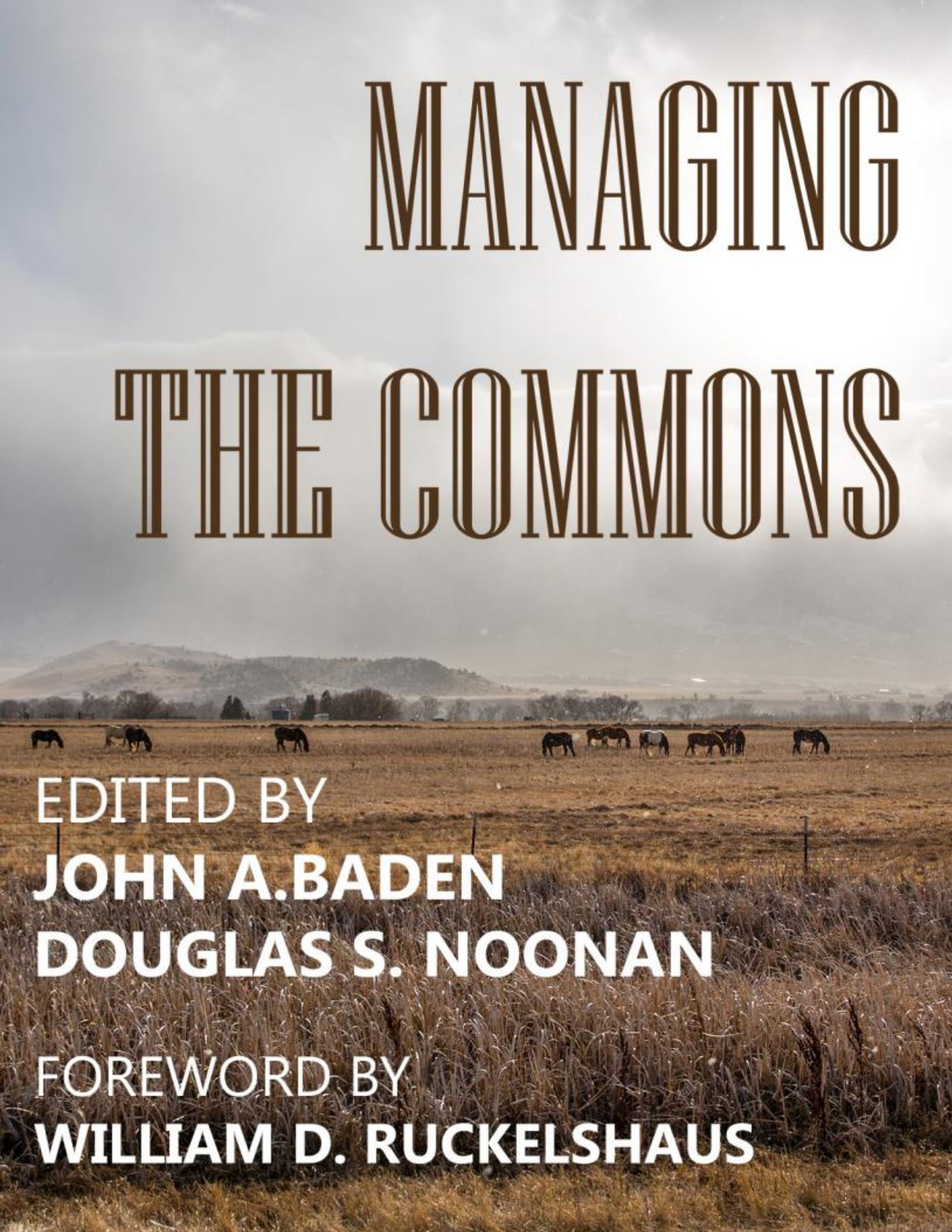
MANAGING THE COMMONS



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MANAGING THE COMMONS

THIRD EDITION

Managing the commons

edited by

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with a foreword by

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I dedicate this edition to
the true gentleman, scholar, and courageous man,
who began this enterprise,
Garrett Hardin,
and to
Bill Siffin,
who urged me to explore and develop new options
and who was always a wonderful source
of advice and sound judgment.

JOHN BADEN, PhD.

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FOREWORD

Managing Commons and Community
Pacific Northwest People, Salmon, Rivers, and Sea

WILLIAM D. RUCKELSHAUS

Managing natural resources that are held in common is a great and grave challenge. It requires addressing the community of users, beneficiaries, and managers. It also requires consideration of how those communities interact with the commons itself. At stake is the prosperity, and even survival, of both the people and the environment.

Understanding and improving how we relate to commons has been the focus of much scholarly and practical research in the last 30 years. A quick look at the various natural resource commons surrounding us indicates that this will no doubt continue.

Pacific Northwest salmon fisheries represent a system of commons, both complex and illustrative. My past history as administrator of the US. Environmental Protection Agency and my fisherman's interest in salmon has heightened my sensitivity to the plight of the salmon and the people whose lives they affect. Recently, my wife and I moved back to the Pacific North-west something the salmon try to do every year as they live out their inspiring life cycles. Unlike us, the salmon do not always find a hospitable environment when they return. There are many reasons: Simply put, there are more people in the salmon's way, and they struggle more with the problems that come with expanding human populations. A number of reports issued over the past few years have chronicled the broad declines and local extinction of many salmon,

steelhead, and sea-run cutthroat stocks in the region. The people who fish for a living and the communities in which they live have been hit hard. Our resource agencies are in danger of being overwhelmed by the complexity and magnitude of the problem. Why are salmon faring so poorly? Who is responsible? What can be done to reverse the recent declines in salmon populations? When tragedy befalls a commons as it has the salmon, I come to no conclusion about who is at fault, and I don't intend to. The one thing that I am certain of is that the only truly innocent parties in all of this are the salmon and the generations of people yet to come. It seems to me that the responsibility falls upon all of us fishermen, resource managers, and concerned citizens alike to take the steps necessary to ensure that salmon populations recover to the point that our children will be able to enjoy the quality of life we once took for granted.

While many people focus on how to get the most from commons, groups like the Sustainable Fisheries Foundation emphasize providing and maintaining those natural resources. Their goal is deceptively simple: "We are trying to put more salmon back in the rivers and lakes of the Pacific Northwest." Determining exactly how to accomplish this goal has defied the efforts of a great many dedicated and talented people.

Many papers and panel discussions, especially reports on the status and trend of wild salmon populations in the North Pacific, make it clear that many salmon stocks in parts of the lower United States, southern British Columbia,and the west coast of Vancouver Island are not faring well. The decline in salmon numbers in these areas corresponds with a rapidly expanding human population, alterations in land and water use, increasing sediment and containment loads, and heavy fishing pressure by a combination of sport, commercial, and tribal groups.

In stark contrast to the situation found in the Columbia River basin, the Puget Sound region, and areas along the Oregon and California coasts, recent returns of wild salmon to streams in the northern portions of their range have been at or near historically high levels. Alaska has enjoyed record returns and harvests in recent years. The health of their runs reflects the abundance of good quality freshwater habitat, favorable growing conditions in the ocean, and also (let's give credit where credit is due) a progressive management regime that assures enough fish return to maintain strong populations. Alaska fisheries management and the benefits that accrue from it are a bona fide success story.

Even Alaska's salmon fishery, however, overlaps with other ecosystem making for another commons problem. Because Alaska fishers catch fish that originate in rivers and streams outside the state, some concessions need to be made to ensure that less productive, non-Alaskan stocks are not overfished, and that benefits are fairly distributed across jurisdictions. Acknowledging this, Alaskan leaders have signaled their state's willingness to work with British Columbia and other states to ensure fair allocation of benefits while maintaining healthy runs of fish.

The maintenance of salmon fisheries can benefit from opportunities for people with diverse backgrounds to meet together in work groups to discuss the issues, establish a shared vision of the future, and identify ways of overcoming obstacles to fulfilling that vision. Work group settings can offer a non-threatening environment in which critical issues facing managers, tribes, resource users, and concerned citizens can be identified and debated. Critical themes include habitat protection and restoration, harvest management, natural and artificial production, community-based fisheries management, and institutional and regulatory structures that support the goal of sustainable fisheries. Work group processes of this sort are inclusive and flexible, structured so that impediments to achieving sustainable fisheries can be identified and appropriate strategies devised to overcome them.Participants are asked to set aside personal preferences and allegiances to encourage frank discussion and to "put the salmon first." The intent is to get all the options, their benefits and drawbacks, on the table and to generate imaginative solutions to the problems facing the commons.

Work groups can make tremendous progress toward defining goals and solutions in terms of what can be achieved collaboratively. At an April 1996 conference co-convened by the Sustainable Fisheries Foundation, problems, principles, and recommendations that came from these groups formed the basis of the "Sustainable Fisheries Strategy for Salmon and Steelhead participants were anxious and genuinely committed to coming up with solutions that would benefit both salmon and society as a whole. Their individual preferences and the desire for short-term gains took a back seat to societal needs and the long-term health of the resource. People have grown tired of seeing fish over-exploited, sacrificed to competing interests, or used to wage larger political battles.

This gives people reason to believe that, as complex as they are, the challenges of "managing the commons" can be overcome. For one, we have a reasonably good understanding of what salmon need to persist and evolve

and what factors influence their well-being at different places and times. We know, for instance, that hatcheries pose special problems, but with improvements in technology they will present fewer risks and help stabilize salmon related economies in the future. The effects of habitat degradation and variable ocean conditions on salmon survival and harvest levels are becoming better understood. The importance of maintaining a diversity of wild stocks and ensuring that weaker stocks are not overfished when mixed with more abundant runs has become a basic tenet of fisheries management.

In general, good science and conservation translate into good management. If our understanding of the problem is adequate and people are committed to improving management, why has the situation not improved? The problem isn't so much with managing fish as it is with managing people having different needs, values, laws, institutions, and accessibility to the fish and the resources upon which they depend. This is the problem of "managing the commons."

Fisheries problems are fundamentally social problems. What we are dealing with is a classic "tragedy of the commons," as articulated nearly 30 years ago by Garrett Hardin. Hardin talked about a meadow or commons where livestock owners would graze cattle. In pursuing their narrow self-interests they would use as much of that pasture as they could, graze as many cows as they could until the whole thing collapsed. Even though it was obvious that the meadow would be over-grazed, the individual owners pursued their narrow, short-term interests at the expense of the whole.The problem was stated in another way by William James: the trouble with man is that he cannot have enough without having too much.

In addition to the salmon themselves, we have several commons: the rivers and lakes in which they spawn, the ocean in which they grow to maturity, and the landscapes affecting the quality of these aquatic ecosystems. Ownership and management of these resources vary across jurisdictions and range in scale from individual and corporate owners, to tribal organizations and smaller governmental units, to state, provincial, and federal governments.

The impulse to accrue wealth and prosperity across all levels of organization tends to foster overuse of the commons on which man's well-being is dependent. We want to use the rivers, oceans, and land to maximize our quality of life. Different people with different interests have all witnessed the decline of the salmon commons.

So what has happened so far? Well, so far we have had rhetoric, a lot of it. More words in fact than fish, and that is likely to continue. We have proponents and Opponents on every issue. We have studies and lawsuits,charges and counter-charges. Any day of the week you can pick up the newspaper and find articles regarding the studies and the lawsuits and the disagreements. As a former lawyer and government official, I can tell you who is the principal beneficiary of all this, and it isn't the fish.

We know better than to believe that if any one of these things the imposition of court orders, tighter regulations, or political interference in decision making—were to succeed, then the problem would be over. They won't solve the larger commons problem, and some actions may even make it worse. Solutions will require broader public education, involvement, and participation in the decision-making process. Public awareness and acceptance will largely determine management success. And the key to gaining acceptance is to get all the parties and stakeholders to put their interests on the table and participate in a process that seeks to accommodate them without compromising the resource or the commons. It is important to recognize that the path we are on now means failure for everyone and particularly the salmon.

Ultimately, in a free society it is not possible to gain a lasting solution to a problem without the consent of the people. Unless people are allowed to participate in the decision-making process today, they will be able to effectively block any solution that is proposed tomorrow. As trust in our governmental institutions has eroded over the past three decades, people have demanded a bigger say in the decisions that affect them. Systems that don't provide that opportunity for public involvement don't work. The public fears hidden or hostile government agendas, mistrusts basic "facts" offered in support of actions or decisions, and feels left out when policy changes are being considered. They must be involved or stagnation will result.

When trust in governmental institutions seriously erodes, two solutions are possible: one is dictatorship and the other is more democracy. What I am suggesting is the second alternative, more democracy. This solution requires that society and the governmental agencies charged with the management of our natural resources establish a shared vision, common policies, and a process for collaborative management.

Let people in, give them a real role in the decision-making process, give them a piece of the action. Don't suggest they have no knowledge of what is going on, that they are not experts, or that they have no right to be included.

Do encourage them to understand the importance of putting more salmon in the lakes and rivers. It is a simple enough message. What is it that they need to do? What is it that their communities need to do? What is it that their industries or institutions, that they feel so much a part of, need to do in order to accommodate the interest of the whole, to preserve the commons? When we have seen people come together around solutions, it works. Solutions can be had; the resource can be enhanced. That is the task of this book.

We also need to look at the next step after this book. Like the work groups who drafted the ”Sustainable Fisheries Strategy for Salmon and Steelhead,” it is the aim of the authors to develop a strategy for sustainable commons resources and figure out how to accomplish it. Obviously, it is a difficult challenge. We cannot give up; after all, we human beings are supposed to be the most intelligent species on Earth. Collectively, we have put in jeopardy species, habitats, communities and commons completely dependent upon us for their survival. Shame on us. Maybe we are not as intelligent as we thought. Now it is time for us to get on with proving that we are. I wish us all good luck in this endeavor, and, on behalf of the residents of our commons, my best wishes for success in the future.

Adapted from a keynote address given by William D. Ruckelshaus at the conference titled ”Toward Sustainable Fisheries: Balancing the Conservation and Use of Salmon and Steelhead in the Pacific Northwest,” held in Victoria, 8. C. As former administrator of the US Environmental Protection Agency and chairman of Browning Ferris Industries, Ruckelshaus is a veteran of the environmental debate in both the public and private sectors. He chairs the Advisory Board of the Sustainable Fisheries Foundation, co-convenor of the Vancouver, B. C., conference along with the American Fisheries Society

PREFACE

Overcoming the Tragedy

It has been 20 years since the first edition of Managing the Commons, 29 years since Garrett Hardin's essay "The Tragedy of the Commons." In that short time, there has been an intellectual revolution in considering resource systems. At the heart of the debate is the confluence of ecology and economics, framed in culture and community. Hardin's simple hypothetical situation ("picture a pasture open to all ") has inspired a tidal wave of commentary from anthropologists to zoologists. Its challenges are compelling and controversial.

Originally argued by William Forster Lloyd in his 1833 Two Lectures on Population, the tragedy of the commons is now well known though often misunderstood. Lloyd, and later Hardin, argue that when individuals reap the full benefits of their exploitation of a limited resource, and society and other resource users all share in the costs, tragedy results. Phrased another way, a individual will overuse other people's resources when it's in her best interests. Aristotle saw it first and wrote, "What is common to the greatest number gets the least amount of care. Men pay most attention to what is their own:they care less for what is common" (Politics, Book II, Chap. 3). In the case of a common pasture, herders rationally add cows to their herds even after such additions worsen the industry and environment of cattle grazing. As Hardin writes, "fractional losses are not enough to deter aggressive cattle owners, so all the exploiters suffer in an unmanaged common."[i]

Thus is the tragedy. Private interest undermines society's best interest. In the commons, the gains of the individual come at the expense of society, and, in many cases, even that individual's long-term welfare as well. To be sure, this paints a bleak picture for commons. Moreover, commons as Hardin defines them are prevalent. A common could be any resource pool open to

many but lacking substantial governing rules. The town pasture, the city water reserves, the regional atmosphere all might be unmanaged commons. Other commons that don't naturally exist might be artificially constructed like highways, dormitory lounges, federal budgets, or the Internet. Society is constantly tapping into new and old common resources.

Then why is it, with so much of the world's resources resembling commons, we don't see more tragedy? Why is it that society had largely avoided these tragedies prior to Hardin's 1968 essay—often without realizing a need to avert them? How can something so dire and so pervasive be so tractable and so rare? The reason is intuitive. Tragedy, be it environmental degradation or economic bankruptcy, provides powerful negative feedback. Conversely, efficient and sustainable use of resources rewards users with prosperity and posterity. These feedback mechanisms are both ecological and economic functions. Beneficiaries of a common resource, when given the freedom to respond to ecological constraints and economic forces, will continually revise rules for effectively using the resource.

As commons become imperiled, overexploited, or otherwise degraded entrepreneurs and managers see opportunities to implement creative conservation rules. The rewards of adapting commons management can be great for individuals and society alike. Political entrepreneurs frequently promulgate laws and regulations in response to the onset of the tragedy. Improved tenure rights on communal farms, limited access to parks, toll fees on bridges, etc., are all examples. An "enclosure movement" reflects this response. Also, business entrepreneurs, community leaders, and other private parties create value for themselves, their community, and society at large by inventing new practices in the commons. Innovations in branding or fencing, for example are one adaptation in the commons used to avert the tragedy[ii].

How we manage the commons is critical to appropriating, allocating, and sustaining the value from common-pool resources. Managing the Commons explores these very questions. Hardin's frequently cited essay provides the launching platform for investigating principles and practices of commons management. This second edition builds upon the first, taking its core arguments as a source and developing them with a variety of writings on the contemporary issues of common-pool resources.

Managing the Commons begins by outlining the theoretical underpinnings of the tragedy of the commons. In the foreword, former EPA chief William Ruckelshaus describes the essential challenge of managing the commons. Chapter 1 of Part One is Garrett Hardin's seminal work, "The

Tragedy of the Commons." Two other classics, H. Scott Gordon's work on common property fisheries and Mancur Olson's description of how group dynamics affect incentives, add to the theoretical premise. John Baden provides a primer on the economics and politics of common-pool resource management.

Part Two comprises recent developments in the debate over the "tragedy of the commons." Robert Bish debates the merits of public and private resource management. David Feeny, Fikret Berkes, Bonnie McCay, and James Acheson recount the research and criticisms of Hardin's commons theory. In an excerpt from Governing the Commons, Elinor Ostrom formally explains common-property economics and alternative arrangements for management.

Part Three focuses on specific case studies on commons management. Terry Anderson and P. J. Hill's "From Free Grass to Fences" outlines how technological innovation and changing legal standards transformed America's ranching commons into private ownership. Baden's "Communitarianism and the Logic of the Commons" describes three efforts at communitarian farming: those of the Mormons, the Hutterites, and the Chinese. Samuel Pooley and Ralph Townsend explore an innovative approach to fisheries management: the notion of a community corporation. Douglas Noonan examines two regional fisheries organizations, in Europe and the South Pacific, and the features that contribute to successful management.

In Part Four, unconventional or problematic common-pool resources are treated. Particularly vexing resource problems serve to test our understanding of the commons; it is the exception that proves the rule. Randal O'Toole outlines "The Tragedy of the Scenic Commons" and presents neighborhood associations as an alternative management tool. Noonan investigates the Internet as a self-organizing commons with a dynamic and uncertain future. Dwight Lee explains the distinction between economic and political pollution and how market forces can mitigate them. Baden and Noonan discuss the federal treasury as a commons, then propose a "predatory bureaucracy" as a possible management tool. "Living on a Lifeboat," by Garrett Hardin, tackles complex issues of population and finite resources. And Lynn Scarlett summarizes much of the debate of the commons and proposes balanced and practical foundations for policy.

Garrett Hardin wrote, "it is now clear to me that the title for my original contribution should have been The Tragedy of the Unmanaged Commons. I can understand how I might have misled others."[iii] Nonetheless, Hard in's

seminal essay has inspired debate as few other essays have. This book is an attempt to carry on that discourse, elaborate Hardin's logic of the commons, and explore alternative ways to manage the commons. There is no singular solution to the tragedy, only a variety of approaches as diverse and adaptable as society itself.

JOHN A. BADEN
DOUGLAS S.NOONAN

26 MARCH 1997

[i] Garrett Hardin, "The Tragedy of the Unmanaged Commons," Trends in Ecology & Evolution, vol. 9, no. 5 (1994), p. 199.
[ii] As Terry Anderson and P. J. Hill demonstrate in chap. 8 of this volume.
[iii] Garrett Hardin, personal communication, 5 October 1994

ACKNOWLEDGMENTS

I acknowledge teachers who focused my attention on the causes of productive and constructive social relations and the predictable costs Of failure to achieve them. They taught me there are no cost-free solutions, only trade-offs, and that different arrangements have dramatically different consequences.

When I was a graduate student, I met Garrett Hardin. He led an intellectual journey that produced, among other things, the first edition of Managing the Commons. Now my student, Douglas Noonan, carries on this discourse through his honors thesis on managing international commons and his contributions to this volume. The problem Of the commons is one that exercised my students throughout my entire teaching career. Their continued probing contributed greatly to this volume.

But neither interest nor good intentions will alone suffice. Ventures Of this sort require financial resources. Each staff member of FREE (Foundation for Research on Economics and the Environment) helped in producing this volume. And the institute's continual work was made possible through the generosity Of the Carthage Foundation, the Ford Foundation, Port Blakely Tree Farms, Temple-Inland, the Texaco Foundation, and several anonymous contributors.

JOHN BADEN

Part One

CLASSIC TRAGEDY OF THE COMMONS

1

The Tragedy of the Commons

GARRETT HARDIN

At the end of a thoughtful article on the future of nuclear war, J. B. Wiesner and H. F. York concluded that: *"Both sides in the arms race are confronted by the dilemma of steadily increasing military power and steadily decreasing national security. It is our considered professional judgment that this dilemma has no technical solution. If the great powers continue to look for solutions in the area of science and technology only, the result will be to worsen the situation."*[1]

I would like to focus your attention not on the subject of the article (national security in a nuclear world) but on the kind of conclusion they reached, namely that there is no technical solution to the problem. An implicit and almost universal assumption of discussions published in professional and semipopular scientific journals is that the problem under discussion has a technical solution. A technical solution may be defined as one that requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality.

In our day (though not in earlier times) technical solutions are always welcome. Because of previous failures in prophecy, it takes courage to assert that a desired technical solution is not possible. Wiesner and York exhibited this courage; publishing in a science journal, they insisted that the solution to the problem was not to be found in the natural sciences. They cautiously qualified their statement with the phrase, "It is our considered professional

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judgment. ”Whether they were right or not is not the concern of the present article. Rather, the concern here is with the important concept of a class of human problems which can be called ”no technical solution problems”, and more specifically, with the identification and discussion of one of these.

It is easy to show that the class is not a null class. Recall the game of tick-tack-toe. Consider the problem, ”How can I win the game of tick-tack—toe?” It is well known that I cannot, if I assume (in keeping with the conventions of game theory) that my opponent understands the game perfectly. Put another way, there is no ”technical solution” to the problem. I can win only by giving a radical meaning to the word ”win.” I can hit my opponent over the head; or I can falsify the records. Every way in which I ”win” involves, in some sense, an abandonment of the game, as we intuitively understand it. (I can also, of course, openly abandon the game——refuse to play it. This is what most adults do.)

The class of ”no technical solution problems” has members. My thesis is that the ”population problem,” as conventionally conceived, is a member of this class. How it is conventionally conceived needs some comment. It is fair to say that-most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy. They think that farming the seas or developing new strains of wheat will solve the problem—technologically. I try to show here that the solution they seek cannot be found. The population problem cannot be solved in a technical way, any more than can the problem of winning the game of tick-tack-toe.

What Shall We Maximize?

Population, as Malthus said, naturally tends to grow ”geometrically” or, as we would now say, exponentially. In a finite world this means that the per capita share of the world’s goods must decrease. Is ours a finite world?

A fair defense can be put forward for the view that the world is infinite or that we do not know that it is not. But, in terms of the practical problems that we must face in the next few generations with the foreseeable technology, it is clear that we will greatly increase human misery if we do not, during the immediate future, assume that the world available to the terrestrial human population is finite. ”Space” is no escape[2].

A finite world can support only a finite population; therefore, population growth must eventually equal zero. (The case of perpetual wide fluctuations

above and below zero is a trivial variant that need not be discussed.) When this condition is met, what will be the situation of mankind? Specifically, can Bentham's goal of "the greatest good for the greatest number" be realized?

No—for two reasons, each sufficient by itself. The first is a theoretical one. It is not mathematically possible to maximize for two (or more) variables at the same time. This was clearly stated by von Neumann and Morgenstern[3], but the principle is implicit in the theory of partial differential equations, dating back at least to D'Alembert (1717—1783).

The second reason springs directly from biological facts. To live, any organism must have a source of energy (for example food). This energy is utilized for two purposes: mere maintenance and work. For man, maintenance of life requires about 1600 kilocalories a day ("maintenance calories"). Anything that he does over and above merely staying alive will be defined as work, and is supported by "work calories" which he takes in. Work calories are used not only for what we call work in common speech; they are also required for all forms of enjoyment, from swimming and automobile racing to playing music and writing poetry. If our goal is to maximize population it is obvious what we must do: We must make the work calories per person approach as close to zero as possible. No gourmet meals, no vacations, no sports, no music, no literature, no art. . . . I think that everyone will grant, without argument or proof, that maximizing population does not maximize goods. Bentham's goal is impossible.

In reaching this conclusion I have made the usual assumption that it is the acquisition of energy that is the problem. The appearance of atomic energy has led some to question this assumption. However, given an infinite source of energy, population growth still produces an inescapable problem. The problem of the acquisition of energy is replaced by the problem of its dissipation, as J. H. Fremlin has so wittily shown[4]. The arithmetic signs in the analysis are, as it were, reversed; but Bentham's goal is unobtainable.

The optimum population is, then, less than the maximum. The difficulty of defining the optimum is enormous; so far as I know, no one has seriously tackled this problem. Reaching an acceptable and stable solution will surely require more than one generation of hard analytical work—and much persuasion.

We want the maximum good per person; but what is good? To one person it is wilderness, to another it is ski lodges for thousands. To one it is estuaries to nourish ducks for hunters to shoot; to another it is factory land. Comparing one good with another is, we usually say, impossible because

goods are incommensurable. Incommensurables cannot be compared.

Theoretically this may be true; but in real life incommensurables are commensurable. Only a criterion of judgment and a system of weighting are needed. In nature the criterion is survival. Is it better for a species to be small and hideable, or large and powerful? Natural selection commensurate the incommensurables. The compromise achieved depends on a natural weighting of the values of the variables.

Man must imitate this process. There is no doubt that in fact he already does, but unconsciously. It is when the hidden decisions are made explicit that the arguments begin. The problem for the years ahead is to work out an acceptable theory of weighting. Synergistic effects, nonlinear variation, and difficulties in discounting the future make the intellectual problem difficult, but not (in principle) insoluble.

Has any cultural group solved this practical problem at the present time, even on an intuitive level? One simple fact proves that none has: there is no prosperous population in the world today that has, and has had for some time, a growth rate of zero. Any people that has intuitively identified its optimum point will soon reach it, after which its growth rate becomes and remains zero.

Of course, a positive growth rate might be taken as evidence that a population is below its optimum. However, by any reasonable standards,the most rapidly growing populations on earth today are (in general) the most miserable. This association (which need not be invariable) casts doubt on the optimistic assumption that the positive growth rate of a population is evidence that it has yet to reach its optimum.

We can make little progress in working toward optimum population size until we explicitly exorcise the spirit of Adam Smith in the field of practical demography. In economic affairs, The Wealth of Nations (1776) popularized the ”invisible hand,” the idea that an individual who ”intends only his own gain,” is, as it were, ”led by an invisible hand to promote the public interest.”[5] Adam Smith did not assert that this was invariably true, and perhaps neither did any of his followers. But he contributed to a dominant tendency of thought that has ever since interfered with positive action based on rational analysis, namely, the tendency to assume that decisions reached individually will, in fact, be the best decisions for an entire society. If this assumption is correct it justifies the continuance of our present policy of laissez faire in reproduction. If it is correct we can assume that men will control their individual fecundity so as to produce the optimum population. If the assumption is not correct we need to reexamine our individual freedoms to see which ones are defensible.

Tragedy of the Commons

The rebuttal to the invisible hand in population control is to be found in a scenario first sketched in a little-known pamphlet in 1833 by a mathematical amateur named William Forster Lloyd (1794-—1852)[6]. We may well call it ”the tragedy of the commons,” using the word ”tragedy” as the philosopher Whitehead used it[7]: ”The essence of dramatic tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things.” He then goes on to say, ”This inevitableness of destiny can only be illustrated in terms of human life by incidents which in fact involve unhappiness. For it is only by them that the futility of escape can be made evident in the drama.”

The tragedy of the commons develops in this way. Picture a pasture Open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy.

As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, ”What is the utility to me of adding one more animal to my herd?” This utility has one negative and one positive component.

1. The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.

2. The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of 1.

Adding together the component partial utilities, 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 a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the

freedom of the commons. Freedom in a commons brings ruin to all. Some would say that this is a platitude. Would that it were! In a sense, it was learned thousands of years ago, but natural selection favors the forces of psychological denial[8]. The individual benefits as an individual from his ability to deny the truth even though society as a whole, of which he is a part, suffers. Education can counteract the natural tendency to do the wrong thing, but the inexorable succession of generations requires that the basis for this knowledge be constantly refreshed. A simple incident that occurred a few years ago in Leominster, Massachusetts, shows how perishable the knowledge is. During the Christmas shopping season the parking meters downtown were covered with plastic bags that bore tags reading: "Do not open until after Christmas. Free parking courtesy of the mayor and city council." In other words, facing the prospect. Of an increased demand for already scarce space, the city fathers reinstituted the system of the commons. (Cynically, we suspect that they gained more votes than they lost by this retrogressive act.)

In an approximate way, the logic of the commons has been understood for a long time, perhaps since the discovery of agriculture or the invention of private property in real estate. But it is understood mostly only in special cases which are not sufficiently generalized. Even at this late date, cattlemen leasing national land on the Western ranges demonstrate no more than an ambivalent understanding, in constantly pressuring federal authorities to increase the head count to the point where overgrazing produces erosion and weed-dominance. Likewise, the oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the Shibboleth of the "freedom of the seas." Pro-fessing to believe in the "inexhaustible resources of the oceans," they bring species after species of fish and whales closer to extinction[9].

The National Parks present another instance of the working out of the tragedy of the commons. At present, they are open to all, without limit. The parks themselves are limited in extent there is only one Yosemite Valley whereas population seems to grow without limit. The values that visitors seek in the parks are steadily eroded. Plainly, we must soon cease to treat the parks as commons or they will be of no value to anyone.

What shall we do? We have several options. We might sell them off as private property. We might keep them as public property, but allocate the right to enter them. The allocation might be on the basis of wealth, by the use of an auction system. It might be on the basis of merit, as defined by some agreed-upon standards. It might be by lottery. Or it might be on a first come,

first-served basis, administered to long queues. These, I think, are all Objectionable. But we must choose—or acquiesce in the destruction of the commons that we call our National Parks.

Pollution

In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in—sewage, or chemical, radioactive, and heat wastes into water; noxious and dangerous fumes into the air; and distracting and unpleasant advertising signs into the line of sight. The calculations of utility are much the same as before. The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of ”fouling our own nest,” so long as we behave only as independent, rational, free-enterprisers.

The tragedy of the commons as a food basket is averted by private property, or something formally like it. But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means, by coercive laws or taxing devices that make it cheaper for the polluter to treat his pollutants than to discharge them untreated. We have not progressed as far with the solution of this problem as we have with the first. Indeed, our particular concept of private property, which deters us from exhausting the positive resources of the earth, favors pollution. The owner of a factory on the bank of a stream whose property extends to the middle of the stream—often has difficulty seeing why it is not his natural right to muddy the waters flowing past his door. The law, always behind the times, requires elaborate stitching and fitting to adapt it to this newly perceived aspect of the commons. The pollution problem is a consequence of population. It did not much matter how a lonely American frontiersman disposed of his waste. ”Flowing water purifies itself every ten miles,” my grandfather used to say, and the myth was near enough to the truth when he was a boy, for there were not too many people. But as population became denser, the natural Chemical and biological recycling processes became overloaded, calling for a redefinition of property rights.

How to Legislate Temperance?

Analysis of the pollution problem as a function of population density uncovers a not generally recognized principle of morality, namely*: the morality of an act is a function of the state of the system at the time it is performed*[10]. Using the commons as a cesspool does not harm the general public under frontier conditions, because there is no public; the same behavior in a metropolis is unbearable. One hundred fifty years ago a plains man could kill an American bison, cut out only the tongue for his dinner, and discard the rest of the animal. He was not in any important sense being wasteful. Today, with only a few thousand bison left, we would be appalled at such behavior.

In passing, it is worth noting that the morality of an act cannot be determined from a photograph. One does not know whether a man killing an elephant or setting fire to the grassland is harming others until one knows the total system in which his act appears. ”One picture is worth a thousand words,” said an ancient Chinese, but it may take ten thousand words to validate it. It is as tempting to ecologists as it is to reformers in general to try to persuade others by way of the photographic shortcut. But the essence of an argument cannot be photographed: it must be presented rationally in words.

That morality is system-sensitive escaped the attention of most codifiers of ethics in the past. ”Thou shalt not. . .” is the form of traditional ethical directives which make no allowance for particular circumstances. The laws of our society follow the pattern of ancient ethics, and therefore are poorly suited to governing a complex, crowded, changeable world. Our epicyclic solution is to augment statutory law with administrative law. Since it ispractically impossible to spell out all the conditions under which it is safe to burn trash in the back yard or to run an automobile without smog-control, by law we delegate the details to bureaus. The result is administrative law, which is rightly feared for an ancient reason—*Quis custodiet Ipsos custodes?*—Who shall watch the watchers themselves? John Adams said that we must have a ”government of laws and not men.” Bureau administrators, trying to evaluate the morality of acts in the total system, are singularly liable to corruption, producing a government by men, not laws. Prohibition is easy to legislate (though not necessarily to enforce); but how do we legislate temperance? Experience indicates that it can be accomplished best through the mediation of administrative law. We limit possibilities unnecessarily if we suppose that the sentiment of Quis custody denies us the use of administrative law. We

should rather retain the phrase as a perpetual reminder of fearful dangers we cannot avoid. The great challenge facing us now is to invent the corrective feedbacks that are needed to keep custodians honest. We must find ways to legitimate the needed authority of both the custodians and the corrective feedbacks.

Freedom to Breed is Intolerable

The tragedy of the commons. is involved in population problems in another way. In a world governed solely by the principle of ”dog eat dog”—— if indeed there ever was such a world how many children a family had would not be a matter of public concern. Parents who bred too exuberantly would leave fewer descendants, not more, because they would be unable to care adequately for their children. David Lack and others have found that such a negative feedback demonstrably controls the fecundity of birds[11]. But men are not birds, and have not acted like them for millenniums, at least.

If each human family were dependent only on its own resources; *if* the children of improvident parents starved to death; *if*, thus, overbreeding brought its own ”punishment” to the germ line—*then* there would be no public interest in controlling the breeding of families. But our society is deeply committed to the welfare state[12], and hence is confronted with another aspect of the tragedy of the commons.

In a welfare state, how shall we deal with the family, the religion, the race, or the class (or indeed any distinguishable and cohesive group) that adopts overbreeding as a policy to secure its own aggrandizement?[13] To couple the concept of freedom to breed with the belief that everyone born has an equal right to the commons is to lock the world into a tragic course of action.

Unfortunately this is just the course of action that is being pursued by the United Nations. In late 1967, some thirty nations agreed to the following: ”The Universal Declaration Of Human Rights describes the family as the natural and fundamental unit of society. It follows that any choice and decision with regard to the size of the family must irrevocably rest with the family itself, and cannot be made by anyone else.”[14]

It is painful to have to deny categorically the validity of this right; denying it, one feels as uncomfortable as a resident of Salem, Massachusetts, who denied the reality of witches in the seventeenth century. At the present time, in liberal quarters, something like a taboo acts to inhibit criticism of the

United Nations. There is a feeling that the United Nations is ”our last and best hope,” that we shouldn’t find fault with it; we shouldn’t play into the hands of the archconservatives. However, let us not forget what Robert Louis Stevenson said: ”The truth that is suppressed by friends is the readiest weapon of the enemy.” If we love the truth we must openly deny the validity of the Universal Declaration of Human Rights, even though it is promoted by the United Nations. We should also join with Kingsley Davis[15] in attempting to get Planned Parenthood—World Population to see the error of its ways in embracing the same tragic ideal.

Conscience Is Self-Eliminating

It is a mistake to think that we can control the breeding of mankind in the long run by an appeal to conscience. Charles Galton Darwin made this point when he spoke on the centennial of the publication of his grandfather’s great book. The argument is straightforward and Darwinian. People vary. Confronted with appeals to limit breeding, some people will undoubtedly respond to the plea more than others. Those who have more children will produce a larger fraction of the next generation than those with more susceptible consciences. The differences will be accentuated, generation by generation. In C.G. Darwin’s words: ”It may well be that it would take hundreds of generations for the progenitive instinct to develop in this way, but if it should do so, nature would have taken her revenge, and the variety Homo contracipiens would become extinct and would be replaced by the variety Homo progenitivus.”[16]

The argument assumes that conscience or the desire for children (no matter which) is hereditary—but hereditary only in the most general formal sense. The result will be the same whether the attitude is transmitted through germ cells, or exosomatically, to use A. J. Lotka’s term. (If one denies the latter possibility as well as the former, then what’s the point of education?). The argument has here been stated in the context of the population problem, but it applies equally well to any instance in which society appeals to an individual exploiting a commons to restrain himself for the general good by means of his conscience. To make such an appeal is to set up a selective system that works toward the elimination of conscience from the race.

Pathogenic Effects of Conscience

The long-term disadvantage of an appeal to conscience should be enough to condemn it; but it has serious short-term disadvantages as well. If we ask a man who is exploiting a commons to desist ”in the name of conscience,” what are we saying to him? What does he hear?—not only at the moment but also in the wee small hours of the night when, half asleep, he remembers not merely the words we used but also the nonverbal communication cues we gave him unawares? Sooner or later, consciously or subconsciously, he senses that he has received two communications, and that they are contradictory: 1. (intended communication) ”if you don’t do as we ask, we will openly condemn you for not acting like a responsible citizen”; 2. (the unintended communication) ”If you do behave as we ask, we will secretly condemn you for a simpleton who can be shamed into standing aside while the rest of us exploit the commons.”

Every man then is caught in what Bateson has called a ”double bind.” Bateson and his co-workers have made a plausible case for viewing the double bind as an important causative factor in the genesis of schizophrenia.”[17] The double bind may not always be so damaging, but it always endangers the mental health off anyone to whom it is applied. ”A bad conscience,” said Nietzsche, ”is a kind of illness.”

To conjure up a conscience in others is tempting to anyone who wishes to extend his control beyond the legal limits. Leaders at the highest level succumb to this temptation. Has any president during the past generation failed to call on labor unions to moderate voluntarily their demands for higher wages, or to steel companies to honor voluntary guidelines on prices?
I can recall none. The rhetoric used on such occasions is designed to produce feelings of guilt in noncooperators. For centuries it was assumed without proof that guilt was a valuable, perhaps even an indispensable, ingredient of the civilized life. Now, in this post-Freudian world, we doubt it.

Paul Goodman speaks from the modern point of view when he says: ”No good has ever come from feeling guilty, neither intelligence, policy, nor compassion. The guilty do not pay attention to the object but only to themselves, and not even to their own interests, which might make sense, but to their anxieties.”[18]

One does not have to be a professional psychiatrist to see the consequences of anxiety. We in the Western world are just emerging from a

dreadful two-centuries-long Dark Ages of Eros that was sustained partly by prohibition laws, but perhaps more effectively by the anxiety-generating mechanisms of education. Alex Comfort has told the story well in The Anxiety Makers[19], it is not a pretty one.

Since proof is difficult, we may even concede that the results Of anxiety may sometimes, from certain points of view, be desirable. The larger question we should ask is whether, as a matter of policy, we should ever encourage the use of a technique the tendency (if not the intention) of which is psychologically pathogenic. We hear much talk these days of responsible parenthood; the coupled words are incorporated into the titles of some organizations devoted to birth control. Some people have proposed massive propaganda campaigns to instill responsibility into the nation's (or the world's) breeders. But what is the meaning of the word conscience? When we use the word responsibility in the absence of substantial sanctions are we not trying to browbeat a free man in a commons into acting against his own interest? Responsibility is a verbal counterfeit for a substantial quid pro quo. It is an attempt to get something for nothing.

If the word responsibility is to be used at all, I suggest that it be in the sense Charles Frankel uses it[20]. "Responsibility," says this philosopher, "is the product of definite social arrangements." Notice that Frankel calls for social arrangements—not propaganda.

Mutual Coercion Mutually Agreed Upon

The social arrangements that produce responsibility are arrangements that create coercion, of some sort. Consider bank robbing. The man who takes money from a bank acts as if the bank were a commons. How do we prevent such action? Certainly not by trying to control his behavior solely by a verbal appeal to his sense of responsibility. Rather than rely on propaganda we follow Frankel's lead and insist that a bank is not a commons; we seek the definite social arrangements that will keep it from becoming a commons. That we thereby infringe on the freedom of would-be robbers we neither deny nor regret.

The morality of bank robbing is particularly easy to understand because we accept complete prohibition of this activity. We are willing to say "Thou shalt not rob banks," without providing for exceptions. But temperance also can be created by coercion. Taxing is a good coercive device. To keep downtown shoppers temperate in their use of parking space we introduce

parking meters for short periods, and traffic fines for longer ones. We need not actually forbid a citizen to park as long as he wants to; we need merely make it increasingly expensive for him to do so. Not prohibition, but care fully biased options are what we offer him. A Madison Avenue man might call this persuasion, I prefer the greater candor of the word coercion. Coercion is a dirty word to most liberals now, but it need not forever be so. As with the four-letter words, its dirtiness can be cleansed away by exposure to the light, by saying it over and over without apology or embarrassment. To many, the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats, but this is not a necessary part of its meaning. The only kind of coercion I recommend is mutual coercion, mutually agreed upon by the majority of the people affected.

