk (saguri) remains, it is good for weaving stiffer products, for racks to dry root vegetables, and for certain purposes in sericulture. In order to prevent the kaya from being cut at an immature stage for horse fodder, villagers usually designated an area with kaya as "closed" during the growing season.

Magusa was a grass used as fodder for draft animals and pack horses. Combined with animal excrement, it also made excellent fertilizer. During the growing season, each household had to cut a fresh supply daily for its

animals. At the end of the growing season, an entire winter's supply had to be cut, dried, and preserved (called hoshikusa or kaiba) so it could be parceled out to the animals during the winter months. To ensure that daily cutting of fresh fodder did not deplete the supply available for winter, villagers, like those in Hirano, usually designated one open area for daily cutting of fresh grass and another closed area as a source of grass to be dried into fodder for the winter. Most households, particularly those with more horses than usual, had to supplement their share of the common supply of winter fodder with grass collected and dried from their own private holdings.

In Nagaike, the animals were allowed to roam within a certain area and pasture at will, but it was more customary for villagers to forbid the use of commons as a pasture and insist instead that people cut the grass and bring it to the horses. This rule may have been devised to eliminate the temptation for a household that relied on common pasturage to acquire more animals than it could supply with fresh-cut fodder; it may have thus been an effort to prevent overgrazing. I was told that villagers wanted to supervise what the horse ate--in particular to make sure that they did not eat grass or plants intended for other purposes. In any case, the role of animals in Japanese agriculture was as a precious form of equipment that had work to do each day, and not as a product in itself, so there never was any need for vast pasturage to fatten up large herds. Those Japanese who violated Buddhism's vegetarian customs generally ate game. A household's need for animals was limited by the amount of land it had to work. It was not until the late 19th and especially early 20th century that the production of animals became a lucrative activity in itself; families in all three villages began to earn extra income by breeding horses and leasing them as pack animals for transporting freight along the rough mountain roads in the Fuji area. As we shall see, horse breeding placed stress on the commons and caused villagers to tighten the rules.

Firewood and charcoal came from two locations. There were patches of forest that villagers could enter at any time as long as they obeyed rules about taking fallen wood first, cutting only certain kinds of trees and then only those that were smaller than a certain diameter, and only with cutting tools of limited strength (to guarantee that no tree of really substantial size could be cut). In addition, all three villages conducted a joint annual tree

cutting: on this occasion they clear-cut everything but the pines, and each household in each village got an equal-sized stack of wood.

Different villages arrived at different arrangements for guaranteeing an adequate supply of the products from the commons. For items that were needed regularly and that the commons yielded in abundance, a village might allow co-owners free and open entry as long as they abided by certain rules to make sure that a self-sustaining population of mature plants or animals was left behind. To enter the commons, one might need to go to village authorities to obtain an entry permit, carved on a little wooden ticket and marked "entrance permit for one person." The rules would probably restrict a villager's choice of cutting tools or the size of the sack or container used to collect plants. Everyone would be expected to abide by the village headman's instructions about leaving so much height on a cut plant so that it could regenerate, or taking only a certain portion of a cluster of similar plants to make sure the parent plant could propagate itself, or collecting a certain species only after flowering and fruiting, and so on.

Villagers usually set aside closed reserves (tomeyama or "closed mountains") for items that had to be left undisturbed until maturity and harvested all at once at just the right time, or that the commons supplied in only adequate, not abundant, amounts. The village headman would be responsible for determining when the time had come to harvest thatch or winter fodder or other products, and would schedule the event (literally, yama no kuchi ake or "mountain-mouth-opening"). The rules for mountain-opening day varied with the village and even the product being collected. If the reserve had been closed merely to assure that the plants were allowed to mature but there was more than enough to go around, opening day might simply mark the annual transition from a closed mountain to an open one, allowing individuals and households to enter at will and collect as much as they wanted. On the other hand, if the supply were limited, the reserve might be declared open for a brief period (two or three days) and households allowed to send in only one able-bodied adult to collect only what could be cut in that time. If the item were limited in supply and had to be collected all at once in a massive effort to prevent spoilage, then the villagers would all enter the reserve together, work until the job was done, and divide the proceeds.

Even among the three villages in this study, there was great variation in the rules applied on mountain-opening days for harvesting different products from closed reserves. In Hirano, for instance, every household had to send one able-bodied adult (two after 1910) and a maximum of one horse to carry what was cut on the day scheduled for opening the closed thatch reserve. Hirano was divided into five kumi (groups), and each kumi was assigned to a particular zone within the thatch reserve.²⁵ To preserve equality, the kumi changed zones according to a fixed rotational sequence each year. Household representatives from each kumi gathered in their kumi zone in the morning, with the kumi chiefs standing guard to make sure no one started cutting prematurely (anyone who did would be fined). At the sound of the great temple bell, everyone started cutting. One could cut only in the zone assigned to one's kumi, but could keep whatever one cut. A strong person could cut an adequate supply in a day (say, 10-15 units), but many would stay until after dark and even come back the next day. After two days, the mountain would be closed again and households would be required to donate two units of thatch to the common village reserve used in emergencies. The punishment for entering the thatch reserve before opening day was loss of the right to cut thatch or to receive a share from the kumi or the village for that year. These rules appeared to be a judicious combination that rewarded strength and hard work but also severely limited the circumstances in which cutting was allowed, which ensured that the total supply was not threatened and no extreme inequality appeared among households in a given year or among kumi over time.

The same village used different rules for collective harvesting of winter fodder for the animals from another closed mountain set aside for that type of grass. As with thatch, each kumi was assigned a zone according to an annual rotation scheme, and each household had to send one, but only one, adult. On the appointed day, each representative reported to the appropriate kumi zone in the winter fodder commons and waited for the temple bell as the signal to begin cutting. However, this grass was cut with large sickles, and since it would be dangerous to have people distributed unevenly around their kumi zone swinging sickles in all directions, the individuals in each kumi lined up together at one end of their zone and advanced to the other end, whacking in step with each other like a great agricultural drill team. The grass was left to dry for two or three days (when it became much

lighter), and then two representatives from each household entered the fodder commons to tie the grass up into equal bundles. The haul for each kumi was grouped together and then divided evenly into one cluster per household. Each household was then assigned its cluster by lottery. This extremely scrupulous division into equal lots per household was done not merely to prevent competitive cutting or to assure an equal amount per household: bundles of grass varied enormously in quality according to how thickly the grass grew in different spots and how much extraneous undesirable plant matter was included, so they were assigned randomly to eliminate the bad feelings that would otherwise result in households that discovered their bundles to be of poor quality. Random assignment of bundles to households also ensured that household representatives, unsure which bundles would become theirs would try to assemble bundles of equal size and quality.

In Nagaike, the rules for cutting and division of thatch and winter fodder from closed reserves were at one time the opposite of those in Hirano. In Nagaike, households kept for themselves the supply of winter fodder that they managed to cut on mountain-opening day to feed their horses, but thatch was divided equally among the households after cutting. The equal division of thatch may have originated in the fairly egalitarian distribution of income among Nagaike households, meaning that households had dwellings of similar size, and therefore similar needs for thatch. Moreover, because all of the thatch for roofing jobs came from the village reserve, there was little value in amassing a private supply. Nagaike had a highly routinized arrangement for collecting a common reserve of thatch to provide a new roof for an outbuilding or barn for two households per year and a complete re-roofing job for all buildings for two more households per year. By the time this communal system had provided a new roof to all of Nagaike's 38 households, it was time to start all over again. In 1923, the growing population of horses in Nagaike was beginning to create much competitive pressure for winter fodder on opening day, so Nagaike switched from the "keep-what-you-cut" system to equal division by kumi and by household, much like the practice in Hirano. (In fact, there is reason to believe that Hirano had originally used the "keep-what-you-cut" system for fodder too, like Nagaike, and that competitive cutting as well as fear of swinging sickles had produced the change to equal division by kumi and household.)

From this brief sketch of the rules for closed reserves in Hirano and Nagaike, one might conclude that the poorer the village or the more dependent it was on its commons, the greater the likelihood that it would set aside closed reserves and develop stricter rules. However, a review of Yamanaka's practices toward the commons indicates that this was not the case.

Yamanaka was the poorest of the three villages, the least endowed with privately owned land, the most dependent on day labor and pack horses and carriage trade to supplement subsistence agriculture; its common lands were scruffy and dismal compared with those of Hirano and Nagaike. Nonetheless, Yamanaka's own commons combined with the huge Kitafuji slope that it shared with 11 villages made up in quantity what it lacked in quality: Yamanaka was located immediately adjacent to the Kitafuji slope and could conveniently use it, whereas the other villages that shared it were located far away and could not easily take advantage of their access rights. Then, in 1939, the Japanese government expropriated the Kitafuji slope, and even though the government was supposed to honor the villages' rights of access, the routine conduct of military exercises on the slope damaged the ecosystem and further reduced the productive potential of the Kitafuji commons. Yamanaka therefore grew more heavily dependent on another piece of common land that it held in its own right, and was forced to set aside a portion of that as a closed reserve for horse fodder. Even then, Yamanaka did not need to set aside a closed reserve for thatch. The supply of thatch on Kitafuji was sufficient, though so sparsely distributed that the hunt-and-peck method required 10 to 15 times the investment of time that was needed in Hirano to collect the same quantity.

A more appropriate conclusion, then, would be that as demand for the products of the commons--whether that demand reflected wealth or poverty--approached the maximum sustainable yield of the commons, portions of the commons would be set aside as reserves and the rules would be progressively tightened.

Thus far we have examined the benefits that villagers drew from the commons, but equally important is the contribution of labor to the maintenance of the commons. In the classic type of commons, villagers did not till the soil or sow seeds, but they often engaged in a systematic program of harvesting and weeding of certain plants in a particular sequence to increase the natural production of the plants they wanted.

One very dramatic technique of this sort was the annual burning of the grasslands, or noyaki. Originally practiced on a small scale on private holdings, the Tokugawa villagers gradually extended this custom; throughout Japan many of the common meadowlands were burned completely clear once a year. The burning undoubtedly altered the ecosystem drastically from its previous state, but the apparently altered ecosystem absorbed this custom of annual burning, and common lands survived in spite of it.²⁶ Noyaki was carefully timed in the early spring to burn off hard and woody grasses and thorny plants, along with "bad" insects, before the shoots of desirable grasses emerged. Noyaki essentially converted

the previous season's leftover dried grass and the current season's early but undesirable grasses into a layer of ash (rich, desirable fertilizer to nourish the desirable vegetation) without the effort of hand weeding, manual composting, or manual redistribution of fertilizer. Even though the furious winds around Mt. Fuji caused the fire to race across the entire Kitafuji slope in just a few hours, somehow the game population was able to evacuate safely, to return later after delicious new shoots of grass had appeared.