To say that we. mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it. Who enjoys taxes? We all grumble about them. But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless. We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons.

An alternative to the commons need not be perfectly just to be preferable. With real estate and other material goods, the alternative we have chosen is the institution of private property coupled with legal inheritance. Is this system perfectly just? As a genetically trained biologist | deny that it is. It seems to me that, if there are to be differences in individual inheritance, legal possession should be perfectly correlated with biological inheritance—that those who are biologically more fit to be the custodians of property and power should legally inherit more. But genetic recombination continually makes a mockery of the doctrine of ”like father, like son” implicit in our laws of legal inheritance. An idiot can inherit millions, and a trust fund can keep his estate intact. We must admit that our legal system of private property plus inheritance is unjust—but we put up with it because we are not convinced, at the moment, that anyone has invented a better system. The alternative of the commons is too horrifying to contemplate. Injustice is preferable to total ruin.

It is one of the peculiarities of the warfare between reform and the status quo that it is thoughtlessly governed by a double standard. Whenever a reform measure is proposed it is often defeated when its opponents triumphantly discover a flaw in it. As Kingsley Davis has pointed out[21], worshipers of the status quo sometimes imply that no reform is possible without unanimous agreement, an implication contrary to historical fact. As

nearly as I can make out, automatic rejection of proposed reforms is based on one of two unconscious assumptions: (1) that the status quo is perfect; or (2) that the choice we face is between reform and no action; if the proposed reform is imperfect, we presumably should take no action at all, while we wait for a perfect proposal. But we can never do nothing. That which we have done for thousands of years is also action. It also produces evils. Once we are aware that the status quo is action, we can then compare its discoverable advantages and disadvantages with the predicted advantages and disadvantages of the proposed reform, discounting as best we can for our lack of experience. On the basis of such a comparison, we can make a rational decision which will not involve the unworkable assumption that only perfect systems are tolerable.

Recognition of Necessity

Perhaps the simplest summary of this analysis of man's population problems is this: the commons, if justifiable at all, is justifiable only under conditions of low-population density. As the human population has increased, the commons has had to be abandoned in one aspect after another. First we abandoned the commons in food gathering, enclosing farm land and restricting pastures and hunting and fishing areas. These restrictions are still not complete throughout the world. Somewhat later we saw that the commons as a place for waste disposal would also have to be abandoned. Restrictions on the disposal of domestic sewage are widely accepted in the Western world, we are still struggling to close the commons to pollution by automobiles, factories, insecticide sprayers, fertilizing operations, and atomic energy installations.

In a still more embryonic state is our recognition of the evils of the commons in matters of pleasure. There is almost no restriction on the propagation of sound waves in the public medium. The shopping public is assaulted with mindless music, without its consent. Our government has paid out billions of dollars to create a supersonic transport which would disturb 50,000 people for every one person whisked from coast to coast 3 hours faster. Advertisers muddy the airwaves of radio and television and pollute the view of travelers. We are a long way from outlawing the commons in matters of pleasure. Is this because our Puritan inheritance makes us view pleasure as something of a sin, and pain (that is, the pollution of advertising) as the sign of virtue?

Every new enclosure of the commons involves the infringement of somebody's personal liberty. Infringements made in the distant past are accepted because no contemporary complains of a loss. It is the newly proposed infringements that we vigorously oppose; cries of "rights" and "freedom" fill the air. But what does "freedom" mean? When men mutually agreed to pass laws against robbing, mankind became more free, not less so. Individuals locked into the logic of the commons are free only to bring on universal ruin; once they see the necessity of mutual coercion, they become free to pursue other goals. I believe it was Hegel who said, "Freedom is the recognition of necessity."

The most important aspect of necessity that we must now recognize is the necessity of abandoning the commons in breeding. No technical solution can rescue us from the misery of overpopulation. Freedom to breed will bring ruin to all. At the moment, to avoid hard decisions many of us are tempted to propagandize for conscience and responsible parenthood. The temptation must be resisted, because an appeal to independently acting consciences selects for the disappearance of all conscience in the long run, and an increase in anxiety in the short.

The only way we can preserve and nurture other and more precious freedoms is by relinquishing the freedom to breed, and that very soon. "Freedom is the recognition of necessity"—and it is the role of education to reveal to all the necessity of abandoning the freedom to breed. Only 50, can we put an end to this aspect of the tragedy of the commons.

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2

The Economic Theory of a Common-Property Resource: The Fishery

H. SCOTT GORDON

I. Introduction

The chief aim of this paper is to examine the economic theory of natural resource utilization as it pertains to the fishing industry[1]. It will appear, I hope, that most of the problems associated with the words ”conservation” or ”depletion” or ”overexploitation” in the fishery are, in reality, manifestations of the fact that the natural resources of the sea yield no economic rent.

Fishery resources are unusual in the fact of their common-property nature; but they are not unique, and similar problems are encountered in other cases of common-property resource industries, such as petroleum production, hunting and trapping, etc. Although the theory presented in the following pages is worked out in terms of the fishing industry, it is, I believe, applicable generally to all cases where natural resources are owned in common and exploited under conditions of individualistic competition.

From H. Scott Gordon, ”The Economic Theory of a Common-Property Resource: The Fishery,” *Journal of Political Economy* 62 (1954):124—42. Reprinted by permission of University of Chicago Press.

II. Biological Factors and Theories

The great bulk of the research that has been done on the primary production phase of the fishing industry has so far been in the field of biology. Owing to the lack of theoretical economic research[2], biologists have been forced to extend the scope of their own thought into the economic sphere and in some cases have penetrated quite deeply, despite the lack of the analytical tools of economic theory[3]. Many others, who have paid no specific attention to the economic aspects of the problem have nevertheless recognized that the ultimate question is not the ecology of life in the sea as such, but man's use of these resources for his own (economic) purposes. Dr. Martin D. Burkenroad, for example, began a recent article on fishery management with a section on "Fishery Management as Political Economy," saying that "the Management Of fisheries is intended for the benefit of man, not fish; therefore the effect of management upon fishstocks cannot be regarded as beneficial *per se*."[4] The great Russian marine biology theorist, T. I. Baranoff, referred to his work as "bionomics" or "bio-economics," although he made little explicit reference to economic factors[5]. In the same way, A. G. Huntsman, reporting in 1944 on the work of the Fisheries Research Board Of Canada, defined the problem of fisheries depletion in economic terms: "Where the take in proportion to the effort fails to yield a satisfactory living to the fisherman"[6]; and a later paper by the same author contains, as an incidental statement, the essence of the economic optimum solution without, apparently, any recognition of its significance[7]. Upon the occasion of its fiftieth anniversary in 1952, the International Council for the Exploration of the Sea published a *Rapport Jubilaire,* consisting of a series of papers summarizing progress in various fields of fisheries research. The paper by Michael Graham on "Overfishing and Optimum Fishing," by its emphatic recognition of the economic criterion, would lead one to think that the economic aspects of the question had been extensively examined during the last half century. But such is not the case. Virtually no specific research into the economics of fishery resource utilization has been undertaken. The present state of knowledge is that a great deal is known about the biology of the various commercial species but little about the economic characteristics of the fishing industry.

The most vivid thread that runs through the biological literature is the effort to determine the effect of fishing on the stock of fish in the sea. This discussion has had a very distinct practical orientation, being part of the effort to design regulative policies Of a "conservation" nature. To the layman the

problem appears to be dominated by a few facts of overriding importance. The first of these is the prodigious reproductive potential of most fish species. The adult female cod, for example, lays millions of eggs at each spawn. The egg that hatches and ultimately reaches maturity is the great exception rather than the rule. The various herrings (Clupeidae) are the most plentiful of the commercial species, accounting for close to half the world's total catch, as well as providing food for many other sea species. Yet herring are among the smallest spawners, laying a mere hundred thousand eggs a season, which, themselves, are eaten in large quantity by other species. Even in enclosed waters the survival and reproductive powers of fish appear to be very great. In 1939 the Fisheries Research Board of Canada deliberately tried to kill all the fish in one small lake by poisoning the water. Two years later more than ninety thousand fish were found in the lake, including only about six hundred old enough to have escaped the poisoning.

The picture one gets of life in the sea is one of constant predation of one species on another, each species living on a narrow margin of food supply. It reminds the economist of the Malthusian law of population; for, unlike man, the fish has no power to alter the conditions of his environment and consequently cannot progress. In fact, Malthus and his law are frequently mentioned in the biological literature. One's first reaction is to declare that environmental factors are so much more important than commercial fishing that man has no effect on the population of the sea at all. One of the continuing investigations made by fisheries biologists is the determination of the age distribution of catches. This is possible because fish continue to grow in size with age, and seasonal changes are reflected in certain hard parts of their bodies in much the same manner as one finds growthrings in a tree. The study of these age distributions shows that commercial catches are heavily affected by good and bad brood years. A good brood year, one favorable to the hatching of eggs and the survival of fry, has its effect on future catches, and one can discern the dominating importance of that brood year in the commercial catches of succeeding years[8]. Large broods, however, do not appear to depend on large numbers of adult spawners, and this lends support to the belief that the fish population is entirely unaffected by the activity of man.

There is, however, important evidence to the contrary. World Wars I and II, during which fishing was sharply curtailed in European waters, were followed by indications of a significant growth in fish populations. Fish marking experiments, of which there have been a great number, indicate that fishing

is a major cause of fish mortality in developed fisheries. The introduction of restrictive laws has often been followed by an increase in fish populations, although the evidence on this point is capable of other interpretations which will be noted later.

General opinion among fisheries biologists appears to have had something of a cyclical pattern. During the latter part of the last century, the Scottish fisheries biologist, W. C. MacIntosh[9], and the great Darwinian, T. H.Huxley, argued strongly against all restrictive measures on the basis of the inexhaustible nature of the fishery resources of the sea. As Huxley put it in 1883: ”The cod fishery, the herring fishery, the pilchard fishery, the mackerel fishery, and probably all the great sea fisheries, are inexhaustible: that is to say that nothing we do seriously affects the number of fish. And any attempt to regulate these fisheries seems consequently, from the nature of the case,to be useless[10]”. As a matter of fact, there was at this time relatively little restriction of fishing in European waters. Following the Royal Commission Of 1866, England had repealed a host of restrictive laws. The development of steam-powered trawling in the 1883, which enormously increased man’s predatory capacity, and the marked improvement Of the trawl method in 1923 turned the pendulum, and throughout the interwar years discussion centered on the problem of ”overfishing” and ”depletion.” This was accompanied by a considerable growth of restrictive regulations.“[11] Only recently has the pendulum begun to reverse again, and there has lately been expressed in biological quarters a high degree of skepticism concerning the efficacy Of restrictive measures, and the Huxleyan faith in the inexhaustibility of the sea has once again begun to find advocates. In 1951 Dr. Harden F. Taylor summarized the overall position of world fisheries in the following words: Such statistics of world fisheries as are available suggest that while particular species have fluctuated in abundance, the yield of the sea fisheries as a whole or of any considerable region has not only been sustained, but has generally increased with increasing human populations, and there is as yet no sign that they will not continue to do so. No single species so far as we know has ever become extinct, and no regional fishery in the world has ever been exhausted[12].

In formulating governmental policy, biologists appear to have had a hard struggle (not always successful) to avoid oversimplification of the problem. One of the crudest arguments to have had some support is known as the ”propagation theory,” associated with the name of the English biologist, E.W. L. Holt[13]. Holt advanced the proposition that legal size limits should be

established at a level that would permit every individual of the species in question to spawn at least once. This suggestion was effectively demolished by the age-distribution studies whose results have been noted above. Moreover, some fisheries, such as the ”sardine” fishery of the Canadian Atlantic Coast, are specifically for immature fish. The history of this particular fishery shows no evidence whatever that the landings have been in any degree reduced by the practice of taking very large quantities of fish of prespawning age year after year.

The state of uncertainty in biological quarters around the turn of the century is perhaps indicated by the fact that Holt’s propagation theory was advanced concurrently with its diametric opposite: ”the thinning theory” of the Danish biologist, C. G. J. Petersen[14]. The latter argued that the fish may be too plentiful for the available food and that thinning out the young by fishing would enable the remainder to grow more rapidly. Petersen supported his theory with the results of transplanting experiments which showed that the fish transplanted to a new habitat frequently grew much more rapidly than before. But this is equivalent to arguing that the reason why rabbits multiplied so rapidly when introduced to Australia is because there were no rabbits already there with which they had to compete for food. Such an explanation would neglect all the other elements of importance in a natural ecology. In point of fact, insofar as food alone is concerned, thinning a cod population, say by half, would not double the food supply of the remaining individuals; for there are other species, perhaps not commercially valuable, that use the same food as the cod. Dr. Burkenroad’s comment, quoted earlier, that the purpose of practical policy is the benefit of man, not fish, was not gratuitous, for the argument at times been advanced that commercial fishing should crop the resource in such a way as to leave the stocks of fish in the sea completely unchanged. Baranoff was largely responsible for destroying this approach, showing most elegantly that a commercial fishery cannot fail to diminish the fish stock. His general conclusion is worth quoting, for it states clearly not only his own position but the error of earlier thinking:

As we see, a picture is obtained which diverges radically from the hypothesis which has been favoured almost down to the present time, namely that the natural reserve of fish is an inviolable capital, of which the fishing industry must use only the interest, not touching the capital at all. Our theory says, on the contrary, that a fishery and a natural reserve of fish are incompatible, and that the exploitable stock of fish is a Changeable quantity, which depends on the intensity of the fishery. The more fish we take from a

body of water, the smaller is the basic stock remaining in it; and the less fish we take, the greater is the basic stock, approximating to the natural stock when the fishery approaches zero. Such is the nature of the matter[15].

The general conception of a fisheries ecology would appear to make such a conclusion inevitable. If a species were in ecological equilibrium before the commencement of commercial fishing, man's intrusion would have the same effect as any other predator; and that can only mean that the species population would reach a new equilibrium at a lower level of abundance, the divergence of the new equilibrium from the old depending on the degree of man's predatory effort and effectiveness The term "fisheries management" has been much in vogue in recent years, being taken to express a more subtle approach to the fisheries problem than the older terms "depletion" and "conservation." Briefly, it focuses attention on the quantity of fish caught, taking as the human objective of commercial fishing the derivation of the largest sustainable catch. This approach is often hailed in the biological literature as the "new theory" or the "modern formulation" of the fisheries problems[16]. Its limitations, however, are very serious, and, indeed, the new approach comes very little closer to treating the fisheries problem as one of human utilization of natural resources than did the older, more primitive, theories. Focusing attention on the maximization of the catch neglects entirely the inputs of other factors of production which are used up in fishing and must be accounted for as costs. There are many references to such ultimate economic considerations in the biological literature but no analytical integration of the economic factors. In fact, the very conception of a net economic yield has scarcely made any appearance at all. On the whole, biologists tend to treat the fisherman as an exogenous element in their analytical model, and the behavior of fishermen is not made into an integrated element of a general and systematic "bionomic" theory. In the case of the fishing industry the large numbers of fishermen permit valid behavioristic generalization of their activities along the lines of the standard economic theory of production. The following section attempts to apply that theory to the fishing industry and to demonstrate that the "overfishing problem" has its roots in the economic organization of the industry.

III. Economic Theory of the Fishery

In the analysis which follows, the theory of Optimum utilization of fishery resources and the reasons for its frustration in practice are developed for a typical demersal fish. Demersal, or bottom-dwelling fishes, such as cod, haddock, and similar species and the various flatfishes, are relatively non-migratory in character. They live and feed on shallow continental shelves where the continual mixing of cold water maintains the availability of those nutrient salts which form the fundamental basis of marine-food chains. The various feeding grounds are separated by deep-water channels which constitute barriers to the movement of these species; and in some cases the fish of different banks can be differentiated morphologically, having varying numbers of vertebrae or some such distinguishing characteristic. The significance of this fact is that each fishing ground will be treated as unique, in the same sense as can a piece of land, possessing, at the very least, one characteristic not shared by any other piece: that is, location. (Other species, such as herring, mackerel, and similar pelagic or surface dwellers, migrate over very large distances, and it is necessary to treat the resource of an entire geographic region as one. The conclusions arrived at below are applicable to such fisheries, but the method of analysis employed is not formally applicable. The same is true of species that migrate to and from fresh water and the lake fishes proper).

We can define the optimum degree of utilization of any particular fishing ground as that which maximizes the net economic yield, the difference between total cost, on the one hand, and total receipts (or total value production), on the other[17]. Total cost and total production can each be expressed as a function of the degree of fishing intensity or, as the biologists put it, "fishing effort," so that a simple maximization solution is possible. Total cost will be a linear function of fishing effort, if we assume no fishing induced effects on factor prices, which is reasonable for any particular regional fishery. The production function—the relationship between fishing effort and total value produced—requires some special attention. If we were to follow the usual presentation of economic theory, we should argue that this function would be positive but, after a point, would rise at a diminishing rate because of the law of diminishing returns. This would not mean that the fish population has been reduced, for the law refers only to the proportions of factors to one another, and a fixed fish population, together with an increasing intensity of effort, would be assumed to show the typical sigmoid

pattern of yield. However, in what follows it will be assumed that the law of diminishing returns in this pure sense is inoperative in the fishing industry. (The reasons will be advanced at a later point in this paper). We shall assume that, as fishing effort expands, the catch of fish increases at a diminishing rate but that it does so because of the effect of catch upon the fish population[18]. So far as the
argument of the next few pages is concerned, all that is formally necessary is to assume that, as fishing intensity increases, catch will grow at a diminishing rate. Whether this reflects the pure law of diminishing returns or the reduction of population by fishing, or both, is of no particular importance. The point at issue will, however, take on more significance in Section IV and will be examined there.

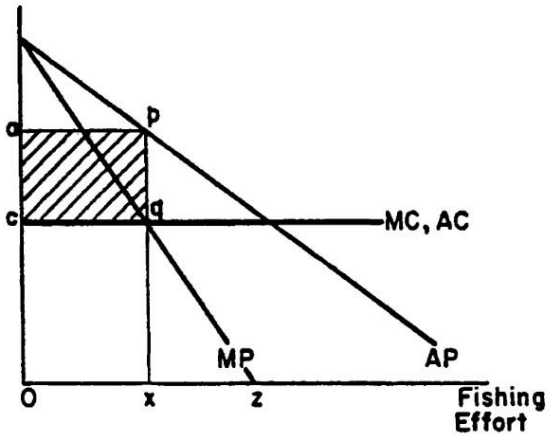

Figure 2.1

Our analysis can be simplified if we retain the ordinary production function instead of converting it to cost curves, as is usually done in the theory of the firm. Let us further assume that the functional relationship between average production (production-per—unit-of-fishing—effort) and the quantity of fishing effort is uniformly linear. This does not distort the results unduly, and it permits the analysis to be presented more simply and in graphic terms that are already quite familiar. In Figure 2.1 the optimum intensity of utilization of a particular fishing ground is shown. The curves *AP* and *MP* represent, respectively, the average productivity and marginal productivity of fishing effort. The relationship between them is the same as that between average revenue and marginal revenue in imperfect competition theory, and MP bisects any horizontal between the ordinate and *AP*. Since the costs of fishing supplies, etc., are assumed to be unaffected by the amount of fishing effort, marginal cost and average cost are identical and constant, as shown by the curve *MC, AC*[19]. These costs are assumed to include an opportunity

income for the fishermen, the income that could be earned in other comparable employments. Then *Ox* is the optimum intensity of effort on this fishing ground, and the resource will, at this level of exploitation, provide the maximum net economic yield indicated by the shaded area *apqc*. The maximum sustained physical yield that the biologists speak of will be attained when marginal productivity of fishing effort is zero, at *0z* of fishing intensity in the chart shown. Thus, as one might expect, the optimum economic fishing intensity is less than that which would produce the maximum sustained physical yield.

The area *apqc* in Figure 2.1 can be regarded as the rent yielded by the fishery resource. Under the given conditions, *0x* is the best rate of exploitation for the fishing ground in question, and the rent reflects the productivity of that ground, not any artificial market limitation. The rent here corresponds to the extra productivity yielded in agriculture by soils of better quality or location than those on the margin Of cultivation, which may produce an opportunity income but no more. In short, Figure 2.1 shows the determination of the intensive margin of utilization on an intramarginal fishing ground.

We now come to the point that is of greatest theoretical importance in understanding the primary production phase of the fishing industry and in distinguishing it from agriculture. In the sea fisheries the natural resource is not private property; hence the rent it may yield is not capable of being appropriated by anyone. The individual fisherman has no legal title to a section of ocean bottom. Each fisherman is more or less free to fish wherever he pleases. The result is a pattern of competition among fishermen which culminates in the dissipation of the rent of the intramarginal grounds. This can be most clearly seen through an analysis of the relationship between the intensive margin and the extensive margin of resource exploitation in fisheries.

In Figure 2.2, two fishing grounds of different fertility (or location) are shown. Any given amount of fishing effort devoted to ground 2 will yield a smaller total (and therefore average) product than if devoted to 1. The maximization problem is now a question of the allocation of fishing effort between grounds 1 and 2. The optimum is, of course, where the marginal productivities are equal on both grounds. In Figure 2.2, fishing effort *0x* on 1 and *0y* on 2 would maximize the total net yield of *0x* + *0y* effort if marginal cost were equal to *0c.* But if under such circumstances the individual fishermen are free to fish on whichever ground they please, it is clear that this

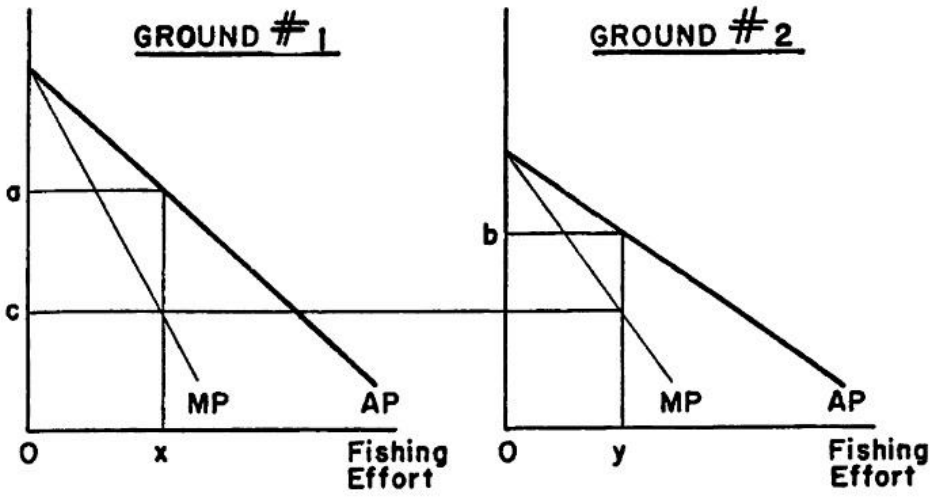

Figure 2.2

is not an equilibrium allocation of fishing effort in the sense of connoting stability. A fisherman starting from port and deciding whether to go to ground 1 or 2 does not care for marginal productivity but for average productivity, for it is the latter that indicates where the greater total yield may be obtained. If fishing effort were allocated in the optimum fashion, as shown in Figure 2.2, with *0x* on 1, and *0y* on 2, this would be a disequilibrium situation. Each fisherman could expect to get an average catch of *0a* on 1 but only *0b* on 2. Therefore, fishermen would shift from 2 to 1. Stable equilibrium would not be reached until the average productivity of both grounds was equal. If we now imagine a continuous gradation of fishing grounds, the extensive margin would be on that ground which yielded nothing more than outlaid costs plus opportunity income in short, the one on which average productivity and average cost were equal. But, since average cost is the same for all grounds and the average productivity of all grounds is also brought to equality by the free and competitive nature of fishing, this means that the intramarginal grounds also yield no rent. It is entirely possible that some grounds would be exploited at a level of negative marginal productivity. What happens is that the rent which the intramarginal grounds are capable of yielding is dissipated through misallocation of fishing effort.

This is why fishermen are not wealthy, despite the fact that the fishery resources of the sea are the richest and most indestructible available to man. By and large, the only fisherman who becomes rich is one who makes a lucky catch or one who participates in a fishery that is put under a form of social

control that turns the open resource into property rights. Up to this point, the remuneration of fishermen has been accounted for as an opportunity-cost income comparable to earnings attainable in other industries. In point of fact, fishermen typically earn less than most other seven in much less hazardous occupations or in those requiring less skill.

There is no effective reason why the competition among fishermen described above must stop at the point where opportunity incomes are yielded. It may be and is in many cases carried much further. Two factors prevent an equilibration of fishermen's incomes with those of other members of society. The first is the great immobility of fishermen. Living often in isolated communities, with little knowledge of conditions or opportunities elsewhere; educationally and often romantically tied to the sea; and lacking the savings necessary to provide a "stake," the fisherman is one of the least mobile of occupational groups. But, second, there is in the spirit every fisherman the hope of the "lucky catch." As those who know fishermen well have often testified, they are gamblers and incurably optimistic. As a consequence, they will work for less than the going wage[20].

The theory advanced above is substantiated by important developments in the fishing industry. For example, practically all control measures have, in the past, been designed by biologists, with sole attention paid to the production side of the problem and none to the cost Side. The result has been a wide-open door for the frustration of the purposes of such measures. The Pacific halibut fishery, for example, is often hailed as a great achievement in modern fisheries management. Under international agreement between the United States and Canada, a fixed-catch limit was established during the early thirties. Since then, cath-per-unit-effort indexes, as usually interpreted, show a significant rise in the fish population. W. F. Thompson, the pioneer of the Pacific halibut management program, noted recently that "it has often been said that the halibut regulation presents the only definite case of sustained improvement of an overfished deep-sea fishery. This, I believe, is true and the fact should lend special importance to the principles which have been deliberately used to obtain this improvement[21]". Actually, careful study of the statistics indicates that the estimated recovery of halibut stocks could not have been due principally to the control measures, for the average catch was, in fact, greater during the recovery years than during the years of decline. The total amount of fish taken was only a small fraction of the estimated population reduction for the years prior to regulation[22]. Natural factors seem to be mainly responsible for the observed change in population, and the

institution of control regulations almost a coincidence. Such coincidences are not uncommon in the history of fisheries policy, but they may be easily explained. If a long-term cyclical fluctuation is taking place in a commercially valuable species, controls will likely be instituted when fishing yields have fallen very low and the clamor of fishermen is great; but it is then, Of course, that stocks are about due to recover in any case. The ”success” of conservation measures may be due fully as much to the sociological foundations of public policy as to the policy’s effect on the fish. Indeed, Burkenroad argues that biological statistics in general may be called into question on these grounds. Governments sponsor biological research when the catches are disappointing. If there are long-term cyclical fluctuations in fish populations, as some think, it is hardly to be wondered why biologists frequently discover that the sea is being depleted, only to change their collective opinion a decade or so later.

Quite aside from the biological argument on the Pacific halibut case, there is no clear-cut evidence that halibut fishermen were made relatively more prosperous by the control measures. Whether or not the recovery of the halibut stocks was due to natural factors or to the catch limit, the potential net yield this could have meant has been dissipated through a rise in fishing costs. Since the method of control was to halt fishing when the limit had been reached, this created a great incentive on the part of each fisherman to get the fish before his competitors. During the last twenty years, fishermen have invested in more, larger, and faster boats in a competitive race for fish. In 1933 the fishing season was more than six months long. In 1952 it took just twenty-six days to catch the legal limit in the area from Willapa Harbor to Cape Spencer, and sixty days in the Alaska region. What has been happening is a rise in the average cost of fishing effort, allowing no gap between average production and average cost to appear, and hence no rent[23].

Essentially the same phenomenon is observable in the Canadian Atlantic Coast lobster-conservation program. The method of control here is by seasonal Closure. The result has been a steady growth in the number of lobster traps set by each fisherman. Virtually all available lobsters are now caught each year within the season, but at much greater cost in gear and supplies. At a fairly conservative estimate, the same quantity of lobsters could be caught with half the present number of traps. In a few places the fishermen have banded together into a local monopoly, preventing entry and controlling their own operations. By this means, the amount of fishing gear has been greatly reduced and incomes considerably improved.

That the plight of fishermen and the inefficiency of fisheries production stems from the common-property nature of the resources of the sea is further corroborated by the fact that one finds similar patterns of exploitation and similar problems in other cases of open resources. Perhaps the most obvious is hunting and trapping. Unlike fishes, the biotic potential of land animals is low enough for the species to be destroyed. Uncontrolled hunting means that animals will be killed for any short-range human reason, great or small: for food or simply for fun. Thus the buffalo of the Western plains was destroyed to satisfy the most trivial desires of the white man, against which the long-term food needs of the aboriginal population counted as nothing. Even in the most civilized communities, conservation authorities have discovered that a bag—limit per man is necessary if complete destruction is to be avoided.

The results of anthropological investigation of modes of land tenure among primitive peoples render some further support to this thesis. In accordance with an evolutionary concept of cultural comparison, the older anthropological study was prone to regard resource tenure in common, with unrestricted exploitation, as a ”lower” stage of development comparative with private and group property rights. However, more complete annals of primitive cultures reveal common tenure to be quite rare, even in hunting and gathering societies. Property rights in some form predominate by far, and, most important, their existence may be easily explained in terms of the necessity for orderly exploitation and conservation of the resource.

Environmental conditions make necessary some vehicle which will prevent the resources of the community at large from being destroyed by excessive exploitation. Private or group land tenure accomplishes this end in an easily understandable fashion[24]. Significantly, land tenure is found to be ”common” only in those cases where the hunting resource is migratory over such large areas that it cannot be regarded as husbandable by the society. In cases of group tenure where the numbers of the group are large, there is still the necessity of coordinating the practices of exploitation, in agricultural, as well as in hunting or gathering, economies. Thus, for example, Malinowski reported that among the Trobriand Islanders one of the fundamental principles of land tenure is the coordination of the productive activities of the gardeners by the person possessing magical leadership in the group[25]. ”Speaking generally, we may say that stable primitive cultures appear to have discovered the dangers of common-property tenure and to have developed measures to protect their resources. Or, if a more Darwinian explanation be preferred, we

may say that only those primitive cultures have survived which succeeded in developing such institutions.

Another case, from a very different industry, is that of petroleum production. Although the individual petroleum producer may acquire undisputed lease or ownership of the particular plot of land upon which his well is drilled, he shares, in most cases, a common pool of oil with other drillers. There is, consequently, set up the same kind of competitive race as is found in the fishing industry, with attending overexpansion of productive facilities and gross wastage of the resource. In the United States, efforts to regulate a chaotic situation in oil production began as early as 1915. Production practices, number of wells, and even output quotas were set by governmental authority; but it was not until the federal ”Hot Oil” Act of 1935 and the development of interstate agreements that the final loophole (bootlegging) was closed through regulation Of interstate commerce in oil.

Perhaps the most interesting similar case is the use of common pasture in the medieval manorial economy. Where the ownership of animals was private but the resource on which they fed was common (and limited), it was necessary to regulate the use of common pasture in order to prevent each man from competing and conflicting with his neighbors in an effort to utilize more of the pasture for his own animals. Thus the manor developed its elaborate rules regulating the use of the common pasture, or ”stinting” the common: limitations on the number of animals, hours of pasturing, etc., designed to prevent the abuses of excessive individualistic competition[26].

There appears, then, to be some truth in the conservative dictum that everybody’s property is nobody’s property. Wealth that is free for all is valued by none because he who is foolhardy enough to wait for its proper time of use will only find that it has been taken by another. The blade of grass that the manorial cowherd leaves behind is valueless to him, for tomorrow it may be eaten by another’s animal; the oil left under the earth is valueless to the driller, for another may legally take it; the fish in the sea are valueless to the fisherman, because there is no assurance that they will be there for him to morrow if they are left behind today. A factor of production that is valued at nothing in the business calculations of its users will yield nothing in income. Common-property natural resources are free goods for the individual and scarce goods for society. Under unregulated private exploitation, they can yield no rent; that can be accomplished only by methods which make them private property or public (government) property, in either case subject to a unified directing power.

IV. The Bionomic Equilibrium of the Fishing Industry

The work of biological theory in the fishing industry is, basically, an effort to delineate the ecological system in which a particular fish population is found. In the main, the species that have been extensively studied are those which are subject to commercial exploitation. This is due not only to the fact that funds are forthcoming for such research but also because the activity of commercial fishing vessels provides the largest body of data upon which the biologist may work. Despite this, however, the ecosystem of the fisheries biologist is typically one that excludes man. Or, rather, man is regarded as an exogenous factor, having influence on the biological ecosystem through his removal of fish from the sea, but the activities of man are themselves not regarded as behaviorized or determined by the other elements of a system of mutual interdependence. The large number of independent fishermen who exploit fish populations of commercial importance makes it possible to treat man as a behavior element in a larger, ”bionomic,” ecology, if we can find the rules which relate his behavior to the other elements of the system. Similarly, in their treatment of the principles of fisheries management, biologists have overlooked essential elements of the problem by setting maximum physical landings as the objective of management, thereby neglecting the economic factor of input cost.

An analysis of the bionomic equilibrium of the fishing industry may, then, be approached in terms of two problems. The first is to explain the nature of the equilibrium of the industry as it occurs in the state of uncontrolled or unmanaged exploitation of a common—property resource. The second is to indicate the nature of a socially optimum manner of exploitation, which is, presumably, what governmental management policy aims to achieve or Promote. These two problems will be discussed in the remaining pages.

In the preceding section it was shown that the equilibrium condition of uncontrolled exploitation is such that the net yield (total value landings minus total cost) is zero. The ”bionomic ecosystem” of the fishing industry, as we might call it, can then be expressed in terms of four variables and four equations. Let P represent the population of the particular fish species on the particular fishing bank in question; L the total quantity taken or ”landed” by man, measured in value terms; E the intensity of fishing or the quantity of

"fishing effort" expended; and *C* the total cost of making such effort. The system. Then, is as follows:

$P = P(L)$, (1)

$L = L(P, E)$ (2)

$C = C(E)$, (3)

$C = L$. (4)

Equation (4) is the equilibrium condition of an uncontrolled fishery.

The functional relations stated in equations (1), (2), and (3) may be graphically presented as shown in Figure 2.3 Segment 1 Shows the fish population as a simple negative function of landings. In segment 2 a map of landings functions is drawn. Thus, for example, if population were P_3, effort of *De* would produce *Ol* of fish. For each given level of population, a larger fishing effort will result in larger landings. Each population contour is, then, a production function for a given population level. The linearity of these contours indicates that the law of diminishing returns is not operative, nor are any landings-induced price effects assumed to affect the value landings graphed on the vertical axis. These assumptions are made in order to produce the simplest determinate solution; yet each is reasonable in itself. The assumption of a fixed product price is reasonable, since our analysis deals with one fishing ground, not the fishery as a whole. The cost function represented in equation (3) and graphed in segment 3 of Figure 2.3 is not really necessary to the determination, but its inclusion makes the matter somewhat clearer. Fixed prices of input factors—"fishing effort"—is assumed, which is reasonable again on the assumption that a small part of the total fishery is being analyzed.

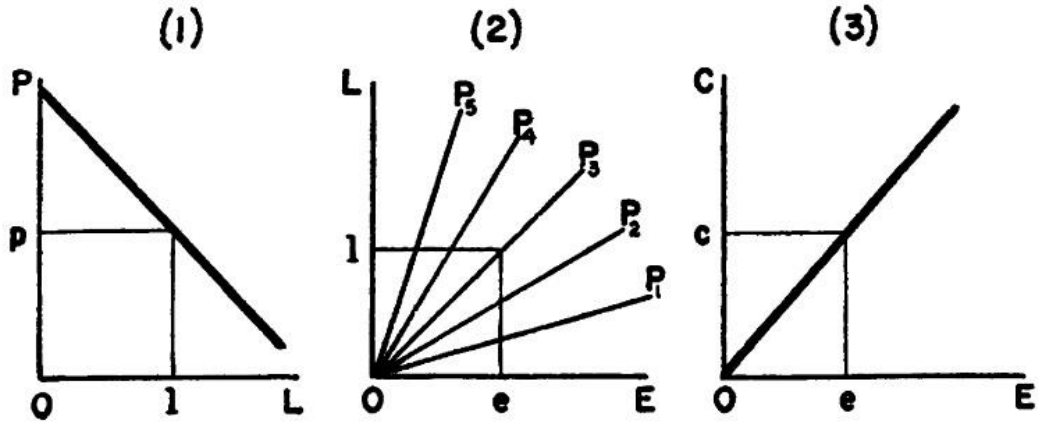

Figure 2.3

Starting with the first segment, we see that a postulated catch of *Ol* connotes an equilibrium population in the biological ecosystem of *0p*.Suppose this population to be represented by the contour P_3 of segment 2. Then, given P3, *0e* is the effort required to catch the postulated landings *Ol*. This quantity of effort involves a total cost of *0c*, as Shown in segment 3 of the graph. In full bionomic equilibrium, *C* = *L*, and if the particular values *0c* and *0l* shown are not equal, other quantities of all four variables, *L, P, E*, and *C*, are required, involving movements of these variables through the functional system shown. The operative movement is, of course, in fishing effort, E. It is the equilibrating variable in the system.

The equilibrium equality of landings *(L)* and cost (*C),* however, must be a position of stability, and *L* = *C* is a necessary, though not in itself sufficient, condition for stability in the ecosystem. This is shown by Figure 2.4. If effort cost and effort-landings functions were both linear, no stable equilibrium could be found. If the case were represented by *C* and *L1*, the fishery would contract to zero; if by *C* and *L2*, it would undergo an infinite expansion. Stable equilibrium requires that either the cost or the landings function be nonlinear. This condition is fulfilled by the assumption that population is reduced by fishing (eq. [1] above). The equilibrium is therefore as shown in
Figure 2.5. Now 0e represents a fully stable equilibrium intensity of fishing.

The analysis of the conditions of stable equilibrium raises some points of general theoretical interest. In the foregoing we have assumed that stability results from the effect of fishing on the fish population. In the standard analysis of economic theory, we should have employed the law of diminishing returns to produce a landings function of the necessary shape. Market factors might also have been so employed; a larger supply of fish, forthcoming from greater fishing effort, would reduce unit price and thereby produce a landings function with the necessary negative second derivative. Similarly, greater fishing intensity might raise the unit costs of factors, producing a cost function with a positive second derivative. Any one of these three population effects, law of diminishing returns, or market effect is alone sufficient to produce stable equilibrium in the ecosystem.

As to the law of diminishing returns, it has not been accepted per se by fisheries biologists. It is, in fact, a principle that becomes quite slippery when one applies it to the case of fisheries. Indicative of this is the fact that Alfred Marshall, in whose Principles one can find extremely little formal error, misinterprets the application of the law of diminishing returns to the fishing industry, arguing, in effect, that the law exerts its influence through the

reducing effect of fishing on the fish population"[27] There have been some interesting expressions of the law or, rather, its essential varying-proportions-of—factors aspect, in the biological literature. H. M. Kyle, a German biologist, included it in 1928 among a number of reasons why catch-per—unit-of fishing-effort indexes are not adequate measures of population change[28].

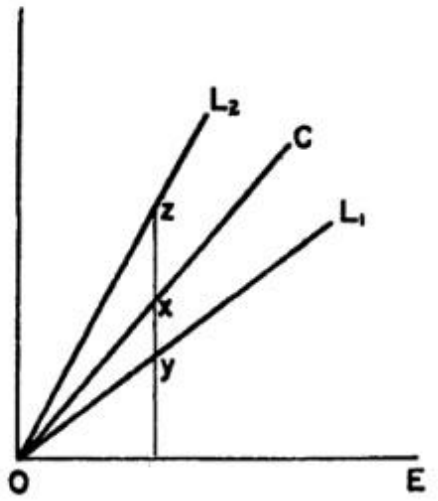

Figure 2.4

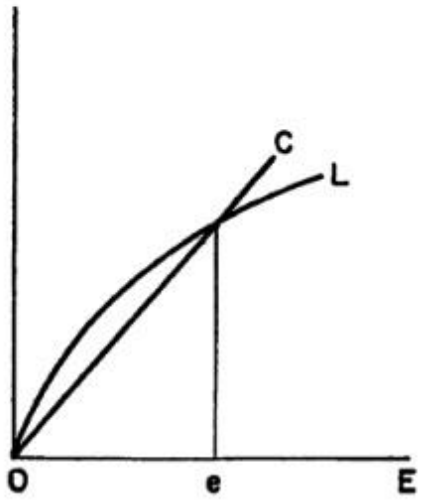

Figure 2.5

Interestingly enough, his various criticisms of the indexes were generally accepted with the significant exception of this one point. More recently, A. G. Huntsman warned his colleagues in fisheries biology that " [there] may be a decrease in the take-per—unit-of-effort without any decrease in the total take or in the fish population. . . .This may mean that there has been an increase in fishermen rather than a decrease in fish[29]". While these statements run in terms of average rather than marginal yield, their underlying reasoning clearly appears to be that of the law of diminishing returns. The point has had little influence in biological circles, however, and when, two years ago, I advanced it, as Kyle and Huntsman had done, in criticism of the standard biological method of estimating population change, it received pretty short shrift.

In point of fact, the law of diminishing returns is much more difficult to sustain in the case of fisheries than in agriculture or industry. The "proof" one finds in standard theory is not empirical, although the results of empirical experiments in agriculture are frequently adduced as subsidiary corroboration. The main weight of the law, however, rests on a *reductio ad absurdum.*

One can easily demonstrate that, were it not for the law of diminishing returns, all the world's food could be grown on one acre of land. Reality is markedly different, and it is because the law serves to render this reality intelligible to the logical mind, or, as we might say, "explains" it, that it occupies such a firm place in the body of economic theory. In fisheries, however, the pattern of reality can easily be explained on other grounds. In the caseat least of developed demersal fisheries, it cannot be denied that the fish population is reduced by fishing, and this relationship serves perfectly well to explain why an infinitely expansible production is not possible from a fixed fishing area. The other basis on which the law of diminishing returns is usually advanced in economic theory is the prima facie plausibility of the principle as such; but here, again, it is hard to grasp any similar reasoning in fisheries. In the typical agricultural illustration, for example, we may argue that the fourth harrowing or the fourth weeding, say, has a lower marginal productivity than the third. Such an assertion brings ready acceptance because it concerns a process with a zero productive limit. It is apparent that, ultimately, the land would be completely broken up or the weeds completely eliminated if harrowing or weeding were done in ever larger amounts. The law of diminishing returns signifies simply that such a zero limit is gradually approached, all of which appears to be quite acceptable on prima facie grounds. There is nothing comparable to this in fisheries at all, for there is no "cultivation" in the same sense of the term, except, of course, in such cases as oyster culture or pond rearing of fish, which are much more akin to farming than to typical sea fisheries.

In the biological literature the point has, I think, been well thought through, though the discussion does not revolve around the "law of diminishing returns" by that name. It is related rather to the fisheries biologist's problem of the interpretation of catch-per—unit-of-fishing—effort statistics. The essence of the law is usually eliminated by the assumption that there is no "competition" among units of fishing gear—that is, that the ratio of gear to fishing area and/or fish population is small. In some cases, corrections have been made by the use of the compound—interest formula where some competition among gear units is considered to exist[30]. Such corrections, however, appear to be based on the idea of an increasing catch-population ratio rather than an increasing effort population ratio. The latter would be as the law of diminishing returns would have it; the idea lying behind the former is that the total population in existence represents the maximum that can be caught, and, since this maximum would be gradually approached,

the ratio of catch to population has some bearing on the efficiency of fishing gear. It is, then, just an aspect of the population-reduction effect. Similarly, it has been pointed out that, since fish are recruited into the catchable stock in a seasonal fashion, one can expect the catch-per—unit—effort to fall as the fishing season progresses, at least in those fisheries where a substantial proportion of the stock is taken annually. Seasonal averaging is therefore necessary in using the catch-effort statistics as population indexes from year to year. This again is a population-reduction effect, not the law of diminishing returns. In general, there seems to be no reason for departing from the approach of the fisheries biologist on this point. The law of diminishing returns is not necessary to explain the conditions of stable equilibrium in a static model of the fishery, nor is there any prima facie ground for its acceptance.

Let us now consider the exploitation of a fishing ground under unified control, in which case the equilibrium condition is the maximization of net financial yield, L— C.

The map of population contours graphed in segment 2 of Figure 2.3 may be superimposed upon the total-landings and total-cost functions graphed in Figure 2.5. The result is as shown in Figure 2.6. In the system of interrelationships we have to consider, population changes affect, and are in turn affected by, the amount of fish landed. The map of population contours does not include this roundabout effect that a population change has upon itself. The curve labeled *L*, however, is a landings function which accounts for the fact that larger landings reduce the population, and this is why it is shown to have a steadily diminishing slope. We may regard the landings function as moving progressively to lower population contours P_7, P_6, P_5, etc., as total landings increase in magnitude. As a consequence, while each population contour represents many hypothetical combinations of *E, L*, and *P*, only one such combination on each is actually compatible in this system of interrelationships. This combination is the point on any contour where that contour is met by the landings function *L*. Thus the curve labeled *L* may be regarded as tracing out a series of combinations of *E, L,* and *P* which are compatible with one another in the system.

The total-cost function may be drawn as shown, with total cost, *C*, measured in terms of landings, which the vertical axis represents"[31]. This is a linear function of effort as shown. The optimum intensity of fishing effort is that which maximizes *L— C*. This is the monopoly solution; but, since we are considering only a single fishing ground, no price effects are introduced, and

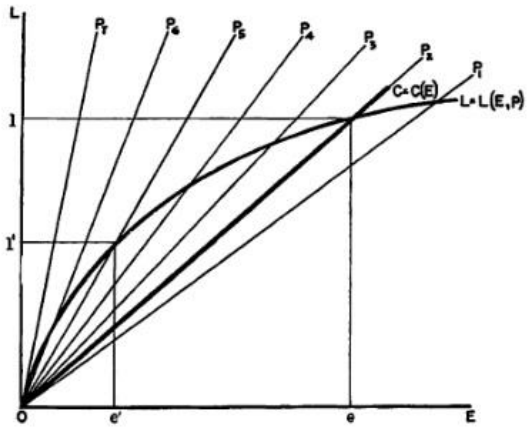

Figure 2.6

the social optimum coincides with maximum monopoly revenue. In this case we are maximizing the yield of a natural resource, not a privileged position, as in standard monopoly theory. The rent here is a social surplus yielded by the resource, not in any part due to artificial scarcity, as is monopoly profit or rent.

If the optimum fishing intensity is that which maximizes *L—C*, this is seen to be the position where the slope of the landings function equals the slope of the cost function in Figure 2.6. Thus the optimum fishing intensity is of fishing effort. This will yield *Ol* of landings, and the species population will be in continuing stable equilibrium at a level indicated by P_5. The equilibrium resulting from uncontrolled competitive fishing, where the rent is dissipated, can also be seen in Figure 2.6. This, being where *C:L*, is at *De* of effort and 0lof landings, and at a stable population level of P_2. As can be clearly seen, the uncontrolled equilibrium means a higher expenditure of effort, higher fish landings, and a lower continuing fish population than the optimum equilibrium.

Algebraically, the bionomic ecosystem may be set out in terms of the optimum solution as follows. The species population in equilibrium is a linear function of the amount of fish taken from the sea:

P = a—bl. (1)

In this function, a may be described as the ”natural population” of the species—the equilibrium level it would attain if not commercially fished. All natural factors, such as water temperatures, food supplies, natural predators, etc., which affect the population are, for the purposes of the system analyzed, locked up in a. The magnitude of a is the vertical intercept of the population function graphed in segment 1 of Figure 2.3. The slope of this function is b,

which may be described as the ”depletion coefficient,” since it indicates the effect of catch on population. The landings function is such that no landings are forthcoming with either zero effort or zero population; therefore,

L = cEP. (2)

The parameter c in this equation is the technical coefficient of production or, as we may call it simply, the ”production coefficient.” Total cost is a function of the amount of fishing effort.

C = qf

The optimum condition is that the total net receipts must be maximized, that is,

L—C to be maximized

Since q has been assumed constant and equal to unity (i.e., effort is counted in ”dollars-worth” units), we may write L—E to be maximized. Let this be represented by R:

R = l—E, (3)

$\frac{\mathrm{dR}}{\mathrm{dE}}$= 0. (4)

The four numbered equations constitute the system, when in optimality, equilibrium. In order to find this optimum, the landings junction (2) may be rewritten, with the aid of equation (1), as:

L = *cE (a-bl)*

From this we have at once

L (1 + cEb) = cEa,

$$L = \frac{caE}{+cbE}$$

To find the Optimum intensity of effort we have, from equation (3):

$$\frac{dR}{dF} = \frac{dL}{dF} - \frac{dE}{dE}$$

$$= \frac{(1+cbE)(ca)-caE(cb)}{(1+cbE)^2} \quad 1,$$
$$= \frac{ca}{(1+cbE)^2} \qquad 1;$$

for a maximum, this must be set equal to zero; hence,

$$ca = (1 + cbE)^2$$
$$1 + cbE = -\sqrt{ca},$$
$$E = \frac{1 - \sqrt{ca}}{cb}$$

For positive E,

$$E = \frac{\sqrt{ca} - 1}{cb}$$

This result indicates that the effect on optimum effort of a change in the production coefficient is uncertain, a rise in c calling for a rise in *E* in some cases and a fall in E in others, depending on the magnitude of the change in *c*. The effects of changes in the natural population and depletion coefficient are, however, Clear, a rise (fall) in a calling for a rise (fall) in *E*, while a rise (fall) in *b* means a fall (rise) in *E*.

[1] I want to express my indebtedness to the Canadian Department of Fisheries for assistance and Cooperation in making this study; also to Professor M. C. Urquhart, of Queen's University, Kingston, Ontario, for mathematical assistance with the last section of the paper and to the Economists' Summer Study Group at Queen's for affording opportunity for research and discussion.

[2] The single exception that I know is G. M. Gerhardsen, "Production Economics in Fisheries," *Revista de economia* (Lisbon), March 1952.

[3] Especially remarkable efforts in this sense are Robert A. Nesbit, "Fishery Management" ("US Fish and Wildlife Service, Special Scientific Reports," No. 18 [Chicago, 1943]) (mimeographed), and Harden F. Taylor, *Survey Of Marine Fisheries of North Carolina* (Chapel Hill, 1951); also R. J. H. Beverton, "Some Observations
on the Principles of Fishery Regulation," *Journal du conseil permanent International pour l'exploration de la mer* (Copenhagen), Vol. XIX, No. 1 (May 1953); and M. D. Burkenroad, "Some Principles of Marine Fishery Biology," *Publications of the Institute of Marine Science* (University of Texas), Vol. II, NO. 1 (September 1951).

[4] M. D. Burkenroad, "Theory and Practice of Marine Fishery Management," *Journal du conseil permanent international pour l'exploration de la mer*, Vol. XVIII, No. 3 (January 1953).

[5] Two of T. I. Baranoff's most important papers—"On the Question of the Biological Basis of Fisheries" (1918) and "On the Question of the Dynamics Of the Fishing Industry" (192'5)—have been translated by W. E. Ricker, now of the Fisheries Research Board of Canada (Nanaimo, BC), and issued in mimeographed form.

[6] A. G. Huntsman, "Fishery Depletion," Science, XCIX (1944), 534.

[7] "The highest take is not necessarily the best. The take should be increased only as long as the extra cost is offset by the added revenue from sales": A. G. Huntsman, "Research on Use and Increase of Fish Stocks," *Proceedings of the United Nations, Scientific Conference on the Conservation and Utilization of Resources* [Lake Success, 1949]).

[8] One example of a very general phenomenon: 1904 was such a successful brood year for Norwegian herrings that the 1904 year class continued to outweigh all others in importance in the catch from 1907 through to 191 9. The 1904 class was some thirty times as numerous as other year classes during the period (Johan Hjort, "Fluctuations in the Great Fisheries of Northern Europe," Rapports et proces-verbaux, *Conseil permanent international pour l'exploration de la mer*, Vol. XX [1914]; see also E. S. Russell*, The Overfishing Problem* [Cambridge, 1942], p. 57).

[9] See his *Resources of the Sea* published in 1899.

[10] Quoted in M. Graham, *The Fish Gate* (London, 1943), p. 111; see also T. H. Huxley, "The Herring," *Nature* (London), 1881.

[11] See H. Scott Gordon, "The Trawler Question in the United Kingdom and Canada," *Dalhousie Review*, summer 1951.

[12] Taylor, op. cit., p. 314 (Dr. Taylor's italics).

[13] See E. W. L. Holt, "An Examination Of the Grimsby Trawl Fishery," *Journal of the Marine Biological Association* (Plymouth), 1895.

[14] See C. G. J. Petersen, "What Is Overfishing?" *Journal of the Marine Biological Association (*Plymouth), 1900—1903.

[15] T. I. Baranoff, "On the Question of the Dynamics of the Fishing Industry," p. 5 (mimeographed).

[16] See, e.g., R. E. Foerster, "Prospects for Managing Our Fisheries*," Bulletin of the Bingham Oceanographic Collection* (New Haven), May 1948; E. 5. Russell, "Some Theoretical Considerations on the Overfishing Problem," *Journal du conseil permanent international pour l'exploration de la me*r, 1931, and *The Overfishing Problem*, Lecture IV.

[17] Expressed in these terms, this appears to be the monopoly maximum, but it coincides with the social optimum under the conditions employed in the analysis, as will be indicated.
[18] Throughout this paper the conception of fish population that is employed is one of weight rather than numbers. A good deal of the biological theory has been an effort to combine growth factors and numbers factors into weight sums. The following analysis will neglect the fact that, for some species, fish of different sizes bring different unit prices.
[19] Throughout this analysis, fixed costs are neglected. The general conclusions reached would not be appreciably altered, I think, by their inclusion, though the presentation would be greatly complicated. Moreover, in the fishing industry the most substantial portion of fixed cost wharves, harbors, etc., is borne by government and does not enter into the cost calculations of the operators.
[20] "The gambling instinct of the men makes many of them work for less remuneration than they would accept as a weekly wage, because there is always the possibility of a good catch and a financial windfall" (Graham, op. Cit., p. 86).
[21] W. F. Thompson, "Condition of Stocks of Halibut in the Pacific," *Journal du conseil permanent international pour l'exploration de la mer*, Vol. XVIII, No. 2 (August 1952).
[22] See M. D. Burkenroad, "Fluctuations in Abundance of Pacific Halibut," *Bulletin of the Bingham Oceanographic Collection*, May 1948.
[23] The economic significance of the reduction in season length which followed upon the catch limitation imposed in the Pacific halibut fishery has not been fully appreciated. E.g., Michael Graham said in summary of the program in 1943: "The result has been that it now takes only five months to catch the quantity of halibut that formerly needed nine. This, of course, has meant profit, where there was none before" (op. cit., p. 156; my italics). Yet, even when biologists have grasped the economic import of the halibut program and its results, they appear reluctant to declare against it. E.g., W. E. Ricker: "This method of regulation does not necessarily make for more profitable fishing and certainly puts no effective brake on waste of effort, since an unlimited number of boats is free to join the fleet and compete during the short period that fishing is open. However, the stock is protected, and yield approximates to a maximum if quotas are wisely set; as biologists, perhaps we are not required to think any further. Some claim that any mixing into the economics of the matter might prejudice the desirable biological consequences of regulation by quotas" ("Production and Utilization Of Fish Population," in a Symposium on Dynamics Of Production in Aquatic Populations, Ecological Society of America, *Ecological Monographs*, XVI [October 1946], 385). What such "desirable biological consequences" might be, is hard to conceive. Since the regulatory policies are made by man, surely it is necessary they be evaluated in terms of human, not piscatorial objectives.
[24] See Frank G. Speck, "Land Ownership among Hunting Peoples in Primitive America and the World's Marginal Areas," *Proceedings of the 22nd International Congress of Americanists* (Rome, 1926), II, 323—32.
[25] B. Malinowski, *Coral Gardens and Their Magic*, Vol. I, Chaps. xi and xii. Malinowski sees this as further evidence of the importance of magic in the culture rather than as a means of coordinating productive activity; but his discussion of the practice makes it clear that the latter is, to use Malinowski's own concept, the "function" of the institution of magical leadership, at least in this connection.
[26] See P. Vinogradoff*, The Growth of the Manor* (London, 1905), chap. iv; E. Lipson*, The Economic History of England* (London, 1949), I, 72.
[27] See H. Scott Gordon, "On a Misinterpretation of the Law of Diminishing Returns in Alfred Marshall's Principles," *Canadian journal of Economics and Political Science*, February 1952.
[28] H. M. Kyle, "Die Statistik der Seefischerei Nordeuropas," *Handbuch der Seefischerei Nordeuropas* (Stuttgart, 192 8).
[29] . A. G. Huntsman, "Fishing and Assessing Populations," *Bulletin of the Bingham Oceanographic Collection* (New Haven), May 1948.

[30] See, e.g., W. F. Thompson and F. H. Bell, Biological Statistics of the Pacific Halibut Fishery, No. 2: Effect of Changes in Intensity upon Total Yield and Yield per Unit of Gear: Report of the International Fisheries Commission (Seattle, 1934).

[31] More correctly, perhaps, C and L are both measured in money terms

3

Group Size and Group Behavior

MANCUR OLSON, Jr.

A. The Coherence and Effectiveness of Small Groups

The greater effectiveness of relatively small groups—the ”privileged” and ”intermediate” groups—is evident from observation and experience as well as from theory. Consider, for example, meetings that involve too many people, and accordingly cannot make decisions promptly or carefully. Everyone would like to have the meeting end quickly, but few if any will be willing to let their pet concern be dropped to make this possible. And though all of those participating presumably have an interest in reaching sound decisions, this all too often fails to happen. When the number of participants is large, the typical participant will know that his own efforts will probably not make much difference to the outcome, and that he will be affected by the meeting’s decision in much the same way no matter how much or how little effort he puts into studying the issues. Accordingly, the typical participant may not take the trouble to study the issues as carefully as he would have if he had been able to make the decision by himself. The decisions of the meeting are thus public goods to the participants (and perhaps others), and the contribution that each participant will make toward achieving or improving these public goods will become smaller as the meeting becomes larger. It is for these reasons, among others, that organizations so often turn to the small

group; committees, subcommittees, and small leadership groups are created, and once created they tend to play a crucial role.

This observation is corroborated by some interesting research results. John James, among others, has done empirical work on this subject, with results that support the theory offered in this study, though his work was not done to prove any such theory. Professor James found that in a variety of institutions, public and private, national and local, ”action taking” groups and subgroups tended to be much smaller than ”non-action taking” groups and subgroups. In one sample he studied, the average Size of the ”action taking” subgroups was 6.5 members, whereas the average size of the ”non-action taking” subgroups was 14 members. These subgroups were in a large banking concern, whose secretary spontaneously offered the following opinion: ”We have found,” he wrote, ”that committees should be small when you expect action and relatively large when you are looking for points of view, reactions, etc.[1]” This is apparently not a situation restricted to banking. It is widely known that in the United States Congress and in the state legislatures, power resides to a remarkable, and what is to many an alarming degree, in the committees and subcommittees,[2] James found that US Senate subcommittees at the time of his investigation had 5.4 members on the average, House subcommittees had 7.8, the Oregon state government, 4.7, and the Eugene, Oregon, municipal government, 5.3[3]. In short, the groups that actually do the work are quite small. A different study corroborates James’s findings; Professor A. Paul Hare, in controlled experiments with groups of five and twelve boys, found that the performance of the groups of five was generally superior[4]. The sociologist Georg Simmel explicitly stated that smaller groups could act more decisively and use their resources more effectively than large groups: ”Small, centripetally organized groups usually call on and use all their energies, while in large groups, forces remain much oftener potential[5]”.

The fact that the partnership can be a workable institutional form when the number of partners is quite small, but is generally unsuccessful when the number of partners is very large, may provide another illustration of the advantages of smaller groups. When a partnership has many members, the individual partner observes that his own effort or contribution will not greatly affect the performance of the enterprise, and expects that he will get his prearranged share of the earnings whether or not he contributes as much as he could have done. The earnings of a partnership, in which each partner gets a prearranged percentage of the return, are a collective good to the partners,

and when the number of partners increases, the incentive for each partner to work for the welfare of the enterprise lessens. This is to be sure only one of a number of reasons why partnerships tend to persist only when the number of partners is fairly small, but it is one that could be decisive in a really large partnership[6].

The autonomy of management in the large modern corporation, with thousands of stockholders, and the subordination of management in the corporation owned by a small number of stockholders, may also illustrate the Special difficulties of the large group. The fact that management tends to control the large corporation and is able, on occasion, to further its own interest at the expense of the stockholders, is surprising, since the common stockholders have the legal power to discharge the management at their pleasure, and since they have, as a group, also an incentive to do so, if the management is running the corporation partly or wholly in the interest of the managers. Why, then, do not the stockholders exercise their power? They do not because, in a large corporation, with thousands of stockholders, any effort the typical stockholder makes to oust the management will probably be unsuccessful; and even if the stockholder should be successful, most of the returns in the form of higher dividends and stock prices will go to the rest of the stockholders, since the typical stockholder owns only a trifling percentage of the outstanding stock. The income of the corporation is a collective good to the stockholders, and the stockholder who holds only a minute percentage of the total stock, like any member of a latent group, has no incentive to work in the group interest. Specifically, he has no incentive to challenge the management of the company, however inept or corrupt it might be. (This argument does not, however, entirely apply to the stock- holder who wants the manager's position and pelf for himself, for he is not working for a collective good; it is significant that most attempts to overthrow corporate management are started by those who want to take over the management themselves.) Corporations with a small number of stock-holders, by contrast, are not only *de jure*, but also *de facto*, controlled by the stockholders, for in such cases the concepts of privileged or intermediate groups apply[7].

There is also historical evidence for the theory presented here. George C. Homans, in one of the best-known books in American social science[8], has pointed out that the small group has Shown much more durability throughout history than the large group:

> At the level of. . . the small group, at the level, that is, of a social unit (no matter by what name we call it) each of whose members can have some firsthand knowledge of each of the others, human society, for many millennia longer than written history, has been able to cohere. . . They have tended to produce a surplus of the goods that make organization successful.
> . . . ancient Egypt and Mesopotamia were civilizations. So were classical India and China; so was Greco-Roman Civilization, and so is our own Western civilization that grew out of medieval Christendom. . .
> The appalling fact is that, after flourishing for a span of time, every civilization but one has collapsed. . . formal organizations that articulated the whole have fallen to pieces. . . . much of the technology has even been forgotten for lack of the large scale cooperation that could putit in effect. . . . the civilization has slowly sunk to a Dark Age, a situation, much like the one from which it started on its upward path, in which the mutual hostility of small groups is the condition of the internal cohesion of each one. . . . Society can fall thus far, but apparently no farther.
> . . . One can read the dismal story, eloquently told, in the historians of civilization from Spengler to Toynbee. The one civilization that has not entirely gone to pieces is our Western Civilization, and we are desperately anxious about it.
> [But a]t the level Of the tribe or group, society has always found itself able to cohere[9].

Homans's claim that the smallest groups are the most durable is quite persuasive and certainly supports the theory offered here. But his deduction from these historical facts is not wholly consistent with the approach in this study. His book focuses on the following idea: "Let us put our case for the last time: At the level of the small group, society has always been able to cohere. We infer, therefore, that if Civilization is to stand, it must retain some of the features of the small group itself.[10]" Homans's conclusion depends on the assumption that the techniques or methods of the small group are more effective. But this is not necessarily true; the small, or "privileged," group is in a more advantageous position from the beginning, for some or all of its members will have an incentive to see that it does not fail. This is not true of the large group; the large group does not automatically find that the incentives that face the group also face the individuals in the group. Therefore, it does not follow that, because the small group has historically been more effective, the very large group can prevent failure by copying its methods. The "privileged" group, and for that matter the "intermediate" group, are simply in a more advantageous position[11]".

B. Problems of the Traditional Theories

Homans's belief that the lessons of the small group should be applied to large groups has much in common with the assumption upon which much small-group research is based. There has been a vast amount of research into the small group in recent years, much of it based on the idea that the results of (experimentally convenient) research on small groups can be made directly applicable to larger groups merely by multiplying these results by a scale factor"[12]. Some social psychologists, sociologists, and political scientists assume that the small group is so much like the large group, in matters other than size, that it must behave according to somewhat similar laws. But if the distinctions drawn here among the "privileged" group, the "intermediate" group, and the "latent" group have any meaning, this assumption is unwarranted, at least so long as the groups have a common, collective interest. For the small, privileged group can expect that its collective needs will probably be met one way or another, and the fairly small (or intermediate) group has a fair chance that voluntary action will solve its collective problems but the large, latent group cannot act in accordance with its common interests so long as the members of the group are free to further their individual interests.

The distinctions developed in this study [of The Logic of Collective Action] also suggest that the traditional explanation of voluntary associations explained in Chapter I [of that work] needs amendment. The traditional theory emphasizes the (alleged) universality of participation in voluntary associations in modern societies and explains small groups and large organizations in terms of the same causes. In its most sophisticated form, the traditional theory argues that the prevalence of participation in the modern voluntary association is due to the "structural differentiation" of developing societies; that is, to the fact that as the small, primary groups of primitive society have declined or become more specialized, the functions that multitudes of these small groups used to perform are being taken over by large voluntary associations. But, if the meaningless notion of a universal "joiner instinct" is to be rejected, how is the membership in these new, large voluntary associations recruited? There are admittedly functions for large associations to perform, as small, primary groups become more specialized and decline. And the performance of these functions no doubt would bring benefits to large numbers of people. But will these benefits provide an incentive for any of the individuals affected to join, much less create, a large voluntary association to

perform the function in question? The answer is that, however beneficial the functions large voluntary associations are expected to perform, there is no incentive for any individual in a latent group to join such an association."[13] However important a function may be, there is no presumption that a latent group will be able to organize and act to perform this function. Small primary groups by contrast presumably can act to perform functions that are beneficial to them. The traditional theory of voluntary associations is therefore mistaken to the extent that it implicitly assumes that latent groups will act to perform functional purposes the same way small groups will. The existence of such large organizations as do exist must moreover be explained by different factors from those that explain the existence of smaller groups. This suggests that the traditional theory is incomplete, and needs to be modified in the light of the logical relationships explained in this study. This contention is strengthened by the fact that the traditional theory of voluntary associations is not at all in harmony with the empirical evidence, which indicates that participation in large voluntary organizations is very much less than that theory would suggest[14].

There is still another respect in which the analysis developed here can be used to modify the traditional analysis. This involves the question of group consensus. It is often assumed (though usually implicitly) in discussions of organizational or group cohesion that the crucial matter is the degree of consensus; if there are many serious disagreements, there will be no coordinated, voluntary effort, but if there is a high degree of agreement on what is wanted and how to get it there will almost certainly be effective group action[15]. The degree of consensus is sometimes discussed as though it were the only important determinant of group action or group cohesion.

There is, of course, no question that a lack of consensus is inimical to the prospects for group action and group cohesion. But it does not follow that perfect consensus, both about the desire for the collective good and the most efficient means of getting it, will always bring about the achievement of the group goal. In a large, latent group there will be no tendency for the group to organize to achieve its goals through the voluntary, rational action of the members of the group, even if there is perfect consensus. Indeed, the assumption made in this work is that there is perfect consensus. This is, to be sure, an unrealistic assumption, for perfection of consensus, as of other things, is at best very rare. But the results obtained under this assumption are, for that reason, all the stronger for if voluntary, rational action cannot enable a large, latent group to organize for action to achieve its collective

goals, even with perfect consensus, then a fortiori this conclusion should hold in the real world, where consensus is usually incomplete and often altogether absent. It is thus very important to distinguish between the obstacles to group-oriented action that are due to a lack of group consensus and those that are due to a lack of individual incentives.

C. Social Incentives and Rational Behavior

Economic incentives are not, to be sure, the only incentives; people are sometimes also motivated by a desire to win prestige, respect, friendship, and other social and psychological objectives. Though the phrase ”socio-economic status” often used in discussions of status suggests that there may be a correlation between economic position and social position, there is no doubt that the two are sometimes different. The possibility that, in a case where there was no economic incentive for an individual to contribute to the achievement of a group interest, there might nonetheless be a social incentive for him to make such a contribution, must therefore be considered. And it is Obvious that this is a possibility. If a small group Of people who had an interest in a collective good happened also to be personal friends, or belonged to the same social club, and some of the group left the burden of providing that collective good on others, they 'might, even if they gained economically by this course of action, lose socially by it, and the social loss might outweigh the economic gain. Their friends might use ”social pressure” to encourage them to do their part toward achieving the group goal, or the social club might exclude them, and such steps might be effective, for everyday observation reveals that most people value the fellowship of their friends and associates, and value social status, personal prestige, and self-esteem.

The existence of these social incentives to group-oriented action does not, however, contradict or weaken the analysis of this study. If anything,it strengthens it, for social status and social acceptance are individual non-collective goods. Social sanctions and social rewards are ”selective incentives”; that is, they are among the kinds of incentives that may be used to mobilize a latent group. It is in the nature of social incentives that they can distinguish among individuals: the recalcitrant individual can be ostracized, and the cooperative individual can be invited into the center of the charmed circle. Some students of organizational theory have rightly emphasized that social incentives must be analyzed in much the same way as monetary

incentives[16]. Still other types of incentives can be analyzed in much the same way[17]".

In general, social pressure and social incentives operate only in groups of smaller size, in the groups so small that the members can have face-to-face contact with one another. Though in an oligopolistic industry with only a handful of firms there may be strong resentment against the "chiseler" who cuts prices to increase his own sales at the expense of the group, in a perfectly competitive industry there is usually no such resentment; indeed, the man who succeeds in increasing his sales and output in a perfectly competitive industry is usually admired and set up as a good example by his competitors. Anyone who has observed a farming community, for instance, knows that the most productive farmer, who sells the most and thus does the most to lower the price, is usually the one with the highest status. There are perhaps two reasons for this difference in the attitudes of large and small groups. First, in the large, latent group, each member, by definition, is so small in relation to the total that his actions will not matter much one way or another; so it would seem pointless for one perfect competitor, or a member of some other latent group, to snub or abuse another for a selfish, antigroup action, because the recalcitrant's action would not be decisive in any event. Second, in any large group everyone cannot possibly know everyone else, and the group will ipso facto not be a friendship group; so a person will ordinarily not be affected socially if he fails to make sacrifices on behalf of his group's goals. To return to the case of the farmer, it is clear that one farmer cannot possibly know all the other farmers who sell the same commodity; he would not feel that the social group within which he measured his status had much to do with the group with which he shared the interest in the collective good. Accordingly, there is no presumption that social incentives will lead individuals in the latent group to obtain a collective good.

There is, however, one case in which social incentives may well be able to bring about group-oriented action in a latent group. This is the case of a "federal" group—a group divided into a number of small groups each of which has a reason to join with the others to form a federation representing the large group as a whole. If the central or federated organization provides some service to the small constituent organizations, they may be induced to use their social incentives to get the individuals belonging to each small group to contribute toward the achievement of the collective goals of the whole group. Thus, organizations that use selective social incentives to mobilize a latent group interested in a collective good must be federations of smaller groups.

The more important point, however, is that social incentives are important mainly only in the small group, and play a role in the large group only when the large group is a federation of smaller groups.

The groups small enough to be classified here as ”privileged” and ”intermediate” groups are thus twice blessed in that they have not only economic incentives, but also perhaps social incentives, that lead their members to work toward the achievement of the collective goods. The large, ”latent” group, on the other hand, always contains more people than could possibly know each other, and is not likely (except when composed of federated small groups) to develop social pressures that would help it satisfy its interest in a collective good. There is, of course, much evidence for this skepticism about social pressures in a large group in the history of perfectly competitive industries in the United States. Now, if the conclusion that the strength of social pressures varies greatly between small and large groups has validity, it further weakens the traditional theory of voluntary organizations[18].

Some critics may protest that even if social pressure does not exist in the large or latent group, it does not follow that the completely selfish or profit-maximizing behavior, which the concept of latent groups apparently assumes, is necessarily significant either; people might even in the absence of social pressure act in a selfless way. But this criticism of the concept of the latent group is not relevant, for that concept does not necessarily assume the selfish, profit-maximizing behavior that economists usually find in the marketplace. The concept of the large or latent group Offered here holds true whether behavior is selfish or unselfish, so long as it is strictly speaking ”rational.” Even if the member of a large group were to neglect his own interests entirely, he still would not rationally contribute toward the provision of any collective or public good, since his own contribution would not be perceptible. A farmer who placed the interests of other farmers above his own would not necessarily restrict his production to raise farm prices, since he would know that his sacrifice would not bring a noticeable benefit to anyone. Such a rational farmer, however unselfish, would not make such a futile and pointless sacrifice, but he would allocate his philanthropy in order to have a perceptible effect on someone. Selfless behavior that has no perceptible effect is sometimes not even considered praiseworthy. A man who tried to hold back a flood with a pail would probably be considered more of a crank than a saint, even by those he was trying to help. It is no doubt possible infinitesimally to lower the level of a river in flood with a pail, just as it is possible for a single farmer infinitesimally to raise prices by limiting his production, but in both

cases the effect is imperceptible, and those who sacrifice themselves in the interest of imperceptible improvements may not even receive the praise normally due selfless behavior.

The argument about large, latent groups, then, does not necessarily imply self-interested behavior, though such behavior would be completely consistent with it[19].The only requirement is that the behavior of individuals in large groups or organizations of the kind considered should generally be rational, in the sense that their objectives, whether selfish or unselfish, should be pursued by means that are efficient and effective for achieving these objectives. The foregoing arguments, theoretical and factual, in this and the previous Chapter [of The Logic of Collective Action] Should at the least justify the separate treatment that large and small groups are given in this study. These arguments are not meant as attacks on any previous interpretations of group behavior, though it seems that some of the usual explanations of large voluntary associations may need elaboration because of the theories offered here. All that need be granted, to accept the main argument of this study, is that large or latent groups will not organize for coordinated action merely because, as a group, they have a reason for doing so, though this could be true of smaller groups. Most of the rest of this study will deal with large organizations and will attempt to prove that most of the large economic organizations in the United States have had to develop special institutions to solve the membership problem posed by the large scale of their objectives.

[1] John James, "A Preliminary Study of the Size Determinant in Small Group Interaction," *American Sociological Review*, XVI (August 1951), 474—477.
[2] Bertram M. Gross, *The Legislative Struggle* (New York: MCGraw-Hill, 1953), pp. 265—337; see also Ernest S. Griffith, *Congress* (New York: New York University Press, 1951).
[3] . For a light-hearted and humorous, but nonetheless helpful, argument that the ideal committee or cabinet has only five members, see C. Northcote Parkinson, *Parkinson's Law* (Boston: Houghton Mifflin, 1957), pp. 33—34.
[4] A. Paul Hare, "A Study of Interaction and Consensus in Different Sized Groups," *American Sociological Review*, XVII (June 1952), 261—2 68
[5] Georg Simmel, *The Sociology of George Simmel*, trans. Kurt H. Wolff (Glencoe, Ill.: Free Press [1950]), p. 92. In another place Simmel says that socialist societies, by which he appears to mean voluntary groups that share their incomes according to some principle of equity, must necessarily be small. "Up to this day, at least, socialistic or nearly socialistic societies have been possible only in very small groups and have always failed in larger ones" (p. 88).
[6] The foregoing argument need not apply to partners that are supposed to be *"sleeping partners*," i.e., provide only capital. Nor does it take account of the fact that in many cases each partner is liable for the losses of the whole partnership.
[7] See Adolph A. Berle, Jr., and Gardiner C. Means, *The Modern Corporation and Private Property* (New York: Macmillan, 1932); J. A. Livingston, *The American Stockholder*, rev. ed. (New York: Collier Books, 1963); P. Sargent Florence, Ownership, *Control and Success of Large Companies* (London: Sweet & Maxwell, 1961);and William Mennell, Takeover (London: Lawrence & Wishart, 1962).
[8] George C. Homans, *The Human Group* (New York: Harcourt Brace, 1950).
[9] Ibid., pp. 454—456. See also Neil W. Chamberlain, *Central Theory of Economic Process* (New York: Harper, 1955), esp. pp. 347—348, and Sherman Krupp, *Pattern in Organization Analysis* (Philadelphia: Chilton, 1961), pp. 118—139
and 171—176.
[10] Homans, p. 468.
[11] The difference between latent groups and privileged or intermediate groups is only one of several factors accounting for the instability of many ancient empires and Civilizations. I have pointed to another such factor myself in a forthcoming
book.
[12] Kurt Lewin, *Field Theory in Social Change* (NewYork: Harper, 1951), pp. 163— 164; Harold H. Kelley and John W. Thibaut, *The Social Psychology of Groups* (New York: John Wiley, 1959), pp. 6, 191—192; Hare, "Study of Interaction and Consensus," pp. 261—268; Sidney Verba, *Small Groups and Political Behavior* (Princeton,N.J.: Princeton University Press, 1961), pp. 4, 14, 99—109, 245—248.
[13] There is no suggestion here, of course, that all groups are necessarily explained in terms of monetary or material interests. The argument does not require that individuals have only monetary or material wants. See note 17 below.
[14] Mirra Komaravsky, "TheVoluntary Associations of Urban Dwellers," *American Sociological Review*, XI (December 1946), 686—698; Floyd Dotson, "Patterns of Voluntary Membership among Working Class Families," *American Sociological Review*, XVI (October 1951), 687; John C. Scott, Jr., "Membership and Participation in *Voluntary Associations," American Sociological Review, XXII (June 1957), 315; and Murray Hausknecht, The joiners—A Sociological Description of Voluntary Association Membership in the United States* (New York: Bedminster Press, 1962).
[15] See Hare, "Study of Interaction and Consensus"; Raymond Cattell, "Concepts and Methods in the Measurement Of Group Syntality," in *Small Groups*, ed. A. Paul Hare, Edward F. Borgatta, and Robert F. Bales (New York: Alfred A. Knopf, 1955); Leon Festinger, *A Theory of Cognitive Dissonance* (Evanston, "1.: Row, Peterson, 1957); Leon Festinger, Stanley

Schachter, and Kurt Back, "The Operation of Group Standards," in *Group Dynamics*, ed. Dorwin Cartwright and Alvin Zander (Evanston, Ill.: Row, Peterson, 1953); and David B. Truman, *The Governmental Process* (New York: Alfred A. Knopf, 1958).

[16] See especially Chester I. Barnard, *The Functions of the Executive* (Cambridge, Mass: Harvard University Press, 1938), chap. xi, "The Economy of Incentives," pp. 139-160, and the same author's Organization and Management(Cambridge, Mass.:Harvard University Press, 1948), chap. ix, "Functions and Pathology of Status Systems in Formal Organizations," pp. 207—244; Peter B. Clark and James Q. Wilson, "Incentive Systems: A Theory Of Organizations," *Administrative Science Quarterly,* VI (September 1961), 129—166; and Herbert A. Simon, *Administrative Behavior* (New York: Macmillan, 1957), esp. pp. 115—1 17. I am indebted to Edward C. Banfield for helpful suggestions on social incentives and organization theory.

[17] In addition to monetary and social incentives, there are also erotic incentives, psychological incentives, moral incentives, and so on. To the extent that any of these types of incentives leads a latent group to obtain a collective good, it could again only be because they are or can be used as "selective incentives," i.e., because they distinguish between those individuals who support action in the common interest and those who do not. Even in the case where moral attitudes determine whether or not a person will act in a group-oriented way, the crucial factor is that the moral reaction serves as a "selective incentive." If the sense of guilt, or the destruction of self-esteem, that occurs when a person feels he has forsaken his moral code, affected those who had contributed toward the achievement of a group good, as well as those who had not, the moral code could not help to mobilize a latent group only to the extent they provided selective incentives. The adherence to a moral code that demands the sacrifices needed to obtain a collective good therefore need *not* contradict any of the analysis in this study; indeed, this analysis shows the need for such a moral code or for some other selective incentive.

At no point in this study, however, will any such moral force or incentive be used to explain any of the examples of group action that will be studies. There are three reasons for this. First, it is not possible to get empirical proof of the motivation behind any person's action; it is not possible definitely to say whether a given individual acted for moral reasons or for other reasons in some particular case. A reliance on moral explanations could thus make the theory untestable. Second, no such explanation is needed; since there will be sufficient explanations on other grounds for all the group action that will be considered. Third, most organized pressure groups are explicitly working for gains for themselves, not gains for other groups. And in such cases it is hardly plausible to ascribe group action to any moral code. Moral motives or incentives for group action have therefore been discussed, not to explain any given example of group action, but rather to show that their existence need not contradict the theory offered here, and could if anything tend to support it.

The erotic and psychological incentives that must be important in family and friendship groups could logically be analyzed within the framework of the theory. On the other hand, "affective" groups such as family and friendship groups could normally be studied much more usefully with entirely different sorts of theories, since the analysis used in this study does not shed much light in these groups. On the special features of "affective" groups, see Verba (note 12above), p. 6 and pp. 142-184.

[18] There is, however, another kind of social pressure that may occasionally be operative. That is the social pressure that is generated, not primarily through person to-person friendships, but through mass media. If the members of a latent group are somehow continuously bombarded with propaganda about the worthiness of the attempt to satisfy the common interest in question, they may perhaps in time develop social pressures not entirely unlike those that can be generated in a face-to- face group, and these social pressures may help the latent group to Obtain the collective good. A group cannot finance such propaganda unless it is already organized, and it may not be able to organize until it has already been subjected to the propaganda; so this form of social pressure is probably not ordinarily sufficient by itself

to enable a group to achieve its collective goals. It would, for example, seem unlikely that there would be much prospect of success in a program to persuade farmers through propaganda to further their interests by voluntarily restricting output, unless there were some captive source of funds to finance the effort. So this form of social pressure generated by mass media does not seem likely to be an important independent source of coordinated effort to bring about the satisfaction of a common interest. Moreover, as was emphasized earlier, the nation-state, with all the emotional loyalty it commands, cannot support itself without compulsion. Therefore it does not seem likely that many large private groups could support themselves solely through social pressure.

[19] Organizations with primarily economic purposes, like labor unions, farm organizations, and other types of pressure groups, normally Claim that they are serving the interests of the groups they represent, and do not contend that they are mainly philanthropic organizations out to help other groups. Thus it would be surprising if most of the members of these ”interest groups” should always neglect their own, individual interests. An essentially selfish group interest would not normally attract members who were completely selfless. Thus self-interested behavior may in fact be common in organizations of the kind under study. For intelligent arguments contending that self-interested behavior is general in politics, see James M. Buchanan and Gordon Tullock, *The Calculus of Consent* (Ann Arbor: University of Michigan Press, 1962), pp. 3—39. See also the interesting book by Anthony Downs, *An Economic Theory of Democracy* (New York: Harper, 1957), pp. 3—35.