There were written rules about the obligation of each household to contribute a share to the collective work to maintain the commons--to conduct the annual burning (which involved cutting nine-foot firebreaks ahead of time, carefully monitoring the blaze, and occasional fire-fighting when the flames jumped the firebreak), to report to harvest on mountain-opening days, or to do a specific cutting of timber or thatch. Accounts were kept about who contributed what to make sure that no household evaded its responsibilities unnoticed. Only illness, family tragedy, or the absence of able-bodied adults whose labor could be spared from routine chores were recognized as excuses for getting out of collective labor. (Temporary absences from the village were not acceptable; all healthy adults had to make themselves available.)²⁷ In such cases, others in the unrepresented family's kumi might cut a share of thatch or fodder for the missing family and the accounts would be evened out later. But if there were no acceptable excuse, punishment was in order.

PATTERNS OF INTERACTION IN THE COMMONS

As we have just seen, villages had elaborate rules to govern both open and closed commons. Abuses were

possible: taking too much or taking unallowed items from an open commons, entering a closed commons before mountain-opening day, violating the strict rules for mountain-opening days, and failing to contribute labor. What actually happened? What were the real behavioral responses to rules and circumstances? What do we learn from these responses about both individual and collective agendas for using and abusing the commons?

Enforcement of Rules

One mechanism for enforcement of the rules about the commons, as well as the rules about everything else, was the general atmosphere of mutual dependence and collective responsibility in the village. Japanese villages observed a universal small-town rule that everything was everybody's business, so everyone understood that a transgression in one area of life--from serving cheap tea to building a pretentious house to cheating on the commons--might cause damage in another. In economic terms, this arrangement served to internalize within the household most of the costs that the household might otherwise have been able to impose on others. To the extent that the formal system of collective responsibility (five-man groups) was effective in a village, all potential violators of rules knew that those near them had strong incentives to advocate compliance as a general rule (or, when persuasion failed, to snitch on one's colleagues rather than be implicated with them). For most people most of the time, obedience to the rules was probably the path of least resistance.

But villages did not rely entirely on formal collective responsibility, or on social pressure from peers, or even on the individual's sense of identification with the welfare of the community to protect the precious commons. Villagers were not so naive as to imagine that there would never be temptations to violate the commons, so they created groups of detectives to patrol them. This task might be assigned to the young men's association or to the village fire brigade (also composed of young men), which would in turn delegate the job to its members on the basis of annual rotation. The detectives would patrol the commons on horseback every day looking for intruders, in effect enforcing exclusionary rules.

In Hirano, the detectives (tantei) had to come from families that could spare a young man's labor and a horse for an entire year, and the job was considered one of the

most prestigious and responsible available to a young man. In Nagaike, these positions (called wakashū there) changed hands more frequently, but all eligible males had to take a turn, so that no family was without its full labor supply for very long but all would have to serve. It is extremely interesting to note that Nagaike, which was the smallest, most egalitarian of the three villages and which also happened to depend completely on the commons for the thatch and animal fodder that private holdings simply did not produce, appears to have had virtually no violations of the commons by Nagaike residents. The detectives there had to deal only with intruders from villages on the other side of the mountain.

Interestingly, Yamanaka had no system of detectives to patrol its commons, although it did observe the principle of "citizen's arrest"--anyone, not merely a designated detective, could report violations. Yamanaka had no closed reserve until 1939, and fewer rules to enforce on the open commons. It may also have been too poor to spare the labor of those who might serve as detectives. In any case, the commons to which Yamanaka had exclusive access rights (not the Kitafuji slope it shared with other villages) had been formally registered as property of a Shinto shrine during the Meiji land reform (this was one of the few available ruses by which a village could preserve common land), and the elders among the parishioners performed functions akin to patrolling the shrine commons for violators.

Violating rules that protected the commons was viewed as one of the most terrible offenses a villager could commit against his peers, and the penalties were very serious. Most villages had written codes to govern the commons, and these stipulated specific punishments for specific violations, with a built-in scheme of escalating penalties for noncooperation. Most violations were handled quietly and simply by the detectives, who would set the penalty. It was considered perfectly appropriate for the detectives to demand cash and saké from violators and to use that as their own entertainment cache. Anyone found violating the rules of an open commons or illegally entering a closed commons was instantly deprived of his equipment, his horse, and whatever he had cut. To retrieve his equipment and horse he would have to pay a fine--usually a bottle or two of saké--and apologize to the detectives who apprehended him. (Such saké given as payment of a fine was referred to by special terms indicating the humility of the giver and fine-payer:

ayamarizaké [apology wine], kotowarizaké [refusal wine], or more quaintly ashiarazaké [foot-washing wine].) The contraband harvest was of course retained by the village. If the offense were relatively large or the apology unsatisfactory, the head of the culprit's household or his kumi or temple priest would have to make the apology on his behalf and offer a larger fine in his stead. To prevent the stain of collective responsibility and humiliation from spreading to them, the culprit's family or kumi members would exert powerful pressure on him to make adequate amends. If the intruder were a resident of another village, the leaders of his village would have to travel to the village whose commons had been violated and apologize. Very rarely did a village have to go beyond these first three stages of punishment to obtain satisfaction.²⁸

When necessary, though, the village could threaten to employ its more powerful sanctions: ostracism in increasingly severe stages, followed by banishment. The Japanese term for ostracism, murahachibu, signifies that the village cuts off all contact with the offender except for assistance at funerals and fire-fighting. In fact, it was usually employed in gradual stages, starting with social contact and only escalating to economic relations if the offender did not express remorse and modify his behavior. To ensure that the villagers would remember to shun contact with someone subjected to ostracism, that person might be expected to wear distinctive clothing (a flashy red belt or pair of unmatched socks. [Minzokugaku kenkyūjo 1951:472]). Ostracism was a horrible punishment for the Japanese villager, not only because it cut him off from a highly group-oriented society and made daily life unpleasant, but because it actually deprived the villager of tangible services essential to daily living: village water supplies, irrigation for his rice paddies, and, of course, access to the commons. A villager of ordinary means would never jeopardize the survival of his household and his family's reputation for many generations when a simple apology could extinguish the controversy, and when strict obedience to the rules could guarantee that such possibilities would not arise in the first place. Only families of great wealth and pride could afford to risk ostracism--often gambling that their social status would win them enough allies that they could either defeat the established village leadership in a political contest or secede from the village and form a new one.

Compliance and Violations

It is very difficult to ascertain how well the rules were obeyed, how well the threatened penalties discouraged violations, and how honestly the rules were enforced, especially when the offender was a resident of the governing village and the locals wished to keep the offense from going to the local magistrate's office and thus becoming a matter of public record. Those who have studied primary documents on Tokugawa villages and the commons have not been very interested in these questions in the past, so it is virtually impossible to arrive at reliable generalizations about Tokugawa villages on the basis of the written record. Moreover, this is a matter about which loyal villagers then and now would be understandably defensive and reticent, and one is forced to be skeptical when the available evidence suggests that all worked well. At the risk of exaggerating dysfunction in the enforcement system, then, I will take special note below of examples of violations of the commons in these three villages that have been so carefully studied.²⁹

It would appear that villagers' reluctance to incur the disfavor of their peers was usually enough to keep violations of the commons at a manageable level--that is, offenses by outsiders were far more numerous than offenses by village residents, and all offenses taken together were usually minor in degree and did not threaten the ecological health of the commons. Moreover, the villagers--certainly village elders and kumi chiefs, and probably heads of all households--thoroughly understood the direct relationship between the rules and the preservation of the commons. These people lived with the seasons and natural cycles and knew their commons very well. Every time I asked about the reason for a particular rule, my informants gave a sophisticated and sensible explanation in terms of environmental protection and fair treatment of all the villagers, never, "Well, we've always done it that way." Even if the village elders were the prime repositories of accumulated scientific knowledge, this information circulated regularly through the village. Obedience to the rules was almost certainly based on an appreciation of their value, not merely on compliance to avoid penalties.

In these three villages taken together, there has been only one case in which violation against the commons led eventually to ostracism. The original violation was a minor one: entering an open commons to cut fresh grass on an official work holiday (essentially a compulsory vacation

to give everyone a rest but to prevent any single family from gaining an advantage over others by working). This would have had no impact on the health of the commons and could have been taken care of quickly with an apology. However, the person who committed the violation was very proud and argued, in effect, that the rules did not apply to him because he was a village elder and former village chief. This claim, of course, was a more serious threat to the rule of law in the village than was the act itself. The man refused to apologize, he rejected his relatives' efforts at mediation, and the controversy and punishments escalated to the point where he had to travel to distant towns to do all of his trading and marketing. Finally, the village deprived him even of assistance at funerals and fire-fighting services, in effect turning murahachibu into murajūbu (in effect, he lost all rights instead of only some of them, as is implied by the term murahachibu).³⁰

Certain more ordinary violations, however, were almost routine. For instance, in the weeks and days preceding mountain-opening days, impatient households would occasionally enter closed reserves prematurely. The detectives ordinarily collected one bottle of saké per minor violation, but during this "peak season" the young men collected more liquor than even they could drink, and they usually had to give it away. Similarly, the detectives were young men with predictable weaknesses, and some households intentionally sent their attractive young daughters into the commons to collect grass in violation of the rules of the commons. The detectives might then be disposed to look the other way, or even to ignore repeated offenses in exchange for sexual favors. Except for this single instance, there is no evidence of detectives exploiting their position by co-opting bits of the commons and concealing their own violations, or by terrorizing suspected offenders against the commons, or by concealing others' violations in exchange for favors. Certainly, there was an intrinsic pride in the importance of doing one's duty by the commons and in preserving the village's well-being; a young man brought credit to his family and future by doing the job properly (which included showing no favoritism). However, these internal incentives were augmented by the system of collective responsibility, since the detectives patrolled in teams. Any detective who felt tempted to violate the rules had to answer to his colleagues and risk the possibility that they would rather report him than be caught later as co-conspirators in an

offense. Apparently, not only violations of the rules but abuse of power by the "police" appointed to search out those violations was expected, and correctives were built into the system. (When the village of Shiwa suffered a drought, farmers at the downstream end of the irrigation system, including the water guards on patrol, were sorely tempted to alter the dikes so as to receive more than their allocated share of water. During such times, the collective response was for all adult males to patrol the dikes all night long in mutual surveillance. [Shimpo 1976: 9-17.])