4

A New Primer for the Management of Common-Pool Resources and Public Goods

JOHN A. BADEN

The fundamental truth that people in a commons have an incentive to ignore the social impact of private behavior provides the key to developing plans for managing the commons. Tragedy strikes when self-interest and social interest diverge. People's behavior adversely affects social welfare, generating a demand for governmental intervention. In each case, some constraint on individual freedom is imposed in order to preclude a greater loss. Questions of equity, freedom, and morality are quite near the surface. The primary goal of this and the following essays in this volume is to offer an orderly perspective on issues that are often muddled and confused.

Why Recourse to Political Organization?

We generally find that the market tends to be an under-appreciated and misunderstood mechanism for generating cooperative behavior. Behavior coordinated by the market has important imperfections but also some compelling advantages. It moves people voluntarily to coordinate their

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Adapted from John A. Baden, "A Primer for the Management of Common Pool Resources", in *Managing the Commons,* Garrett Hardin and John A. Baden, eds. (San Francisco: W. H. Freeman, 1977), pp.137-46.

actions. When dealing with commodities, prices serve as effective and efficient coordinating, rationing, and incentive-generating devices. Why then do we often turn to government?

Government is needed for at least the following purposes: to serve as an arbiter among parties when disagreements arise; to protect the weak from the strong; and to prevent market forces from being disrupted and distorted by monopolists and other powers. Government is also needed to enforce property rights and to maintain a context of law and order in which productive social relations can be undertaken. All of the above functions must be carried out in a modern society if social welfare is to be served. However, there is a danger inherent in reliance upon political organization: government involves coercion rather than willing consent to coordinate behavior and coercion can be abused. The key question then becomes, to what extent should the scope of government be expanded beyond those tasks.

Should the scope of government be expanded beyond those tasks?

Two traditional forms of government intervention attempt to provide public goods and common-pool resources.

A public good is one which, if available for anyone, is available for everyone. (A similar definition applies to public bads). This suggests that the good is not easily packaged for sale, and people cannot be excluded from its consumption. In other words, property rights cannot be readily established for public goods. A public good is also one whose incremental use does not reduce, subtract, or consume it. Standard examples of public goods have included the benefits derived from national defense, light-houses, and mosquito control programs. If people cannot be excluded from the benefits of these programs, they do not ordinarily have an incentive to contribute to the provision of such goods. In the market context, where willing consent is required for action, these goods will be undersupplied. To correct this, governmental action, in the form of tax collecting, is instituted.

There are exceptions to these generalizations. First, in small groups (as in some communal situations) social pressure can induce contributions for public goods. Second, if there is a situation in which the private benefit from providing a public good is greater than its private costs, the public good will be supplied privately. An example of this situation occurs when a logging company maintains a road to a public area used by hunters, snow-mobilers,

and other recreationists. This, of course, is done to provide access for the company. In these cases, the provision of the public good is a positive externality generated by the company's self-serving actions.

A second area for governmental action is the management of common-pool resources. Briefly, a common—pool resource is a resource for which there are multiple owners (or a number of people who have nonexclusive rights to use the resource) and where one or a set of users can have adverse effects upon the interests of other users. In the situation where there is no agency with the power to coordinate or to ration use, action which is individually rational can be collectively disastrous. This is the central point of the "tragedy of the commons."

As a simple example, assume a valley airshed that has air-breathing citizens and two copper smelters owned by different companies. In this situation the air is the common-pool resource and the breathing citizens and the copper smelters are the resource users. If the damage done by the smelters is greater than the cost of cleaning the air, there is a net advantage to be gained by controlling pollution. Yet the copper companies cannot be expected voluntarily to reduce their despoliation. A relaxation of the rule of willing consent may be necessary, therefore, to reduce pollution and increase social welfare.

An alternative example involves the overexploitation of a common-pool resource. If we consider whales or salmon a common-pool resource with independent harvesters, each harvester has an incentive to maximize his catch. In the absence of collective management and rationing of the resource, we can expect the catch to go beyond sustainable yield. Further, after it is understood that the resource is being depleted, we often find overinvestment in harvesting technology as each resource user tries to sustain his catch in the face of a diminishing resource.

Thus, in the absence of clear, exclusionary rights to the resource and of a coordinating arrangement based on some rule other than that of willing consent, a scarce resource will be unnecessarily depleted. Furthermore, a socially inefficient capital investment will be made in the equipment required to harvest the resource. Imagine the dynamics we would find in the national forests if all the timber were suddenly put up for grabs on a cut-out and get-out basis with no provision for ownership and storage of the standing trees. In addition to a speedy mining of the forests, there would be great overinvestment in logging machinery. This example is directly analogous to the behavior found in the exploitation of common-pool resources without

institutions geared to manage and ration the resource and to adjudicate conflicts among the competing users.

Problems Inherent in Private Solutions

There are situations in which significant social advantages may be gained by establishing agencies and bureaucracies and assigning them responsibilities and power. In principle, it would be possible to accomplish the same ends through voluntary agreements among the interested parties. In practice, however, we encounter a number of factors that preclude this solution except by groups small enough to coordinate and enforce behavior on a face-to-face basis. Public goods and common-pool resources are provided and managed because these actions are projected to increase social welfare. If this can be demonstrated to the satisfaction of all parties involved, why must one resort to governmental action? Why will this action not be undertaken voluntarily?

The Free-Rider Problem

The first reason is the free-rider problem. Assume we know from energy-cycling studies that by investing 200 units in nutrient enrichment, fish production will be increased by 1,000 units in a fishery resource harvested by 400 commercial fishermen. Also assume that there are no relevant externalities involved in the nutrient enrichment program. Clearly, there are great advantages to such a program. In this situation, however, each fisherman has an incentive to avoid contributing his share of the 200 units. If he doesn’t contribute and others do, he will be far ahead, having with-held his contributions from the enrichment program to invest his half unit in more effective harvesting tools. (This is true if we assume, within the range given here, a linear relationship between enrichment and production. Obviously, if we were dealing with a step function whose first threshold was encountered between the 199.5 unit and the 200 unit in investment, then the marginal contribution of the last fisherman would be enhanced. Such possibilities should not detract from the thrust of the example.) The marginal improvement of any one contribution would be spread over the 400 fishermen. So unless each fisherman knows that he can collect a share of the marginal improvement generated by the contribution of each of the other 399 fishermen, it is to his advantage not to invest in the program and to be a free rider on the backs of

those who do contribute. Under such assumptions, no fisherman would contribute his share.

Thus, it is beneficial to relax the rule of willing consent and rely upon the potential for coercion (governmental action) if the resource is to be rationally managed. A similar logic is involved in efforts to protect or improve the quality of an airshed or a body of water. In each case, reliance upon voluntary agreement yields a less than optimal resource base. To what degree is freedom to be sacrificed through the replacement of willing consent by coercion in order to protect or enhance an environmental resource? One of the most substantial consequences of an increasing population is precisely the sacrifice in freedom necessitated by the need for maximizing production in a context of increasing interdependence and increasing demands on the resource base. It may seem that many of the world's resources are increasingly taking on common-pool attributes. Concurrently, as technology becomes better and monitoring and enforcing these rights become easier, common-pool problems are reduced. On net, it's not clear which force dominates.

Decision-Making or Bargaining Costs

The second reason for governmental action is prohibitively high decision- making costs. In the absence of enforceable property rights to a resource or service, it is extremely difficult for those involved to reach voluntary agreements. Clearly, two neighbors may be able to agree to construct and maintain a common or public lane serving their contiguous holdings. Because the marginal costs of additional traffic tend to be quite low, each neighbor has an incentive to come to an agreement with the other. By the same principle, a road servicing *n* parties could similarly be agreed upon.

There is a second set of costs involved in building the road, however. In addition to the actual cost of construction and maintenance, there are the opportunity costs associated with the time spent in agreeing how to finance and administer the road[1]. I have a potential interest in a very large number of roads. If I attended negotiations for each road in which I have an interest, I would not have time for anything else. Hence, the opportunity costs of voluntary agreement become grossly unreasonable. Commons management by voluntary agreement is most problematic in large, impersonal situations where people have little opportunity to meet, negotiate, and hammer out informal rules and customs to restrain rationally opportunistic actions.

Virtually all national and regional problems fall into this category. In such large—scale situations, we use political negotiations to overcome transactions costs and create mechanisms to constrain people's behavior. Perhaps we create tolls that force people to pay for the social and atmospheric costs of driving. Or we impose regulations and mandates that coordinate road use so social welfare is promoted.

We can now develop a general statement describing the role of governmental action. As Gordon Tullock has remarked, government is nothing more than a prosaic instrument designed to coordinate human behavior through potential resort to coercion when the costs associated with reliance upon voluntary agreement are considered to be excessively high by a group of people possessing sufficient power to set and enforce the rules under which rules are made. That sentence contains the rationale for instituting a government; it is the definitive rejection of anarchy.

Dangers Inherent in Bureaucracies

There are situations in which net welfare can be enhanced by relaxing the rule of willing consent and permitting coercion for the coordination of human affairs. This, however, was not to suggest that the assignment of decision-making capabilities on other than a voluntary basis and the establishment of bureaus and agencies to provide goods and services will necessarily result in welfare gains. Unless careful attention is given to the information and incentives with which bureaucrats are provided, the order the bureau was established to provide will occur only rarely. Following are some examples to aid in understanding this problem, with the hope that improvements in bureaucratic performance will result.

The Potential for Bureaucratic Performance in a Common-Pool Situation

Consider an airshed where pollution production currently exceeds the airshed's capacity with an environment cost reckoned as $16. Not all environmental costs can be satisfactorily converted to dollars, but this is the best tool we have in our kit. For an expenditure of $2 the cost of the pollution damage could be reduced to $4. There is a net gain of $10 (minus administrative costs). Thus, instituting an agency to compel rather modest

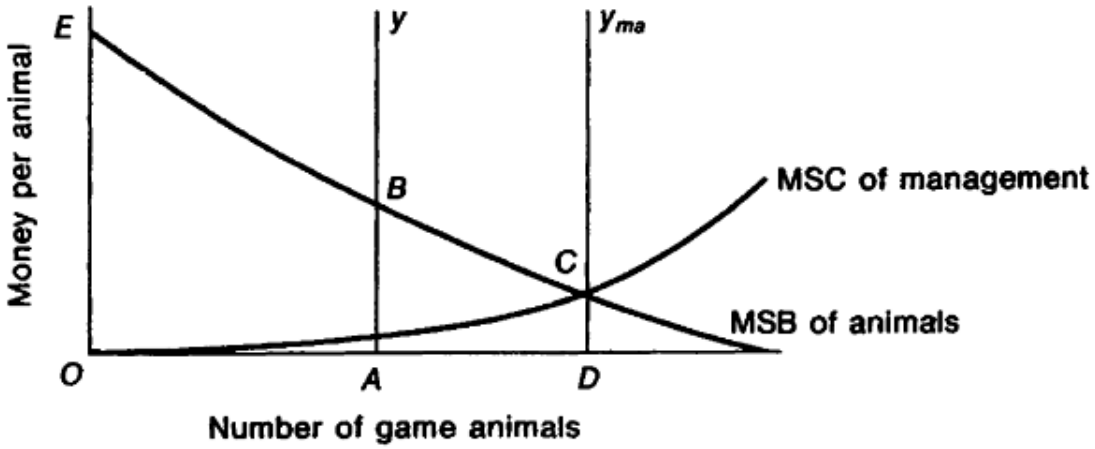

Figure 4.1. Social benefit of wildlife management. Relation of marginal social cost to marginal social benefit.

investments in pollution control produces substantial gains in environmental quality. (For social efficiency, we would want to stop control when the marginal benefit of the improvement equaled the marginal cost of additional control. This point is discussed later.)

Assume a game herd with a sustained yield potential of *y* if in an unmanaged habitat (*A*), and y_{ma}if in a managed habitat (*D*), as illustrated in Figure 4.1.

Note that with no rationing (via pricing, lottery, etc.) and no management, at zero price the demand for the game animal will be greater than the sustained yield. Hence, after a short period of time, the herd may be hunted beyond the level necessary for replacement and may vanish from the habitat in question. Under assumptions of no habitat management, this will result in a net social loss of *0EBA* each year into the indefinite future. If the habitat were to be managed at level y_{ma} but not rationed, the net loss each year would be (*0ECD*) — (*0CD*) for the indefinite future. It is this amount, (OECD) — (0CD), that is the potential to be gained by establishing an agency to regulate and manage this resource. The cost of not doing so is the value of the lost resource less administrative costs discounted into the indefinite future. Again, there is a compelling argument for establishing a bureaucracy to manage this resource if the resource is to remain public.

The Potential for Bureaucratic Performance in Providing Public Goods and Services

Within a prescribed territory, the provision of law and order has important aspects of a public good. Assume, for example, that during the evening hour when a man walks his brace of German shepherds around and around a block in New York City, crime on that block is reduced to 10 percent of normal nighttime level. By the strictly private action of exercising his dogs this man is providing a public good. But public goods, when provided privately, tend to be undersupplied. The man does not walk his dogs when it is raining, and he does not walk them all night. The provision of this public good is of little importance to the man. It is merely a positive externality generated by a strictly private action. If plotted on a graph, the values take
the form illustrated in Figure 4.2.

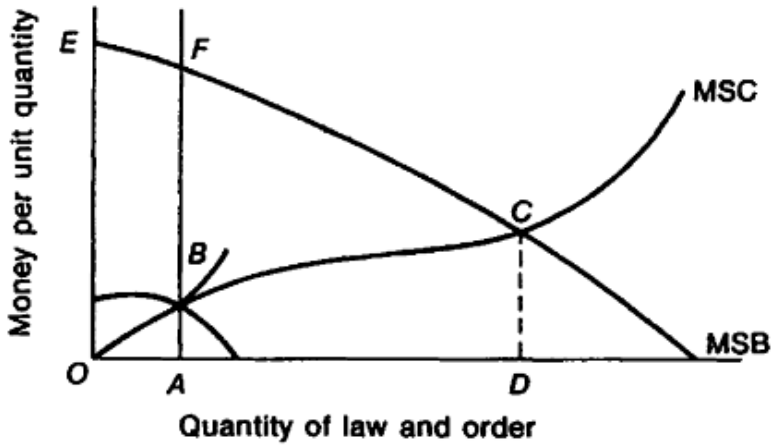

Figure 4.2. Costs and benefits of providing law and order. Relation of marginal social cost to marginal social benefit.

In this case there is *0A* quantity of law and order provided privately with a value of *0EFA*. The optimum amount of law and order to be provided is OD with a value of *0ECD*, and an increase in net value from *0EFB* to (*0EC*). Again, there is a compelling reason to establish an agency with the power to tax and to use this revenue to provide a public good. There is an important distinction between the common-pool and the public good situation. A failure to supply a public good merely results in an undersupply of some good or service, which presumably could be provided at some later time. In sharp contrast, were we to ”blow it” now, we may never again have a chance with the polar bears,

snow leopards, or black rhinos. The cost of failing to manage a common pool is the loss, perhaps irretrievable, of a valued resource.

Actual Bureaucratic Performance

In theory, any common-pool or public-good problem can be substantially ameliorated if we assume the conjunction of well-intended, intelligent, and informed bureaucrats and the appropriate technology. The bureaucracy will then perform up to the level where the marginal social benefit curve intersects the marginal social cost curve. At this level of production, social welfare will be maximized for the resource or good in question. Unfortunately, however, this is rarely the case.

Several of the factors that keep this from happening are obvious. First, we have very poor estimates of the value of the social benefits that flow from various actions. Because these benefits are not packaged and sold, we simply do not know what they are worth to people. It is especially difficult to determine the optimal demand for some resources. In addition, various competing parties are strongly motivated to give highly distorted estimates of the values.

Second, we lack adequate scientific information about most of the processes with which we are concerned. We simply do not know what impact submicroscopic air pollution has on human health or upon natural systems. Hence, we cannot estimate costs (or perhaps even benefits, as when acid rain improves the productivity of alkaline soils) of this type of pollution.
Given these considerations, even the best—intended and most intelligent agency would not know at what level to produce.

The Political Economy of Bureaucracies

Quite apart from the above considerations, there is a subtle and more pervasive problem inherent in reliance upon bureaucratic order to provide public goods and manage common—pool resources. Every bureau has a bias toward growth beyond the point where marginal cost equals marginal benefits. Nearly every bureaucracy is more comfortable and rewarding when it is expanding at a moderately rapid rate than when it is stationary or declining in size. With a 6 to 10 percent rate of growth, promotions are relatively frequent and can come from inside the agency. Plus, the lack of competition inherent in bureaucratic authority allows incompetent or marginally competent

personnel to be hidden or their efforts ignored. People are secure, their futures are relatively bright, and morale tends to be high. This was the picture of the universities in the late 1950s and 1960s. The contrast between those times and the wailings of doom that one now hears is very striking. Growth and lack of growth are both costly, but the implications of the two are quite different.

Assume that line *AB* in Figure 4.3 is the marginal social benefit function generated by an agency's actions, and that line *CD* is the marginal social cost, that is, what society has to give up in taxes for producing that benefit. Under these circumstances, social welfare will be maximized if the bureaucracy produces F quantity of its good or service. Beyond *F,* society has to give up more to expand the bureaucratic output than it gets in return for the additional expenditure. Hence, production and budgeting should stop at leaving society with a net gain of (*0AEF*) — (*0CEF*) or the area in *CAE*.

When producing items that are consumed publicly, it is very difficult to determine when "enough" has been reached. Firms can judge with fairly tight tolerances when they have produced enough Edsels, golf balls, or cotter pins. Determining when we have "enough" national defense is a more difficult problem. Compounding the problem is the fact that preferences for Varying amounts of national defense must be summed and in some way averaged. Obviously some people would wish to buy more national defense than they now obtain while others believe that they are already buying too much and would prefer lower taxes or greater medical research. It is, then, incumbent upon the military bureaucrats to identify those segments of the public who want more national defense expenditures and provide them with information useful for lobbying on behalf of increased military appropriations.

Weather forecasting and environmental monitoring are also extremely complex. Hence, it takes moderately sophisticated mathematics in the form of sensitivity analysis to determine even roughly the socially efficient investment in obtaining information. Nearly all high-level bureaucrats seem to believe that their program is indeed vital, critical, imperative, necessary, and essential to the national well-being, and that legislators would be well advised to increase the agency's budget. It just happens that what is best for the country (or district, or whatever unit) also makes the particular agency a more comfortable place. Bureaucrats carry on a continuous struggle to increase their budgets, and the most "successful" bureaucrat is the one who can claim responsibility for obtaining the largest budget increase.

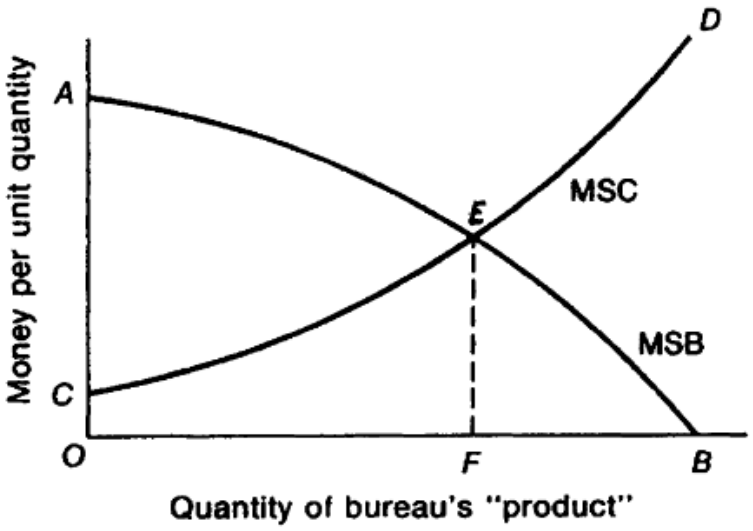

Figure 4.3. Optimum level of bureaucratic production.

Referring again to Figure 4.3, the tendency is for bureaucracies to push beyond the *F* level toward *B*. William Niskanan, a former RAND scientist and member of the President's Council of Economic Advisors, has a fairly involved mathematical argument that shows that a bureaucracy will expand its performance beyond *F* to the point where the entire net social benefit (*ACE*, if stopped at *F*) is consumed by the deviation of the increasing marginal social cost curve *CD* from the marginal social benefit curve *AB*. In a mature bureaucracy, the area in *DEB* has increased as production moved to the right (toward B) until it is equal to area in *ACE*. At that point, of course, society is not better off with the bureaucracy than it would have been without it. An analogous example is the purchase of a hunting dog by a subsistence hunter and the resultant discovery that he not only destroys much gear but also eats enough to outweigh the extra game he brings in.

Private Solutions Revisited

This understanding of political economy promotes rational management of common pools and public goods. We make institutional choices at the margin, balancing the effects of a given institution in a particular situation, rather than an all-or—nothing embrace of government or of markets with laws. A mix of for-profits, government bureaucracies and regulation, and innovative institutions such as public, nongovernmental endowment boards or

trusts allows us to address the particular circumstances of different common—pool goods.

For-Profit, Private Firms

Private entities are uniquely effective institutions for improving the efficiency of commodity production. When dealing with commodities, scarcity has never won a race with creativity. By concentrating profits on stockholders, entrepreneurs, and effective managers, private businesses encourage innovation and the movement of resources to more highly valued uses. The effective operation of businesses depends on freedom of exchange, free movement of prices, and, to reduce uncertainty about the future, security of property and contract.

For-profit businesses' performance, however, is much less stellar for public goods and common-pool resources, often failing to allocate, preserve, and nurture noncommodity values or goods with high transaction costs. Biotic diversity, nonpoint source pollution (such as auto emissions), and common pools such as ocean fisheries cannot easily be owned by any one person or business and thus are inefficiently provided in markets.

Government Agencies

In situations where there are large numbers of participants, efficient solutions require decision rules of less than unanimity. Some people must be coerced. To control the abuse of political power we can create competition among the levels and branches of government—federalism and separation of powers. We may wish to emphasize local rather than interstate competition. For problems that are inescapably national or international in scale, market-mimicking regulations limit political discretion and use price information to encourage optimal agency production. Emissions trading systems for some forms of atmospheric pollution are one example of this.

Non-Profit, Nongovernmental Firms

Finally, nonprofit, nongovernmental institutions are important. Everyone is familiar with institutions managed by trusts: nongovernment schools, nonprofit hospitals, and museums are common examples. Lacking the need to earn profits, trusts can promote and protect difficult—to-price

values such as biodiversity, watershed preservation, and aesthetics. With legal liability, limited budgets (as opposed to budgets controlled by Congress), and flexibility in hiring and firing, trusts can avoid many of the problems associated with government resource management. Tax-exempt status further lessens pressures to develop only commodity values.

Trusts encompassing US. public lands might be created by Congress and given one-time appropriations, then completely separated from government management. I have suggested this approach as a method of protecting endangered species[2] and removing national forests from federal control[3].

Nonprofit firms already facilitate the incidental production of public goods (positive externalities) by for—profit firms. Thanks to the nonprofit Wildlife Habitat Enhancement Council, over 300 corporate sites are being managed to benefit wildlife. Companies such as Dupont, IBM, Ford, and Weyerhaeuser find they are saving money, improving community relations, and bolstering employee productivity by returning portions of their corporate estates to nature. This is a voluntary program wherein WHEC provides expertise and companies provide the land, time, and will[4].

Ducks Unlimited, Trout Unlimited, North American Elk Foundation, the Ruffed Grouse Society, Quail Unlimited, and North America Wild Sheep Foundation are nongovernmental organizations with millions of members committed to preserving habitat as a public good. The Boone and Crockett Club, founded in 1887, is one of the first US. conservation organizations. Early on, it helped protect Yellowstone and Glacier National Parks. The club's 6000-acre Theodore Roosevelt Memorial Ranch in Montana harbors elk, white-tailed deer, grizzly bears, cougars, eagles, falcons, and other wildlife. Other organizations have increasingly used easements and covenants to encourage socially beneficial land use actions. Voluntary conservation is not just wishful thinking.

Good intentions, scientific and business know-how, and dedicated people are necessary but not sufficient conditions for promoting the rational, sustainable use of common resources. The critical factor often ignored by policy makers is getting the incentives right through careful institutional design. Centralized government resource management often results in the degradation of ecosystems and separates those best positioned to care for and from responsibility for outcomes. It is time to rediscover the virtues of the market, to decentralize political management and rule making, and to experiment with novel institutional designs. It is these reforms, aligning action with accountability, that yield productive and sustainable resources.

[1] Transactions costs are the costs of bargaining, negotiating, and exchanging. Ronald Coase made transactions costs a central issue in economics with his 1960 article "The Problem of Social Cost," *Journal of Law and Economics.*

[2] John A. Baden and Tim O'Brien, "Toward a True ESA: An Ecological Steward- ship Act," in Building Economic Incentives into the Endangered Species Act, ed. W. Hudson (Washington, DC, Defenders of Wildlife, 1993), pp. 95—100.

[3] John A. Baden and Tim O'Brien, "Political Management, Bureaucratic Incentives, and Forest Service Pathologies", 1993, unpublished paper, Bozeman, Montana, Foundation for Research on Economics and the Environment.

[4] Daphne White, "Taking a Walk on the Wild Side," *Hemispheres*, February 1994.

Part Two

DEVELOPING THEORIES OF THE COMMONS

5

Environmental Resource Management: Public or Private?

ROBERT L. BISH

Recent interest in the environment, accompanied by predictions of imminent destruction, has led to a crisis atmosphere with requests for government prohibition of some resource uses, government regulation of other uses, and government ownership of natural areas such as wildlife refuges and biologically productive salt marshes. Requests are common for regulation of environmental and natural resources by public agencies, as if regulation itself could solve the problems.

This essay claims that environmental resource problems are not new, that similar problems have been faced and resolved historically, and that there are a variety of alternative institutional arrangements for managing environmental resources efficiently and preventing their destruction. Furthermore, a good understanding of the relationship between institutional arrangements and environmental consequences carries one considerably further than a simple private greed—public good dichotomy analysis. The approach will be first to indicate the critical resource problems and institutions for efficient use and prevention of environmental destruction; second, to

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From Robert L. Bish, "Environmental Resource Management: Public or Private?" in *Managing the Commons*, Garrett Hardin and John A. Baden, eds. (San Francisco: W. H. Freeman, 1977), pp. 217-28. Reprinted by permission of W. H. Freeman and Company. This essay is a summary of some of the points raised in lectures at a Utah State University Special Summer Curriculum in Public Policy and Environment.

analyze alternative institutional arrangements with regard to the critical issues; and finally to consider the relevance of the public-private dichotomy in institutional arrangements for environmental control.

Critical Issues in Environmental Management

The most critical issue in environmental management is that users of environmental resources do not see that their use imposes costs on others, either directly or indirectly. The costs may accrue at different times or in different places, or the costs of any individual's use may be so small that he does not notice them, while the cumulative costs of many users yield destructive consequences. Costs may involve such a large group of individuals that no single affected person has the incentive to do something about costs imposed upon him alone. These cost problems are magnified if individuals have no legal means of forcing modification of the actions of the cost generator, and if there is a lack of valid scientific information about environmental consequences.

External Effects and Common Pools

External effects are consequences, either beneficial or harmful, accruing to third parties from the use or sale of economic resources. However, the simple existence of negative external effects does not indicate that a problem needs correction if the costs of correction would exceed the benefits to be gained by removing the effects.

A special kind of external effect occurs in common-pool resources. In a common-pool resource each individual's use increases the costs or decreases the value to other users. An example of a common pool is a water basin: each user's pumping lowers the water table and makes the use of the resource more costly for other pumpers. A major risk with common pools is that overuse may result in destruction of the resource. For example, if pumping from a water basin exceeds the safe annual yield, the basin may become compacted and cease to store water; or if a fishery is overfished, it may be completely eliminated. The effects common-pool users have on one another are external effects, but the large number of individual users and the potential destructibility of the resource constitute a specialized case of externality problems[1].

Property Rights

If there existed easily enforceable property rights (including liability for damages imposed on others) to all resources, the allocation of environmental resources could function efficiently within the traditional private market system. The issue of property rights is important for two reasons: first, it is not always clear who possesses ”rights” to limit the use of environmental resources; and second, the costs of enforcing these rights may be extremely high.

The existence of valuable unowned resources provides an incentive for individuals to try to capture the resource before other potential users can do so. This is likely to lead to premature use of the resource and increase the possibility of its destruction. Also, the lack of firm property rights makes it more costly for an individual to enter into a private agreement for managing the resource. For example, even if one has a right to fish in a common fishery forever, it may not be wise to limit one’s own fishing in order to preserve the fishery if others do not do likewise. Even if all fishermen agree to limit their activities, a fisherman could come along in the future and negate the agreement by overfishing.

Air, water, and many public land benefits are not easy to capture; and exclusion or limitation of users, a necessary condition for preservation of an overused common pool, would require considerable expenditure. Technology is available to enforce virtually any kind of property right; however, the cost of enforcement may exceed the value of the preserved resource.

If enforceable property rights exist, the possessor of those rights has an incentive either to use the resource in such a manner that it provides the highest benefits and is not destroyed, or to sell the rights for beneficial nondestructive use to another who values them more. Thus an individual pursuing his own interests can be expected to utilize efficiently resources that carry firm property rights. This tendency, however, cannot be expected in individuals pursuing their own interests on unowned resources[2].

Large Group Problems

The use of resources by many individuals, or external effects accruing to many individuals, complicate resource management problems even when property rights are specific. This is due to the time and effort needed for effective cooperation among large groups of people, especially if the group is

so large that any individual sees the costs of participating in group decision making as greater than his benefits[3].

Both common pool and environmental externality problems are likely to involve large groups. For example, 100,000 sportsmen fish for salmon on Puget Sound, or 10,000 farmers draw water from the same water basin in West Texas; air pollution may affect six million people in the Los Angeles Basin, or pesticide runoff from agriculture may contaminate much of Lake Michigan.

Externality problems also may be caused by individuals; the externality becomes a problem only when many individuals engage in the same activity at the same time and in the same place. For example, 1 or even 100,000 cars on the Los Angeles freeway system would not make the air unbreathable, but several million automobiles cause severe smog problems.

These large group problems provide the most significant rationale for dealing with environmental problems in the public rather than the private sector. However, the use of political organization to reduce decision-making costs so that large groups can better indicate their preferences is primarily a demand aspect rather than a supply or management aspect of resource use; therefore, it is not relevant for determining whether supply or management should be private or public. Political units can lease or buy without assuming direct management of basic resources, and many questions of political organization would be much clearer if the differences between demand and supply functions were made explicit in analysis of the public sector[4].

Information

Two information problems are significant in efficient environmental resource use. First, it may be very costly or impossible to determine the full effects of environmental resource use because their occurrence is distant in either space or time. Furthermore, many effects are indirect; i.e., smog itself is not released into the air but rather occurs as a result of photochemical reactions. It is unlikely that any single resource user will undertake to study effects of use because the cost of acquiring information compared to his personal gain is very small. Thus some kind of cooperative or political action may well be necessary to finance scientific research on environmental uses.

A second problem is weighing the benefits of information on resource use against the costs[5]. This is difficult to estimate, because users are not forced to be accurate in their evaluations. If one individual benefits more than

another from using a resource, he will be willing to pay a high price to compensate the second in exchange for his rights. Therefore, it is to the advantage of each to overstate the value of the resource to him in order to benefit as much as possible. Unless a mechanism exists to force each potential user to reveal the true value of the resource to him, allocation is difficult and arbitrary[6].

The critical nature of environmental resources and the problems of information and enforcement of property rights have now been identified. In the following section each issue will be considered in relation to alternative arrangements for environmental management.

Institutional Alternatives

Any proposal for environmental resource management is unlikely to be successful if it does not specify property rights; or, when large groups are involved, provide a mechanism to reduce the decision-making costs among the group members. However, within these constraints a variety of institutional arrangements are feasible—including the classic dichotomy of private or public ownership and management. Both of these general alternatives will be examined to determine if the public-private distinction is relevant or whether it is simply a screen which hides the crucial issues of environmental resource management.

Private Ownership

Many natural resources are privately owned, including land, mines, forests, and beaches. In exchange for his management of the resources, the owner receives payment from users. Part of the payment may be seen as compensation for his managerial function and part as an ”unearned” rent, accruing simply because the resource is scarce[7]. If it is decided in the political process that the owner has no special claim to the rents, they may be taxed away with no effect on the allocation or use of the resources[8]. Private ownership of natural resources leads to the most efficient resource use when there are no third party effects from use, and when users of the resource can easily be charged. The owner, in seeking to maximize his return, will sell the resource to the individual who places the highest value on it and excludes potential users who are not willing to pay the market clearing price. Thus the

difficult problem of identifying the value of a resource is overcome when the users reveal their preferences by paying the market price. There is then no need for an administrative official to determine how much each potential user values the resource and to administer it accordingly. This is the usual process through which resources are allocated in a private property economy[9].

A good example of privatization of a publicly owned natural resource was the enclosure movement in medieval England. An increase in the demand for wool stimulated peasants to graze a large number of sheep on common pasture lands, with the result of overgrazing and destruction of the pasturage. From each peasant's point of view, adding another sheep would not increase destruction noticeably, and besides, he reasoned, if he did not add sheep, his neighbor probably would. However, all the peasants' actions taken together had the potential for destroying the valuable resource. Partially to preserve pasture lands, but mostly to obtain the increases in the value of pasturage as wool became more valuable, the stronger lords and nobles undertook to exclude peasant flocks from what had formerly been common land, and eventually they turned most of the land into private property under their control. The new owners then had an incentive to limit the number of sheep permitted to graze the land in order to prevent over grazing. In some cases, peasants were permitted to graze specified numbers of sheep for a fee; in other cases owners grazed only their own flocks. Once the land was private, its use was also no longer restricted to pasturage. If the demand for wool fell, less land would be needed for grazing sheep, and the owner could turn the land to the production of grain. On the other hand, if the demand for wool increased, potential sheep raisers had an incentive to purchase or rent privately owned land from nonsheep raisers and turn that land into pasturage. Once the resource was private the owner could be expected to put the land to its best use in response to changing social demands.

The income distribution effects of the enclosure movement were extremely unfavorable to peasants and provided windfall gains to lords and nobles. However, in a society regulated more by justice than police power, it would be possible either to sell natural resources, with the proceeds going to the general public treasury or to former users, or to tax the rents away from the owners, leaving only sufficient returns to compensate for their management.

Other examples of privatization of natural resources include grants of large timber acreages to the railroads and private control of ocean or waterfront beaches in much of the United States. If the resource had a very

low value, a private owner might find it in his interest to use the resource up as happened with the cut-and-run logging practices of the last century. But when the resource has a high value, the owner has an incentive to manage it for highest possible returns, as is done with the vast tree farms owned by timber companies, especially in the Northwest and the Southeast. Privately owned ocean beaches are less common, but it is not clear that the only way to preserve natural amenities and high quality recreational land is to make beaches public rather than private. Where private beaches do exist, the owner limits his gathering of oysters and clams and regulates access to maintain low density use. Public beaches, especially those near large population concentrations, are Often overrun with people, and they also become depleted of marine life. Making beaches public may mean simply that many features of the beaches are destroyed. Presumably, this result is not the objective of conservationists who recommend that natural resources be maintained in the public domain.

Ironically, some more socialized countries rely much more on private resource management than does the United States. For example, in England fishing rights to a good salmon stream belong to adjacent land owners. The rights cost over $2000 annually (taxed of course)[10]. Also in England, surface rights to reservoirs are usually granted or sold to a ”Club” which then undertakes to manage all surface uses such as sailing and boating, thus putting the entire common pool under control of a single manager. Nonclub members have access, but they are charged on the basis of their use of the resources[11]. Having different resources managed by different organizations provides greater variety in the quality of resource usage than can be provided in a country where all resources are managed by a single public bureaucracy. Usage based on direct payment may well be the best way to prevent resource destruction in a small, densely populated country like England.

While many examples of efficient resource management through privatization exist, the cost of enforcing property rights, including the right not to be damaged, makes some resources unsuited for relatively unregulated, private management. For example, third party effects from private forestry, such as the siltation of salmon streams caused by logging, are not likely to be controlled without public regulation, unless, as in England, the land-owner could receive payment from the fishermen too. Information regarding grazing, forestry, or beach use may be too costly for any individual owner to acquire, but it would be valuable to all if some joint financing could be arranged. Also, it may be more efficient for an owner to lower the value of

his resource simply because of pricing convenience. The owner of a primitive area may rent his land for logging because stumpage can be sold, although hikers and campers place a higher value on the area remaining in a natural state. It would be virtually impossible for the owner to try to charge each individual user of the area. For cases of these kinds, it is necessary to examine public ownership and management and evaluate the alternatives.

Public Ownership

Public ownership and management is often advocated as a means of preserving environmental resources. However, public ownership does not necessarily mean that every member of the public can use the resource as often and as much as he wants. If public ownership did mean completely open and unrestricted access, common-pool resources would quickly be destroyed from overuse because no single individual would see destructive consequences from his use, while the combined use by all individuals would likely exceed the capacity of the resource. Instead, public ownership and management means that some political official is going to decide by whom, how, and how much a resource is used, rather than private market transactions rationing the resource. That is, the political official rather than the private owner has been assigned the property rights. When a public official controls a resource the question becomes: What incentives does the official face? What benefits will he receive from alternative allocations of the resource that will influence or determine his decisions?

There are cases in which public officials are officially supposed to sell resources to gain revenue for general governments[12]. Even here, a public official may not manage as efficiently as a private owner because he does not share the gains of increased revenues resulting from more efficient use, and he may find it in his interest to sell resources below their opportunity cost to politically powerful or friendly groups. If publicly owned resources are not sold, the rationale for public management is often that the nature of the resource makes direct sale unfeasible, even though the potential users still place a high value on the resource. Thus publicly owned resources are likely to generate high unearned rents, like any factor in fixed supply. The question then becomes: Who shall receive the rents?

First, it is not clear that a public official has any incentive to assign publicly owned resources to anyone who does not undertake the most political activity to obtain them; and second, it might not be possible to identify the

value various users place on the resource because preferences are not revealed in market-like transactions. Instead, the public official is faced with competing claims,- each potential user listing all the reasons he, rather than some other user, should be permitted to use the resource. Competing claims which exceed the capacity of the resource are exactly what can be expected when something valuable is given away.

A public official is also faced with the problem of the disposition of the rents. In general, the constitutions of government agencies in the United States specify that no profits may be made, and revenues are held down to a level just sufficient to cover the direct operating costs of the agency. A scarce resource should be generating large rents which could then be applied to the general costs of government. With prices much lower than they would be if the rents were obtained by a private owner, these potential rents go instead to the users of the resource, thus providing additional incentives for over-stating benefits and undertaking political action to obtain larger shares of resource use.

Only limited consideration has so far been given to the allocation of publicly owned resources in the United States[13]. Thus, while we know where problems of private ownership lie, it is difficult to draw firm conclusions about the effects of public ownership. However, the evidence available supports these observations[14]:

1. A majority of decisions in the public sector are bargained among administrative officials, between administrative and elected officials, or between administrative Officials and private individuals, rather than made in voting or in direct formal administrative relationships.
2. The individuals in the public sector as well as those in the private sector appear to respond to immediate and direct incentives.
3. These incentives appear to be most effectively offered by well-organized groups rather than by unorganized individual citizens.

Most decisions on environmental resource use are also made in bargained agreements between administrative officials and individual representatives of well-organized groups. Elected officials tend to play only a minor role except for the legislation of some constraints as general policy guidelines. Organized groups such as timber interests, mining interests, and cattle ranchers have much more influence on national forest policy than would individual hikers, campers, and fishermen. Traditional marine users such as shippers, commercial fishermen, chambers of commerce, and allied industrial and commercial shoreline users exercise greater influence on shoreline use than

swimmers, surfers, picnickers, duck hunters, and others who prefer the shoreline to be left in a relatively natural state.

Public ownership and management of resources will probably benefit well-organized groups as would the private assignment of property rights; although with public ownership valuable rents will be obtained by users instead of resource owners. Even public agencies may neglect third party interests. (For example, is the Army Corps of Engineers any better than Weyerhaeuser in this regard? Probably not.) Unless individual citizens become well organized and active in the political process, their interests are neglected. And even when citizens do become interested enough to organize, their political staying power is likely to be much weaker than that of well-organized economic interests whose welfare depends on the dominance of public agencies[15].

If we return to the issues raised previously and ask what differences exist because Of public rather than private ownership of natural resources, it appears that there are very few. The possibility of external effects and the common-pool nature of the resource remain the same. Property rights must be allocated, in one case by a private owner and in the other case by public officials. The large group problem may or may not have been resolved in either case. Unless the political organization managing the resource is designed very carefully, large numbers of individual users are more likely to be neglected under public ownership. As for information, when the resource can be sold, a private owner will obtain the most accurate information available for evaluating alternative potential users. A public official, however, will have only equally competing demands to evaluate. If the scale is large, the public official may have an incentive to undertake research to learn the long-range effects of alternative resource uses. However, in general, the American political process with its two— and four-year election cycles is not noted for long-range planning or for sacrificing current benefits for greater future benefits.

All that really changes in converting resources from private to public ownership are the incentives faced by the managers of the resources. The private owner faces market demands (which can also be articulated by political groups), and the political official faces political demands. If anything, the private owner might respond to all potential user demands much more efficiently than the political official. He will certainly have better information on alternative values. Equally important, if private ownership does create negative external effects, individuals affected still have recourse to political Officials and the courts to obtain compensation. If the effects are generated by a political official allegedly managing public resources in the public interest,

recourse is much more difficult to obtain, as political units usually avoid being subjected to lawsuits without their permission.

In order to make a rigorous comparison of the expected consequences of private or public management of a natural resource, one has to examine the nature of the particular resource involved, the constraints and incentives that exist for either the private owner or the public official, and the ability of large groups to deal with private owners or to compete politically. In addition, one has to examine whether either private or public management would ever permit a single group or interest to Obtain a monopoly over the resource use and exclude other users. And finally, one would have to determine just what kind of information would be produced in either market transactions or in the political bargains struck between the public manager and resource user. In none of these issues can one draw the conclusion that one form of ownership and management is unquestionably superior to the other.