Violations of rules to protect the commons would also increase noticeably in response to certain special circumstances. First, there might be a real challenge to the wisdom of a village chief who, for instance, set mountain-opening day too late. In this instance, an entire faction of disgruntled villagers might violate the rules together in an act of civil disobedience; this would clearly be a protest against an error in the leadership rather than disrespect for the rules to protect the commons. One former detective in Hirano, now a respected village elder, described how he had been patrolling a closed commons one day and came upon not one or two intruders but thirty, including some of the heads of leading households. It was not yet mountain-opening day, but they had entered the commons en masse to cut a particular type of pole used to build trellises to support garden vegetables raised on private plots. If they could not cut the poles soon enough, their entire vegetable crop might be lost, and they believed that the village headman had erred in setting opening day later than these crops required. Out-classed in both numbers and status, the detectives were unable to resolve this episode quietly and had to go through channels "all the way to the top." By way of apology, the thirty offenders were ordered to make a donation to the village school (rather than giving the huge quantity of saké that would otherwise be called for to the five detectives).

Second, sudden changes in the economy or in the supply of certain products that increased dependence on the commons as a source of some particular item would increase violations. This seems to have been the case in Yamanaka, which experienced a fairly severe breakdown of the rules during the depression of the 1930s. Almost all the villagers knew that almost all the other villagers were breaking the rules: sneaking around the commons at night, cutting trees that were larger than the allowed size, even using wood-cutting tools that were not permitted. This is

precisely the behavior that could get a tragedy of the commons started, but it did not happen in Yamanaka.

Instead of regarding the general breakdown of the rules as an opportunity to become full-time free riders and cast caution to the winds, the violators themselves tried to exercise self-discipline out of deference to the preservation of the commons, and stole from the commons only out of desperation. Inspectors or other witnesses who saw violations maintained silence out of sympathy for the violators' desperation and out of confidence that the problem was temporary and could not really hurt the commons. Yamanaka was also fortunate to have ready access to the Kitafuji slope, so that when its own commons was endangered the villagers could switch to its more widely shared commons instead. Finally, I strongly suspect that the rules villages adopted for the commons were very conservative and left wide margins for error, so that the violations that did occur did not often pose a serious threat to the commons. Interestingly, villagers did not question the rules themselves or become more casual about obeying them when they observed that violations did not damage the commons; the system of rules, and the values they embodied, seem to have been perceived as entirely legitimate and not subject to being challenged as unnecessarily cautious.

However, when villagers felt that the rules were too lax, or when they began to fear the environmental consequences of too many violations, they modified their management techniques in the direction of still greater caution in order to save the commons. For instance, when Yamanaka found in 1939 that the Kitafuji slope was no longer very productive, it converted its own commons--from which it had silently conspired to steal earlier that decade--into a closed reserve to make enforcement of the rules and identification of violators much easier. Similarly, when Hirano and Nagaike discovered that competitive cutting even on a closed reserve became a problem, they removed the incentives for individuals to race against each other on mountain-opening day by abolishing "keep-all-you-cut," instituting equal distribution, and assigning the harvest to households by lottery, which automatically reduced the frantic pace of cutting and thus the total quantity cut in a season.

OUTCOMES AND LESSONS

We have explored the experience of these three villages in governing access to their commons in order to diagnose the factors that help and hinder a community in dealing with common property. I must point out that, in addition to the rules and enforcement schemes, these three villages had other factors--their small size, their very strong community identity, and a sense of mutual interdependence that was reinforced by a formal structure of collective responsibility--that almost certainly enhanced their ability to make any regulatory scheme work, even a very badly designed one. Nonetheless, we can extract a few themes and suggestions about the necessary and sufficient ingredients of successful management of common property, all else being equal, since there was variation among the villages in the types of commons they possessed, in their respective risks of producing a tragedy of the commons, and in the economic changes they endured over time. Naturally, it is early to generalize from just three villages, and hazardous to extrapolate from the commons in a closed agrarian society in the historical past to common property problems today, but I will still take the liberty of presenting tentative conclusions that can serve as hypotheses to be tested and refined in later studies. I will organize these evaluations around four questions suggested by the facts themselves and by Oakerson's analytical framework.

Efficiency of Use of Common Property

One might handily dismiss the value of the Japanese experience with common property by arguing that the natural environment was never hard-pressed in Tokugawa Japan, and that communities never created tragedies on their commons because they were never very close to any trouble--that they would have succeeded at managing the commons no matter what they did because they imposed so little on their common resources. However, we must remember that in the 17th century the Japanese did face the threat of massive deforestation, and there is good reason to believe that within the limits of local preindustrial technology the Japanese were actually pressing their natural environment--their agricultural potential--to its limits by the late Tokugawa period.

Villagers knew how much forest they had to leave intact to produce the fertilizer they needed for their cultivated plots. It is not clear whether villagers got as much from the commons as the commons could have spared without deterioration, but to extract more from the commons would have required a still greater investment of labor. Village resistance to shogunal pressures to reclaim more arable land from the forest suggests that villagers viewed the reclamation of additional upland fields from the forest (inevitably of poorer quality than what they already had) to be an inefficient use of their labor, especially later in the period when conditions of labor shortage arose.

Villages sensed that they might be pushing the commons too far when they let the rules break down, and they did alter the rules to relieve pressure on the commons at various times, suggesting that Tokugawa and later peasants were indeed pressing the commons, and, by extension, that managing the commons did require both skill and planning. In other words, it seems clear that they did have to be concerned about an efficient use of their commons and were aware that haphazard control or management would threaten their resources.

Equity Among Co-owners of the Commons

It is quite apparent that Japanese villagers were deeply concerned with some notion of fairness. This can be concluded from the rules, the sanctions for violations of rules, the kinds of disputes over the commons that reached the courts, and from the explanations of behavior that are still offered today. Fairness was not synonymous with equality in material possessions--many villages had considerable inequality in holdings of private property and did not seem troubled by this.

But there was an overriding sense that access to the commons should be distributed according to some principle of fairness that ignored existing maldistributions in private wealth. Hence the frequent use of random distributions, assignment to parcels or products of the commons by lottery, frequent rotations to move the good and the bad around, and scrupulous attention to bookkeeping to keep track of contributions and exchanges and offsetting aid offered by one household to another. Such methods provided assurance to each co-owner that the sacrifices and gains of other co-owners would be similar, and offered the additional advantage of removing the competitive

impulse (which is very dangerous when it becomes a race to see who can deplete the commons first) and thus relieving pressure on the commons. Yet laziness was not rewarded, because someone who failed to do his share of the work lost entitlement to a share of the proceeds altogether. Nor did this notion of fairness mean that entitlement was automatic for all comers (the way food stamps or food aid sometimes are); a household had to earn its eligibility through some period of established residence in the village, and casual drifters were ignored.

Enforceability of the Rules

Violations of the rules and conflicts over use of the commons suggest that any rules for the commons must be designed to have an obvious and direct relationship to the goal of preserving the commons. Co-owners of the commons will not obey regulations that they regard as frivolous or arbitrary. They will obey regulations that are quite clearly based on maximum-sustainable-yield principles. They will consent to being deprived of certain products of the commons if they can be convinced that what they do not extract from the commons is truly needed for the long-term maintenance of the commons and that others will exercise similar self-restraint.

The Japanese experience also demonstrates that no rules are self-enforcing. Japanese villagers had a strong community identity and were very concerned about social reputation and bonds with the group, and they internalized the preservation of the commons as a vital goal. Nevertheless, even this most cooperative, compliant group of people were vulnerable to temptations to bend, evade, and violate the rules governing the commons. Thus there had to be a scheme of penalties, and these had to be enforced. The rules and the penalties had to be aimed directly at free riding, and to make enforcement possible at all they had to be designed to distinguish handily between good and bad behavior. It was hard to enforce the rules governing open commons without individual inspection of each user's activities. Therefore, as pressure on the commons increased, it became necessary to close off the commons so that any intruder could be instantly and automatically designated as a violator.

Moreover, villages not only assumed that violations could occur but that even the police or detectives who patrolled the commons would be tempted to stray and steal

from the commons or abuse their privileged position in other ways. Even though traditional Japanese were about as far from being libertarians as anyone might imagine, they too worried about who would watch the watchers. Correctives for this problem were built into the system: the watchers watched each other, collective responsibility applied to the watchers as well as to the watched, and the duty of watching rotated through the body of co-owners so that everyone got his turn to exercise power, to be suspected of abusing his power, and finally to prove himself innocent by exercising exemplary behavior on duty. All of this also suggests that small intimate communities of co-owners united not only by their mutual interest in the commons but by other social relationships were essential. The ever-present anxiety about preservation of the commons and the expectation that violators would harm the commons seemed in itself to operate as some sort of deterrent. (I am reminded of modern urban Japanese, who have the safest cities in the world and are simultaneously nervous wrecks about crime. They put bars on their first floor windows, build walls--sometimes topped with chipped glass--around their houses, and almost never leave their houses totally unoccupied. Asked why they exert themselves so over a nearly nonexistent problem, they offer the same reply as the man who snaps his fingers to keep the elephants away--"it works, doesn't it?")

Although the system of collective responsibility by community, kumi, and household is not at all attractive to someone who values liberty, we have to admit that it was a very cheap tool for enforcement because it encouraged each village, each kumi, and each household to monitor its own recalcitrant members. A somewhat more palatable lesson may be in the use of a unit other than individuals for calculating contributions to and benefits from the commons: this practice seemed to induce each unit (here, the household) to restrict its own size--and by extension to restrain its own demand for products of the commons.

Finally, these villages had an escalating scale of penalties that began with confiscation of the contraband taken from the commons--instantly negating the advantage of violating the rules--and proceeded through gradual stages of exclusion from the commons and eventually from all contact and exchange with other co-owners of the commons. This scale of punishments may seem harsh, but in fact it operated rather gently, most violators confessing and apologizing quickly rather than having to suffer more severe consequences. This graduated scheme of punishments

to fit the offense may be very important in controlling repeat offenders: the desperate know that they may be forgiven this once, but the malicious know that they will suffer severely.

Legitimacy of the Rules

In conclusion, it is also important to point out that the villagers themselves invented the regulations, enforced them, and meted out punishments, indicating that it is not necessary for regulation of the commons to be imposed coercively or from the outside. This, along with the fact that villagers could change their own rules through a process of consultation and consensus that was democratic in form if not always in fact, almost certainly increased the legitimacy of the regulations. Although the Tokugawa social order was very oppressive toward individuals whom it classified as "deviant," the village itself was largely self-regulating in this regard, and did not require intervention by an autocratic state to protect the commons. The implications for democratic processes and individual liberties in societies that face tragedies of the commons are mixed: there is, indeed, something ominous and inequitable about a system of collective responsibility that victimizes innocent members of groups that contain free riders, and about the village's power to impose ostracism to the point where life is threatened. The importance of uniform and impartial applications of law, the restraint exercised before harsh penalties are employed, and the room for democratic rule making and rule amending are more assuring.

NOTES

1. I would like to thank David Feeny, Pauline Peters, and Kristina Kade Troost for very helpful comments on an earlier version of this paper. I am also grateful to the Joint Committee on Japanese Studies of the Social Science Research Council and the American Council of Learned Societies, as well as the Duke University Research Council, for the support that allowed me to gather material for this study.
2. Estimates are that there were between 70,000 and 150,000 villages before amalgamation.
3. For a summary of the literature on free rider and public goods problems, see McMillan (1979). Other major works are G. Hardin (1968); R. Hardin (1982); Olson (1965); Brubaker (1975); Buchanan (1968a, 1968b); Coase (1974); Demsetz (1964); Frohlich et al. (1975); Furubotn and Pejovich (1972); Groves and Ledyard (1977); Sweeney (1973, 1974); Mishan (1971); and Stigler (1974). James Buchanan (1975) reaches the unhappy conclusion that exclusion must be used.
4. The great body of Japanese scholarship on common lands is devoted to this process of attrition and the legal and social controversies it engendered. Fortunately, Japanese scholars tend to be meticulous about publishing early documents and gathering details as they go, and as a result the primary materials compiled by these scholars serve as a catalog of management practices and even of disputes over how to deal with abuse and abusers of the commons.
5. The brief history of the nationalization and decentralization of landholding that follows is based on two studies by Asakawa (1914, 1929a) that are reprinted in Asakawa (1965); and Asakawa (1918); Arnesen (1979); Duus (1969); Hall (1966:99-295, 1968, 1981); Smith

(1968a, 1968b); Sato (1974); Mass (1974); Wintersteen (1974); Miyagawa and Kiley (1974); Nagahara and Yamamura (1974; 1981); Ishii (1980); Sansom (1958:339-389); Totman (1979); Wakita (1982).

6. Kurosawa Akira's well-known recent film, Kagemusha, is a reasonably accurate account of the rise and fall of Takeda Shingen and his son Katsuyori, very serious competitors during the final stages of this struggle for political leadership during the 16th century. Shingen's double, the shadow warrior who is the centerpiece of the film, is fictional.

7. Another Kurosawa film, The Seven Samurai, is a plausible depiction of the struggle of one such village to protect itself against ravaging bands of warriors and thieves during the 15th and 16th centuries.

8. On the attrition of common lands since the Meiji period, see Furushima et al. (1966); Hōjō (1979b); Kainō (1958, 1964); Kawashima et al. (1959-61); Watanabe (1972).

9. A crucial distinction between owning a share of the commons and owning any other form of property jointly with others is that traditional co-ownership rights to the commons are conferred only on households of long standing in the village, and they cannot be sold to anyone else. Each household possesses one share in the commons and no more, and households or persons not invited into the group of co-owners (iriai shūdan) are simply not entitled to a share. For a brief explanation of the current legal status of ownership of common access rights, see Watanabe and Nakao (1975:67-97).

10. Kristina Kade Troost's (pers. com. 1984) dissertation research (in progress) on the indigenous development of village governance for three villages on Lake Biwa near Kyoto that kept their own documents has uncovered examples of all three of these forms of management (classic, direct group control, and divided use) well before the Tokugawa period.

11. The most important general work on the history of the evolution of common access rights is Furushima (1955). The major works on the history of the common lands in the particular area studied here--Kitafuji--

are Hōjō and Fukushima (1964); Hōjō (1977:191-433, 1978, 1979a); Kamimura (1979); Oshima (1978); Watanabe and Hōjō (1975).

12. These three communities were three independent villages or mura during the Tokugawa period, and I will continue to use the term "village" to refer to the classical Tokugawa-period village. Since 1868, the Japanese government has encouraged administrative amalgamation of villages. The three villages of Yamanaka, Hirano, and Nagaike have in fact been amalgamated once so that together they now compose one modern village, called Yamanaka-mura, but they have rejected further amalgamation with additional communities in the area.

13. The Japanese government expropriated Mount Fuji's north slope in 1939 for use as a military base but guaranteed that it would continue to honor traditional access rights. Villagers recently fought a lawsuit claiming that the government frequently denied them access without cause and that military practice on the land has disrupted the ecosystem and damaged the trees so that certain plants are no longer available. The villagers won, and now receive regular compensation from the government for damage to their commons. During the trial, the Japanese Self Defense Forces (SDF) continued to use the land for practice, and at that time the villagers entered the land in nonviolent protest to prevent these military operations. Many who follow the news in Japan are familiar with these Kitafuji protests against the SDF, but do not realize that the cause of the protesters is not pacifism so much as it is the tradition of centuries-old rights of access to commons. Similar arguments underlie the famous farmers' protest against the construction of Narita Airport on an expropriated commons.

14. The following descriptions draw principally on the work of Hōjō Hiroshi, Kamimura Masana, and the interviews that they arranged for me. A shorter version appears in McKean (1982).

15. The Tokugawa administrative structure, established in the early 1600s, is sometimes called "centralized feudalism," a bewildering and misleading label for a political system that was at once federalist,

authoritarian, highly bureaucratic, and perhaps even totalitarian in the extent to which the state controlled information and monitored individual lives. On the Tokugawa political order, see Duus (1969); Hall and Jansen (1968); Ishii (1980); Totman (1967). Berry (1982) suggests that Hideyoshi began much of what Ieyasu has been given credit for.

16. One aspect of this confusion is just how long the Tokugawa shogunate really exercised the peremptory powers and tight administrative controls that are implied in the formal structure it created. Recent evidence on the relationship between the shogunate and its supposedly most loyal subgroup of daimyō suggests that after the first three shoguns, central control began to decline. The Tokugawa gradually lost the ability to enforce the use of their currency in the domains and to extract the tax revenue they expected from the domains, and they never were able to exert control over the seemingly irrepressible growth of commerce. See Bolitho (1974). However, even if the daimyō acquired considerable independence from the shogunate, we cannot be sure that the daimyō were any less autocratic toward their subjects than the shogunate controls had been.

17. After the Meiji restoration, all land was re-registered so that it could be taxed anew by the young government. At this point, much of the land that had been held and used in common by villages all over Japan was registered as public (national or government-owned) land, and the system of commons was greatly reduced. Villages were able to protect their commons against expropriation by the land-hungry Meiji government only if they had ample documentation of use rights acknowledged by Tokugawa-period daimyō or revealed in legal decisions made when disputes over land use arose during the Tokugawa period.

18. For the consequences of such a separation of land rights from tree ownership in Niger, see Thomson et al., this volume.

19. On the early development of Japanese law, see Asakawa (1929b); Bock (1970); Mass (1979); Grossberg and Kanamoto (1981); Wigmore (1969).

20. An interesting exception to this trend is available

in Henderson (1975:66-67), in which two villages that could not agree on the precise location of a boundary between them decided to create a joint commons for grass in the area in dispute instead.

21. On the traditional village, see Asakawa (1909-11); Befu (1968); Smith (1959, 1968a); Nagahara and Yamamura (1974); Chambliss (1965). For twentieth-century survivals of these traditional forms of organization and cooperation, see Embree (1939); Fukutake (1967); Shimpō (1976); Marshall (1984).

22. Tsurumi Kazuko (1975) summarizes these views of the traditional village. See also Irokawa (1973a, 1973b: 508-564); and Gluck (1978).

23. The argument that slow population growth in the Tokugawa period was a result of natural disasters and famines--these definitely did occur--has been thoroughly trounced. Detailed studies of family size and income based on the shūmon aratame for villages with fairly complete series of registers for the Tokugawa period demonstrate that Japanese farm families chose not to reproduce rapidly after famine, that they limited family size even during good economic times, and that wealthy families and wealthy villages as well as poor ones limited family size. Hanley and Yamamura (1977) and Smith (1977) conclude that the effort to limit family size was a conscious one intended to increase the family's standard of living. Kalland and Pedersen (1984) agree but argue that the family's motives might have had a darker side as well: to increase the family's standard of living and therefore its potential for savings and accumulation as insurance against potential destitution in the future. These are essentially the glass-half-full and the glass-half-empty versions of the same argument. See Smith (1977); Hanley and Yamamura (1977); Kalland and Pedersen (1984).

24. Smith (1977:1-14) and Hanley and Yamamura (1977: 92-334) point out that Tokugawa Japan's low population growth rates came not from high death rates but from a combination of low death rates and low birth rates (20-30 per thousand). Combined with a reasonable average life expectancy for preindustrial society (to the early 40s), this meant that throughout the Tokugawa period two-thirds of the population were productive adults supporting a

dependent population of children and elderly one half their own number. Such conditions have been matched in history only in preindustrial Europe, where low birthrates were due in part to some attempts at birth control but more importantly to even later female marriage than in Japan (the late 20s in Europe), and most critically of all to the very high rates (more than 50 percent of the adult female population in some times and places) of celibacy thanks to Catholic nunneries. Kelley and Williamson (1971) concluded in one of their early studies that the low population growth rate in the Tokugawa period was the single most important factor permitting the later rise of the Meiji. Later, however, they retreated from their earlier stress on low population growth as a factor in economic growth; experimental simulations of Meiji economic models had shown that Japan could have sustained almost as much economic growth in the Meiji period as it in fact experienced even with the very high rates of population growth that we are familiar with today in developing countries. However, their counterfactual simulation run tested the effect on Meiji economic growth of a higher Meiji population growth rate (starting in 1887), and did not concern the role of low Tokugawa population growth rates in permitting capital accumulation during the Tokugawa period at all. It is quite possible that high population growth rates during the Tokugawa period would have produced very different conditions for the Meiji economy to work with, quite possibly absent the potential for subsequent take-off. See Kelley and Williamson (1974).

25. Kumi are sometimes considered survivors of the Tokugawa five-man groups. See Embree (1939:112-157); Fukutake (1967:96-104). The major work on kumi and other horizontal organizations in the traditional village has been done by followers of Yanagida Kunio's school of folklore, particularly by Segawa Kiyoko and Sakurai Tokutaro.

26. I am assured by students of forestry that brief brushfires of this sort that do not penetrate the soil to burn roots do not tax the ability of a natural system to restore itself.

27. Gradually, with the commercialization of agriculture, it occasionally became possible for a household to buy its way out of these obligations by contributing

equipment instead of labor, or cash for some needed collective purchase, or even to hire someone else to stand in; on the other hand, this was regarded in some villages as dereliction of duty and the unfair exploitation of economic advantage, so substitution of material contributions for labor was not allowed.