Conclusions

Distinguishing between private and public resources management is usually meaningless in determining how effectively a resource will be used or preserved. Instead, one must look at the specific incentives either the private owner or the public manager faces in allocating the resources he controls. This leads to an entire range of questions about market structure and political structure within which private and public sectors interact in many complex ways. For example, even a private owner depends on governmentally enforced property rights, and the public manager depends on private rewards such as a salary increase or professional promotion. If the private owner can capture the gains from efficient resource management, there are reasons to expect he will manage and preserve the resource more efficiently than a public official. There is not justification for assuming that merely changing the ownership of a resource from private to public will result in more efficient usage or prevent its destruction.

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[1] Externality issues and their complications are treated in more detail in Robert L. Bish, *The Public Economy of Metropolitan Areas* (Chicago: Markham, 1971), chap. 2. For the classic

statement on common-pool resources, see H. Scott Gordon, "The Economic Theory of a Common-Property Resource: The Fishery," *Journal of Political Economy*, 62 (April 1954), 124—42.

[2] For an analysis of property rights and transaction costs, see R. H. Coase, "The Problem of Social Cost," *Journal of Law and Economics*, 3 (October 1960), 1—44; and N. S. Cheung, "The Structure of a Contract and the Theory of a Non-exclusive Resource," *Journal of Law and Economics*, 13 (April 1970), 49—70.

[3] The Classic analysis of group size in relation to undertaking action for individual benefit is Mancur Olson, Jr., *Logic of Collective Action: Public Goods and the Theory of Group*s (Cambridge, Mass.: Harvard University Press, 1965).

[4] For an analysis of the separation of demand and production factors in the urban public economy, see Robert Warren, "A Municipal Services Market Model of Metropolitan Organization," *Journal of the American Institute of Planners*, 30 (August 1964), 193—204. For an analysis of British Government demand articulation and private supply of parks, see Warren A. Johnson, *Public Parks on Private Lands in England and Wales* (Baltimore: Johns Hopkins University Press, 1971).

[5] These conclusions are based on the assumption that for prices to be meaningful in comparing gains and losses to different individuals, the prices must emerge from voluntary transactions which exhaust all potential gains from trade. That is a situation in which no one can benefit without someone else losing, each by their own evaluations of their own situation. For an analysis of efficiency conditions, see Francis M. Bater, "The Simple Analytics of Welfare Maximization," *American Economic Review*, 47 (March 1957), 22—49.

[6] For further analysis of the relation between incentives and information, see F. A. Hayek, "The Use of Knowledge in Society," *American Economic Review*, 70 (September 1945), 519—30.

[7] An "economic rent" is the difference between the cost of providing the resource and the amount paid for its use. The cost of natural resources is very low, and yet high prices must be paid in order to bid them out of reach of destruction.

[8] Economic rents are generally captured only by the first owner of a resource. For example, the discoverer of a mine may sell it for a high price, the difference between the cost of discovery and the selling price being a rent. Subsequent owners, however, do not receive rents as they pay for the value of the mine when they purchase The Tragedy of the Commons

[9] Ethical justification for resource allocation based on market forces depends on the competitive functioning of labor markets as well.

[10] Johnson, p. 35

[11] Johnson, p. 79.

[12] For example, the Washington State Department of Natural Resources manages state-owned forests, tide lands, and subsurface lands with a maximizing revenue mandate.

[13] See Vincent Ostrom, "Water Resource Development: Some Problems in Economic and Political Analysis of Public Policy," in Austin Ranney, ed*., Political Science and Public Policy* (Chicago: Markham, 1968), pp. 123—150

[14] One analysis that brings out these conclusions very well is Aaron Wildavsky, *The Politics of the Budgetary Process* (Boston: Little, Brown, 1964).

[15] The primary role of political organization may be to overcome the cost-benefit problems of large groups. For further analysis of the use of political organizations to resolve large group problems, see Bish, Chap. 3; and James M. Buchanan and Gordon Tullock, *The Calculus of Consent* (Ann Arbor: University of Michigan Press,1962).by many as the definitive insight. To make his points about the need for major social change to deal with problems such as overpopulation, resource depletion, and air and water pollution, Hardin (1968) relied upon a thought experiment. He asked the reader to imagine what would happen to a metaphorical village commons if each herder were to add a few animals to his herd. His metaphor highlighted the divergence between individual and collective rationality. If each herdsman

found it more profitable to graze more animals than the pasture could support, because each took all the profit from an extra animal but bore only a fraction of the cost of overgrazing, the result would be a tragic loss of the resource for the entire community of herders. Thus Hardin concluded that ”freedom in the commons brings ruin to all” (Hardin, 1968, p. 1244).

6

The Tragedy of the Commons: Twenty-Two Years Later

David Feeny,Fikret Berkes
Bonie J.MCay and James M. Acheson

Introduction

Garrett Hardin's "The Tragedy of the Commons" was published some time ago—in 1968. Although it focused attention on overpopulation, the dominant legacy of the paper has been its metaphor of common-property resource management. In the intervening years, the ideas that Hardin popularized have become the most widely accepted explanation for overexploitation of resources that are commonly held. The essential idea was that resources held in common, such as oceans, rivers, air, and parklands, are subject to massive degradation. Hardin was neither alone nor novel in making the argument. He noted that Lloyd had made the same point in a series of lectures in the 18305 (Lloyd, 1968). Two modern resource economists, Gordon (1954) and Scott (1955), are usually credited with the first statement of the conventional theory of the commons, although Hardin does not mention them. In this paper, we examine the accumulated evidence pertaining to common-property resource management and provide a critique of the conventional theory expounded by Hardin.

Although Hardin was referring to global concepts such as carrying capacity, his observations about resources held in common are considered by many as the definitive insight. To make his points about the need for major

From David Feeny et al., "The Tragedy of the Commons: Twenty-Two Years Later," *Human Ecology* 18 (1990):1—19. Reprinted by permission of Plenum Publishing Corporation.

social change to deal with problems such as overpopulation, resource depletion, and air and water pollution, Hardin (1968) relied upon a thought experiment. He asked the reader to imagine what would happen to a metaphorical village commons if each herder were to add a few animals to his herd. His metaphor highlighted the divergence between individual and collective rationality. If each herdsman found it more profitable to graze more animals than the pasture could support, because each took all the profit from an extra animal but bore only a fraction of the cost of overgrazing, the result would be a tragic loss of the resource for the entire community of herders. Thus Hardin concluded that "freedom in the commons brings ruin to all" (Hardin, 1968,p. 1244).

This conclusion has been accorded by some the status of scientific law. The tragedy of the commons has become part of the conventional wisdom in environmental studies, resource science and policy, economics, ecology, and political science (McEvoy, 1988, p. 214) and is featured in textbooks (Nebel, 1987, pp. 484—485; Lineberry, 1983, pp. 579—580). J. A. Moore, author of a major environmental education project for the American Society of Zoologists, states: "Hardin's 'Tragedy of the Commons' should berequired reading for all students ... and if I had my way, for all human beings" (Moore, 1985, p. 602). It has also been used in formulating resource-management policy, as recently shown for Atlantic Canada fisheries(Matthews, 1988).

To avoid the tragedy, Hardin (1968; Hardin and Baden, 1977) concluded that the commons could be privatized or kept as public property to which rights to entry and use could be allocated. Hardin has been widely cited as having said that resource degradation was inevitable unless common property was converted to private property, or government regulation of uses and users was instituted. In a later paper, Hardin (1978) specifically recognized two general solutions, and presumably no others: private enterprise and socialism (control by government). Hardin argued that if we do not act in one of these two ways, we "acquiesce in the destruction of the commons" (Hardin, 1968, p. 1245).

We examine the evidence on factors associated with successful vs. unsuccessful exploitation of common—property resources, focusing in particular on communally held resources. Surprisingly little careful empirical work on common property followed Hardin's seminal publication. However, several recent volumes summarize a growing and rich body of evidence relevant to common-property resource management (National Research Council, 1986; McEvoy, 1986, 1988; Marchak et al., 1987; MCCay and

Acheson,1987; Wade, 1987; Fortmann and Bruce, 1988; Pinkerton, 1989; Berkes,1989; Cordell, 1989; Ostrom, forthcoming). A few definitions will be presented before examining this new evidence in the light of the predictions of Hardin's model.

Definitions and Concepts

Common-property resources include fisheries, wildlife, surface and groundwater, range, and forests. It is important to delineate the characteristics shared by these resources, and to distinguish between the resource and the property-rights regime in which the resource is held (National Research Council, 1986).

Common-property resources share two important Characteristics. The first is excludability (or control of access). That is, the physical nature of the resource is such that controlling access by potential users may be costly and, in the extreme, virtually impossible. Migratory resources such as fish, wildlife, and groundwater pose obvious problems for regulating access. Similarly, range and forest lands typically pose problems of exclusion. For large bodies of water, the global atmosphere, and radio frequency bands, exclusion is even more problematic.

The second basic characteristic of common-property resources is subtractability, that is, each user is capable of subtracting from the welfare of other users. Even if users cooperate to enhance the productivity of their resource, for instance by replanting trees, the nature Of the resource is such that the level of exploitation by one user adversely affects the ability of another user to exploit the resource. Subtractability (or rivalry) is the source of the potential divergence between individual and collective rationality. If one user pumps more water from an aquifer, other users will experience an increase in pumping costs as aggregate use approaches or exceeds recharge capacity. If one user harvests fish, the catch per unit of fishing effort of other fishermen declines. Hence, we define common-property resources as *a class of resources for which exclusion is difficult and joint use involves subtractability* (Berkes et al., 1989, p. 91).

The definition here resembles one given by Elinor Ostrom (1986, p. 604; see also Fortmann and Bruce, 1988, p. 2). Ostrom underscores the importance of the distinction between the intrinsic nature of the resource and the

property-rights regime under which it is held, by defining the class of resources as ”common-pool resources”. Because of the widespread use of the term common property for certain kinds of resources, we have chosen to use this term to refer to the resource and the term communal property to refer to one of the four basic property-rights regimes.

In order to facilitate analysis, we define four categories of property rights within which common-property resources are held: open access, private property, communal property, and state property. These are ideal, analytic types. In practice, many resources are held in overlapping, and sometimes conflicting combinations of these regimes, and there is variation within each. It is nevertheless important to distinguish these four basic property rights regimes (Ciriacy-Wantrup and Bishop, 1975; for similar distinctions see also Berkes et al., 1989, p. 91; Bromley, 1986, 1989b, pp. 872—875; Bromley and Cernea, 1989, pp. 3—5; Demsetz, 1967, p. 354; Gibbs and Bromley, 1989, pp. 24—27; Godwin and Shepard, 1979, p. 267; Jacobs and Munro, 1987, p. 442; Libecap, 1986, p. 33; Marchak, 1987, pp. 4—5; Ostrom, 1986).

Open access is the absence of well-defined property rights. Access to the resource is unregulated and is free and open to everyone. Many offshore ocean fisheries before the twentieth century, or the global atmosphere provide examples.

Under *private property*, the rights to exclude others from using the resource and to regulate the use of the resource are vested in an individual. (or group of individuals such as a corporation). Private-property rights are generally recognized and enforced by the state. Unlike rights under open access, private-property rights usually are exclusive and transferable (Regier and Grima, 1985). Examples include forests and rangelands that are held privately.

Under *communal property*, the resource is held by an identifiable community of interdependent users. These users exclude outsiders while regulating use by members of the local community. Within the community, rights to the resource are unlikely to be either exclusive or transferable; they are often rights of equal access and use. Some inshore fisheries, shellfish beds, range lands, and forests have been managed as communal property; similarly, water—users associations for many groundwater and irrigation systems can be included in this category. The rights of the group may be legally recognized. In other cases the rights are de facto, depending on the benign neglect of the state. Some scholars use the term common property, or simply a common, to refer exclusively to the regime we classify as communal

property (Ostrom, 1986; Bromley, 1986, 1989a,b; Marchak, 1988—1989; Blaikie and Brookfield, 1987, pp. 186-187).

Finally, under *state property*, or state governance, rights to the resourceare vested exclusively in government which in turn makes decisions concerning access to the resource and the level and nature of exploitation.Examples include forests and rangelands held by the government or crownowned, and resources such as fish and wildlife that may be held in public trust for the citizenry. The category of state property may refer to property to which the general public has equal access and use rights such as highways and public parks. The nature of the state property regime also differs from the other regimes in that, in general, the state, unlike private parties, has coercive powers of enforcement.

Although the nature of the property-rights regime under which the resource is held is important, that information is not sufficient to draw valid conclusions concerning behavior and outcomes. One theme of the paper is that one must understand a whole host of institutional arrangements governing access to and use of the resource. Knowledge of the property rights is necessary but not sufficient. Many Of the misunderstandings found in the literature may be traced to the assumption that common property is the same as open access. Hardin's prediction of the inevitability of over—exploitation follows from this assumption. Yet the assumption is inaccurate and it has led to a great deal of confusion. Based on our definition of common property, an approach to testing Hardin's hypothesis is to examine two broad challenges in the management of common-property resources: (1) the exclusion of other potential users, and (2) the regulation of use and users to ameliorate the problems associated with subtractability. Evidence on each will be examined for each Of the property—rights regimes listed above.

In evaluating evidence to test Hardin's hypothesis, a criterion with which to classify the outcome as a success or failure is needed. The choice of any particular standard is arbitrary, but we will use ecological sustainability as the working criterion of success, that is, whether the resource in question has been used "without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p. 8). Sustainability is a rough index of management success; it does not necessarily imply that resource utilization is optimal from either ecological or economic points of view (see World Conservation Strategy, 1980). Note that the criterion of sustainability is both human, and resource- centric regarding the source of valuation, not exclusively one or the other.

Evidence on Exclusion

Open Access. The evidence supports Hardin's argument concerning degradation due to the inability to regulate access to resources held as open access. Examples are many, and include the classic case of the historical depletion of various whale stocks in the open ocean. Several examples, however, reveal a point not mentioned by Hardin. In many cases, the tragedy occurred only after open—access conditions were created, often as a consequence of the destruction of existing communal land-tenure and marinetenure systems. A number of these cases involved the imposition of colonial rule, as in sub-Saharan Africa (Johnson and Anderson, 1988), the Pacific Islands (Johannes, 1978), and northwest North American salmon rivers (Berkes, 1985, and references therein).

Private Property. The establishment and enforcement of private property rights have frequently provided the institutional arrangements for successful exclusion. Private-property rights may not, however, be sufficiently precise for solving the exclusion problem. A classic example is the exploitation of oil pools in much of the United States. In an 1889 Pennsylvania Supreme Court decision, the doctrine of law of capture was applied to oil. Private property rights in oil were assigned only upon extraction. In practice, this means that each owner of surface rights has the incentive to accelerate their pumping of oil to the surface. The result is a duplication of drilling and other capital costs, substantial reduction in the overall rate of recovery, and dissipation of economic rents. A remedy to the problem has long been recognized—to define property rights in the underground pool as a unit (unitization) before extraction rather than after. In jurisdictions (such as Wyoming) in which unitization is required before drilling on land leased for oil exploration, greater efficiency has been achieved. In spite of the potential gains for all users through unitization, this form of contract is uncommon in other jurisdictions (such as Texas and Oklahoma) because the high cost of private contracting inhibits its adoption. Private property rights and the incentives they afford are not always sufficient to achieve efficient exploitation (Libecap and Wiggins, 1985; Wiggins and Libecap, 1985).

There is an enforcement problem with all types of property rights, including private property. For common-property resources, which by definition pose exclusion problems, such enforcement can be costly. Well recognized dejure rights of the medieval lord, and even contemporary landlords, to fish and game have been routinely violated by poachers (MCCay,

1987; Thompson, 1975). The extent to which the community regards private-property rights as legitimate affects the cost of enforcement. The difficulty of enforcing private claims to common-property resources is exacerbated by competing Claims to communal rights in those resources. This is evident in the United States oyster industry, where a private property regime, including leasehold, is not politically acceptable in many areas (MCCay, 1987) regardless of the fact that it is logical, feasible, and demonstrably more efficient (Agnello and Donnelley, 1984).

Communal Property. Hardin did not consider the possibility of exclusion under communal—property regimes. By exclusion we mean the power to exclude people other than members of a defined community. Evidence suggests that successful exclusion under communal property is the rule rather than the exception. Well-documented contemporary cases include Amerindian community hunting and fishing lands in James Bay, eastern subarctic Canada (Berkes, 1977, 1987; Feit, 1987). Here, the communal property regime collapsed as a result of incursions by outsiders and recovered with the re-establishment of exclusion at least twice since the nineteenth century (Feit, 1986). Other examples come from the Pacific islands where communal-property regimes have collapsed in some areas but continue to be viable in many others (Johannes, 1978, 1982; Ruddle and Akimichi, 1984; Ruddle and Johannes, 1985).

Communal property is not confined to remote and sparsely populated areas. Cooperative-based coastal fisheries in Japan provide many successful examples of communal-property systems. These fishing communities hold legally guaranteed exclusive fishing rights in coastal areas (Ruddle, 1987, 1989). One of the major conclusions of the National Research Council conference (1986, p. 621) was that legal recognition of communal rights, as in Japanese coastal fisheries, was crucial for the success of communal-property regimes. Many of the island nation states in the Pacific are creating formal legal guarantees of traditional communal-property rights (Ruddle and Johannes, 1985; Baines, 1989). Even when there is no legal recognition of communal property, the exclusion of outsiders by local users through such means as threats and surreptitious violence is not uncommon (Acheson, 1975; McEvoy, 1988). The persistence of community-based lobster fishing territories in Maine is merely one example, but an important one because it occurs in a country and culture in which the belief in right of free access is deeply held (Acheson, 1987, 1988).The examples given thus far are for fish and wildlife for which exclusion is particularly difficult because of the migratory nature of

the resource. Successful exclusion can also be found for other resource types, including grazing lands, forests, and water resources (National Research Council, 1986; Fortmann and Bruce, 1988; Dani, et al., 1987; Maass and Anderson, I 978).

Pressure on the resource because of human population growth, technological change, Or economic change, including new market opportunities, may contribute to the breakdown of communal-property mechanisms for exclusion. The role of population growth is especially controversial. For example, some argue that in the case of East Africa, the carrying capacity of rangelands under any management regime has been exceeded (Talbot, 1986). Other cases indicate that population is merely one of many interrelated social and economic problems (Jodha, 1985; Johnson and Anderson,1988; Peters, 1987; Fortmann and Roe, 1986).

Communal-property regimes fail to provide for exclusion for other reasons as well. Many of these failures are associated with the appropriation of the resource by politically or militarily powerful groups, or by other factors such as land reform that disrupt existing communal management systems (Jodha, 1987). Others are associated with problems of scale and internal organization. The social and political characteristics of the users of the resource and how they relate to the larger political system affect the ability of local groups to organize and manage communal property (Ostrom,1987, 1988, forthcoming).

State Property. Exclusive state governance of the resource has in many cases been sufficient to provide for adequate exclusion. However, difficulties in exclusion are not necessarily overcome by declaring the resource to be state property. A vivid example comes from Nepal. Alarmed by deforestation, the government nationalized forests in 1957, converting what were often communal forests into de jure state property. But the result more closely approximated the creation of de facto open access. Villagers whose control of nearby forests had been removed often succumbed to the incentives of law of capture. Deforestation accelerated instead of decelerated. In the face of worsening conditions the government began tO experiment in 1976 with the re-creation of communal-property rights (Arnold and Campbell, 1986; Bromley and Chapagain, 1984).

Similar evidence on exclusion is found in the management of state forests in Niger and Thailand. In both countries state property has often been treated as open access. In response to the growing crisis of degradation in Niger, some farmers began in the 19805 to extend their private property rights

in arable land to include the trees, which are de jure state property (Thomson et al., 1986, 1989; Feeny, 1988a).

Another problem with state governance is that imperfections in the political process will often be mirrored in resource management (McEvoy, 1988). In some cultures, free access to certain resources for citizens at large is viewed as a right. In other cases, the state is especially responsive to the interests of the elite (Feeny, 1982, 1988b; Jodha, 1985). Some instances of apparent tragedies of the commons are more accurately construed as examples of government failure (Anderson, 1987; Marchak, 1988—1989).

The logic of the argument of "The Tragedy of the Commons" is that we should not observe sustainable management of common-property resources and the exclusion of some uses or users, under regimes other than private or state property. But as we have illustrated, exclusion is feasible, if not always successful, under private, state, and communal-property regimes. Furthermore, private or state ownership is not always sufficient to provide for exclusion.

Evidence on Regulations of Use and Users

Open Access. Hardin's predictions that incentives for successful resource management are absent from or weak in open access regimes are in general consistent with the evidence. In such regimes, under conditions in which demand exceeds the capacity of the resource to sustain itself, and where the technology is available to exploit the resource at a high level, many species, including the North American passenger pigeon and the bison, have become extinct, or virtually extinct. In the context of the day, free and unregulated use of resources such as the bison initially made sense. To illustrate the individual rationality that lay behind ecological tragedy, Hardin (1978) invokes the image of Kit Carson shooting bison on the plains, taking only the tongue and leaving the rest. This is not economically irrational if one considers that the game was then abundant but the hunter's time was scarce. Depletion occurred rapidly, before countervailing institutional arrangements or changing cultural values could prevent it.

Private Property. Privatization usually provides incentives for rational exploitation of the resource. If the owner has property rights in the resource and those rights are tradeable, both the costs and benefits will accrue to the

same owner and will be reflected in the market price of the resource, giving the owner the pecuniary incentive to refrain from destructive use. These incentives, however, are not necessarily consistent with sustainable use. Suppose a redwood planted for $1 is worth $14,000 at maturity—which may take 2000 years. The implied rate of return would be less than 0.5%,well below the rates of return generally available to investors. Although planting a redwood may make ecological sense, it does not make economic sense under a private—property regime (Hardin, 1979).

More realistically, Clark (1973) has shown that for relatively Slow-growing and late—maturing species such as whales, it may be economically optimal to deplete the resource rather than to use it sustainably. For the Antarctic blue whale with a maximum sustainable yield level of probably no more than 5% a human-rate of time preference (discount rate) of greater than this 5% would be sufficient to lead to its extinction, even under exclusive and enforceable private-property rights. These rights permit the owner to maximize the present value of the resource, yet the resource is not protected from extinction.

Communal Property. There is abundant evidence, contrary to Hardin, on the ability of social groups to design, utilize, and adapt often ingenious mechanisms to allocate use rights among members. The medieval English commons featured in Hardin's paper, like many other historic and contemporary commons, were often subject to comprehensive systems of regulation. For example, stinting was often practiced, that is, limiting the number of head that each owner could graze. Not only was access exclusive to certain members of the village, but their rights were Often closely regulated (McCloskey, 1976; Cox, 1985; Campbell and Godoy, 1986; Dahlman,1980; Fenoaltea, 1988). A plethora of scholars have noted in passing that the commons operated successfully for several hundred years in medieval England, and have questioned if a tragedy of the sort described by Hardin (1968) ever occurred widely (Schumacher, 1979, p. 139; Repetto, 1985, p. 145; Potter, 1974, p. 813; Dasgupta, 1983, p. 13; Marchak, 1988—89, p. 9).

Forest and meadow commons in Japanese villages were also the subject of elaborate regulations. Village leaders set opening and closing dates for the harvest of certain products. In some villages, thatch was harvested collectively; bundles were then randomly assigned to each household. This device permitted the aggregate level of utilization to be controlled while giving each household an incentive to be reasonably conscientious in its harvesting effort. Guards patrolled the common lands to prevent poaching both by

villagers and outsiders. Written rules provided a graduated schedule of fines for violators. Harvesting tools were also regulated. Regulations legislated by villagers ensured sustainable use of common lands for generations (McKean, 1982, 1986).

In the Japanese case, forest and meadow lands and irrigation works were held as communal property while crop lands were held privately. This is not an isolated example of the co-existence of two property-rights regimes. There are other cases indicating the ability of users to match appropriately the resource with the regime (Netting, 1976). In some societies, the same resource may alternate back and forth between communal and private control seasonally or over the long term (Bauer, 1987; Vondal, 1987; Acheson, 1989b; Wade, 1986, 1987).

Not all examples of successful regulation are historic or based on long-standing tradition. In a study of Turkish coastal fisheries, successful regulation was found to have evolved within 15 years in two cases (Alanya,Tasucu), and 9 years in one case (Berkes, 1986a). Alarmed by the increasing numbers of users and escalating conflicts, fishermen in Alanya developed a system to regulate use: fishing sites were spaced sufficiently apart to avoid interference, and fishermen agreed among themselves to fish in rotation to ensure equitable access to the best sites, with their starting position determined by drawing lots. Although only half of the licensed fishermen belonged to the local marketing cooperative, the authority under which the system was operated, all participated in the process for creating and maintaining it (Berkes, 1986b).

Self-regulation of resource use to improve livelihood was also achieved by a local marketing cooperative of New Jersey fishermen. Because large catches depressed prices on the New York fresh fish market, a cooperative was formed to enhance producers' bargaining power. This cooperative decided on total catch levels for the fleet, and provided for the sharing of revenues regardless of the catch levels of individual boats. The pooling of revenues reduced the incentives to overfish. Although the system was devised to raise prices, a spillover benefit may have been conservation (MCCay,1980).

A case from South India provides another example. In a village in Andhra Pradesh, villagers at the tail end of a large government-run irrigation scheme found that they were particularly vulnerable to fluctuations in water supply after the end of the rainy season. Although the traditional practice, in which households attempted to have plots at various locations throughout the village, reduced the variability in household agricultural production, villagers realized that careful management of village water resources could further

increase and stabilize yields. A village water-user's association was formed and rules were developed. Irrigators were hired to manage the allocation of water; salaries were paid through taxes levied on landowners, based on the area irrigated. Along any particular irrigation ditch, fields closest to the source of the water could only be watered after downstream fields had been adequately wetted. The fact that prominent village landowners owned plots throughout the village helped to ensure their assistance in organizing a village-wide system of irrigation (Wade, 1986, 1987).

These case studies illustrate that people are not helpless but are able to organize, to monitor resource use by members, to allocate use rights among members, and to adjust aggregate utilization levels to maintain sustainable use of the resource (McEvoy, 1988). These cases, and those detailed elsewhere, indicate that under the appropriate circumstances, voluntary collective action is feasible and effective (McCay, 1978; National Research Council, 1986; McCay and Acheson, 1987;'Ostrom, forthcoming; Wade, 1986,1987).

State Property. Government ownership (state governance) permits the formulation of appropriate regulations for resource use. It also provides for the expression of public interest and for accountability. But state governance does not necessarily ensure sustainable use. Given that the officials who make decisions do not have the same time horizon or interests as private owners, the general public, or the government itself, this is not surprising.

One of the oft-mentioned problems of state ownership is the proliferation of such regulations. Smith points out, for example, that in a New England regional fishery, the combination of quotas, allocations, and trip limitations generated more than 100 different limits, with the result that there was widespread violation of the law (Smith, 1988). Noncompliance of users and de facto open access has led to an assertion by some that better protection can be achieved under private- rather than state-property regimes.

State ownership is seldom associated with successful management in less-developed countries. The professional resource-management infrastructure of the state is usually poorly developed and enforcement of regulations problematic. In India, for example, communally held forests were nationalized before the state had developed the capacity for management. Local communities are, however, starting to re-assert their cultural traditions of conservation (Gadgil, 1985, 1987; Gadgil and Iyer, 1989). In much of South Asia, Africa, and elsewhere, poorly-defended state property, in conjunction with population pressure, has led to widespread poaching of government

forest and other resources. Repetto argues that ”villagers who ruthlessly cut trees for firewood and fodder in government forests will zealously nurture and protect groves that belong to them or—if their community is sufficiently strong—to their Village” (Repetto, 1986, pp. 30—31).

The logic of the argument of ”The Tragedy of the Commons” is that private owners or state managers can and often do manage resources successfully. That is, these two property-rights regimes would provide the incentives to regulate use in a fashion consistent with sustainability. Implicitly Hardin argues that these incentives would be absent or weak for other regimes. However, the evidence indicates that complex interactions among the characteristics of the resource, the property-rights regime and other institutional arrangements, and the socio-economic environment contribute to the degree of management success. Success in the regulation of uses and users is not universally associated with any particular type of property-rights regime. Communal property, private property, and government property have all been associated both with success and failure.

Conclusions

Hardin’s model is insightful but incomplete. His conclusion of unavoidable tragedy follows from his assumptions of open access, lack of constraints on individual behavior, conditions in which demand exceeds supply, andresource users who are incapable of altering the rules. Actual common property situations often do not conform to all four of these assumptions. This leads us to amend Hardin’s heuristic fable. The ”tragedy” may start as in Hardin (1968). But after several years of declining yields, the herdsmen are likely to get together to seek ways to (1) control access to the pasture and (2) agree upon a set of rules of conduct, perhaps including stinting, that effectively limits exploitation. Whether or not the intended self-regulation works depends on a number of factors. Here the simple model breaks down—no single metaphor can tell the full story. The medieval English commons usually were regulated by the community, sometimes effectively, sometimes not. The outcome was never so clear and deterministically predictable as in Hardin’s model.

Thus, a major conclusion of the paper is the rejection of the simple one-to-one relationship between property-rights regime and outcome postulated by Hardin. The Hardin argument overlooks the important role of institutional

arrangements that provide for exclusion and regulation of use. It also overlooks cultural factors (Feeny, 1988b; Charles, 1988). In order to understand the outcome, one needs to know the nature of the resource, the whole array of decision-making arrangements, including the property-rights regime, and the nature of the interactions among users and regulators (Oakerson, 1986; Godwin and Shepard, 1979, p. 266; McEvoy, 1988, p. 229). Complex interactions are an important characteristic of commons situations, and models of the commons must take these interactions into account (for a review Of the mathematics of describing complex interactive systems see West and Shlesinger, 1990). Success may be found under three, not just two property—rights regimes.

The original Hardin paper did, however, allude to the potential viability of communal property. Hardin's (1968, p. 1247) phrase, "mutual coercion, mutually agreed upon" is consistent with communal-property arrangements, although he appears to have meant state institutions under representative government. Societies have the capacity to construct and enforce rules and norms that constrain the behavior of individuals. In many societies and in many situations, the capacity for concerted social action overcomes the divergence between individual and collective rationality. The cases discussed in this paper provide ample evidence of the ability of groups of users and local communities to organize and to manage local resources effectively. Contrary to assumptions by many common-property analysts, these communal-property arrangements have persisted. A diversity of societies in the past and present have independently devised, maintained, or adapted communal arrangements to manage common-property resources. Their persistence is not an historical accident; these arrangements build on knowledge of the resource and cultural norms that have evolved and been tested over time. The new interest in communal property arrangements is perhaps related to the resurgence of interest in grassroots democracy, public participation, and local-level planning. State property regimes in which officials exercise exclusive decision-making powers have been falling into disfavor. Given that there are many situations in which users have the capacity for self-management, it makes administrative and economic sense to involve them in resource management. Communities of resource users are, however, no longer relatively isolated and resources often have multiple uses. Therefore, complete devolution may not be appropriate; it makes sense for the state to continue to play a role in resource conservation and allocation among communities of users. Shared governance or state regulation jointly with user

self-management is thus a viable Option. Such CO-management can capital-size on the local knowledge and long-term self-interest of users, while providing for coordination with relevant uses and users over a wide geographic scope at potentially lower transaction (rule-enforcement) cost (MCCay,1988; Acheson, 1989a; Pinkerton, 1989).

Further, the logic of communal property can also be applied to resources that are global (rather than local) in scope. Here, tragedies are more difficult to prevent. This is perhaps why the World Conservation Strategy (1980) and the World Commission on Environment and Development (1987) both emphasized the global commons. Problems such as ozone depletion and carbon dioxide accumulation in the atmosphere are clearly global tragedies of the commons in the making. The solution of such problems will necessarily involve co-management on a large scale. The 1987 Montreal Protocol to protect the ozone layer is an example of international co-management. The case of oil pollution on the high seas, with various international conventions going back to 1954 (Cuyvers, 1984), and leading to reductions in accidental oil spills in the 19805, the Alaska spill notwithstanding, demonstrates that international cooperation can be effective (World Resources Institute, 1988, p. 330).

The problem posed by Hardin over 20 years ago captured the attention of a multi-disciplinary collection of scholars and practitioners, including anthropologists, development planners, ecologists, economists, geographers, political scientists, resource scientists, and sociologists. The Common Property Resource Digest, published since December 1986, is distributed to more than 3500 individuals and institutions. Hardin's model provided insights and focused attention on important analytical issues. However, as with many seminal but simple models, Hardin's analysis has been shown by subsequent studies to be overly simplified and deterministic. As is the usual process in science, theory will have to be revised to take into account the new evidence (Feeny, 1989).

A new and more comprehensive theory for common-prOperty resources must be able to account for sustainable resource management under communal-property regimes. The theory should be capable of accommodating user self-organization or the lack of it. Such a model can better explain whether and under what conditions sustainable resource management will occur, rather than simply predicting the demise of all resources held in common.

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7

Reflections on the Commons

ELINOR OSTROM

Hardly a week goes by without a major news story about the threatened destruction of a valuable natural resource[1]. In June of 1989, for example, a New York Times article focused on the problem of overfishing in the Georges Bank about 150 miles off the New England coast. Catches of cod, flounder, and haddock are now only a quarter of what they were during the 1960s. Everyone knows that the basic problem is overfishing; however, those concerned cannot agree how to solve the problem. Congressional representatives recommend new national legislation, even though the legislation already on the books has been enforced only erratically. Representatives of the fishers argue that the fishing grounds would not be in such bad shape if the federal government had refrained from its sporadic attempts to regulate the fishery in the past. The issue in this case—and many others—is how best to limit the use of natural resources so as to ensure their long-term economic viability. Advocates of central regulation, of privatization, and of regulation by those involved have pressed their policy prescriptions in a variety of different arenas.

Similar situations occur on diverse scales ranging from small neighborhoods to the entire planet. The issues of how best to govern natural resources used by many individuals in common are no more settled in academia than in the world of politics. Some scholarly articles about the

From Elinor Ostrom, *Governing the Commons* (New York: Cambridge University Press, 1990), pp. 2-24. Reprinted with permission of Cambridge University Press.

”tragedy of the commons” recommend that ”the state” control most natural resources to prevent their destruction; others recommend that privatizing those resources will resolve the problem. What one can observe in the world, however, is that neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource system. Further, communities of individuals have relied on institutions resembling neither the state nor the market to govern some resource systems with reasonable degrees of success over long periods of time.

Three Influential Models

The Tragedy of the Commons

Since Garrett Hardin’s challenging article in Science (1968), the expression ”the tragedy of the commons” has come to symbolize the degradation of the environment to be expected whenever many individuals use a scarce resource in common. To illustrate the logical structure of his model, Hardin asks the reader to envision a pasture ”open to all.” He then examines the structure of this situation from the perspective of a rational herder. Each herder receives a direct benefit from his own animals and suffers delayed costs from the deterioration of the commons when his and others’ cattle overgraze. Each herder is motivated to add more and more animals because he receives the direct benefit of his own animals and bears only a share of the costs resulting from overgrazing. Hardin concludes:

> Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. (Hardin 1968, p. 1,244).

Hardin was not the first to notice the tragedy of the commons. Aristotle long ago observed that ”what is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest” (*Politics*, Book II, ch. 3). Hobbes’s parable of man in a state of nature is a prototype of the tragedy of the commons: Men seek their own good and end up fighting one another. In 1833, William Forster Lloyd (1977) sketched a theory of the commons that predicted improvident use for property

owned in common. More than a decade before Hardin's article, H. Scott Gordon (1954) clearly expounded similar logic in another classic, "The Economic Theory of a Common-Property Research: The Fishery."
Gordon described the same dynamic as Hardin:

> There appears then, to be some truth in the conservative dictum that everybody's property is nobody's property. Wealth that is free for all is valued by no one because he who is foolhardy enough to wait for its proper time of use will only find that it has been taken by another. . . The fish in the sea are valueless to the fisherman, because there is no assurance that they will be there for him tomorrow if they are left behind today. (Gordon 1954, p. 124)

John H. Dales (1968, p. 62) noted at the same time the perplexing problems related to resources "owned in common because there is no alternative" Standard analyses in modern resource economics conclude that where a number of users have access to a common-pool resource, the total of resource units withdrawn from the resource will be greater than the optimal economic level of withdrawal (Clark 1976, 1980; Dasgupta and Heal 1979).

If the only "commons" of importance were a few grazing areas or fisheries, the tragedy of the commons would be of little general interest. That is not the case. Hardin himself used the grazing commons as a metaphor for the general problem of overpopulation. The "tragedy of the commons" has been used to describe such diverse problems as the Sahelian famine of the 19705 (Picardi and Seifert 1977), firewood crises throughout the Third World (Norman 1984; Thomson 1977), the problem of acid rain (R. Wilson 1985), the organization of the Mormon Church (Bullock and Baden 1977), the inability of the US. Congress to limit its capacity to overspend (Shepsle and Weingast 1984), urban crime (Neher 1978), public-sector/private-sector relationships in modern economies (Scharpf 1985, 1987, 1988), the problems of international cooperation (Snidal 1985), and communal conflict in Cyprus (Lumsden 1973). Much of the world is dependent on resources that are subject to the possibility of a tragedy of the commons.

The Prisoner's Dilemma Game

Hardin's model has often been formalized as a prisoner's dilemma (PD) game (Dawes 1973, 1975). Suppose we think of the players in a game as being herders using a common grazing meadow. For this meadow, there is an

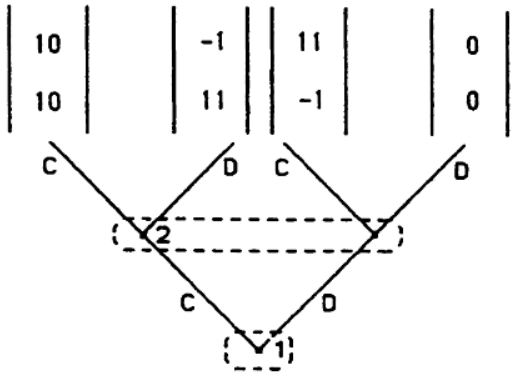

Figure 7.1. Game 1: The Hardin herder game.

upper limit to the number of animals that can graze on the meadow for a season and be well fed at the end of the season. We call that number L. For a two-person game, the ”cooperate” strategy can be thought of as grazing L/2 animals for each herder. The ”defect” strategy is for each herder to graze as many animals as he thinks he can sell at a profit (given his private costs), assuming that this number is greater than L/2. If both herders limit their grazing to L/2, they will obtain 10 units of profit, whereas if they both choose the defect strategy they will obtain zero profit. If one of them limits his number of animals to L/2, while the other grazes as many as he wants the ”defector” obtains 11 units of profit, and the ”sucker” obtains —1. If each chooses independently without the capacity to engage in a binding contract, each Chooses his dominant strategy, which is to defect. When they both defect, they obtain zero profit. Call this the Hardin herder game, or Game 1 (see Figure 7.1). It has the structure of a prisoner’s dilemma game.

The prisoner’s dilemma game is conceptualized as a noncooperative game in which all players possess complete information. In noncooperative games, communication among the players is forbidden or impossible or simply irrelevant as long as it is not explicitly modeled as part of the game. If communication is possible, verbal agreements among players are presumed to be nonbinding unless the possibility of binding agreements is explicitly incorporated in the game structure (Harsanyi and Selten 1988, p.983). ”Complete information” implies that all players know the full structure of the game tree and the payoffs attached to outcomes. Players either know or do not know the current moves of other players depending on whether or not they are observable.

In a prisoner’s dilemma game, each player has a dominant strategy in the sense that the player is always better off choosing this strategy—to

defect— no matter what the other player chooses. When both players choose their dominant strategy, given these assumptions, they produce an equilibrium that is the third-best result for both. Neither has an incentive to change that is independent of the strategy choice of the other. The equilibrium resulting from each player selecting his or her ”best” individual strategy is, however not a Pareto-optimal outcome. A Pareto-optimal outcome occurs when there is no other outcome strictly preferred by at least one player that is at least as good for the others. In the two—person prisoner’s dilemma game, both play-ers prefer the (cooperate, cooperate) outcome to the (defect, defect) outcome. Thus, the equilibrium outcome is Pareto-inferior.

The prisoner’s dilemma game fascinates scholars. The paradox that individually rational strategies lead to collectively irrational outcomes seems to challenge a fundamental faith that rational human beings can achieve rational results. In the introduction to a recently published book, *Paradoxes of Rationality and Cooperation,* Richmond Campbell explains the ”deep attraction” of the dilemma:

> Quite simply, these paradoxes cast in doubt our understanding of rationality and, in the case of the Prisoner’s Dilemma suggest that it is impossible for rational creatures to cooperate. Thus, they bear directly on fundamental issues in ethics and political philosophy and threaten the foundations of the social sciences. It is the scope of these consequences that explains why these paradoxes have drawn so much attention and why they command a central place in philosophical discussion. (Campbell 1985, p. 3)

The deep attraction of the dilemma is further illustrated by the number of articles written about it. At one count, 15 years ago, more than 2,000 papers had been devoted to the prisoner’s dilemma game (Grofman and Pool 1975).