28. If the offender belonged to another village, the village whose commons was violated would have to take its case to the local magistrate for adjudication, and indeed we find many such disputes in Tokugawa records. Villages might make reciprocal claims of violations against each other, and the documents presented and the decisions rendered formed part of the documentary record by which villagers were later able to establish their claims to commons in the Meiji period.

29. I have drawn these examples from Kamimura Masana's research and from several interviews with former commons detectives who were remarkably forthcoming about matters that would not ordinarily be revealed to outsiders. I am very grateful to Professor Hōjō Hiroshi for giving me the introductions that allowed these candid discussions to take place.

30. When the ostracized man's children went out to play, other children threw stones at them. When the grandfather of the household drowned in Lake Yamanaka, no one would come to help recover the body. At the funeral, rather than helping to carry the coffin, the village fire brigade actually tried to block the path to the cemetery until prefectural police arrived. Then finally the man's house burned down--it is said that village officials actually started the fire intentionally--and no one came to his assistance. When other villagers felt sympathy for the man's perfectly innocent family, village officials pointed out that having any contact with a family that was the target of ostracism would destroy the effectiveness of the sanction and make the contactor subject to ostracism, too. The fear of spreading ostracism was so powerful that even though prefectural police arrested some of the onlookers at the fire for negligence (standing idly by was actually a violation of fire laws), no one offered to help extinguish the fire. This episode of ostracism

lasted 5-6 years, and it took four generations for the family to shake off the taint of having been ostracized. See Kamimura (1979:219-222).

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PART THREE: Conclusions

Closing Comments at the Conference on Common Property Resource Management

Daniel W. Bromley

After a week of stimulating exchange we are left with the following question: are there useful activities in which the development assistance community might engage that can enhance resource management regimes in the developing countries? The prior question, of course, is whether we know enough about resource situations and the structure of resource management regimes to: (1) recommend a specific regime in a particular resource situation; or (2) analyze the fact situation in a particular resource setting and make pertinent statements about needed change to solve an observed problem?

Each of the systems under discussion this week has a fixed capacity to support humans. However, too often we see these systems criticized because they will not continue to support ever-increasing populations. In fact, agriculture practiced on private lands also has a finite capacity to absorb more people. With conventional agriculture, fewer and fewer people are able to be supported as "progress" occurs, and the surplus production is used to support consumption in urban places. It is certainly no fault of a particular resource--nor of its management regime--that a finite population is required; it is wrong to think otherwise.

If we escape the logical trap of expecting ever-increasing populations to be supported by these natural resource complexes, then we are free to ask more

pertinent questions. I suggest that one of these concerns the sustainability of a particular use regime pending further articulation of ultimate resource and user disposition. If there is a decision to overexploit the resource, then let that be a conscious one, not one made by default. If there is to be a decision to exclude people from using the resource, then let that decision be a conscious one, not one that follows inexorably from resource exhaustion.

The problem, quite often, is that these resource systems are asked to absorb the very people who cannot be absorbed by the more conventional agricultural regimes found on private lands. In essence, people are marginalized, and the marginal ecosystems are asked to take on those sloughed off from the highly commercialized lands; the exclusion rights that run with fee-simple land redirect people to the marginal ecosystems. It hardly seems fair to condemn these resource complexes for failing to do what the commercialized ecosystems cannot do.

A common property regime is really a people management regime. The presumption of a private property regime is that people management is not an interest of the collective. Indeed, the premise is that the sum of actions taken by a large number of atomistic entrepreneurs will contribute to the larger public good. With common property regimes, the presumption is that the interests of the group transcend the individual interests--at least with respect to the use of certain resources during particular times of the year.

Turning to a discussion of the performance of common property regimes, I suggest that we consider a management goal to be a level of sustainability of such renewable resources that gives future generations the option to continue such management or to liquidate the resource. This goal does not advocate sustained yield for its own sake, but rather casts sustained yield as an explicit human choice that passes on to the future what we have inherited from our past. Each successive generation retains the option of destroying the resource, but carries the burden of breaking the "golden rule" of resource use. This management goal says, in effect, let us not exhaust natural resources by accident or by default; if we do exhaust the resource, then let it be explicitly, so that we might then have a plan for what we will do when the resource is gone.

I support purposeful sustainability as well as purposeful exhaustion, if that should be the social

decision. As resources are sustained, future generations have the option of continued sustainability or of purposeful exhaustion. Of course there are economically optimal plans for utilizing both renewable and nonrenewable resources, but that must be understood as only one of several possible management strategies.

While our focus this week has often been with the management and protection of natural resources rather than with those who depend on such resources, we should recall that development assistance is equally to be concerned with preventing a continued decline in human welfare within degraded resource regimes. In most instances, improved resource management can restore or improve human welfare. In a sense, we are dealing with problems of human relations in common property regimes. This degradation of the management regime is often less visible than is the degradation of the physical resource. If development assistance can correct the degraded management regimes, then human welfare will surely increase.

ON CONCEPTS AND LANGUAGE

Throughout the week I have observed a persistent and potentially troublesome problem with language and concepts. I would start by asking that we ought to be very careful in our use of the terms "common pool resources" and "common property resources." We have not yet arrived at a consistent definition of what is, and what is not, a common pool resource. More seriously, to talk of common property resources may leave the impression that there are certain natural resources that are only controlled by common property arrangements. After all, do we ever talk of "private property resources?"

I believe that is preferable to talk of resource management regimes. There are natural resources that are managed (even mismanaged) by common property regimes, just as there are natural resources managed (and, yes, mismanaged) by private property regimes. But to talk generically of common property resources is to suggest that there are resources that belong uniquely to a particular control/management/institutional regime. Of course this is false.

Hence, let us talk of alternative management regimes--really institutional structures--and then explore the efficacy of those regimes for a specific natural

resource in a particular situation. We then have four candidate regimes: (1) open access regimes; (2) common property regimes; (3) private property regimes; and (4) state property regimes.

Moving to the more detailed matter of language and concepts, I believe it would lend continuity to our future discussions of common property regimes if we adopted some consistent definitions.

I would propose that we regard a primary decision unit as one that is the basic economic decision unit in a society with respect to managing assets, allocating resources, and for managing risk. The primary decision unit (PDU) is a domain of redistribution of the most primitive sort; it is the minimal management unit in the society under study. For some societies, the PDU may be the individual, in others it may be the family, and in still others it may be the kinship group. Of course the PDU will vary depending upon the particular management decision under consideration. This unit is worthy of definition because the very essence of the "common" is that more than one PDU is involved in its use. We must also recognize that for different times of the year, and with respect to different assets, the primary decision unit will differ. In the Swiss Alps, for example, the family is the PDU for arable lands, but the co-equal owners of the alp become the relevant decision unit during the summer grazing season. When multiple families come together to make decisions regarding summer grazing, we might regard this as a resource decision unit.

A resource decision unit is a constellation of primary decision units that are jointly involved in the management and control of a common resource. In common property regimes, it is the resource decision unit (RDU) that will determine rules for deciding who is in the group and who is not, as well as the rules controlling use rates of those recognized as being "in."

The discussion this week has also suffered by persistent yet inconsistent use of the term "property." Property is a secure expectation over some benefit stream, with the security arising from collective sanctions and enforcement. Property represents the owner(s), and the thing(s) owned, against all others with an interest in the thing(s). Property is the social convention that precludes all others from converting their interest in the asset (or income stream) into a claim. These others have duties to observe the rights of the owners.

Once this basic truth is apprehended, it becomes logically impossible to denote open access situations as common property. For where group size is not controlled, and/or any potential user may make unrestricted claims on the asset, then it is not possible for any particular user to have a claim to a benefit stream; all the users have access. The popular phrase "everybody's property is nobody's property" is thus seen to be nonsense. What should be said is that "everybody's access is nobody's property."

We have heard much this week about free riding, yet it is not yet clear what we have meant. I propose that we regard free riding as the shifting costs others bear as a result of actions I take either: (1) because I expect others will do the same; (2) because I do not know (or care) what others will be doing; or (3) because I am convinced that I will be the only one to do so and thus will not be noticed.

Transaction costs play a prominent role in the use of common pool resources. By transaction costs economists mean the real or monetary costs of: (1) gathering information; (2) arranging bargains with others; and (3) enforcing bargains that have been struck.

Property regimes represent specific aspects of the broader institutional structure in a society. By institutions we mean the structure of rules and conventions that define individuals vis-à-vis others, as well as with respect to objects of value. An example of institutions would be the rights and duties that define users with respect to a common resource. Organizations, then, which are often confused with institutions, become entities that exist pursuant to an institutional structure--examples would be a water-user's association, a panchayat, or a fishermen's group.

Consider now the four types of management regimes over natural resources. Under private property, it is the primary decision unit that retains ownership. This means that PDUs can independently determine use rates, can reap the income from the asset, and can alienate it at will. The institutional structure is such that PDUs retain exclusive rights over the resource.

Under common property, resource decision units (RDUs) are formed when multiple PDUs unite with respect to the management and control of the particular resource. Each PDU retains important rights in the service flows from the resource (the income stream), yet each PDU also has certain duties with respect to other PDUs that are considered part

of the resource decision unit. The essence of common property is that a certain number of PDUs have explicit rights to be included in the management of the resource, as well to share the income stream arising from the resource. But with those rights also come duties to respect the rights of other PDUs. Common property can often be thought of as "private property with consensus" among the relevant PDUs.

State property gives no rights to primary decision units, yet each PDU has duties. A military reservation is an example of state property.

An open access regime is one in which each PDU has access to the resource. There is no property in an open access situation since there are no secure claims on resource services.

In essence, the management regimes under study this week have consisted of a constellation of rights and duties, and privileges and exposures. These institutional arrangements give rise to patterns of interaction among resource users that will determine the ultimate fate of the resource base--and so of the dependent populations. Management regimes are not successful when those institutional arrangements lead to counterproductive patterns of interaction vis-à-vis the resource. The problem for the scientific community is to learn as much as we can of the intricate relationships that exist among the ecosystem, technique, and the institutional arrangements that influence human interactions. This has been an inspiring session, but the real work still lies ahead.

Issues of Definition and Theory: Some Conclusions and Hypotheses

Elinor Ostrom

Pauline Peters made some perceptive comments last evening that have stimulated some of these remarks. She first indicated that it was important to recognize that many seemingly different resource systems, previously described with different terminologies, share central characteristics of common-pool resource systems. Pauline stressed, however, that it was also important to recognize that different types of resource systems had been brought together under this broad unifying concept; she urged us to be careful to distinguish among the systems we examine.

This is the way that I view the scientific endeavor. The world in which we live is so complex that our first problem is how to cluster phenomena so that we can understand some processes in the most general way. It is hard to develop theoretically useful ways of clustering phenomena, but once we've done so, we must be careful not to let the use of terms that focus on similarities fool us into thinking that everything clustered together is similar on all dimensions.