The Logic of Collective Action

A closely related view of the difficulty of getting individuals to pursue their joint welfare, as contrasted to individual welfare, was developed by Mancur Olson (1965) in The Logic of Collective Action. Olson specifically set out to challenge the grand optimism expressed in group theory: that individuals with common interests would voluntarily act so as to try to further those interests (Bentley 1949; Truman 1958). On the first page of his book, Olson summarized that accepted view:

> The idea that groups tend to act in support of their group interests is supposed to follow logically from this widely accepted premise of rational, self-interested behavior. In other words, if the members of some group have a common interest or object, and if they would all be better off if that objective were achieved, it has been thought to follow logically that the individuals in that group would, if they were rational and self-interested, act to achieve that objective. (Olson 1965, p. 1)

Olson challenged the presumption that the possibility of a benefit for a group would be sufficient to generate collective action to achieve that benefit. In the most frequently quoted passage of his book, Olson argued that

> unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act to achieve their common or group interests. (Olson 1965, p. 2; emphasis in original)

Olson's argument rests largely on the premise that one who cannot be excluded from obtaining the benefits of a collective good once the good is produced has little incentive to contribute voluntarily to the provision of that good. His book is less pessimistic than it is asserted to be by many who cite this famous passage. Olson considers it an open question whether intermediate-size groups will or will not voluntarily provide collective benefits. His definition of an intermediate-size group depends not on the number of actors involved but on how noticeable each person's actions are.

The tragedy of the commons, the prisoner's dilemma, and the logic of collective action are closely related concepts in the models that have defined the accepted way of viewing many problems that individuals face when attempting to achieve collective benefits. At the heart of each of these models is the free-rider problem. Whenever one person cannot be excluded from the benefits that others provide, each person is motivated not to contribute to the joint effort, but to free-ride on the efforts of others. If all participants choose to free-ride, the collective benefit will not be produced.

The temptation to free-ride, however, may dominate the decision process, and thus all will end up where no one wanted to be. Alternatively, some may provide while others free-ride, leading to less than the Optimal level of provision of the collective benefit. These models are thus extremely useful for explaining how perfectly rational individuals can produce, under

some circumstances, outcomes that are not ”rational” when viewed from the perspective of all those involved.

What makes these models so interesting and so powerful is that they capture important aspects of many different problems that occur in diverse settings in all parts of the world. What makes these models so dangerous when they are used metaphorically as the foundation for policy—is that the constraints that are assumed to be fixed for the purpose of analysis are taken on faith as being fixed in empirical settings, unless external authorities change them[2]. The prisoners in the famous dilemma cannot change the constraints imposed on them by the district attorney; they are in jail. Not all users of natural resources are similarly incapable of Changing their constraints. As long as individuals are viewed as prisoners, policy prescriptions will address this metaphor. I would rather address the question of how to enhance the capabilities of those involved to change the constraining rules of the game to lead to outcomes other than remorseless tragedies.

Current Policy Prescriptions

Leviathan as the ”Only” Way

Ophuls (1973, p. 228) argued, for example, that ”because of the tragedy of the commons, environmental problems cannot be solved through cooperation and the rationale for government with major coercive powers is overwhelming.” Ophuls concluded that ”even if we avoid the tragedy of the commons, it will only be by recourse to the tragic necessity Of Leviathan” (1973, p. 229; emphasis added)[3]. Garrett Hardin argued a decade after his earlier article that we are enveloped in a ”cloud of ignorance” about ”the true nature of the fundamental political systems and the effect of each on the preservation of the environment” (1978, p. 310). The ”cloud of ignorance” did not, however, prevent him from presuming that the only alternatives to the commons dilemma were what he called ”a private enterprise system,” on the one hand, or ”socialism,” on the other (1978, p. 314). With the assurance of one convinced that ”the alternative of the commons is too horrifying to contemplate” (1968, p. 1,247), Hardin indicated that change would have to be instituted with ”whatever force may be required to make the change stick” (1978, p. 314). In other words, ”if ruin is to be avoided in a crowded world,

people must be responsive to a coercive force outside their individual psyches, a 'Leviathan,' to use Hobbes's term" (Hardin 1978, p.314).

The presumption that an external Leviathan is necessary to avoid tragedies of the commons leads to recommendations that central governments control most natural resource systems. Heilbroner (1974) opined that "iron governments," perhaps military governments, would be necessary to achieve control over ecological problems. In a less draconian View, Ehrenfeld (1972,p. 322) suggested that if "private interests cannot be expected to protect the public domain then external regulation by public agencies, governments, or international authorities is needed." In an analysis of the problems involved in water resource management in developing countries, Carruthers and Stoner (1981, p. 29) argued that without public control, "overgrazing and soil erosion of communal pastures, or less fish at higher average cost," would result. They concluded that common property resources require public control if economic efficiency is to result from their development" (1981,p. 29; emphasis added)[4]. The policy advice to centralize the control and regulation of natural resources, such as grazing lands, forests, and fisheries, has been followed extensively, particularly in Third World countries.

One way to illustrate these proponents' image of centralized control is to modify the Hardin herder game using the assumptions that underlie this policy advice. The proponents of centralized control want an external government agency to decide the specific herding strategy that the central authority considers best for the situation: The central authority will decide who can use the meadow, when they can use it, and how many animals can be grazed. Let us assume that the central authority decides to impose a penalty of 2 profit units on anyone who is considered by that authority to be using a defect strategy. Assuming that the central agency knows the sustainable yield of the meadow (L) and can unfailingly discover and penalize any herder using the defect strategy, the newly restructured game imposed by the central authority is represented in Game 2 (see Figure 7.2). Now, the solution to Game 2 is (cooperate, cooperate). Both players receive 10 profit units each, rather than the zero units they would have received in Game 1. If an external authority accurately determines the capacity of a common-pool resource, unambiguously assigns this capacity, monitors actions, and unfailingly sanctions noncompliance, then a centralized agency can transform the Hardin herder game to generate an optimally efficient equilibrium for the herders. Little consideration is given to the cost of creating and maintaining such an

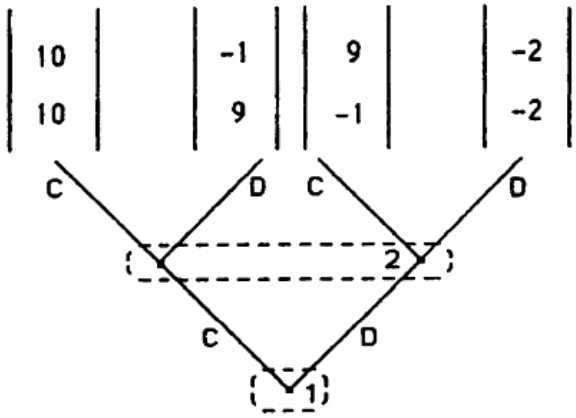

Figure 7.2. Game 2: The central-authority game with complete information.

agency. This is seen as exogenous to the problem and is not included as a parameter of Game 2[5].

The optimal equilibrium achieved by following the advice to centralize control, however, is based on assumptions concerning the accuracy of information, monitoring capabilities, sanction in reliability, and zero costs of administration. Without valid and reliable information, a central agency could make several errors, including setting the carrying capacity or the fine too high or too low, sanctioning herders who cooperate, or not sanctioning defectors. The implications of all forms of incomplete information are interesting. However, as an example, I shall focus entirely on the implications arising from a central agency's incomplete information about the herders' strategies. The implicit assumption of Game 2 is that the central agency monitors all actions of the herders costlessly and imposes sanctions correctly.

In Game 3, we assume that the central agency has complete information about the carrying capacity of the meadow, but incomplete information about the particular actions of the herders. The central agency consequently makes errors in imposing punishments. Let us assume that the central agency punishes defections (the correct response) with probability y and fails to punish defections with probability $1—y$ (the erroneous response). Let us also assume that the central agency punishes cooperative actions (the erroneous response) with probability x and does not punish cooperative actions (the correct response) with probability $1—x$. The payoff parameters are illustrated in Figure 7.3.

A central agency with complete information would make no errors in its punishment level; in that case, $x = 0$ and $y = 1$. Game 2 would then be a special case of Game 3 in which $x = 0$ and $y = 1$. However, if the central

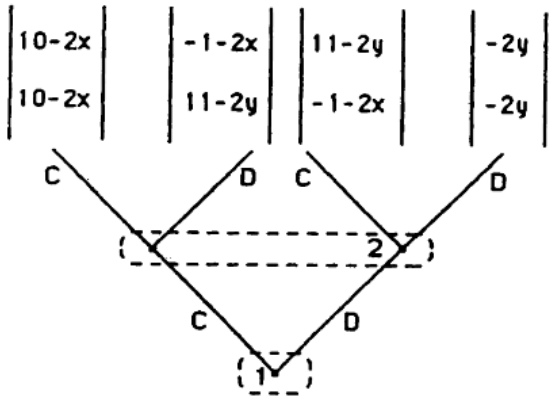

Figure 7.3. Game 3: The central-authority game with incomplete information.

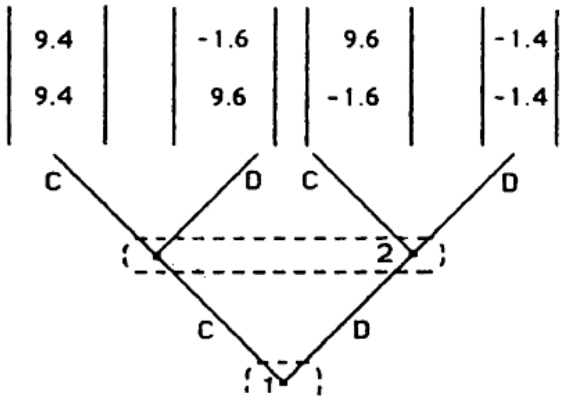

Figure 7.4. Game 4: An example of the central-authority game with incomplete information.

agency does not have complete information about the actions of the herders, it imposes both types of sanctions correctly with a probability of 0.7 (x = 0.3, y = 0.7). An example of the specific payoffs for this game is shown as Game 4 in Figure 7.4. Given this payoff structure, the herders again face a prisoner's dilemma game. They will defect (overgraze) rather than cooperate (graze within the carrying capacity). In Game 4, as in the original Game 1, the equilibrium outcomes for the herders were (0, 0). In a game in which a central agency sanctions correctly with a probability of 0.7, the equilibrium outcomes are (-1.6, —1.6). The equilibrium of the regulated game has a lower value than that of the unregulated game. Given the carrying capacity and profit possibilities of Game 1, the central agency must have sufficient information

so that it can correctly impose sanctions with a probability greater than 0.75 to avoid pushing the herders to the (*D, D*) equilibrium[6].

Privatization as the "Only" Way

Other policy analysts, influenced by the same models, have used equally strong terms in calling for the imposition of private property rights whenever resources are owned in common (Demsetz 1967; O. Johnson 1972). "Both the economic analysis of common property resources and Hardin's treatment of the tragedy of the commons" led Robert J. Smith (1981, p. 467) to suggest that "the only way to avoid the tragedy of the commons in natural resources and wildlife is to end the common-property system by creating a system of private property rights"(emphasis added); see also the work of Sinn (1984). Smith stressed that it is "by treating a resource as a common property that we become locked in its inexorable destruction" (1981, p. 465). Welch advocated the creation of full private rights to a commons when he asserted that "the establishment of full property rights is necessary to avoid the inefficiency of overgrazing" (1983, p. 171). He asserted that privatization of the commons was the optimal solution for all common-pool problems. His major concern was how to impose private ownership when those currently using a commons were unwilling to change to a set of private rights to the commons.

Those recommending the imposition of privatization on the herders would divide the meadow in half and assign half of the meadow to one herder and the other half to the second herder. Now each herder will be playing a game against nature in a smaller terrain, rather than a game against another player in a larger terrain. The herders now will need to invest in fences and their maintenance, as well as in monitoring and sanctioning activities to enforce their division of the grazing area (B. Field 1984, 1985). It is presumed that each herder will now choose *X/2* animals to graze as aresult of his own profit incentive[7].This assumes that the meadow is perfectly homogeneous over time in its distribution of available fodder. If rainfall occurs erratically, one part of the grazing area may be lush with growth one year, whereas another part of the area may be unable to support *X/2* animals. The rain may fall somewhere else the next year. In any given year, one of the herders may make no profit, and the other may enjoy a considerable return.

If the location of lush growth changes dramatically from year to year, dividing the commons may impoverish both herders and lead to overgrazing

in those parts where forage is temporarily inadequate. Of course, it will be possible for the herder who has extra fodder in one year to sell it to the other herder. Alternatively, it will be possible for the herders to set up an insurance scheme to share the risk of an uncertain environment. However, the setup costs for a new market or a new insurance scheme would be substantial and will not be needed so long as the herders share fodder and risk by jointly sharing a larger grazing area.

It is difficult to know exactly what analysts mean when they refer to the necessity of developing private rights to some common-pool resources (CPRs). It is clear that when they refer to land, they mean to divide the land into separate parcels and assign individual rights to hold, use, and transfer these parcels as individual owners desire (subject to the general regulations of a jurisdiction regarding the use and transfer of land). In regard to nonstationary resources, such as water and fisheries, it is unclear what the establishment of private rights means. As Colin Clark has pointed out, the "'tragedy of the commons' has proved particularly difficult to counteract in the case of marine fishery resources where the establishment of individual property rights is virtually out of the question" (1980, p. 117). In regard to a fugitive resource, a diversity of rights may be established giving individuals rights to use particular types of equipment, to use the resource system at a particular time and place, or to withdraw a particular quantity of resource units (if they can be found). But even when particular rights are unitized, quantified, and salable, the resource system is still likely to be owned in common rather than individually[8]. Again, referring to fisheries, Clark has argued that "common ownership is the fundamental fact affecting almost every regime of fishery management" (1980, p. 117).

The "Only" Way?

Analysts who find an empirical situation with a structure presumed to be a commons dilemma Often call for the imposition of a solution by an external actor: The "only way" to solve a commons dilemma is by doing *X*. Underlying such a claim is the belief that *X* is necessary and sufficient to solve the commons dilemma. But the content of *X* could hardly be more variable. One set of advocates presumes that a central authority must assume continuing responsibility to make unitary decisions for a particular resource. The other presumes that a central authority should parcel out ownership rights to the resource and then allow individuals to pursue their own self-interests

within a set of well-defined property rights. Both centralization advocates and privatization advocates accept as a central tenet that institutional change must come from outside and be imposed on the individuals affected. Despite sharing a faith in the necessity and efficacy of ”the state” to change institutions so as to increase efficiency, the institutional changes they recommend could hardly be further apart.

If one recommendation is correct, the other cannot be. Contradictory positions cannot both be right. I do not argue for either of these positions. Rather, I argue that both are too sweeping in their claims. Instead of there being a single solution to a single problem, I argue that many solutions exist to cope with many different problems. Instead of presuming that optimal institutional solutions can be designed easily and imposed at low cost by external authorities, I argue that ”getting the institutions right” is a difficult, time-consuming, conflict-invoking process. It is a process that requires reliable information about time and place variables as well as a broad repertoire of culturally acceptable rules. New institutional arrangements do not work in the field as they do in abstract models unless the models are well specified and empirically valid and the participants in a field setting understand how to make the new rules work.

Instead of presuming that the individuals sharing a commons are inevitably caught in a trap from which they cannot escape, I argue that the capacity of individuals to extricate themselves from various types of dilemma situations varies from situation to situation. The cases to be discussed in this book illustrate both successful and unsuccessful efforts to escape tragic outcomes. Instead of basing policy on the presumption that the individuals involved are helpless, I wish to learn more from the experience of individuals in field settings. Why have some efforts to solve commons problems failed, while others have succeeded? What can we learn from experience that will help stimulate the development and use of a better theory of collective action—one that will identify the key variables that can enhance or detract from the capabilities of individuals to solve problems?

Institutions are rarely either private or public—”the market” or ”the state.” Many successful CPR institutions are rich mixtures of ”private-like” and ”public—like” institutions defying classification in a sterile dichotomy. By ”successful,” I mean institutions that enable individuals to achieve productive outcomes in situations where temptations to free-ride and Shirk are ever present. A competitive market—the epitome of private institutions—is itself a public good. Once a competitive market is provided, individuals can enter and

exit freely whether or not they contribute to the cost of providing and maintaining the market. No market can exist for long without underlying public institutions to support it. In field settings, public and private institutions frequently are intermeshed and depend on one another, rather than existing in isolated worlds.

An Alternative Solution

To open up the discussion of institutional options for solving commons dilemmas, I want now to present a fifth game in which the herders themselves can make a binding contract to commit themselves to a cooperative strategy that they themselves will work out (see Figure 7.5). To represent this arrangement within a noncooperative framework, additional moves must be overtly included in the game structure. A binding contract is interpreted within noncooperative game theory as one that is unfailingly enforced by an external actor—just as we interpreted the penalty posited earlier as being unfailingly enforced by the central authority.

A simple way to represent this is to add one parameter to the payoffs and a strategy to both herders' strategy sets. The parameter is the cost of enforcing an agreement and will be denoted by e. The herders in Game 5 must now negotiate prior to placing animals on the meadow. During negotiations, they discuss various strategies for sharing the carrying capacity of the meadow and the costs of enforcing their agreement. Contracts are not enforceable, however, unless agreed to unanimously by the herders. Any proposal made by one herder that did not involve an equal sharing of the carrying capacity and of enforcement costs would be vetoed by the other herder in their negotiations. Consequently, the only feasible agreement and the equilibrium of the resulting game—is for both herders to share equally the sustainable yield levels of the meadow and the costs of enforcing their agreement so long as each herder's share of the cost of enforcement is less than 10.

Further, in Game 5, players can always guarantee that the worst they will do is the (defect, defect) outcome of Game 1 .They are not dependent on the accuracy of the information Obtained by a distant government Official regarding their strategies. If one player suggests a contract based on in complete or biased information, the other player can indicate an unwillingness to agree. They determine their own contract and ask the enforcer to enforce only that on which they have agreed. If the enforcer should decide to charge

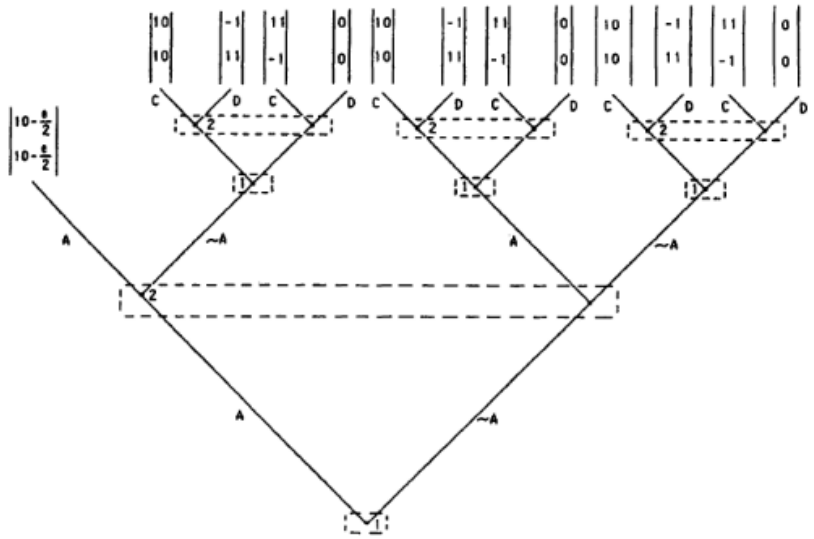

Figure 7.5. Game 5: Self-financed contract-enforcement game.

too much for its services (any number equal to or greater than P_i *(C, C)* —P_i *(D, D), i= 1, 2*), neither player would agree to such a contract.

The ”solution” of a commons--dilemma game through instrumentalities similar to Game 5 is not presented as the’ ’only way” to solve a commons dilemma. It Is merely one way. But this way has been almost totally ignored in both the policy-analysis literature and the formal-theory literature. Contemplating such an option raises numerous questions. First, might it be possible for the herders to hire a private agent to take on the role of enforcer? This is not as farfetched as it might seem at first. Many long-term business exchanges have the structure of a prisoner’s dilemma. Businesses are hesitant to accept promises of future performance rather than enforceable contracts, especially when beginning new business relationships. To reduce enforcement costs, however, a frequent practice is to use a private arbitrator rather than a civil court as the mechanism to achieve enforcement. In *N*-person settings, all professional athletic leagues face problems similar to those illustrated here. During the play of a professional game, the temptation to cheat and break the rules is ever present. Further, accidents do happen, and rules get broken, even by players who were intending to follow the rules. Athletic leagues typically employ private monitors to enforce their rules.

As soon as we allow the possibility of a private party to take on the role of an external enforcer, the nature of the ”solution” offered by Game 5 to the commons dilemma begins to generate a rich set of alternative applications. A self-financed contract-enforcement game allows the participants in the

situation to exercise greater control over decisions about who will be allowed to graze and what limits will be placed on the number of animals, as compared with either Game 2 or Game 3. If the parties use a private arbitrator they do not let the arbitrator impose an agreement on them. The arbitrator simply helps the parties find methods to resolve disputes that arise within the set of working rules to which the parties themselves have agreed. Arbitrators, courts, and other arrangements for enforcement and dispute resolution make it possible for individuals to initiate long—term arrangements that they could not otherwise undertake. Further, as soon as one thinks about a "solution" like Game 5, it is a small step to thinking about the possibility of several arbitrators offering enforcement services at varying charges during the negotiation stage. The payoff-dominant equilibrium is to agree on that arbitrator who will enforce the contract at the lowest *e*.

The key difference between Game 5 and Games 2 and 3 is that the participants themselves design their own contracts in Game 5 in light of the information they have at hand. The herders, who use the same meadow year after year, have detailed and relatively accurate information about carrying capacity. They observe the behavior of other herders and have an incentive to report contractual infractions. Arbitrators may not need to hire monitors to observe the activities of the contracting parties. The self-interest of those who negotiated the contract will lead them to monitor each other and to report observed infractions so that the contract is enforced. A regulatory agency, on the other hand, always needs to hire its own monitors. The regulatory agency then faces the principal-agent problem of how to ensure that its monitors do their own job.

The proponents of the central-authority "solution" presume that such agencies have accurate information and are able to change incentives to produce something like Game 2. It is difficult for a central authority to have sufficient time-and-place information to estimate accurately both the carrying capacity of a CPR and the appropriate fines to induce cooperative behavior. I believe that situations like that in Game 3, in which incomplete information leads to sanctioning errors, occur more frequently than has been presumed in the policy literature. The need for external monitors and enforcers is particularly acute when what is being enforced is a decision by an external agent who may impose excess costs on participants.

A further problem for consideration is that games in which enforcers have been arranged for by mutual agreement may be mistaken by analysts and public officials for games in which there has been no agreement about

how to cooperate and enforce agreements. In other words, some examples of a ”Game 5” may be mistaken for a ”Game 1.” These situations may be construed to be ”informal,” carrying a presumption that they are not lawful. This goes to fundamental presumptions about the nature of governments as external authorities governing over societies.

A self-financed contract-enforcement game is no panacea. Such institutional arrangements have many weaknesses in many settings. The herder can overestimate or underestimate the carrying capacity of the meadow. Their own monitoring system may break down. The external enforcer may not be able to enforce ex post, after promising to do 50 ex ante. A myriad of problems can occur in natural settings, as is also the case with the idealized central—regulation or private-property institutions.

The structure of the institutional arrangements that one finds in natural settings is, of course, far more complicated than the structure of any of the extremely simple games presented here for discussion. What I attempt to do with these simple games is to generate different ways of thinking about the mechanisms that individuals may use to extricate themselves from commons dilemmas—ways different from what one finds in much of the policy literature. To challenge this mind-set, one needs only simple mechanisms that illustrate alternatives to those that normally are presented as the dominant solutions.

An Empirical Alternative

Game 5 illustrated a theoretical alternative to centralization or privatization as ways to solve CPR problems. Let us now briefly consider a solution devised by participants in a field setting—Alanya, Turkey—that cannot be characterized as either central regulation or privatization. The inshore fishery at Alanya, as described by Fikret Berkes (1986), is a relatively small operation. Many of the approximately 100 local fishers operate in two- or three-person boats using various types of nets. Half of the fishers belong to a local producers’ cooperative. According to Berkes, the early 19705 were the ”dark ages” for Alanya. The economic viability of the fishery was threatened by two factors: First, unrestrained use of the fishery had led to hostility and, at times, violent conflict among the users. Second, competition among fishers for the better fishing spots had increased production costs, as well as the level of uncertainty regarding the harvest potential of any particular boat.

Early in the 1970s, members of the local cooperative began experimenting with an ingenious system for allotting fishing sites to local

fishers. After more than a decade of trial-and-error efforts, the rules used by the Alanya inshore fishers are as follows:

- Each September, a list of eligible fishers is prepared, consisting of all licensed fishers in Alanya, regardless of co-op membership.
- Within the area normally used by Alanya fishers, all usable fishing locations are named and listed. These sites are spaced so that the nets set in one site will not block the fish that should be available at the adjacent sites.
- These named fishing locations and their assignments are in effect from September to May.
- In September, the eligible fishers draw lots and are assigned to the named fishing locations.
- From September to January, each day each fisher moves east to the next location. After January, the fishers move west. This gives the fishers equal opportunities at the stocks that migrate from east to west between September and January and reverse their migration through the area from January to May (Berkes 1986, pp. 73—4)

The system has the effect of spacing the fishers far enough apart on the fishing grounds that the production capabilities at each site are optimized. All fishing boats also have equal chances to fish at the best spots. Resources are not wasted searching for or fighting over a site. NO signs of overcapitalization are apparent.

The list of fishing locations is endorsed by each fisher and deposited with the mayor and local gendarme once a year at the time of the lottery. The process of monitoring and enforcing the system is, however, accomplished by the fishers themselves as a by-product of the incentive created by the rotation system. On a day when a given fisher is assigned one of the more productive spots, that fisher will exercise that option with certainty (leaving aside last-minute breakdowns in equipment). All other fishers: expect that the assigned fisher will be at the spot bright and early. Consequently, an effort to cheat on the system by traveling to a good spot on a day when one is assigned to a poor spot has little chance of remaining undetected. Cheating on the system will be observed by the very fishers who have rights to be in the best spots and will be willing to defend their rights using physical means if necessary. Their rights will be supported by everyone else in the system. The others will want to ensure that their own rights will not be usurped on the days when

they are assigned good sites. The few infractions that have occurred have been handled easily by fishers at the local coffee-house (Berkes 1986, p. 74).

Although this is not a private-property system, rights to use fishing sites and duties to respect these rights are well defined. And though it is not a centralized system, national legislation that has given such cooperatives jurisdiction over ”local arrangements” has been used by cooperative officials to legitimize their role in helping to devise a workable set of rules.That local officials accept the signed agreement each year also enhances legitimacy. The actual monitoring and enforcing of the rules, however, are left to the fishers. Central-government officials could not have crafted such a set of rules without assigning a full-time staff to work (actually fish) in the area for an extended period. Fishing sites of varying economic value are commonly associated with inshore fisheries (Christy 1982; Forman 1967), but they are almost impossible to map without extensive on-site experience. Mapping this set of fishing sites, such that one boat’s fishing activities would not reduce the migration of fish to other locations, would have been a daunting challenge had it not been for the extensive time-and-place information provided by the fishers and their willingness to experiment for a decade with various maps and systems. Alanya provides an example of a self-governed common-property arrangement in which the rules have been devised and modified by the participants themselves and also are monitored and enforced by them.

Game 5 and empirical cases of successfully governed CPRs provide theoretical and empirical alternatives to the assertion that those involved can not extricate themselves from the problems faced when multiple individuals use a given resource. The key to my argument is that some individuals have broken out of the trap inherent in the commons dilemma, whereas others continue remorsefully trapped into destroying their own resources[9]. This leads me to ask what differences exist between those who have broken the shackles of a commons dilemma and those who have not. The differences may have to do with factors internal to a given group. The participants may simply have no capacity to communicate with one another, no way to develop trust, and no sense that they must share a common future. Alternatively, powerful individuals who stand to gain from the current situation, while others lose, may block efforts by the less powerful to change the rules of the game. Such groups may need some form of external assistance to break out of the perverse logic of their situation.

The differences between those who have and those who have not extricated themselves from commons dilemmas may also have to do with

factors outside the domain of those affected. Some participants do not have the autonomy to change their own institutional structures and are prevented from making constructive changes by external authorities who are indifferent to the perversities of the commons dilemma, or may even stand to gain from it. Also, there is the possibility that external changes may sweep rapidly over a group, giving them insufficient time to adjust their internal structures to avoid the suboptimal outcomes. Some groups suffer from perverse incentive systems that are themselves the results of policies pursued by central authorities. Many potential answers spring to mind regarding the question why some individuals do not achieve collective benefits for themselves, whereas others do. However, as long as analysts presume that individuals cannot-change such situations themselves, they do not ask what internal or external variables can enhance or impede the efforts of communities of individuals to deal creatively and constructively with perverse problems such as the tragedy of the commons.

Policy Prescriptions as Metaphors

Policy analysts who would recommend a single prescription for commons problems have paid little attention to how diverse institutional arrangements operate in practice. The centrists presume that unified authorities will operate in the field as they have been designed to do in the textbooks—determining the best policies to be adopted for a resource based on valid scientific theories and adequate information. Implementation of these policies without error is assumed. Monitoring and sanctioning activities are viewed as routine and nonproblematic.

Those advocating the private—property approach presume that the most efficient use patterns for CPRs will actually result from dividing the rights to access and control of such resources. Systematic empirical studies have shown that private organization of firms dealing in goods such as electricity, transport, and medical services tends to be more efficient than governmental organization of such firms; for a review of this literature, see De Alessi (1980). Whether private or public firms are more efficient in industries in which certain potential beneficiaries cannot be excluded is, however, a different question.

We are concerned with the types of institutions that will be most efficient for governing and managing diverse CPRs for which at least some potential beneficiaries cannot be excluded. Privatizing the ownership of CPRs need not have the same positive results as privatizing the ownership of an airline.

Further, privatizing may not mean ”dividing up” at all. Privatization can also mean assigning the exclusive right to harvest from a resource system to a single individual or firm.

Many policy prescriptions are themselves no more than metaphors. Both the central izers and the privatizers frequently advocate oversimplified, idealized institutions—paradoxically, almost ”institution-free” institutions. An assertion that central regulation is necessary tells us nothing about the way a central agency should be constituted, what authority it should have, how the limits on its authority should be maintained, how it will obtain information, or how its agents should be selected, motivated to do their work, and have their performances monitored and rewarded or sanctioned. An assertion that the imposition of private property rights is necessary tells us nothing about how that bundle of rights is to be defined, how the various attributes of the goods involved will be measured, who will pay for the costs of excluding nonowners from access, how conflicts over rights will be adjudicated, or how the residual interests of the rights-holders in the resource system itself will be organized.

An important lesson that one learns by carefully studying the growing number of systematic studies by scholars associated with ”the new institutionalism” is that these ”institutional details” are important[10]. Whether or not any equilibria are possible and whether or not an equilibrium would be an improvement for the individuals involved (or for others who are in turn affected by these individuals) will depend on the particular structures of the institutions. In the most general sense, all institutional arrangements can be thought of as games in extensive form. As such, the particular options available, the sequencing of those Options, the information provided, and the relative rewards and punishments assigned to different sequences of moves can all change the pattern of outcomes achieved. Further, the particular structure of the physical environment involved also will have a major impact on the structure of the game and its results. Thus, a set of rules used in one physical environment may have vastly different consequences if used in a different physical environment.

[1] [Several footnotes have been edited where the detail was exhaustive. Please refer to *Governing the Commons* for complete notations]

[2] Hardin recommends "mutual coercion, mutually agreed upon" as a solution to the problem, but what "mutual agreement" means is ambiguous given his emphasis on the role of central regulators; see Orr and Hill (1979) for a critique.

[3] Michael Taylor (1987) analyzes the structure of Hobbes's theory to show that Hobbes proposed the creation of a Leviathan in order to avoid the equilibrium of situations structured like prisoner's dilemmas. See also Sugden (1986).

[4] Stillman (1975, p. 13) points out that those who see "a strong central government or a strongruler" as a solution implicitly assume that "the ruler will be a wise and ecologically aware altruist," even though these same theorists presume that the users of CPRs will be myopic, self-interested, and ecologically unaware hedonists.

[5] The form of regulation used in Game 2 would be referred to in the resource economics literature as a "pure quota scheme." Alternative regulatory instruments that are frequently proposed are a "pure licensing scheme" and a "pure tax scheme." As Dasgupta and Heal (1979) point out, however, it is "the" government in each of these schemes that takes control of the resource and sets up the regulatory scheme. The idea, in each case, is for the government to take charge of the common property resource and to introduce regulations aimed at the attainment of allocative efficiency" (Dasgupta and Heal 1979, p. 66). All of the models of these various schemes assume that the costs of sustaining these systems are nil (as in Game 2). Dasgupta and Heal repeatedly stress that these costs are not nil in field settings and may affect whether or not any of them actually will solve a commons problem or the relative efficiency of one scheme versus another. But Dasgupta and Heal's careful warnings about the importance of the relative costs of various constitutional arrangements are rarely heeded in the policy literature.

[6] More accurately, the sum Of the two types of errors must be less than 0.50, given the fixed parameters of this game, for the restructured game to have a (C, C) equilibrium. I am grateful to Franz Weissing, who suggested this particular analysis for illustrating the problem of incomplete information on the part of a central agency.

The last two decades of work in social-choice theory also have revealed other problems that may be involved in any system where a collective choice about policy must be reached through mechanisms of collective choice. Even if complete information is available about the resources, problems associated with cycling and/or agenda control can also occur (McKelvey 1976, 1979; Riker 1980; Shepsle 1979).

[7] This overlooks the fact that in a dynamic setting the decision whether to manage the meadow at a sustainable level or to "mine" it rapidly will depend delicately on the discount rate used by the private owner. If the discount rate is high, the private owner will "overuse" a commons just as much as will a series of unorganized co-owners. See Clark (1977) for a clear statement of how over-exploitation can occur under private property.

[8] And it should be pointed out that the private-rights system is itself a public institution and is dependent on public instrumentalities for its very existence (Binger and Hoffman 1989).

[9] That the "remorseless logic" was built into Hardin's assumptions, rather than being an empirical result, was pointed out by Stillman (1975, p. 14): "But the search for a solution cannot be found within the parameters of the problem. Rather, the resolution can only be found by changing one or more of parameters of the problem, by cutting the Gordian knot rather than untying it."

[10] See Shepsle (1979, 1989), Shepsle and Weingast (1987), Williamson (1979, 1985), North and Weingast (1989), and North (1981).

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Part Three

ORGANIZING THE COMMONS

8

From Free Grass to Fences: Transforming the Commons of the American West

TERRY L. ANDERSON AND P. J. HILL

In his oft-quoted article describing ”The Tragedy of the Commons,” Garrett Hardin stated that ”the commons, if justifiable at all, is justifiable only under conditions of low-population density. As the human population has increased, the commons has had to be abandoned in one aspect after another”[1]. The reasons for such changes are clear: as utility-maximizing individuals make decisions, the costs and benefits of those decisions must be internalized if society is to obtain the optimal results. In other words, the way in which property rights are assigned, enforced, and transferred affects the allocation of resources and, hence, the amount and distribution of output. Who controls what resources? Who receives the benefits and bears the costs of various actions? How clearly are the property rights specified? How are they exchanged and how are these exchanges enforced? The answers to these questions clearly influence the consequences of human activity at any given time.

From Terry L. Anderson and P. J. Hill, “From Free Grass to Fences: Transforming the Commons of the American West” in *Managing the Commons*, Garrett Hardin and John A. Baden, eds. (San Francisco: W. H. Freeman, 1977), pp. 200-16. Reprinted by permission of W. H. Freeman and Company. This article is a revision by the same authors of “The Evolution of Property Rights: A Study of the American West”, *Journal of Law and Economics,* 12 (1975), 163-179.The new title was inspired by Robert Fletcher’s *Free Grass to Fences* (New York: New York University Press, 1960).

But Professor Hardin's statement raises another very important question: At what point is it advisable to transfer rights from common to private holdings? It is clear from the history of property rights in the United States that the structure of rights is continually changing. For example, as early as the second half of the seventeenth century, the commonly held forest lands of the New England colonies had been exploited to the point where regulation of their use was necessary. "By a law passed by the town in 1669, refusing permission to transport wood or timber by land or sea from the town commons, without leave of the selectmen, we can judge that a free use has been made of the native forest of Salem for lumber, staves, and ship building, as well as wood for the fishermen, and the common use of the town, and that the scarcity was beginning to be felt"[2]. The settlement of the Great Plains followed a similar pattern. Cattlemen were initially willing and able to share the vast grasslands, but as pressure on the resource increased, an alternative structure of rights became necessary. It is also possible for rights to be converted back to a communal status, as in the case of horses in the 19205 in some western states.

What triggers these changes? Is population density the sole cause? Believing the cases to be more complex, we present below a perspective of the dynamic process of property right development which enumerates the variables responsible for changing definition and enforcement activity. Our theory is then tested in the case of property rights as they evolved on the American Great Plains. We shall concentrate on the economic and social relations which define the position of individuals with respect to the utilization of land, water, and cattle on the Plains. However, our analysis applies more generally to the mutually coercive, mutually agreed-upon, contractual arrangements between individuals.

Many historians have examined the relationship between ownership institutions and the economic and social institutions of the Great Plains[3]. Our interpretation, however, formulates the variables in terms of economic theory. Furthermore, it provides a general explanation of how and why existing institutions change in response to changes in variables such as demand, factor endowments, and technology. Consequently, the theory is extremely useful for explaining contemporary problems involving property rights.

A Theory of Property Rights Evolution

Works by Davis and North, and North and Thomas emphasize the role of primary and secondary institutions but provide only a broad framework for analysis in terms of benefits and costs[4]. Other works by economists such as Cheung, Demsetz, North, and Pejovich have posited theories of property rights change[5]. Demsetz, for example, suggests ”that property rights arise when it becomes economic for those affected by externalities to internalize benefits and costs”[6]. Pejovich states: ”The creation and specification of property rights over scarce resources is endogenously determined” and that ”some important factors which govern changes in the content of property rights are asserted to be: technological innovations and the opening of new markets, changes in relative factor scarcities, and the behavior of the state”[7].

All of these works suggest that property rights decisions basically depend upon the marginal benefits and costs of such activities. None, however, explicitly specifies what is meant by ”more private property” or what variables determine the benefits and costs. If the relevant economic variables are to be used for more than ad hoc theorizing, they must be developed into functional relationships which predict and are capable of being tested.

To narrow this analysis and overcome these deficiencies we have chosen to focus specifically on property rights definition and enforcement activities expressed in terms of the traditional marginal decision model of neoclassical economics. Establishing and protecting property rights is very much a productive activity to which resources can be devoted. But like any other activity, the amount of investment will depend upon the marginal benefits and costs to investors of allocating resources to these endeavors. By expressing the amount of property rights definition and enforcement activity as a function of marginal benefits and marginal costs, and by specifying the shift parameter for each function, it is possible to explain the existing structure of property rights in a society and provide a vehicle with which we can analyze changes in property rights over time.

Figure 8.1 illustrates a hypothetical marginal benefit (MB) and marginal cost (MC) curve for property rights definition and enforcement activity. The vertical axis measures dollar values of private benefits or costs perceived by initiators of activities. On the horizontal axis we measure the amount of activities aimed at defining and enforcing property rights. In other words, a rightward movement along the abscissa implies an increase of inputs into the production of property rights and not necessarily an increase in the degree of

private property[8]. This distinction is crucial, because the same amount of activity may yield different levels of private property under different circumstances. For example, where capital punishment exists, locking one's house may effectively deter burglars and insure a high degree Of private property; where the penalty for burglary is a $5 fine, the same activity may deter no one. In the final analysis, however, it is the degree of private property rights that determines efficient resource allocation. As the level of property rights is not directly observable, and as there is some question about what constitutes more or less private property, we have confined our analysis to definition and enforcement activities, which are observable variables.

The slopes for the marginal gain and marginal cost curves in Figure 8.1 can be defended on theoretical grounds. The benefit from increasing levels of definition and enforcement activity accrues because of the increased probability of appropriating the worth of the asset. The rate of increase in total benefits, however, occurs at a decreasing rate for much the same reasons that the marginal physical product of any input declines. The marginal cost increases because of the increased opportunity cost of resources used in property rights activities[9].

The equilibrium level of definition and enforcement activity occurs at the point where the curves intersect, but why does this level of activity vary over time and between areas? The benefits depend upon the value of the asset and the degree to which the activity insures that the value will be captured by the owner. Any change in the price of a well-defined and enforced bundle of rights changes the return on resources devoted to property rights questions. "The higher market value attaching to goods with strong ownership rights spurs individuals to seek laws that would strengthen private property rights"[10]. For example, as our air, water, and scenery have become increasingly scarce, individuals or groups have attempted to better define their rights to these resources through legal action. Furthermore, any increase in the productivity of a definition and enforcement activity will shift the marginal benefit curve outward. An increase in the probability of loss of an asset will usually result in an increase in the productivity of property rights activity and thus will result in such a shift[11]. An increase in the neighborhood crime rate means that locks, burglar alarms, and watch dogs all will have higher benefits than previously because each does more to insure appropriation of an asset's value. The probability of loss is also affected by variables such as population density, cultural and ethical attitudes, and the existing "rules of the game" or institutional structure. These in turn will be directly influenced by the political

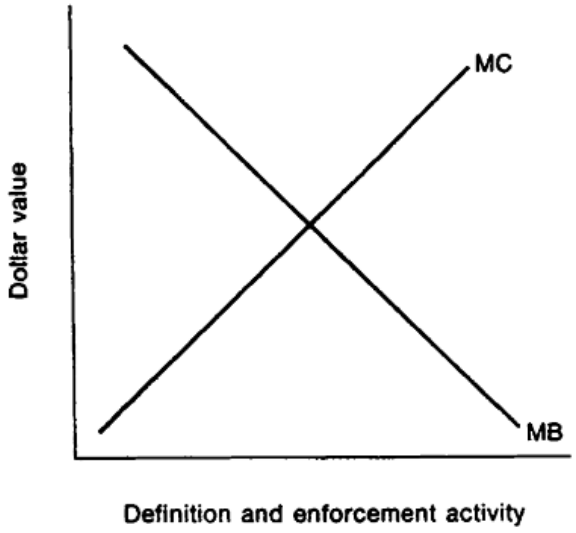

Figure 8.1. Hypothetical marginal benefit and marginal cost.

structure, historical precedent, the decision-making rule (majority, plurality, etc.), the nature of the court system, and the penalty for infringements upon another person's property rights"[12].

The marginal cost of property rights reorganization is a function of the quantity and opportunity cost of resources necessary for a given amount of activity. Hence anything that reduces the quantity of resources or lowers the opportunity cost will shift the marginal cost curve. Changes in technology, resource endowments, and scale of operation all could cause such a shift. The above discussion offers a starting point for explaining varying degrees of definition and enforcement activity and, concomitantly, arrangements covering the spectrum from completely common to completely private property rights. Furthermore, it provides a basis for assessing the importance of parametric shifts which influence the evolution of property rights.

It should be noted that this formulation of decision making has been solely in terms of private benefits and private costs while many activities[13] involve economies of scale, and hence may lead to group action. Though the benefits from economies of scale through collective action are evident, the free-rider problem and the burden of costs often preclude such action. Because of this divergence between private and social costs and benefits associated with definition and enforcement activities, property rights will not always be redefined in accordance with social welfare. Indeed, the gainers from reorganization may be able to make others bear the costs through such coercive devices as the government". Institutionally organized externalities

play an important part in what actually happens to the property rights structure.

Application of the Model

By extending the above model to include the costs and benefits of defining and enforcing, the existence and Change of institutions can be explained. The following is a test of the model, based on historical data from the Great Plains[14].

Property rights are at the heart of most issues discussed in the historical literature of the region. The Great Plains was one of the last regions of the United States to be settled, and climate and topography were considerably different from other regions. Webb captures the impact of these forces on the institutions of the region:

> The Easterner, with his background of forest and farm, could not always understand the man of the cattle kingdom. One went on foot, the other went on horseback; one carried his law in books, the other carried it strapped round his waist. One represented tradition, the other represented innovation; one responded to convention, the other responded to necessity and evolved his own conventions. Yet the man of the timber and the town made the law for the man of the plain; the plainsman, finding this law unsuited to his needs, broke it and was called lawless[15].

In terms of our theory, the intersection of the marginal benefits and cost functions dictated different levels of property rights activity in the West than in the East. Therefore, opportunities for gain existed from the reorganization of institutions which were aimed at defining and enforcing property rights. Since much of the formal (legal) decision-making apparatus that controlled these institutions was centered in the East, it was often very costly to use the normal channels of change. As a result, various alternatives developed, including voluntary local agreements and extralegal institutions. These alternative activities are consistent with and predicted by our theory Of property rights change.

Our theory will be tested by focusing on the property rights governing the three important productive factors on the Great Plains: land, livestock, and water[16]. Since some combination of these three resources was used in nearly every economic endeavor on the Plains, how they were controlled was

crucial to the amount and distribution of output. The model suggests that the changing scarcity of these factors over time changed the benefits from establishing and enforcing exclusive rights to each factor's share of total output. Furthermore, these changing benefits in combination with the changing costs of establishing and enforcing ownership determined the system of property rights governing land, livestock, and water in the American West.

Land

Land in the Great Plains had several characteristics that affected its productive use. First, the mean average rainfall over much of the area does not exceed 15 inches annually, precluding the use of land for farming as practiced in the East[17]. Second, the forage was mainly short grass, implying a land—intensive output. And finally, the lack Of trees over much of the Plains meant that it was difficult to fence with natural materials.

There was little precedent for the type of agriculture appropriate to the Great Plains. It has often been noted that the resource endowments of the arid, treeless West forced the farmer to alter the productive process drastically. These same characteristics also provided the impetus for a change in methods of defining and enforcing property rights. Initially, land on the Great Plains was not a scarce resource and little attention was paid to the property rights questions. "There was room enough for all, and when a cattleman rode up some likely valley or across some well-grazed divide and found cattle thereon, he looked elsewhere for range"[18]. For much of the 1860s and 1870s "squatter sovereignty" was sufficient for settling land ownership questions. But the growing demand for land by cattlemen, sheep herders, and grangers eventually caused the value of land to increase and hence increased the benefits from definition and enforcement activity[19]. To remedy this situation, attempts were made to establish some extra-legal claims to property. "As yet, no ranchman owned land or grass; he merely owned cattle and the camps. He did possess what was recognized by his neighbors (but not by law) as range rights"[20]. These rights provided some exclusivity over use of land, but as population increased, settlement became more dense and land values rose even more (see Table 8.1). Individuals and groups began devoting more resources toward the definition and enforcement of private property rights. Early laws provided punishment for those who drove their stock from the accustomed range. This idea of accustomed right on the basis of priority

rights is also reflected in the claim advertisements run in local newspapers. Such activities certainly cost very little, but their benefits were also quite low because such advertisements were unenforceable in any court of law. For instance, they did not preclude sheep herders from also claiming some right to the land.

Table 8.1
Population of the Great Plains, 1850–1900[a]

1850	274,139
1860	872,892
1870	1,481,603
1880	3,549,264
1890	6,044,884
1900	7,377,091

a. This series includes the states and territories of North Dakota, South Dakota, Kansas, Nebraska, Texas, Montana, Wyoming, Colorado, and New Mexico.
Source: U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1957* (Washington, D.C.: GPO, 1960), pp. 12–13.

The inelastic supply of land meant that as demand increased, the rental value of the asset rose rapidly and hence made the rate of return on definition and enforcement activity even more attractive. To capture these returns, cattlemen organized in groups and used the coercive authority of the government. By banding together in stock growers' associations, cowmen attempted to restrict entry onto the range through control of access to the limited water supplies. Furthermore, groups were able to put pressure on state and territorial governments to pass laws providing punishment for those who drove stock from their "accustomed range." In 1 866, the Montana Territorial Legislature passed a law attempting to control grazing on public land, and in 1884 a group of cattlemen meeting in St. Louis suggested that the federal government allow leasing of unclaimed land[21]. To the extent that they were successful, such actions moved the West toward private property by restricting entry onto commonly owned land.

The influence of these associations remained strong until the winter of 1886—1887. This winter was "the severest one the new businesses of the northern plains had yet encountered, with snow, ice, wind and below-zero temperatures gripping the area from November to April, in a succession Of storms that sent the herds drifting helplessly, unable to find food or water"[22].

Cattle numbers decreased dramatically because of the storm, and many ranchers went broke and left the area. The temporary decline in land values which accompanied the reduction in herds shifted back the marginal benefit curve for enforcement activity[23]. As the theory predicts, activity decreased. Associations established to enforce property rights declined. From 1886 to 1889 membership in the Wyoming Stock Growers Association dropped from 416 to 183[24]. Similar results of the winter were evident in the Montana Stock Growers Association. In his 1887 presidential address to only one third of the members, Joseph Scott stated that ”Had the winter continued twenty days longer, we would not have had much necessity of an Association; we would not have had much left to try to do”[25].

While all of the laws and restrictions on land use did provide a step toward exclusive ownership, they still did not stop livestock from crossing range boundaries. Only physical barriers could accomplish this, but in the grasslands of the West where wood and rock were scarce, the cost of fencing was high. Fences of smooth wire did not hold stock well and hedges were difficult to plant, grow, and maintain.

In the 1870s the introduction of barbed wire greatly reduced the cost of enclosing one’s land. To the homesteader whose land was invaded by cowboys and their herds which trampled down crops, barbed wire ”defined the prairie farmer’s private property”[26]. Some stockmen ridiculed the new fencing material, but others saw the advantage of controlling their own pastures. In Texas, for example, ”they began buying land with good grass and water and fencing it. In 1882, the Frying Pan Ranch, in the Panhandle, spent $39,000 erecting a four—wire fence around a pasture of 250,000 acres.[27]” Other cattlemen turned to enclosing their ”accustomed range” with cheap and easily erected barbed wire. Such actions however, were forbidden by a federal law of 1885 which provided for the ”prosecution of those who stretched fences out upon the public domain”[28]. The ensuing ownership conflicts were settled through range wars as well as legal institutions.

Between 1860 and 1900, changing land values and costs caused individuals and groups to devote more resources to definition and enforcement activity in order to capture potential rents to land. As a result of these activities, the institutions governing land ownership on the Great Plains moved successively toward exclusivity. Measures were enacted which attempted to control grazing on the public domain and efforts were made to lease from the government unclaimed communal property. During the 1870s and 1880s many acres were privately claimed under the homestead, preemption, and

desert land laws. And finally, land was granted outright to the transcontinental railroads, who in turn transferred much of it into private hands.

Livestock

While the lack of rainfall made tillage impractical over the majority of the Great Plains, native grasses of the area could support livestock. By combining sheep, cattle, and horses with large amounts of arid land, settler produced a marketable commodity. However, before the value of these assets could be captured, property rights definition and enforcement was again necessary. Although the livestock were similar in many ways to those used in other areas of the United States, the way they were combined with other factors of production in the West—the form of the production function—meant that previous methods of defining property rights were no longer appropriate.

In eastern regions where farms were much smaller, it was easy to watch one's animals and to know when they strayed from one's property. Positive identification by natural marking was also feasible on farms with only a few head of livestock. Furthermore, the lack of common property and the availability of rails for fencing made enforcement of property rights less costly. The western livestock producer, however, not only had to run his cattle over a large acreage, but also had to pasture them on lands over which he did not have exclusive control. These factors, combined with the difficulty of fencing the large areas where wood was scarce, made eastern methods of enforcement of livestock property rights costly on the Plains.

Since eastern methods produced a low, if not negative, rate of return, settlers on the Plains searched for alternatives. During the 1860s sheepmen turned to herding while "property rights in unbranded cattle were established by the fact that they ran on a certain range. . ."[29]. As long as individuals agreed upon the ownership of animals there was little need to devote valuable resources to the definition and enforcement questions. However, increasing human and cattle populations in the region did shift the marginal benefit curve and thus changed the equilibrium level of definition and enforcement activity (see Table 8.1). "The questions arising over the ownership of cattle and the rights of grazing, difficulties that have bothered the pastoral industry from the beginning of time, were intensified as the number and value of the herds increased"[30]. This in turn raised the marginal physical product of enforcement activity and shifted the marginal benefit curve to the right.

The predicted response to this shift is increased property rights activities. Although branding had existed from the beginning of the settlement of the region, the laws governing branding activity changed.

> There was a time when brands were relatively few and a man could easily remember who owned the different ones, but as they grew more numerous it became necessary to record them in books that the ranchers could carry in their pockets. Among the first laws enacted by territorial legislatures were those requiring the registration of brands, first in counties and later with state livestock boards[31].

The laws enacted by the early territorial legislatures of Wyoming and Montana provided for the central registration of distinctive brands[32], but as the population increased, the benefit curve continued to shift to the right. Osgood captures the effect of this shift on enforcement activity:

> In a country of limited ranges and small herds, the legal protection would have been sufficient. Wherever and whenever the range-cattle industry developed, such laws were found to be wholly inadequate. In Wyoming, the arrival of the Texas herds in the seventies resulted in each legislature passing laws to adjust the grand system to the changing character of the business. The drover who brought cattle to or through the Territory must see to it that every head in his herd was branded. He must frequently examine his herd and drive away any cattle not his own. Because whole brands of cattle were changing hands, provision was made for the lawful purchase of a brand. Penalties were provided for those who failed to brand any animal over a year old, who used a ”running brand,” who failed to obtain a bill of sale with a full list of the brands of the animals purchased, who killed an unbranded calf, or who skinned an animal carrying another’s brand, unless he could produce evidence of purchase. Conflicts over brands, which had been left to the county clerk for decision, were, in 1877, turned over to a committee composed of the clerk and two resident stock growers of the county; for with the increase of herds, the brand system became so intricate that it required the knowledge of the community to administer it. All owners bringing cattle into the territory were required to lay the brands of these cattle before the committee, which was instructed to reject all brands that were duplicates of existing brands. The addition of a circle or a half circle, a bar or a box, did not create a new brand and must be rejected. In 1879, all drovers were required to brand with a road-brand before driving over any portion of the Territory. Such a brand would distinctly set Off trail cattle from all others. At the same time, the law on illegal branding was strengthened by making such an offense a felony with a penitentiary term

> attached. Similar legislation in Montana as to the recording of brands, the changing of brands, and the driving off of stock was passed at about the same time. Not until 1881, when the arrival of thousands of Texas stock in eastern Montana made it imperative, did the Montana legislature pass a roadbrand law[33].

A cross-sectional comparison provides further evidence of differences in the benefits and costs of branding between the West and other regions. As early as 1864, laws were enacted in western territories which specified brands as legal proof of ownership. However, in many midwestern states, central brand registration is still absent and brands are not a requirement for proof of ownership.

Although many efforts to define and enforce property rights in livestock were undertaken by individual ranchers, group activity was not absent. Voluntary collective action afforded cattlemen the opportunity to capture gains from economies of scale in certain activities. The roundup is a case in point. Originally each rancher conducted his own gathering and branding of cattle. On the open range, this meant that herds were gathered as many times as there were individual operators in an area. However, as the number of operators increased, the costs of handling the cattle in this fashion increased proportionately and cooperation became profitable. The returns from these joint roundups were so high that cattlemen's associations found it worthwhile to elicit statutes such as a Wyoming law of 1883 which provided for a legal roundup.

> By the law of that year, no stock could be branded between February 15 and the commencement of the general spring roundup of the Association. In practice, this meant that the calf roundup was wholly in the hands of the Association. Since the chief reasons for rounding up in the spring was to brand the calves, and since any roundup before February 15 was dangerous to the cattle, the stock grower was practically prohibited from an independent roundup[34].

Technological change also decreased the cost of definition and enforcement activity in livestock. As noted above, in the 1870s homesteaders and ranchers alike began using newly invented barbed wire to define and enforce their rights to land. Cattlemen saw the value of barbed wire for

Table 8.2

Value of Horses in Montana, 1918–1926

	Price per Head
1918	$98
1919	94
1920	61
1921	50
1922	42
1923	39
1924	33
1925	32
1926	29

Source: *Livestock on Farms, January 1, 1867–1935.* U.S. Department of Agriculture, Bureau of Agricultural Economics (Washington, D.C., January 1938), p. 117.

enforcing one's rights to livestock. By confining cattle to a certain range, the losses from strays and the costs of roundup could be reduced. Furthermore, once cattle were separated, controlled management and breeding of herds could be practiced. Use of the wire started in 1874 when 10,000 pounds were sold. By 1880, just six years later, over 80,500,000 pounds had been sold and fencing was being used all across the West[35]. The rightward shift in the cost curve for fencing greatly increased definition and enforcement activity in both land and livestock.

All of the changes in livestock raising have been in one direction, i.e., the shifts in the benefit and cost curves have been such that increased definitions and enforcement activities have been forthcoming. The theory predicts decreases in activity if the shifts were in the other direction. An example of this occurred in the 19205 in Eastern Montana. From 1918 until 1926, horse prices in Montana dropped dramatically, from $98 to $29 per head (see Table 8.2). This occurred because mechanization on farms was replacing horses and, particularly in the West, because the US. Cavalry was no longer buying horses after World War I. The sharp decline in the price of horses shifted the marginal benefit curve to the left and significantly lowered the optimum level of definition and enforcement activity. Finding it unprofitable to define and enforce these rights, many horse owners allowed their animals to run the open range. The wild horse herds increased so rapidly during this period that community roundups were held in an attempt to clear the range of the unclaimed property.

Water

Water presented special ownership problems. Unlike land and livestock, it moves freely across many different pieces of real estate and can Change its course over time. Furthermore, the quantity of water can vary from season to season and even from day to day. This is especially true in the Great Plains states where average rainfall ranges between 15 and 20 inches annually. The ever-Changing physical nature of the resource makes definition and enforcement of rights most difficult, and, as such, led the classic eighteenth-century jurist Blackstone to say: For water is a moving, wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient, usufructuary property therein"[36].

To the frontiersman entering the Plains, it was clear from the start that access to water was a prime consideration when locating. Hence, initial settlement patterns can be traced to the river and stream bottoms[37]. As in the case of land, if an individual found a stream location taken, he simply moved on to another water supply. Under these circumstances the right to use the water accrued to the one who owned the bank of the stream and who had access to it by virtue of position. These rights found historical precedent in Eastern laws which were, in turn, developed from English common law. Early judges and lawyers were familiar with nothing but Eastern law and thus transferred it to the legal system of the West[38]. Secondly, riparian rights were appropriate to the factor endowments of the region at the time. Initially, land with adjacent water was abundant. As long as these conditions continued, rights which granted all riparian owners equal use of the flowing stream sufficed for resource allocation. The benefits from changing the existing institutions governing water were not sufficient compensation for the time and effort required to initiate the change.

As the settlement pressure increased, however, so too did these benefits. Especially in the states on the western edge of the Plains, land with available water became increasingly scarce. The value of water rights was rising in this arid country where water was an absolute necessity for raising any crops or livestock. Moreover, in areas where gold mining was prevalent, water was required at the mine site, which was often far from the nearest stream. The value of the marginal product of water in mining was high. As our theory predicts, these conditions induced individuals to devote more resources to the redefinition of property rights in water. For example, in the mining regions (especially California), there were no established customs of mining

and no recognized laws. Hence, the miners set up mining districts, formed miners' associations, and established mining courts which provided laws.

> These miner's rules and regulations were very simple and as far as property rights were concerned related to the acquisition, working, and retention of their mining claims, and to the appropriation and diversion of water to be used in working them. There was one principle embodied in them all, and on which rests the "Arid Region Doctrine" of the ownership and use of waters, and that was the recognition of discovery, followed by prior appropriation, as the inception of the possessor's title, and development by working the claim as the condition of its retention[39].

Though advised by eastern lawyers, the miners recognized the need for an alternative system of water law in the West and worked hard in the California and United States courts to have their customs and regulations regarding water recognized[40].

While precedent established in California in 1850 lowered the cost of establishing new property rights in water, the increasing scarcity of water increased the benefits to definition and enforcement activity on the Great Plains. Settlers moved toward a system of water laws that:

1. Granted to the first appropriator an exclusive right to the water, and to later appropriators rights conditioned upon the prior rights of those who have gone before;
2. Permitted the diversion of water from the stream so that it could be used on nonriparian lands;
3. Forced the appropriator of water to forfeit his right if the water was not used; and
4. Allowed for the transfer and exchange of rights in water between individuals[41].

Our theory predicts that activities designed to establish and enforce exclusivity will be strongest in areas where water is most scarce. Hence it is not surprising to find that in Montana, Wyoming, Colorado, and New Mexico, where rainfall averages 15 inches per year, the common law was eventually abrogated; in North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas, where rainfall is greater, the common law was retained in a modified form[42]. The evolution of water law on the Great Plains was a response to the benefits and costs of defining and enforcing the rights to that valuable resource.

Conclusion

The analysis herein suggests that a comparison of the benefits and costs of defining and enforcing property rights helps explain the evolution of property institutions. We have argued that the social arrangements, laws, and customs which govern asset ownership and allocation are established on the basis of variables endogenous to the economic system. Surely there is tragedy in the commons, but the extent of that tragedy is limited by the ability of individuals to alter the nature of rights. As long as the benefits of eliminating the commons are low relative to the costs, there is little incentive for individuals to define and enforce private property rights; the tragedy of the commons is small. However, as this ratio of perceived benefits and costs changes, so will the level of definition and enforcement activity. On the benefit side of an individual's investment decision are the value of the asset and the productivity of the activity designed to establish or enforce property rights. The higher the value of the asset and the higher the probability of losing the right to use that asset, the greater the degree of definition and enforcement activity. On the cost side are the "production functions" for such activities and the opportunity costs of resources devoted to definition and enforcement. Technological change or lower resource prices will increase property rights activity. From our examination of the American West it is clear that as the ill effects of common ownership manifested themselves, individual efforts were channeled toward transforming the nature of ownership in land, livestock, and water.

[1] Garrett Hardin, "The Tragedy of the Commons," *Science*, 162 (1968), 1243—1248; reprinted as Chapter 1 of this volume.
[2] George F. Chaver, "Some Remarks on the Commerce of Salem from 1626 to 1740," *Historical Collections of the Essex Institute*, 1 (July 1859), 82.
[3] For example, see Walter Prescott Webb, *The Great Plains* (New York: Grosset & Dunlap, 1931); and Carl Frederick Kraenzel, *The Great Plains in Transition* (Norman: University of Oklahoma Press, 1955).
[4] Lance Davis and Douglass C. North, *Institutional Change and American Economic Growth* (Cambridge: Cambridge University Press, 1971); and Douglass C. North and Robert Paul Thomas, *The Rise of the Western World*: A New Economic History (Cambridge: Cambridge University Press, 1973).
[5] See, for example, Steven S. Cheung, "The Structure of a Contract: The Theory for a Non-Exclusive Resource," *Journal of Law and Economics*, 13 (April 1971); Harold Demsetz, "Toward a Theory of Property Rights," *American Economic Review*, 57 (May 1967); Douglass C. North, "The Creation of Property Rights in Europe, 900—1700 A.D.," unpublished manuscript (University of Washington, 1972); and Svetozar Pejovich, "Towards an Economic Theory of the Creation of Property Rights," *Review of Social Economy*, 30 (1972), 309—325.
[6] Demsetz, p. 354.
[7] Pejovich, pp. 310, 316.
[8] Our unit of measure on the x—axis is essentially the same as that used in information theory where a rightward shift implies an increase in search activity and not necessarily an increase in information. See for example, Armen Alchian and William Allen, *University Economics*, 3rd ed. (Belmont, Calif: Wadsworth, 1972), pp. 137—155; or Paul Heyne, *The Economic Way of Thinking* (Chicago: Science Research Associates, 1973), p. 86.
[9] We have drawn the MB and MC curves, with negative and positive slopes, respectively, but the sufficient condition for stable equilibrium only requires that the MC curve cross the MB curve from below. Hence, it is permissible that over some range the marginal benefits may be rising and the marginal cost may be falling.
[10] Alchian and Allen, p. 141
[11] We say "usually" will increase the productivity, because, although one would expect that an increased probability of loss would make a given activity more productive, situations are conceivable where that doesn't happen. For instance, if one discovered that one lived on an earthquake fault, the probability of loss would be greater, but one also might entirely cease definition and enforcement.
[12] Professor Douglass North has stated, "a theory of property rights and of their creation is certainly incomplete without a theory of the state." As the evolution of institutions that influence the marginal gain from private definition and enforcement activity fits into the theory of collective property rights decisions, an understanding of individual decisions is imperative. See Douglass C. North, "The Creation of Property Rights in Europe, 900—1700 AD."
[13] See Alchian and Allen, p. 141.
[14] Most of our information is from Montana and Wyoming but many of the same trends were experienced throughout the region between the 98th meridian and the Rocky Mountains.
[15] Webb, p. 206.
[16] There are other property rights questions of interest in the Plains that we do not consider here. For instance, the conflict between the Indian and the settler was obviously a question of defining property rights. The near extermination of the buffalo is a good example of what can happen to a common-property resource.
[17] Webb, p. 17
[18] Ernest Staples Osgood, *The Day of the Cattleman* (Minneapolis: University of Minnesota Press, 1929), p. 182.
[19] For a discussion of crowding on the open range see Osgood, pp. 181—183.
[20] Webb, p. 229.

[21] Osgood, pp. 21, 201.
[22] Maurice Frink, W. Turrentine Jackson, and Agnes Wright Spring, *When Grass Was King* (Boulder: University of Colorado Press, 1956), pp. 98—99.
[23] The stockgrowers' organizations were created to define rights in both land and livestock. The winter of 1886—1887 had the effect of decreasing enforcement and definition activity in both assets. W. Turrentine Jackson points out, for instance, that
[24] Jackson, "The Wyoming Stock Growers Association," p. 265.
[25] Minutes of the Montana Stockgrowers Association, 1885—1889, as quoted by Ray H. Mattison, "The Hard Winter and the Range Cattle Business," *The Montana Magazine of History*, 1, no. 4 (October 1951), 18.
[26] Alistair Cooke, Alistair Cooke's America (New York: Knopf, 1973), p. 237.
[27] Jay Monaghan, ed., *The Book of the American West* (New York: Bonanza, 1963), p. 292.
[28] Osgood, p. 193.
[29] Osgood, p. 33.
[30] Osgood, p. 114.
[31] Frink et al., p.12.
[32] *Laws of the Montana Territory*, 1864—1865, Session I, p. 401 ; Laws of Wyoming Territory, 1869, Session I, chap. 62, pp. 426—427.
[33] Osgood, pp. 124—126.
[34] Osgood, p. 187.
[35] For a complete account of the use of barbed wire over time see Webb, p. 309.
[36] As quoted in Webb, p. 434.
[37] For a discussion and map of settlement along streams see Webb, p. 433.
[38] For a discussion of the importance of this historical precedent see Webb, p. 447.
[39] Clesson S. Kinney, *Law of Irrigation and Water Rights and the Arid Region Doctrine of Appropriation of Waters*, vol. 1 (San Francisco: Bender-Moss, 1912), sec. 598.
[40] See Webb, pp. 444—448.
[41] For a discussion of the rights of property under prior appropriation see Wells A. Hutchins, Water *Rights Laws in the Nineteen Western States*, Natural Resource Economics Division, U.S.D.A., Miscellaneous Publication no. 1206, vol. 1, pp. 442-454.
[42] See Webb, p. 446

9

Communitarianism and the Logic of the Commons

JOHN A. BADEN

The practice of communitarianism implies the recognition of and respect for interdependence among people in their various associations. Ideally, this goes beyond material and political relations to actual caring and concern for the well-being of fellow community members, beyond citizenship to fellowship. It really sounds quite cozy and nurturing. It seems misanthropic to question the movement.

How might members of a society convert this ideal into actual operation? Even if we assume full agreement regarding goals, this question would remain. And it is not intellectually or practically trivial. Whenever we find a divergence between narrow individual advantage and social welfare, problems of shirking and monitoring are inescapable. Those who support the goal of a more communitarian society (as I do) do no one a favor by pretending these issues away. And there is the certain possibility of defection from community. Those who opt out do not compose a random sample of the community. Rather, people who exit, economically, physically, or psychologically, will be those who find it most costly to remain. Some people place a high value on independence. Others chafe at constraints upon personally favorable economic opportunities. Communitarianism seems likely to be fostered by cultural homogeneity. It is easier to feel spiritual interdependence with those who share our values than with aliens, enemies, or moral strangers.

Adapted from Karl Bullock and John A. Baden, "Communes and the Logic of the Commons", in *Managing the Commons*, Garrett Hardin and John A. Baden, eds. (San Francisco: W. H. Freeman, 1977), pp. 182-99.

This is not to assert that these problems 'are insurmountable but only to indicate their existence and hint at their importance. Advocates of the communitarian movement may be well advised to consider historical evidence of the outer bounds of actual experiments with communal orders.

Communes in America

Most modernized societies give children a dual behavioral standard. For most social interactions, competition is an accepted and even a favored mode of behavior. In the family, however, unselfish and altruistic behavior is upheld as the ideal. The child is expected to learn to adjust his behavior to differing situations. Careful discrimination, then, becomes very important in determining appropriate action in any given situation.

No society is perfectly successful in its acculturation of its children. Further, no individual is capable of perfect discrimination. He cannot apply one standard with perfection outside the family context, and concurrently apply another within. These weaknesses invariably create problems and tensions.

One effort to resolve the problem involves the establishment of a communally organized society. Such a society is noted for its relative absence of individual property rights. Material wealth is dispersed equally among the members of the group and property is held in common. Since all share equally in group assets, the opportunity for discrimination among individuals on the basis of wealth is reduced, if not entirely absent.

It has been assumed that in the absence of private property and wealth that individuals have little incentive to be competitive and that, therefore, greed, selfishness, and other negative characteristics associated with competition would be greatly ameliorated in a communal setting. Hence, the cooperative behavior held to be the ideal within the familial order is expanded and applied to the communal order, giving greater consistency to society’s ideal patterns for behavior.

Experiments with such social arrangements are essentially experiments with institutional design. The underlying assumption is that with institutional change, behavioral change will follow. The United States witnessed dozens of these experiments during the first half of the 18005. Among the more famous are the communities of the Shakers, the Rappites, and the Zoarites.

In none of these cases were the institutional arrangements sustained. Either the attractions Offered by communal life were not as great as the

perceived opportunities in the larger society, or the organization was incapable of operating as a viable unit. In order to understand the causes of this type of institutional failure, a close examination of two unsuccessful and one successful experiment may be useful.

Communal Organization of the Mormons

One of the most successful institutions in the world today is the Mormon church. This organization, officially known as the Church of Jesus Christ of Latter-Day Saints, has experimented with various institutional designs. Through a gradual process of testing, modification, abandonment, and change, the church has evolved to its present form. One of the earliest Mormon efforts was the development of a communal organization in Jackson County, Missouri, during the years 1831 to 1834. This effort, like many others throughout America at that time, ultimately failed. The logic of common-pool resources will be useful in understanding the reasons for this failure.

Logic of the Commons

Each individual drawing upon the common—pool resource is expected to attempt to maximize private benefits. The benefits of resource utilization are directly realized by the individual, but, because ownership of the resource is dispersed among the community of users, the costs suffered in resource depletion are also dispersed. In adopting maximizing strategies, then, the individual user need not take into account the entire costs of his actions, but only that small fraction of the costs which he must bear directly. If the private benefits of an action exceed the costs, he will logically engage in that action, maximizing his take and ignoring any spillover costs to the community.

When demand upon the resource begins to exceed the its productive capacity, the situation begins to generate tragedy. Every individual seeking to maximize his gain follows the same logic. Rapid exploitation of the resource results and spillover costs are largely ignored. Detrimental impacts upon the resource are overlooked and depletion accelerates. When the commons becomes overloaded, ruin is likely to be the eventual outcome.

In the tragedy of the commons, predictions of individual behavior expose the inherent problems. Problems arise, for example, whenever voluntary cooperation for joint action is the only means of generating possible

collective benefits. Only if the entire community of users participates and follows the rule of willing consent will each user share equally in the costs of the endeavor. If individuals are able to withdraw cooperation, some will surely do so. Such strategies would enable an individual to reap the benefits of the collective action without paying any of the costs.

The Law of Consecration and Stewardships

Joseph Smith established the Mormon church in 1830. Immediately after its conception, the church began to flourish and attract new converts at a rapid rate. The expanding membership quickly created a potentially independent society. A cohesive socializing force was needed which would aid in assimilating new members and perpetuate a discrete identity; the ministry of the church required a source of support; and funds had to be provided for church projects. This gave Joseph Smith the opportunity and incentive to combine the church's practical needs with utopian idealism in synthesizing a new Christian society.

It is likely that the variety of experiments in communal living prevalent at the time influenced Smith's idealism. Initial stimulus for his plan seems to have derived from a visit he made to Mentor, Ohio where he preached to and converted some members of the Morley Family, including its leader Jacob Morley.

This communal group was attempting to live by a rule that required the complete sharing of all goods and possessions. According to an account given by a contemporary church member, the family was "going to destruction very fast as to temporal things [because] they would take each other's clothes and other property and use it without leave, which brought on confusion and disappointment"[1]. Seeing this state of confusion which plagued the Morley Family, Smith instructed them to abandon their attempt, and instead endeavor to live by the more perfect law of the Lord. These instructions necessitated an explication of this higher law, which Smith provided on February 9, 1831 in, as he termed it, a revelation from God. The body of the revelation outlined what became known as the Law of Consecration and Stewardships.

The fundamental premise of this law was that everything belongs to the Lord and that men are merely stewards over their earthly possessions[2]. Management of stewardships in harmony with religious imperatives and dissolution of private property follow from the premise. When applied to social

organization, the result was an initial establishment of relative equality and, ideally, a perpetuation of that equality. The Mormons who attempted to organize themselves in compliance with the Law called their society the Order of Stewardships[3].

Upon entering the Order of Stewardships, members of the Mormon church were required to consecrate to the Lord, via the bishop, all their properties and possessions, both in kind and liquid, both real and personal. The bishop then reciprocated by allotting each family head a stewardship, which included many of the initially consecrated items such as clothing, furniture, a building lot within the community, and some form Of an inheritance. The ”inheritance” was a means by which a family could make a living. It might be a farm, a workshop, a store, or a factory. The size of the stewardship varied from family to family. Apportionment of material goods and the allocation of inheritances was based upon relative rather than absolute equality. The law defined equality according to the size of a family, its circumstances, and its ”just wants and needs.” It therefore allowed for inequalities in individual responsibilities and individual control in management of enterprises.

After the initial allocation of a stewardship, the church ceased to exercise control over its operation. Inheritances were deeded to the individual steward, and he was accountable only to God. Even if the individual was excommunicated or voluntarily withdrew from the Order, his ownership of the inheritance was absolute. (However, all other properties that were initially or subsequently consecrated remained in church ownership.) Competition was therefore not entirely absent; however, it was potentially diminished bi. a further provision of the Law of Consecration and Stewardship.

By requiring an annual socialization of surpluses, the order hoped to wide a mechanism by which the initial equalization of material wealth could be maintained. Each year, the family heads or stewards were required to make an account of the year’s production to the bishop. Surplus incomes, abuse that which constituted a family’s ”just wants and needs,” were to be consecrated to the order, and held in the Bishop’s Storehouse for further distribution. These surpluses were to be used in the support of widows, orphans. the poor, and any who failed to produce enough for themselves. The support of the public ministry, as well as payments on church expenditures such as publications, buildings, and land acquisitions, were to be supplied by the surpluses. Any additional surpluses could be used by stewards who wished to expand or improve upon their expenditures.

Individual participation in the Order and cooperation with the mandates of the law were essentially voluntary. In fact, the entire outline Of the Law of Consecration and Stewardship lacked coercive control. Any member of the Mormon church was free to join the Order of Stewardships, each new member was free to determine the extent of his initial consecration, and each steward was free to consecrate annually as much or as little as he desired. These freedoms rendered the Order susceptible to the economic problems associated with common-pool resources.

The town of Independence in Jackson County, Missouri, became the focal point for the gathering of the Church membership. In another revelation, Joseph Smith identified it as Zion, the centerplace of God's people and their church. Various other revelations instructed the people to gather in Zion, to prosper and flourish, and to build the kingdom of God. Here they were to establish the Order of Stewardships. The Mormons responded enthusiastically to these commandments and quickly began to emigrate to Zion.

Tapping the Common Pool

From its beginning, the Mormon church has been actively involved in proselytizing and converting new members. Each new convert was a potential, and eager, emigrant to Zion. This precipitated a flux of immigration larger and more rapid than was anticipated by church leaders.

Emigration to Zion was open and no one was refused admittance to the Order upon arrival in Jackson County. For the potential immigrants, the benefits of Close association with other Mormons, and especially the benefits of receiving a stewardship, outweighed costs of moving to Zion. Obviously. the poorer members could improve their economic situation by joining the Order. Soon, demand for a place in the Order of Stewardships began to exceed supply.

Each new family was supplied with an inheritance and a building lot within the community. Lands had to be bought, houses built, and mercantile goods provided. These required time and money to obtain and neither were in sufficient supply. The problem was compounded by the arrival of increasing numbers of families without possessions. Some were utterly destitute.

The church leadership made an attempt to regulate the over-rapid immigration. Through another revelation, and again in the church newspaper, church members abroad were instructed to gather "not in haste, nor by flight"[4]. They were to make advance preparations by notifying church Officials

of their desire to move to Jackson County, and by sending money ahead to buy land. They were then to move to Kirtland, Ohio, to await permission to join the Order in Zion. Compliance with these regulations, however, was essentially voluntary as those who arrived without having made advance preparations were not turned away. One Mormon later reflected upon the problem and said that ”the Church got crazy to go up to Zion, as it was then called. The rich were afraid to send their money to purchase lands, and the poor crowded up in numbers, without having any places provided, contrary to the advice of the Bishop and others[5].

As the poor crowded up in numbers they became the dominant exploiters of the commons. In attempting to provide stewardships for the influx of poor families, the bishop was forced to draw heavily on the Order’s limited resources. The prospect of forfeiting material well-being to accommodate such a large proportion of poor deterred migration of the wealthier Mormon converts.

The benefits of receiving a stewardship so greatly outweighed the personal costs incurred by migration, that the poor had little incentive to comply with the regulations for advance preparation. Each immigrant could also ignore the high costs his arrival inflicted upon the Order, because those costs were paid by the entire group out of consecrated funds. Because of the large percentage of poor, the size of stewardship diminished, as did opportunities for economic growth and expansion. Attempts to curb the influx of the poor and to encourage immigration of the well-to-do were many but ineffective; the poor continued to come.

Consecrations and Stewardships

”Every man must be his own judge, how much he should receive and how much he should suffer to remain in the hands of the bishop”[6]. These are the words of Joseph Smith spoken in reference to the consecrations made by each new member of the Order of Stewardships. When a family desired to enter the Order, they consecrated their possessions to Bishop Partridge, overseer of the Order, and subsequently received from him a steward-ship. Most consecrated items were loaned back to the family as part of their stewardship. Surplus from consecrations was kept for redistribution. The church leadership expected that in many cases the consecrations would substantially exceed the allotted stewardship, to compensate other cases where the consecrations were expected to be less.

With every man as his own judge, Bishop Partridge had little, if any, control over the size of consecrations he received. The existing members of the order had little control over incoming members, the goods they supplied, or the demands they made, other than by appeals for voluntary cooperation in consecrations.

There is only one surviving legal document recording an individual consecration and stewardship, that of a man named Titus Billings[7]. Upon entering the Order of Stewardships,

Billings consecrated $316.52 in personal belongings. All these items were subsequently loaned back to him as part of his stewardship as sufficient only for himself and his family. There was nothing left over to buy lands for Zion, to help in the support of the ministry, or to help in the support of the poor. Billings himself was poor. His consecrations weren't even enough to pay for the $27\ 1/2$ acres of farm land he was given.

Surpluses and the Bishop's Storehouse

The maxim "from each according to his ability; to each according to his need" summarizes the ideal underlying the annual consecration of surpluses to the Bishop's Storehouse. Each year, members of the Order of Stewardships were required by their initial covenant to render up an accounting of their year's production, and to consecrate all goods and profits above what was required for their own just wants and needs. These annual surpluses were turned over to Bishop Partridge and kept in the Bishop's Storehouse for future distribution.

The Law of Consecration and Stewardship as applied in Jackson County overestimated the extent of human altruism. The amount of the yearly consecrations was left completely to individual discretion. The only guidelines consisted of loose terms such as "just wants and needs," "frugality," and "simplicity." Voluntary cooperation was the only means of perpetuating the commons of the Storehouse. If an individual decided to keep his surplus, it was entirely within his rights to do so, and "in the final analysis, the Order [was] powerless to enforce its basic stipulations"[8].

Years later, Brigham Young, who "never knew a man yet who had a dollar of surplus property"[9], commented on the success of voluntary cooperation in annual consecrations.

> Some were disposed to do right with their surplus property, and once in a while you would find a man who had a cow which he considered surplus, but generally she was of the class that would kick a person's hat off, or eyes out, or wolves had eaten off her teats. You would once in a while find a man who had a horse that he considered surplus, but at the same time he had the ringbone, was broken-winded, spavined in both legs, had the pole evil at one end of the neck and a fistula at the other, and both knees sprung[10].

The problems encountered by the Order of Stewardships led Leonard J. Arrington, the church historian, to make the following observation:

> Since the plan provided that each steward voluntarily consecrate his annual surplus, the faithful gave much, and the unfaithful little. A premium was placed on liberality and honesty. In the distribution of charity out of surplus, some demanded much, others little, and there was not always correspondence between need and participation in the consecrated surpluses[11].

The key sentence here is "A premium was placed on liberality and honesty." It was to any single participant's advantage to underestimate his surpluses and to overestimate his just wants and needs. Liberality and honesty were expensive, and those who joined in the practice of these virtues were penalized by being placed at a competitive disadvantage. By maximizing private benefits and minimizing private costs, many stewards were led to underinvest in the maintenance of the common surplus and to overinvest in its depletion.

Management Policies and Institutional Design

The problems associated with managing the communal Order of Stewardships focused attention on the need for a management agency. And so, on April 26, 1832, Joseph Smith organized the United Firm as the governing agency of the Order of Stewardships. Not only was the Firm charged with the management of several of the community's vital business concerns, but it possessed ultimate control over the community lands and the community wealth that was held in the Bishop's Storehouse.

This newly formed institution was organized as a joint stewardship for its members. That is, initial financing came from church funds. The United Firm drew upon the Bishop's Storehouse and consecrated surpluses to pay operation expenses and to provide for the needs of the member's families. It

was hoped that the Firm would quickly become at least partially self-sufficient, presumably through the profits from the mill, tannery, printing press, and real estate. At this point further grants from the Storehouse would diminish and the Firm would operate largely on its own profits with any surplus profits consecrated to the Storehouse.

The five members of the United Firm were primarily religious leaders, mainly concerned with the establishment and Viability of their new religion. With the possible exception of two members, the Firm could boast no outstanding business talents capable of solid management.

Had the United Firm been engaged in a purely market situation in which the personal incomes of its members directly reflected the successes or failures in policy, fluctuations in these incomes would have provided a strong incentive for efficiency. However, since the support of the Firm was guaranteed by the Order, this incentive was removed.

In the absence of a strong economic incentive, the United Firm had its motivation in the religious nature of its mandates. The duties of the Firm were God given and thus prudence was best served by obedience to the command. It is always wise for believers to obey the directives of someone as powerful as God, just as it is foolish to question his judgment. In addition to this incentive, the members of the Firm had a large measure of credibility to maintain with their followers. As God's instruments they were expected to function efficiently. Failure to do so would generate doubt and skepticism.