In our discussion yesterday, Ford Runge talked about culture and the specific rules used by individuals to organize contractual arrangements; he characterized both as being important in reducing the time and effort required to organize joint activities. Without cultural norms and rule systems, every pair of individuals would have to

organize each and every activity using a short-term contract. Today, they would have to agree to form a team to go hunting. Tomorrow, they would have to agree to build a house. Still later, they would have to agree on ways to bring water to the village. Instead of spending substantial time and effort in negotiating each of these short-term contracts, individuals can develop generally accepted rules governing community life. Such rules state who will do the hunting, and how the hunt will be shared, as well as who will build the houses, and how housing will be allocated. Specialization of labor and definite rules for allocating tasks and benefits save lots of time in unpleasant haggling over how individuals organize their efforts to survive.

The classification of the world into classes and subclasses of events is also a great economizer. Once the concept of a tree is developed, one does not have to treat each tree as a unique event. By giving things general names, many properties of these unique events can be viewed as the same. General ways of relating to the specific instances could be developed.

We are attempting to classify the world into the most economical set of concepts to enable us to understand the similarities and differences of processes associated with broad classes of individual events. No single method of classifying events will serve all purposes. Many of those attending this conference have developed different, but effective, scientific classification systems based on major attributes of biological systems. It took a long time for biologists to develop the most economic and effective way of classifying biological species and the process continues. After many trials and much scholarly conflict, biologists have developed a relatively useful general scheme for organizing phenomena into an inclusive, conceptual hierarchy.

Knowing that an animal is a mammal immediately conveys substantial information about expected behavior. We immediately know, for example, that young mammals are dependent upon the mother for a long period of time before they are ready to go forth and seek their own food. Being told that an animal is a mammal is not, however, the last of the knowledge that can be obtained from biological classification systems. All members are further subdivided into an inclusive, conceptual hierarchy. While some theoretical generalizations can be made about all mammals, other propositions are made only about a subset of

mammals. Still other propositions can be made about only a subset of a subset of mammals.

Returning to our task, we are trying to understand how difficult property systems affect the incentives of participants, their interdependent behavior, and the outcomes they produce for themselves and others. Several of us have been trying to develop a system for identifying a broad class of resource systems, which we have called common pool resource systems. We have then attempted to ascertain the problems of organizing human behavior in relation to this entire class of resource systems. We will initially make two types of errors in this endeavor, since we are still relatively new at it. This is the thrust of Pauline Peters' cautionary note (see this volume). The two types of errors are:

1. A wrong assertion that a proposition about relationships between resource systems and property systems holds for all common pool resource systems when in fact the proposition holds only for a subset of such systems.
2. A wrong assertion that a proposition about relationships between resource systems and property systems holds for only a subset of such systems when the proposition actually holds for the entire class.

Peters is concerned that the emphasis on a general level would lead to the first type of error. She is wise to warn of the dangers of an overemphasis on the similarities of all common pool resources. However, too much emphasis on the particular leads to the second type of error. In this instance, scholars assume that a proposition is related only to a specific type of situation when it actually holds for a broader class of situations. As long as scientific discourse develops around very specific situations, we are apt to make errors of the second type.

My strategy to cope with these epistemological threats would be to urge that we first try to develop broad, conceptual definitions and theoretical propositions stated at as broad a level as possible. When we conduct research and find that such propositions do not hold at the broadest level, we can begin to proceed downward to ascertain how many further conditions must be met before the proposition appears to have scientific warrant. Eventually we either

reject the proposition as describing no "real" situation, or find the appropriate level of generality. I think this is a better strategy than starting with a discretely stated proposition.

Let us then begin to identify the relevant characteristics needed to most economically identify classes and subclasses of common pool resources on the one hand, and of organizational forms on the other. First we turn to the world of events. For a long time, economists classified the world of events--commodity space--into two broad classes: "pure private goods" and "pure public goods." This classification was based on variation along two analytical dimensions: exclusion and jointness of use. Purely private goods can be excluded at relatively low cost from those who did not produce the good. Such goods are consumed individually and not jointly. My consumption of a private good subtracts that particular item completely from your set of options. Pure public goods have the opposite characteristics. Once such a good is produced, it is difficult or costly to exclude others from consumption. Further, my consumption of a pure public good does not subtract from the availability of that good to you. The concepts of "pure private goods" and "pure public goods" group broad classes of phenomena that share the extreme points along two dimensions of exclusion and jointness.

Dividing the world into two classes of events based on two (rather than a single) dimension, should have hinted that a dichotomy may not be the most useful way to classify phenomena for the purpose of understanding how organizational arrangements work. Further, referring to the events in the world--the phenomena--by names ("private" and "public") that are most closely related to the presumed "optimal" organizational arrangements for their provision has also created confusion. The phenomena in the world were given names that were too similar to those of the organizational arrangements that many thought were needed to make the best decisions related to their provision.

Looking briefly at this earlier classification, we can see somewhat better where we were. As shown in Figure 1, the concepts of exclusion and jointness were used to define two types of phenomena: private goods and public goods. Similarly, the concept of free entry was used to distinguish two broad types of organizational arrangements: the private market sector and the public sector.

The market has been conceptualized as an area in which

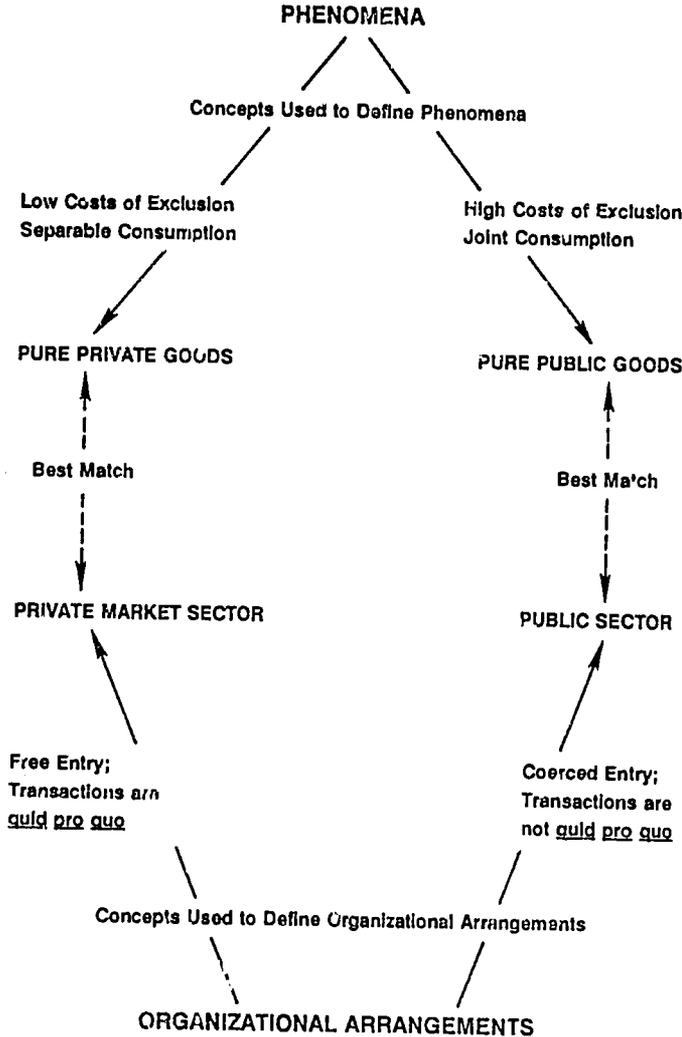


FIGURE 1 The dichotomous view of phenomena and organizational arrangements.

individuals--both buyers and sellers--are free to enter and exit. Contracts are made by mutual consent. Transactions involved quid pro quo relationships: something specific is exchanged for something else specific. The public sector has also been characterized using entry rules. Here the fundamental relationship is that one can

be coerced into a jurisdiction and may find it costly to leave. In a modern "state," there is no place to go to escape coerced payment to some public jurisdiction or, most likely, several jurisdictions. Choice of a residence carries with it membership in a set of public jurisdictions to which one will pay taxes. We cannot engage in quid pro quo relationships with our public jurisdictions at the individual level. We cannot directly tell the U.S. government that we would like so much national defense this year and so many social services. We must try to do some of this through the imperfect mechanism of electing representatives to articulate our preferences for us.

Microeconomic theory concludes that market arrangements lead to optimal patterns of production and allocation of pure private goods, but that some form of organization in the public sector is necessary to obtain optimal levels of public goods. When the opposite organization is used to produce either type of good, institutional failure is predicted. Dichotomizing both the world of phenomena and the world of organizational arrangements proved to be a useful initial strategy for considerable theoretical development. But these dichotomies are not sufficient to analyze the problems of concern to those of us interested in common pool resource systems and common property organizational arrangements.

We are grappling with a mixed phenomenon that has attributes of both pure private goods and pure collective goods. Similarly, common property management arrangements are neither simple market nor public sector arrangements. A definition of a broad class of phenomena called "common pool resources" is: a natural or man-made facility that produces a flow of use units per unit of time (or several flows of different types of use units) where exclusion from the resource is difficult or costly to achieve and the resource can potentially be utilized by more than one individual or agent simultaneously or sequentially.¹

This is still a working definition and needs further refinement, but it seems to capture the broad class of phenomena that have been discussed at this conference. And it clearly separates the phenomena from the institutions used to regulate its use. Institutional arrangements will be discussed below.

By distinguishing between the resource system and the flow of use units produced by such a system, one can use the attributes of jointness and exclusion to identify a third, broad class of events relatively well. The problem

of exclusion is related to the resource system itself: the ocean fishery, the common pasture, the forest lands, the large irrigation system, etc. Once exclusion is conceptualized as a variable, one recognizes that the cost of excluding individuals from resource systems varies across different types of common pool resources, and even within types of common pool resources, such as fisheries. The problem of devising a system of enforceable rules to exclude anyone from an ocean fishery, as contrasted to an offshore fishery, is obviously of a different order of magnitude.

While many individuals can jointly consume use units from the same common pool resource, the actual consumption by one person is subtractive in terms of the use units. The problems of congestion and degradation illustrate the subtractive nature of using a common pool resource; these problems are not characteristic of pure public goods. My consumption of scientific knowledge, or any other pure public good, does not subtract from your consumption of the same knowledge. On the other hand, my gathering morel mushrooms on the commons subtracts from the number of mushrooms left for you. Congestion and degradation are the key problems of interest across all of the case studies. Viewed this way, common pool resources share one attribute in common with pure public goods (cost of exclusion) and one attribute with pure private goods (separable consumption).

Turning to the organizational or institutional spectrum, it is also possible to identify organizational arrangements in addition to the private market sector and public sector (see Figure 2). Common property management systems are those that have some clear-cut role for who is and is not a member: the "ins" and the "outs." As I have thought about these entry rules during the week, it seems to me that entry into a common property organization arrangement is either by rights or by invitation. By right, you were born, or otherwise incorporated, into this tribe, village, extended family, or other collectivity. Thus, you have a right to the use of property held by the collectivity. When entry is by invitation, it means that both you and those whom you are joining must agree that you can become a member. Entry into a cooperative is of this latter fashion.² Further, common property management systems involve some form of regulated use patterns.

The open access sector is characterized by unrestricted entry and unregulated use. Unfortunately, many scholars

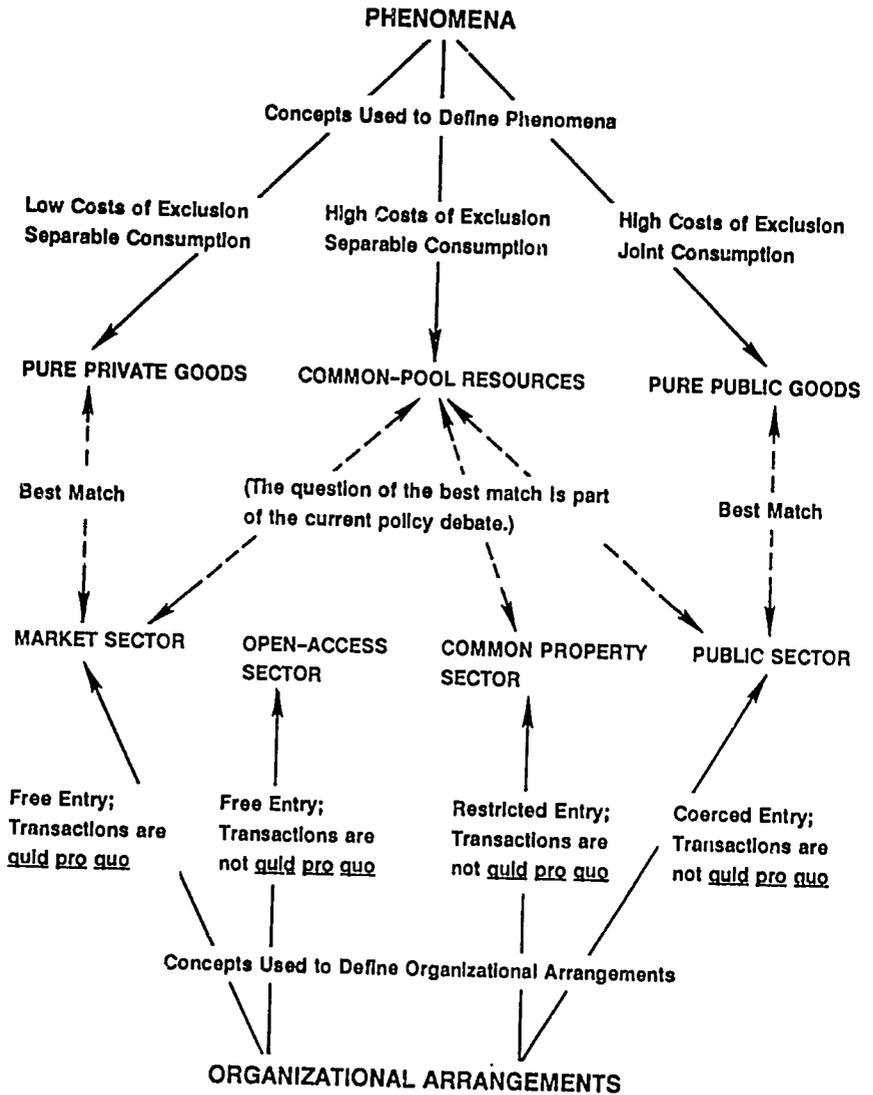


FIGURE 2 A more complex view of phenomena and organizational arrangements.

confuse open access arrangements with common property arrangements. As Bromley and Runge have argued in this volume, this confusion needs to be alleviated. Open

access arrangements lead to many perverse results when used with any type of good. Common property arrangements may, on the other hand, work very well in helping individuals to manage some common pool resource systems. Thus, we can think of at least four types of arrangements that could be used in relationship to phenomena in the world.³

The key question is that of a good match between the resource system and the organizational arrangements used to manage the resource. In regard to common pool resource systems, different prescriptions are made. Some analysts focus entirely on the separability of consumption of these resources and argue that rights to specific quantities of use units should be defined and managed by arrangements similar to a private market; this is the privatization camp. Others focus entirely on the problem of exclusion from these resources and argue that the management of these resources should be turned over to central government authorities; this is the central government camp. Others, including some of the participants at this conference, argue that in regard to many, but not necessarily all, common pool resources, it is possible to use common property management methods. I tend to identify with this third camp.

The successful case studies discussed here demonstrate that some common property management systems work very well. The cases also provide evidence that more common property systems exist than central government and donor agency officials presume. On the other hand, considerable evidence exists of common pool resource systems that have not been successfully managed. Major fisheries have disappeared. Traditional grazing areas have become deserts. Irrigation systems have been neglected.

Thus, the question of how organizational arrangements are well-matched to common pool resource systems is key to the further understanding of the management of such resources. How such organizational arrangements survive over time is the next question requiring further work. Finally, the question of what factors enhance the performance of common property management systems must be raised.

Let me turn first to the issue of origin. To examine this question, let us first define the concept of a user group. A user group is a set of individuals that makes (or has claims to make) use of a particular common pool resource. A user group may live in or nearby the common pool resource or live far away and travel to the resource (which itself may shift locations) to harvest use units.

Jim Roumasset used the term "latent group" at the conference to describe the same concept. A user group is "latent as a group" until those in the group establish rules to define membership and order activities within the group. Entry rules can be used as a distinguishing characteristic between latent user groups, with no organizational arrangements, and some form of a user group organization (UGO) that may be able to undertake some form of common property management.

A UGO has at least a minimal rule for defining who is and who is not a member. When membership is associated with access to a common pool resource, a UGO is a minimal form of organization that may be able to undertake common property management. In addition to making and enforcing entry and exit rules, UGOs frequently also engage in other activities, such as: (1) making and enforcing rules to regulate patterns of use of the resource (e.g., partitioning rules--who, how much, and when various individuals with particular types of claims can consume use units); (2) assessing penalties on outsiders and insiders for rule infractions and developing conflict resolution mechanisms; and (3) organizing investment in the enhancement of the common pool resource as well as raising revenue through diverse arrangements.

A major, though tentative, finding coming from the conference is that it is highly likely that any relatively small residential group that has lived for a long period of time in close proximity to and dependent upon a common pool resource system of moderate scarcity (given the demands made by users) will have organized some type of UGO.

This tentative finding formed the underlying premise for our recommendation to policymakers: that host country and donor officials should assume the local organization exists until they establish otherwise, instead of assuming that no local organization exists in relationship to common pool resource systems. This recommendation, which reverses the burden of proof currently in vogue, is based on an implicit proposition. The underlying proposition is this:

- o If not prevented from exercising local organizational capacities by central governments, UGOs will be organized by user groups whenever:
 - the user group is relatively small and has lived in close proximity and dependent upon a common pool resource for a long time;

- the flow of use units is moderately scarce when compared with the demands that individuals within the user group make upon the common pool resource; and
- the resource is subject to multiple uses (simultaneous and sequential) and hence requires careful coordination and management of use.

Now we have the beginnings of a testable proposition of the type that Roumasset pushed us toward last evening. The proposition, as stated, applies to most smaller, common pool resources that exist on land or near to a shore.⁴ By definition, it excludes ocean fisheries. If we now find situations meeting these conditions and no UGO, the proposition will have to be revised to add further restrictions based on further evidence.

This proposition is arrived at inductively from the cases and discussion this past week. It would be possible to derive this proposition from a relatively simple theory of the type that Ford Runge sketched here yesterday, focusing on the relative benefits and costs of different types of contracts among individuals to organize production activity in diverse ways.

This initial proposition states that, given particular conditions, a UGO will eventually be organized. It is also possible to generalize further from our cases and discussion about the relative difficulty or ease that diverse user groups may face in attempting to create UGOs. The fewer difficulties that a user group faces, the faster the group should form a UGO. Thus, these propositions are related to the speed of organizing. When scarcity of a common pool resource becomes apparent to user groups, the speed with which they are able to organize is dependent upon:

1. Some heterogeneity of asset structure. Remember our discussion of the need for some entrepreneurship to get an organization started even though homogeneity may help later. The relevant example is the businessman who helped start the fisherman's cooperatives in Turkey.
2. Some prior or concurrent experience with other local organizations that provide an easy model to copy. Negotiating the constitution of a UGO from

scratch is much costlier than borrowing the basic structure of a constitution from an extant organization. The "model" UGO may be in the immediate neighborhood or may be in a neighboring village--I assume that organizational innovation and diffusion behave somewhat like technological innovation and diffusion--spreading out from some central locations.

3. The availability of a general purpose UGO that may be able to take on additional purposes. Many village organizations do several different activities, including the management of local common pool resource systems.
4. The homogeneity in the community in terms of the uses made of the common pool resource system. Two different groups who see their task as using the CPR in conflicting manners would make it more difficult for a UGO to develop.
5. The users' shared perceptions that the risks involved in continued open access arrangements may be reduced or better spread across the community by such an organization. The users' shared perception of the nature of their common situation may itself be enhanced by cultural homogeneity, value systems, and potentially by the size of the group. Communication costs are much lower in a smaller group and information about scarcity needs to be shared and discussed.
6. The physical unity of the user community. It is harder for two fishing villages located on either side of a large lake to organize into one user group organization. Two UGOs may develop with considerable intergroup conflict over the lake.

The above propositions all need to be more carefully stated and to be integrated into a more general theoretical framework.⁵ Right now, they are simply an initial effort to summarize many of the relationships discussed at this conference.

Additional discussions at the conference turned to the identification of factors that participants thought would

enhance the likelihood of UGOs' surviving. Some factors discussed included:

1. Development of a clear-cut and unambiguous set of rules that all participants can know and agree upon. The fewer rules used to organize activities, relative to the complexity of the activities, the more likely that individuals can understand them, remember them, and follow them, and the more likely that infractions will be interpreted by all as infractions. Thus, punishment will be perceived to be meted out to those who have broken the rules and not to others. Remember our discussion of the multiple functions of the simple rule: "you have to live locally to use this system." That rule leads to enhanced local knowledge, reciprocity and trust, lower decision-making costs and solves the problem of exclusion.
2. Clear enforcement of rules by officials backed up by social enforcement by users. I think this is very important. Social enforcement needs to be there at all times. One's co-workers are ever-present. If they are willing to impose mild social sanctions on infractions swiftly and clearly, then the cost of guards or other officials can be much lower.
3. Slow exogenous changes. Or, if rapid external changes come, they should come one change at a time--not population growth, and major changes in technology. and hostile government, etc.
4. Internally adaptive institutional arrangements. One of our discussions focused on the necessity for a creative use of conflict so that the source and extent of problems could be discovered. The creative uses of conflict could lead participants in a UGO to make new rules governing use patterns when the old rules do not appear to serve the community of users well.
5. Different decision rules for different purposes, if many purposes are involved. A single decision maker may be most effective in regard to some types

of rapidly changing variables. A council may be most effective when concerns exist over equity or distribution. A broad consensus or extraordinary majority may be most effective in deciding on actions that involve major sacrifice or penalties.

6. The capacity of a UGO to nest into a set of larger organizations for dealing with the external environment or for dealing with a larger segment of a common pool resource. If the UGO has effectively organized a tertiary irrigation distribution channel, for example, users of this channel need to be able to communicate with the operations of the headwaters from time to time.

Having now started to identify some factors that may be associated with survival of a UGO, it is important to bear in mind that simple survival is not a sufficient condition for effective performance. The survival of a UGO over a long period leads one to presume that the UGO is doing something well. However, the key question is, "what is it doing well?" For some UGOs, the answer may be that the only thing it is doing well is surviving. Unless UGOs are in highly competitive environments where selection pressures tend to eliminate inefficient and inequitable UGOs, we cannot assume that those that survive are performing well. If UGOs were firms in a highly competitive market, the theory of market processes would enable us to infer that survivors use efficient, long-term strategies (even though the survivors may not have consciously selected these strategies through a full analysis).

Some UGOs have extraordinary powers not available to private firms in a competitive market. These powers enable such UGOs to survive even though performing poorly. UGOs that can coerce membership and contributions to collective actions (e.g., they have public powers) can survive even when most of their members do not evaluate them as performing efficiently or equitably. It is even possible for a UGO that has survived for a long time to generate more costs than benefits. The latter can occur when membership is coerced and the costs of existence are high. Consequently, it is especially important not to assume that surviving UGOs, which have full governmental powers, automatically perform well.

UGOs operating over a long period without full govern-

mental powers--established and maintained primarily through voluntary agreement--are more likely to generate benefits that exceed costs. Unless the users badly misperceive benefits and costs, it is hard to imagine how strictly voluntary UGOs could survive unless net benefits were positive. In a strictly voluntary association, members can leave the UGO at any point when they perceive that costs of participation exceed the benefits.

We discussed several factors at these meetings--in addition to those identified as conducive to emergence and to survival--that some participants thought should enhance the performance of UGOs in maintaining withdrawal of use units below maximum sustainable yield in an efficient and equitable manner. One broad set of conditions was concerned with the "match" of the membership of the UGO and that of the user group. A second consideration involved the relationship between the incidence of benefits and the incidence of costs derived from the operation of the UGO. A third factor was the knowledge generated by users about the CPR and about user preference, benefits, and costs.

These ideas and concerns deserve further attention, and should be explored more thoroughly in the future.

NOTES

1. Given the importance of developing a set of technical terms that scientists trained in many different disciplines (biology, political science, economics, anthropology, sociology, forestry, management, and history) could use to communicate with one another about common property resource management, I circulated several versions of some of the definitions and propositions contained herein. During the conference, I received thoughtful and critical responses to these initial efforts from Fikret Berkes, Piers Blaikie, Edwin Connerly, David Feeny, Timothy Jessup, Ronald Oakerson, Pauline Peters, Emery Roe, and Ford Runge.
2. It must be pointed out that a private firm or any corporate entity is also of this type, and that the model that Ford Runge has explicated during our meetings is similar to the model used by Coase and Williamson to show the benefits of establishing firms to reduce the contractual costs of market arrangements. So, by formulating the problem in this fashion, we already have models of human organization available that we can "try on" to see how well they fit the general class of phenomena of interest to us.
3. This classification of organizational arrangements is similar to that presented by Daniel Bromley in his final summary. Bromley relied on the distribution of rights and duties to arrive at his classification.
4. The size of the common property resource (CPR) is a factor. A small residential group using only a small portion of a large CPR (such as the Great Lakes) may not organize to manage the CPR because of its incapacity to affect the resource system. On the other hand, small user group organizations (UGOs) may manage parts of a large CPR, such as grazing lands, relatively effectively for long periods of time if they are able to exclude others from their territory.

5. Since the conference, I have tried to develop the rudiments of such a theory. A working paper describing these efforts is available by writing to me at the Workshop in Political Theory and Policy Analysis, 513 North Park, Indiana University, Bloomington, Indiana 47405, U.S.A.

Concluding Statement

Pauline E. Peters

The papers by Bromley and Ostrom presented their views of the major findings and conclusions that emerged from the conference. In this final brief section, we wish to summarize some of the main points and directions for future research and action raised in our plenary sessions and in the smaller groups' discussions that were organized by resource type and by topical theme.

PERFORMANCE

The studies demonstrated the widespread use of resources managed under common property regimes, and the important role these resources play in the diversified income-producing strategies used by a substantial majority of the world's population. Common property regimes are especially important for the large numbers of poor peasants and small farmers, but others benefit as well.

A central topic at the conference was that uses of resources are as often competitive as they are complementary. For example, the practice of allowing cattle to graze postharvest stubble does not interfere with cultivation based on a single crop season, but where permanent water sources enable double cropping, grazing livestock can endanger the crops. Similarly, where newly introduced

water sources facilitate year-round pasturing of cattle, the transhumant movements of other herds will compete with year-round users of the pastures. It was made clear that where there are competing uses and/or users, and where the economic and other values of the resources are changing--circumstances that are connected--there has tended to be increased stress on both the management regime and on the resource(s) being used. It thus becomes important, in any situation of perceived environmental or social stress, to untangle the relations among uses, among users, and among the varying influences on use (such as rapid increase or decrease in human or animal populations, change in technology, political and administrative organization, and so forth).

Measures of performance were considered to be difficult to specify; more work is needed in conceptualizing and operationalizing them for each type of resource. Participants also emphasized that measures of performance must be selected carefully in relation to the appropriate unit of analysis, which will vary from the individual user, through a particular common property regime, to a set of such regimes. The questions to be asked, then, are whose equity and whose efficiency, or whose success and whose failure are we measuring in assessing performance?

Among the relations that were hypothesized as being crucial to performance were:

- o The size of regime and the size of the management and/or user group
- o Relative scarcity
- o Homogeneity and/or heterogeneity*
- o Legitimacy
- o Clarity of rules
- o Interaction between rules and practices
- o Place of the regime in wider social and political structures.

*Several dimensions were noted--one use by different groups, multiple uses by one group, multiple uses by different groups, type and extent of social/political/economic differentiation among users/managers.

RESEARCH

Several topics were considered pertinent for further research. These are summarized below:

- o Cross-resource linkages and interactions (e.g., agro-pastoral; irrigation and fisheries; forestry and irrigation or pastoral). The issues here are: (1) to understand the way in which a common property regime operates within systems of production, rather than seeing it as an isolate; and (2) to document the implications of these interactions for levels of livelihood and consumption among different categories of resource users.
- o Bureaucratic administration and cross-sector linkages and interactions. For example, the management and use of resources are frequently affected by different administrative structures that are often at cross purposes or act in ignorance of each other. These relations are critical to an understanding of how a common property regime is working, yet often are not included in such an assessment.
- o Indigenous or local knowledge concerning different resources, regimes, rules and practices. A frequent observation in the conference papers and discussions was that local users of common property resources are often more competent and knowledgeable as resource managers than are highly trained technicians from elsewhere, because local residents and users know the exact local physical conditions and local history of the resource so well (as opposed to knowing only general principles of resource management that may not apply smoothly to local conditions). In addition, the definitions of resources often differ between local users and outside experts (see, for example, the paper by Messerschmidt) and, unless this difference is recognized, misunderstanding and misdirection are the frequent results.
- o The relations between national legal systems regulating resource use and nongovernment systems. It is important to note that the use of

the term "informal" to refer to nongovernmental and/or noncodified systems of resource management is inappropriate and misleading. As many of the cases demonstrate, these systems are usually highly formalized in the sense of including rules, expected and conventional practices, dispute-settling mechanisms, and sanctions, even though codification may be absent. Two foci for research seem important: (1) the reciprocal influence between the rules and practices of the national legal systems and local systems including actual and potential conflict; and (2) the role of government recognition of local systems of management and resolution, including enabling legislation, as well as more indirect administrative action such as taxation.

- o Comparative contemporary studies are needed. These should be both within a region and cross-regional, and should examine institutional alternatives and critical conditions of performance.
- o Coordinated, cross-disciplinary research is also important. It would facilitate more fully considered studies of common property regimes. For example, the study of a rangeland-forestry resource system might be carried out by a team including plant and animal biologists, ecologists, economists, sociologists, anthropologists, and policy and law specialists.
- o Time-related studies must be conducted. These would give comparative insights and provide a foundation for valid generalizations about common property regimes. The question here is how are we to study and learn from changes over time in these institutional arrangements? First, historical studies (such as the Japanese case presented by McKean, and that comparing the English and Andean systems by Campbell and Godoy) are invaluable for providing comparative evidence and hypotheses. Second, longitudinal data can be gathered by systematic observation of particular systems over extended periods of time. Both of these methods would increase our knowledge base and our ability to test hypotheses.

ACTION

Most action would be specific to the resource, regime, and situation. However, the following general points were made:

- o Provide small-scale infrastructure (such as communications or processing technologies) that facilitates management in common property regimes.
- o Establish data collection and monitoring procedures for the communication of technical and other necessary information as well as mechanisms for communication of the views, opinions, and problems of the users of common property resources.
- o Build the administrative capacity for handling the diversity that typifies common property regimes; in particular, combine a capacity for decentralized management structures with a centralized information system.
- o Be particularly wary of inappropriate legal imposition (in legislative and judicial form). Common property management systems often will be found to require legal recognition. Also, enabling legislation may be useful, both direct (e.g., recognizing and providing support or sanctions for existing management systems) and indirect (e.g., taxation, group organization, limited liability regulation). But extreme caution is urged: the burden of proof that systems are not working and will benefit from interference from outside must rest with the potential intervenors.
- o Prepare training manuals intended to inform and sensitize donor agencies and project officers with reference to current knowledge, analytical frameworks, and critical questions about understanding common property regimes.

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