But again, the incentive tended to operate perversely. As the leaders were primarily concerned with religion, economic concerns were secondary. Perhaps the assumed divine guidance and inspiration tended to shift the burden of responsibility from the Firm to God. After all, He had promised them prosperity. Success was regarded as inevitable as long as the people remained faithful to their religion. Problems and internal strife were treated as signs of unfaithfulness and spiritual faltering. Rather than adjusting management policies to increase efficiency, the church's leaders called upon the members of the Order of Stewardships to repent of their selfishness and trust in the Lord.

The Order was a victim of the tragedy of the commons. It attempted to implement a level of human altruism that proved unattainable. The motivations to substantially contribute to the success of the Order through consecrations were in direct opposition to the motivations for maximizing personal success.

The Mormons suffered continual and ever-increasing opposition and persecution by their non-Mormon neighbors in Jackson County. In early 1834, hardly three years after its birth, the Order Of Stewardship was abruptly ended by the expulsion of the Mormons from the county[12]. The United Firm was dissolved and its properties were divided among its members. The Law of Consecration and Stewardship was suspended by revelation on June 22, 1834. To provide an alternate source of church funds, Joseph Smith instituted the Law of Tithing, and later forbade any further attempts at establishing the Order of Stewardships[13].

I hope to have explained how the best of intentions may go awry due to a failure of institutional design. The following section demonstrates how the goals of a communal order may be achieved through appropriate institutional design.

The Hutterite Communes

In marked contrast to the Mormons' failure at communal organization is the success of the Hutterite communes[14]. These groups, also based on revelation and theological dictates, comprise a highly successful and fast growing set of agricultural enterprises. Although the Hutterites faced the problems inherent in the logic of the commons, they evolved a set of institutions adequate to the test.

The two hundred agricultural colonies of the Hutterites are spread throughout the northern Great Plains of the United States and Canada. From their initial three small settlements established in the Dakota Territories in the 18705, they had by 1970 expanded to over 20,000 members, their population and per capita holdings nearly doubling each sixteen years. Their lifestyle is marked by extreme simplicity and frugality but not exceptionally hard work by North American agricultural standards. While the life expectancy of communal orders is generally brief indeed, the Hutterite communes of North America have persisted and prospered for over a century. Within a collectively run, viable economic system, political conflict has been managed without the pitfall of collective paralysis.

Nearly all members are born into a Hutterite colony; the Hutterites thus need not decide who will share the public goods. The Hutterites freely acknowledge that "all wheat has chaff" and they provide each individual with the option of leaving. Should this decision be made, however, he has no claim

on the benefits provided by the colony, nor may he take any resources with him[15].

The organization of the Hutterites reflects an especially good understanding of social behavior. For example, they acknowledge that the efficiency of their enterprise decreases if the size of a colony is much below 60 or above 150 people. Underpopulation creates problems in lack of specialization and economies of scale. Problems of overpopulation are explained in Mancur Olson's *The Logic of Collective Action*[16]. With reference to a committee meeting, Olson has stated: "When the number of participants is large, the typical participant will know that his own efforts will probably not make much difference to the outcome, and that he will be affected by the meeting's decision in much the same way no matter how much or how little effort he puts into studying the issues[17]. This implies that "the decisions of the meeting are thus public goods to the participants (and perhaps to others), and the contribution that each participant will make toward achieving or improving these public goods will become smaller as the meeting becomes larger[18]."

There is a common saying among Hutterites: "All colonies [especially other colonies] have their drones." Further, it is recognized that the number of drones increases more than proportionately with an increase in colony size. Given that all goods are in the common pool, individual economic incentives are minimal, material differentials are outlawed, and everyone has equal rights to the resources but the allocation of resources is not individually defined, then a rational, maximizing person would Operate to maximize his pleasure, including leisure. He might engage in such self-seeking activities as trips into town or to a neighboring ranch to "check on" or "pick up" something allegedly relevant to his assigned task.

In a relatively small colony, the proportional contribution of each member is greater. Likewise, surveillance by each of the others is more complete and an informal accounting of contributions is feasible. In a Hutterite colony, there are no elaborate formal controls over a person's contribution. Thus, in general, the incentive and surveillance structures of a small or medium-size colony are more effective than those of a large colony, and shirking is lessened.

The traditional Hutterite political structure is so structured that the best strategy for the individual colony member coincides rather closely with the interests of the whole.

Scarcity virtually guarantees the existence of conflicts of interest among people with differing tastes and abilities. In a society without private property,

where so many decisions are collective and thus politically made, these conflicts do not disappear. Instead, the increased interdependence expands the scope and intensity of the political problem as it decreases the need for, and importance of, private decisions. In a commune, with minimum privacy and maximum interaction, questions of how things should be run must be made to generate as little animosity as possible. This requirement is not easy to meet. Under any decision rule, some Choices contrary to any particular individual's interests will be made. To survive and prosper, the Hutterites must select decision rules that handle conflict with minimum rancor, but which yield rational, reasonably prompt decisions.

Using "external costs" to mean labor, drudgery, or deprivation resulting from the action of others, when the decision rule requires unanimity for action the expected "external costs" for any individual approach zero. As a corollary, any individual has the capacity to preclude the enactment of a decision. We assume that the individual engages in a calculus that includes himself as a beneficiary[19].

In addition to the external costs, every individual undergoes some costs in the form of effort in arriving at a decision. When more than one person is required to make any given decision, time and effort are involved, and the time and effort required appear to be rapidly increasing functions of the size of the group. When the consent of the entire group is required for agreement, these costs may be very high indeed. Any given member, in an attempt to maximize his advantage, may attempt to extract an exorbitant price (up to the sum of joint-action benefits) for his agreement. Clearly, forms of decision making requiring less than unanimity have significant advantages.

Levy states, "In general the recruitment, ideally and actually, of the leadership roles of the government on the basis of predominantly universalistic criteria is quite modern and quite rare"[20]. Yet if the Hutterite system is to remain viable in a modern and highly competitive setting, it is increasingly important that the positions of leadership be rationally allocated. The Hutterites have demonstrated ability to make consistently rational decisions in two crucial areas, the selection of the colony head, and the distribution of persons at the time of branching. Each of these situations is dangerous, for the stakes are high and the decisions are binding and inclusive. Not only must the decisions be rational in a technical sense, but also they must not split the colony into warring factions.

The dominant position in the colony hierarchy is that of preacher. He is charged with general responsibility including the settlement of personal

disputes, the conducting of rites of passage, and political contacts with the world outside the colony.

Next in authority is the householder, or manager. The individual in this position manages the accounts and advises regarding the prudence of suggested purchases. It is either he or the preacher who negotiates with banks, implement dealers, feed mills, cattle buyers, insurance salesmen, realtors, tax assessors, and the buyers of produce. In the past, when relations with the outside could be restricted primarily to commercial transactions, the householder was commonly the only representative to the outside. He also received the local and regional newspapers reporting grain and livestock prices.

The major political question faced by the Hutterites becomes: How do we give God a rational way of making decisions? Every political system must identify those who are assigned primary decision-making roles. There are, of course, methods which deny those subject to the decision the responsibility for selection of decision makers. Given a relatively simple system with little coordination of roles necessary, selection may be based upon ascriptive characteristics, commonly sanctified by God.

As an alternative, the decision may be left up to God by enabling Him to render an Opinion via a random generating device. Given the existence of varying competence and ambition among individuals, it is helpful to place a mechanism of constraint on such a selection process. Purely ascriptive or purely random criteria for leaders seem unlikely components of any viable political system in a highly modernized context. With the very important exception of the preacher, positions are filled entirely by election. The council, which is also elected, initiates changes in appointments to lesser positions, executes justice, and determines who can go into town.

Due to the rapid growth in population and the upper limit of 130 to 175 persons who may live in a single compound, each colony must branch every 14 to 18 years. Upon splitting, a parallel structure is established and a new preacher selected. It would be difficult to overemphasize the importance of the preacher's position, especially as the preacher commonly fills the householder's position during the first few years of a colony's existence.

Although there is some variation in the means of choosing a preacher among the three endogamous groups of colonies, the following is representative. As the time for selection approaches, a group of preachers from nearby colonies assembles at the colony where the selection is to be made. Nominations of the baptized males of the colony are offered. If deemed

satisfactory by the visitors, these individuals are entered as candidates. After all nominations are in, votes are cast by the local males and visiting preachers. The persons receiving five votes or more are entered in the runoff where, from the perspective of the Hutterites, God casts the deciding ballot.

For each individual in the final round there is a piece of paper put into a hat. On one piece is inscribed the word ”Preacher”; the remainder are blank. Each candidate then draws a slip. After all have been drawn, the papers are unfolded and the preacher is known.

Given their traditional mean completed family size of 10 or more, it is essential that provision be made to accommodate population increase. Among the Hutterites the technique is called ”branching out.” In addition to providing additional resources, the split permits a solution to factionally aligned conflict. Given that a very large capital outlay (about $1,000,000 in 1970) is required for a fully equipped colony, fragmentation by other than carefully planned bifurcation is prevented. Further, departure by the malcontented is severely inhibited by the fact that an individual has no claim to the corporate assets after leaving.

Political matters may be at least as important as economic necessity in reaching a decision to branch. There are only a limited number of managerial roles available within any colony and election based on good behavior. Thus, when the population of baptized males exceeds the number of leadership roles by an unknown but potentially predictable margin, problems involving the coordination and allocation of responsibility increase. Eventually severe strain is generated. Hutterites realize that branching should occur before the organization becomes unwieldy.

It is common for the mother and daughter colonies to divide the debt incurred in the establishment of the daughter colony. The mother colony, however, is a proven and productive ongoing enterprise. Although the labor pool of the mother colony will be reduced substantially by branching, there is relatively little danger of overwork—especially since one of the primary factors precipitating division was an excessive number of individuals for the number of productive roles available. Even after division, the man-work ratio will be much higher in the mother colony than on surrounding farms “and ranches.

In the daughter colony, however, the situation is less favorable. A portion of the land at the time of purchase is likely to be of marginal or submarginal quality. Often land must be hacked out of the bush. Although the nucleus farm buildings will have been constructed prior to the actual division, facilities for both livestock and humans will be spartan. Fences must be built,

stock ponds and corrals constructed, and the entire complex of essential sheds, poles, trenches, and lanes must receive attention. Thus, there are clear and present advantages for those individuals who remain at the mother colony. Therefore, the selection of migrating individuals could be filled with tension, conflict, and charges of favoritism. Each of these factors could seriously disrupt the highly interdependent network of relationships that are requisite to the successful functioning of their social order.

Two matters must be settled in the process of division. First, there is the question of division into two groups with a preacher at the head of each. The rules for division prescribe that nuclear families are not to be split and that the two groups are to be nearly parallel regarding demographic and skill characteristics. In addition to spreading responsibility for the maintenance of nonproductive persons, the rule also guarantees a basis for cultural continuity keeping at least three generations in constant contact. In creating the two groups, informal measures are employed. This is possible since everyone knows the rules, and most adults claim to have an intuitive appreciation for the need for demographic balance.

The second matter involves determining which group goes to the new site. The Hutterites, in accordance with their pragmatic orientation, act on an awareness of rules for institutional design. As mentioned above, the basic facilities of the new colony are erected prior to permanent habitation, but to preclude anyone's neglecting his work on the assumption that he will move, no one knows if he will live in the old or new colony until the date of departure.

Prior to departure the members divide into two parallel groups. On the day before departure everyone in both groups packs all personal belongings. The following morning, the junior and senior preachers heading each group meet in the schoolhouse church, pray for divine attention, and draw a slip of paper from a hat. One slip says "go," the other "stay." The group destined to stay helps those leaving to load the trucks. With prayers and tears, the division is completed, each group professing confidence that the will of God has indeed been expressed and that His people will continue to enact His bidding while they are transient participants in His earthly sector.

The charter of the Hutterites provides a suitable guide for the two extremely important decisions to be made by each colony during each cycle. The first is the selection of the new minister prior to division. The second involves the allocation of individuals upon division of the colony. Each of these decisions is made in such a way as to preserve the cohesiveness of the colony.

The absence of overt, disruptive conflict is paramount in the decision-making process. The Hutterites cannot allow the situation to reach the point of binary opposition. This is accomplished by structuring the situation in such a manner as to have decisions made by chance with the accompanying assumption of God's active intervention. The intervention by God guarantees the legitimacy of the decision.

In selecting which group migrates, there is little problem when there are only two alternatives. The selection of a minister is more complex. The Hutterites are fully aware that all who are ascriptively eligible are not equally competent for governing roles. Therefore, the field is narrowed as to make the task easier for God. In this way, the decision God makes will
be relatively rational and the cost in terms of deliberation and bargaining will be kept to a minimum. In this manner, consensus can prevail, legitimacy will be attained, and traditional communal arrangements maintain viability.

Chinese Communes

A third case study, based primarily on an analysis offered by Roy L. Prosterman, Tim Hanstad, and Li Ping in Scientific American, brings a different yet compatible view to communitarian farms[21]. The authors outline the changes in property ownership regimes in Chinese agriculture after the 1949

> The government confiscated the holdings of landlords and wealthy farmers and distributed the property among all farming households on an egalitarian basis. The new landowning families operated small, independent farms and sold their harvest on an open market. Farmers responded to the new system with extraordinary zeal: grain production went up by about 15 kilograms per person each year between 1949 and 1955.

But such progress was not to last, as China began to collectivize agriculture. After consolidating household farms into collectives with hundreds of families, by 1958 the government had further combined collectives into massive communes with thousands of households. Prosterman et al. write:

> These communes took sole ownership of all property, including the private plots. All the farmers worked together on the land, receiving pay for time spent in the field, no matter how little they accomplished. And everyone shared the excess harvest. Under this system, none of the farmers had an individual stake

> in the land, so few cared about making improvements—in effect, the communes severed farmers from their land.

The new farming communes led to massive famine, and leaders began to reconsider their strategy. While keeping formal ownership of farms with the collectives, the new Household Responsibility System divided land among households. After selling a portion of their harvest to the state, families could reap the gains of their harvest. ”The system clearly encouraged farmers to become more efficient: between 1980 and 1984, grain production increased by 16.2 kilograms per person each year, up from an annual average increase of 1.3 kilograms per person between 1955 and 1980.”

But progress peaked, and innovation and investment in the collectives remains stifled. Two—thirds of China’s farmland is underutilized, either ignored, poorly irrigated, or not developed for high crop yields. Prosterman etal. continue:

> The farmers’ reluctance to sink money and labor into any extensive modifications can be directly attributed to their underlying fear that they may not be able to hold on to their property long enough to realize a return on their investment. (In contrast to the changes already made, the costs of which were recovered quickly, the next phase of improvements will take many years to pay for itself).

Chinese farmers face severe disincentives to improve their practices. Their landholdings are very insecure, as governmental interference and ”takings” are commonplace. Certainly, households are not compensated for any improvements they make, and the possibility of takings discourages farmers from cultivating and irrigating unused but fertile fields.

> Fundamentally, though, China’s farmers want more than just improved rules for land takings. They want longer and more secure rights to manage their small plots. With longer and more secure rights in place, farmers would also begin to cultivate undeveloped land—another important step toward achieving agricultural self-sufficiency.

> For China to meet the demands of a rapidly growing and prospering nation, continued reform will be necessary. Prosterman et al. note that perpetual land-use rights are essential to improving agriculture, but that does not necessarily mean private ownership. The authors conclude optimistically about the possibility for Chinese collectives to institute viable agricul ture. Recent

> extensions of land rights to users for thirty years by the government are a move in the right direction. 50 is the strengthening of exchangeable and inheritable land-use rights. The former encourages the best farmers to be most active, while the latter encourages long-term stewardship. Limiting government ”takings” of land also helps conserve productive farmland. Lastly, reforming the practice of reallocating commune land based on changing family size will address its unintended consequence of promoting population growth—something unlikely to help China’s long-term food problems. It is clear that changing China’s property ownership system has great repercussions on farmers’ productivity and quality of life. Continuing to give Chinese farmers greater control and greater certainty about their future use of the land will improve China’s ability to feed itself.

Conclusion

Any society devoted to permanence and continuity must be economically viable. Optimally, the perceived opportunities and benefits flowing from membership in that society will be attractive to the individual participants, and individual maximizing strategies will harmonize with social goals. Under these conditions individually rational behavior will be collectively rational.

Competition has substantial social benefits. General equilibrium models demonstrate that under restrictive assumptions private exchanges in a competitive economy lead to Pareto optimum solution5.The assumption yielding this result is the independence of producers and consumers. Obviously, then, the common property feature that distinguishes communally organized societies creates special problems. The benefits of competition come from the fact that the fruits of individual labor and management can be captured by that individual. Hence he faces pervasive incentives to improve the efficiency of his operation. In marked contrast, the individual in a communal situation finds that both the rewards of beneficial innovations and the costs of mistakes are diffused throughout the community. Communes amplify the problem of harmonizing private with collective rationality.

None of the three societies here examined succeeded, through the forces of religion, culture, and state, in eradicating self-interest, competition, and their results. Although there are strong evolutionary pressures against pure altruism, we do not argue that humans are genetically competitive and selfish[22]. In principle, institutions could be created that substantially reduce

the dysfunctions of competition. The Mormon's Order of Stewardship and the Hutterian Brotherhood provide a sharp contrast in the success of their institutional designs. While the Mormons seem to have assumed that changes in individual behavior would follow from changes in expectations for behavior, the Hutterites developed an intuitive appreciation for man's carnal or selfish nature. They evolved a set of institutional arrangements which tend to align individual maximizing strategies with the collective welfare.

When the Order of Stewardships failed to effectively limit its memberships, it invited and actually encouraged the congregation of the poor. These people drew excessively upon the limited resources of the Order without making commensurate contributions to its maintenance and perpetuation. The Hutterites, in contrast, established an upper limit to the population of any single community. By adhering to this limit, and branching out whenever it is exceeded, the Hutterites have developed a system of informal surveillance of individual work habits and contributions. Although it is accepted that "all colonies have their drones," the number of drones is held to a minimum, and those that exist are subject to informal pressures to produce.

Because the Mormons relied so heavily upon a system of voluntary cooperation in the production and allocation of goods and services, it became possible and profitable for any individual to withdraw cooperation and exploit the system. Such strategies, though individually beneficial in the short run, were collectively disastrous. To keep individual economic incentives to a minimum, and thus avoid damaging exploitation, the Hutterites have rendered all goods and properties public and have disallowed significant differentials in material accumulation. One can realize only those benefits that are available to all other members of the colony.

Of eminent importance in any communal setting are management policies and decision-making capacities. The Mormons made two major errors in the management of the Order of Stewardships. First, membership in the governing body was determined solely through appointment by the revelator, and those appointed to positions of responsibility had no incentives to function efficiently in the economic interests of the Order. Second, although costs in terms of deliberation and bargaining were minimized by the small Size of the governing body, costs in terms of disproportionate deprivations to particular individuals (the wealthy) were high.

The Hutterite system for allocating the position of head preacher employs a balance between rationality and revelation. Achievement records of candidates narrow the field of possibilities, fostering rational selections. To

avoid conflict and rancor, God makes the final decision and manifests His will through the drawing of lots. Other positions of responsibility are filled by election. Since all baptized males have a vote, all enjoy a degree of participation in management. This acts to minimize deprivation costs to individuals. Bargaining costs are minimized as well by employing the elected council in most decisions and by incorporating a measure of chance defined as divine intervention.

Somewhere in between the success of the Hutterites and the failure of the Mormons rests the changing Chinese system. By partially aligning private interests (food from the land) with social interests (good collective harvests), Chinese agriculture has avoided a disastrous ”commons” situation. But economic viability is stifled by a system of insecure land-use rights and indefinite tenure. And without that viability, the Chinese collectives and any other commons face a tenuous future.

[1] John Whitmer, "John Whitmer's History," unpublished manuscript (Modern Microfilm Co., Salt Lake City, Utah), chap. 2
[2] Joseph Smith, *The Doctrine and Covenants of the Church of Jesus Christ of Latter-Day Saints*, vol. 40 (Salt Lake City, Utah: The Church of Jesus Christ of Latter- day Saints, 1948), pp. 30—32. All subsequent references to Mormon doctrine in this article are taken from this source.
[3] The Order of Stewardships is variously known by other names such as the United Order, the First United Order, the Order of Consecration and Stewardships, and the Order of Enoch.
[4] *The Evening and Morning Star* (Nauvoo, Ill.), 1 (July 1832), 6.
[5] John Corrill*, A Brief History of the Church of Christ of Latter-Day Saints* (printed for the author, St. Louis, 1839), pp. 18—19.
[6] Joseph Smith, *History of the Church of Jesus Christ of Latter Day Saints*, Per. I, Vol. I, 2nd rev. ed. (Salt Lake City, Utah: Deseret Book Company, 1963), pp. 364— 365
[7] Ibid., p.365
[8] Joseph A. Geddes, *The United Order among the Mormons* (Salt Lake City, Utah: Deseret News Press, 1924), P. 149
[9] Brigham Young, Sermon of April 17, 1873, cited in *Journal of Discourses*, Vol. 16, p. 11. Communitarianism and the Logic of the Commons 153
[10] Brigham Young, Sermon of April 1854, cited in A. L. Neff, *History of Utah 1847 to 1869,* edited and annotated by L. H. Greer (Salt Lake City, Utah: Deseret News Press, 1940), p. 541.
[11] Leonard J. Arrington, *Mormon Economic Policies and Their Implementation on the Western Frontier*, 1847—1900 (Chapel Hill: University of North Carolina Press, 1952), p. 365.
[12] It is not my intention to underestimate the importance of outside persecutions in the termination of Mormon settlements in Jackson County or elsewhere. However, this factor is extraneous to our discussion, as our focus is on the behavior of individuals within the Order and their effects upon its operation.
[13] Joseph Smith, *History of the Church of Jesus Christ Of Latter Day Saints*, Per. I, Vol. IV, 2nd rev. ed. (Salt Lake City, Utah: Deseret Book Company, 1963), p. 43.
[14] This section draws upon John Baden and Richard Stroup, "Choice, Faith and Politics: The Political Economy of Hutterite Communes," *Public Choice*, Spring 1972, I—I I .
[15] Net attrition has been roughly 5 percent
[16] Mancur Olson, Jr., *The Logic of CoIlective Action* (Cambridge, Mass.: Harvard University Press, 1965), pp. 53—65.
[17] Ibid., p. 53
[18] Ibid.
[19] This section draws heavily upon the conceptualization presented in James M. Buchanan and Gordon Tullock, *The Calculus of Consent* (Ann Arbor: University of Michigan Press), esp. pp. 63—116
[20] Marion Levy*, Modernization and the Structure of Societies*, Vol. 2 (Princeton, N.J.: Princeton University Press, 1966), p. 453.
[21] Roy L. Prosterman, Tim Hanstad, and Li Ping, "Can China Feed Itself?" *Scientific American*, 275 (1996), 90—96.
[22] E. O. Wilson, "Human Decency Is Animal," *New York Times Magazine*, October 12, 1975.

10

A Community Corporation Approach to Management of Marine Fisheries: With Some Potential Applications to Hawaii

SAMUEL G. POOLEY AND RALPH E. TOWNSEND

Introduction

The basic premise of this paper is that in a modern capitalist society, the corporate form (whether for-profit or nonprofit) is a logical and perhaps attractive possibility for community management of common-use resources. The corporate form may have particular advantages for long-term efficient conservation of a commercially utilized natural resource asset, such as most marine fisheries (Townsend, 1995). But it may also be applicable for small-scale commercial, recreational, and subsistence uses. Granted well-designed allocation of initial shares, including the potential for restrictions on their monetization, the community corporation can also foster several attractive political and sociological values.

Critics of neoclassical economics tend to underestimate the heuristic power of its explanatory pedagogy. Certainly this is true in fisheries, where an overarching bioeconomic framework (e.g., Gordon, 1954), combined with the idea of the "tragedy of the commons" (Hardin, 1968), shapes fisheries policy analysis. This perspective can be summed up in the idea of optimization"

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(*maximum economic yield*) and the application of social benefit—cost assessment to fisheries regulation. Both are premised on the foundations of microeconomic theory, particularly individual maximization by well-informed economic agents (e.g., fishing vessel owners), and the
social optimality of the market in equilibrium. These coexist uneasily with natural variabilities of population dynamics in fisheries and the incomplete information upon which fishers must act.

Economists were long unsuccessful in their efforts to import the concept of maximum economic yield into the dominant biological paradigm of fisheries management (Anderson, 1987). Their promotion of economic efficiency as legitimation for privatization of fisheries allocation (i.e., who gets the fish) has been more successful. The idea of *individual transferable quotas* (ITQs) has been the vehicle for this success, with Australia and New Zealand being major sources of policy leadership (Annala, 1996)[1]. The ITQ approach is consistent with the new social structure of regulation (described next), but fails to resolve further problems of regulatory discordance.

Social Structure of Regulation

A central problem in natural resource management involves a gap between the *public trust* (e.g., long-term conservation of fishery stocks and their ecological environment) and the immediate interests of those utilizing a fishery. The tension between private and public interests leads to conflicts over decisions concerning the use and conservation of natural resources.
Regulatory government evolves from these conflicts over natural resource management, with the state mediating relationships between capital and nature (O'Connor, 1988, p. 23).

However, the regulatory regime that constrained natural resource use over the past twenty to thirty years is rapidly changing. Eisner (1994) summarizes the earlier situation as societal regime based on the conviction that government had to accept responsibility for preventing or minimizing hazards to human health and the environment. Government extended its regulatory authority over many decisions previously reserved for business. That *regime* required a highly professionalized, complex governmental structure.

This regulatory regime was initiated during the apogee of the US. economic growth following World War II. The recessions of the 19705 and 19805 weakened the fiscal resources available to government and increased competition in the private sector. There was also increased international competitiveness, particularly from Europe and Japan but also from the newly industrializing countries. Together these factors generated a strong incentive to reduce the social overhead of US. business. The *efficiency* regime was initiated in which market mechanisms are viewed as appropriate for dealing

with negative externalities (e.g., pollution permits) and Where the general level of economic competitiveness is more important than (marginal) improvements in the environment (Eisner, 1994).

Community and environmental groups have been of several minds about these regulatory changes. Some accept that many government-based approaches to regulation and resource management have been inefficient and frequently have failed[2]. Nationally, the more conservative wing of the environmental movement favors market-based approaches to natural resource regulation[3]. Many communities and some environmental groups are sympathetic to the plight of small business bearing the costs of adjustment to government regulation in an increasingly competitive marketplace. Yet many, if not all, conservation groups also believe that only government can guarantee resource conservation and environmental protection. Hence, a community corporation approach to natural resource management may meet multiple social objectives.

Fishery Management in the United States

Fishery management policy in the United States occurs largely Within a constricted world of localized politics, a specialized bureaucracy, and a relatively small industry. Much wider political and economic forces influence the choice of regulatory options and constrain those compatible with a market-based economic system.

Two apparently contradictory forces drove U.S. fisheries management policy for twenty-five years following World War II: (1) the conservationist natural science perspective Of professional fisheries biologists (who dominate the public policy technocracy) and (2) the private property prerogatives of commercial fish harvesters and processors. This conjunction failed to meet the interests of small-scale commercial, recreational, subsistence, and indigenous fishers. The oft-competing interests of environmental organizations and natural-resource-intensive commercial development (e.g., fishery development, water supply, hydroelectric) were likewise neglected.

The Magnuson Fishery Conservation and Management Act of 1976 (Magnuson Act) broadened federal government mediation of fisheries. This asserted federal government control over marine fisheries within the 200mile exclusive economic zone. It also initiated a process of strategic bargaining by interest groups participating in newly formed regional fishery councils. As such, the Magnuson Act represents a classic example of political pluralism Within tightly constrained political boundaries and loosely structured economic and social systems (Pooley, 1993). Despite considerable expenditure of time and money, the Magnuson Act has generated little satisfaction with the fisheries management process in the United States and very little progress

toward substantive procedural reform in the twenty years after the Act's implementation.

However, federal requirements for benefit-cost assessments of regulation and the basic contradiction between conservation and commercial fishery interests opened a window for economists. One proffered solution has been the initiation of a rights-based approach to fisheries management (Neher et al., 1989). This assigns conservation management to government while devolving allocation decisions to the market. These market-based approaches complement the new conservative era. The "efficiency regime" is contentious but increasingly incorporated into fishery management in the United States.

Economics and Fisheries Management Alternatives

Fisheries economists soon discovered that without traditional social controls, monetized fisheries tend toward overexploitation. Economists first suggested reducing the number of fishing units (e.g., vessels) permitted to participate in a fishery (termed *limited entry*). Later they found that owners would invest in more fishing power per vessel (*capital stuffing*), defeating the conservation Objective of constraining fishing capacity (Townsend, 1990).

Economists followed with the development of ITQs. Under this system the government would continue to set the conservation rules, but shares in the proposed total harvest (the quota) of a marine resource would be sold at auction or given to the previous participants (Squires et al., 1995). Those holding quota shares could then conduct their fishing operations more efficiently by modulating their fishing inputs (capital, operations, and labor) to their anticipated quota. Fisheries administrators initially liked the ITQ approach because it vested in the government the "conservation" decision (how much fish could be harvested as a whole) While leaving to the marketplace the "allocation" decision (who would get to catch it)[4].

However, at least four important limitations in the implementation of these property-rights systems have tempered initial enthusiasm. First, these systems monetize fishery access. As a result, there was exploitation of these salable rights by those with greater access to financial capital and greater finesse in handling the financial side of fisheries operations. This produced some migration of fishing rights away from local communities. Second, to avoid this, restrictions were imposed on the sale or lease of such quota shares. These restrictions increase administrative complexity (hence government costs), reduce economic efficiency, and occasionally cause hardship for individuals unable to sell their shares. Third, frequently the initial allocation of quota to individuals and to communities is controversial. Allocation of shares either creates a de facto asset from a public resource or requires current fishery participants to buy back into their own fishery. This process, and the reallocation caused by tradeable shares, can create additional fissures

between user groups. Fourth, when the total quota is determined by the outside government, the separation between the governed and government continues.

Several management systems in Alaska have an interesting wrinkle: local fishing communities were vested with certain quota rights, termed CDQs (community development quotas). However, this approach maintains government control over the total allowable catch (the quota). Could more control over the entire resource management process, including determination of quota (Q), be vested in local governance? This question leads conveniently to the idea of corporate, and community, management of fisheries.

Corporate Management

Townsend (1995) and Townsend and Pooley (1995b) suggest ”distributed governance” in marine fisheries. This places the practical elements of rights based management into a regulatory and governance continuum sensitive to conditions in particular communities. The existing ITQ and CDQ systems. maintain government centrality in the conservation and management decision process, which continues the alienation of many users from the difficult decisions concerning regulation of natural resource uses. Alternatives include co-management, cooperative and corporate institutions holding rights to make overall management decisions within a conservation and ecological framework monitored by government. This would redirect many management functions from the government to the community, reducing regulatory alienation and increasing the level of information for fishery management decisions.

The concept behind corporate management of natural resources relates primarily to the incentive structure rather than the decision structure of the dispersed management authority. There are important differences between the incentives under cooperative and corporate governance. These differences are most pronounced when considering long-run incentives for owner-members. ”The decision structure under democratic, cooperative governance generates a greater financial stake in current income and lesser financial stake in future income, as compared to the financial interests of a shareholder in a corporation” (Townsend, 1995, p. 42).

Corporate management is a business model that emphasizes financial equity in fisheries optimization. Those with a long—term interest in a fishery (which could include any of the stakeholders, including conservation groups) could bid current resource use away from those with short-term interests. Conservation of the natural resource in the short term would represent a long-term investment in that resource, to the benefit of those with a higher valuation of the future.

For an industrial fishery, this is fairly straightforward (Townsend and Pooley, 1995a). However, in multiuse fisheries, political problems deciding which elements of the community would be incorporated into these corporations, and how they would operate. And how would a corporate structure evolve, particularly in small communities where distrust of business roughly equals distrust in government? Still, reliance on government centered institutions of old-style natural resource management is probably less viable as the economic environment and access to natural resources become more competitive.

Community Management

Efficiency is a central concern under the neoclassical fisheries economics paradigm. Recommendations toward private property rights approaches (both ITQs and corporate management) address that concern. But efficiency has its own costs, especially without compensation to those whose welfare is reduced by the new rights regime. ”Co-management” alternatives based on cooperative approaches and local self-government are proposed (Pinkerton, 1994; Jentoft and MCCay, 1995). However, with heterogeneous users of a common-pool resource, cooperatives may also be limited in applicability. In addition, there are operational difficulties with cooperatives which reduce their prospects for long—term conservation (Townsend, 1995). The community corporation, by combining the advantages of locality with equity, may be superior.

The basic approach for a community corporation approach to natural resource management is to identify the stake in regulatory decisions of participants, potential participants, and the general public. Determining these stakes is a political question with broad ramifications. Founding precepts of the community corporation must include norms of consensual accommodation and flexibility in the allocation and reallocation of resource use rights. Rights and responsibilities of the community corporation must be explicit. This type of distributed governance would probably involve a covenant with the central government listing separable and mutual Obligations and authorities for the parties. This might include covenants concerning the long-term conservation of the resource, along with other elements of the public interest.

A community fishery resource corporation might issue shares to current fishers and other shares to remaining stakeholders in the fishery. These shares might be transferable within a particular interest group (e.g., within the commercial fishery sector) or between like-minded organizations within a particular interest group (e.g., between recreational fishing clubs). A neighborhood organization might hold nontransferable shares. This would preserve their voice regarding their geographical interest in the fishery (e.g.,

harbor use). Alternatively, all shares could be freely transferable (i.e., access shares could be purchased by anyone).

The community corporation could generate revenue by charging user fees, harvest fees, or other fees as a condition for access to the natural resource. This revenue would finance resource management activities. The community corporation would operate like any other owner of an asset, even if its ability to restrict use of the asset were limited by its governance agreement.

Community corporation decisions (e.g., on access fees, fishery regulations, etc.) would be based on voting shares and on the fiduciary responsibilities of the management board. These would not necessarily be equity shares (although this could be the case, particularly if each interest were required to purchase its initial shares from the government). To the extent that shares differed from equity (e.g., if shares were divided evenly between commercial, recreational, and community interests Without an explicit tie to the value of the fishery resource itself), then some of the efficiency characteristics of equity shares would be lost and inconsistent decision-making encouraged (Easterbrook and Fischel, 1983, p. 195). In a fully monetized community corporation, residual claims (net revenues from fishing access rights) could be distributed to the shareholders or recycled into the community or the fishery resource—as determined by the shareholders and their directors.

One concern involving any kind of ”distributed governance” involves the balance with the central government. Throughout the world we find problems with the vulnerability of the local community to external forces (e.g., speculative investment, environmental degradation) and to the limited resources for scientific research, monitoring, compliance, and enforcement. Frequently ”institution-building” resources will be needed to ensure that the new management authority has the capability to meet the terms of its governance covenant.

Some concerns about multiuse dispersed governance relate to issues of geography and community homogeneity. Should particular geographical communities be vested with the management of natural resources in their own backyards? How can people who do not live in those geographical communities but who have utilized resources accessible through those communities be involved in the governance community? These are the familiar boundary issues raised in the fisheries co—management literature (see Hanna et al., 1995), but extending to the sociological boundaries of multiuse resources. One potential solution is ”nested” Co-management, where conservation and management decisions are exercised over a range of levels (Ostrom, 1995). And the ”communities” themselves should not be strictly geographical but also include aspects of ancestral heritage, conservation interest, and previous participation.

Another issue has to do with the scope of authority for the governance community. If a governance community makes a discriminatory or ”foolish” resource allocation, should the state or federal authority determine and protect the public interest? Would such issues be included in the basic governance covenant? The more heterogeneous the governance community, the more likely that such issues would need to be adjudicated with the civil courts, a viable alternative to the political process.

Establishing or reestablishing local authority also requires weighing the advantages of more immediate knowledge of the natural resource against the potential increase in institutional costs incurred by these new authorities. A similar weighing involves economies of scale in scientific, monitoring, and enforcement activities. Although there may be a strong argument for distributing governance, in some cases the costs may outweigh the benefits. This is not strictly an economic algebra, but the ultimate effectiveness of the new structure depends on whether it can be effective with the available fiscal and human resources.

There is no obvious choice of management structure for a community used natural resource, particularly a fishery with heterogeneous users. What should also be obvious is that agency costs currently inherent in a government-centered approach to fisheries management can be reduced. The community corporation is one of several options, and its advantages should be weighed along with those of other co-management alternatives.

Hawaii as a Potential Application

Hawaii’s ocean fisheries and related coastal and marine resources are examples of local-scale regulatory decisions within a political and economic system structured by multinational capital (Neubauer and Pooley,1982). Fishing and related ocean industries are primarily small-scale in Hawaii’s economy[5]. Even in a small state, the psychological distance between government and the governed is not trivial. The near-shore fisheries are regulated by the State of Hawaii. The off-shore fisheries are managed by the Western Pacific Regional Fishery Management Council under the Magnuson Act. Achieving consistency between federal and state regulations is a substantial political feature of Hawaii fisheries management.

In Hawaii, a community-oriented perspective toward fisheries regulation might change the terms of governance. The state and federal governments shift from reactive regulators of fishing operations to government as performance monitor. Local communities might find creative means for dealing with regulatory problems if they had the authority and incentive to make those decisions.

Unfortunately it is not clear that neighborhood, community, or voluntary organization politics are inherently any more democratic than other levels of

politics. Many issues of real significance require cross—cutting authority with other neighborhoods and other jurisdictions. A mixture of community, user group, and broader governmental authority might be productive. The community corporation has many advantages in these situations. That includes both the formality of its initial structure (the initial specification of shares) and the corporation's flexibility for making agreements and contracting with other interests.

In Hawaii one could imagine vesting control over harvest Of reef resources in the hands of specially constituted reef-user cooperatives based on shoreline boundaries. For harvest of near-shore fisheries, where access may be much more important than efficiency and the ocean boundaries may be too permeable to allow tighter definition of property or management rights, neighborhood boards might be responsible for controlling physical access (e.g., at boat launch ramps). We might imagine communities requiring anyone fishing in local waters—commercial, recreation, or subsistence—to participate in community meetings on resource use as a condition of access to the fishery. We could imagine that multifaceted Off-shore fishing interests could be incorporated as management corporations with authority over the harvest of selected resources. We could imagine that a marine council might devise methods for geographical separation of competing marine users (fishers, boaters, etc.) to reduce at-sea conflict by setting limits on fishing access, times, or grounds in exchange for a more direct stake in the future of their ocean resources. Any of these institutions might be organized as community corporations, Whether on a profit or nonprofit basis. These approaches would have to be worked out while building these institutions.

In the nonmonetized fisheries (e.g., recreational and small-scale commercial), the state and federal governments might remain as enforcement powers, backing up the social power of the community. Even in a commercial fisheries corporation, the legal framework and constitutional protections of the state and federal authorities would be available. These authorities might vest much of their formal power into locally instituted conflict-resolution approaches rather than applying formal citations and court appearances. In each of these situations, strict contractual relationships between the community authority and the government would be needed to ensure the broader public interest in conservation and equitable access for those from outside the governance community.

Conclusion

There are undoubtedly parallels between this potential application of a community corporation in fisheries and other natural resource management situations. However, marine fisheries are unique. They are one of the few remaining commercial harvests of wildlife. Their human and natural

boundaries seldom coincide, and both boundaries are fluid. They coexist within overlaying uses of the ocean and its coastal regions. How an actual community corporation would operate must be developed more fully, with a particular application in mind. Relevance to more generalizable results would be better tested then.

As local fisheries throughout the United States, as in Hawaii, become increasingly urbanized and heterogeneous, it is becoming more difficult to depend on traditional community norms to manage natural resource use. Concurrently, the traditional methods of governmental fisheries regulation are increasingly less useful in balancing Optimum use with long-term conservation. The future within this status quo is not appealing: fewer and fewer fishery resources for people to enjoy and from which to generate incomes and social value. Increasingly complex governmental controls on resource use, or expensive centralized application of a monetized rights-based management system are additional possibilities. Adoption of community-based governance regimes is an alternate approach. Finding ways to vest authority over fisheries resources in the relevant communities is one way to rebuild ”community.”

[1] The idea behind ITQs is that markets for fish quota shares would optimize the individual economics of the fishery while avoiding the inefficiencies of direct biological controls, except for quota determination. See Squires et al. (1995) for a thorough discussion.
[2] But see also Gregg Easterbrook's defense of liberalism and the environment ("Dept. of Disputation: Here Comes the Sun," *New Yorker*, April 10, 1995, pp. 38— 43).
[3] In some cases environmental groups have bought up pollution permits, reducing the amount of pollution industries in particular areas can generate and forcing dramatic changes in industrial operations. Similar approaches have been suggested for wetlands (as in the Nature Conservancy's land purchases).
[4] Leasing or selling of quota shares was the means of reallocation of quota among users.
[5] Fisheries and seafood marketing comprise less than 1% of Hawaii's gross state product. Even the charterboat industry is a small component of the tourism industry. Fishing, however, is a broadly based activity, with as many as 25% of Hawaii's resident households engaged in fishing during the year (Pooley, 1993).

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11

International Fisheries Management Institutions: Europe and the South Pacific

DOUGLAS S. NOONAN

Marine affairs and fisheries science rest somewhere between public policy and biology, between economics and politics, and between international and local arenas. These synergies generate powerful challenges and subtleties for managers trying to balance environmental conservation with economic growth and stability in the face of collective-action problems. The ”enclosure movement” during the 19705 partitioned oceanic resources to national jurisdictions in order to avoid the tragedy of the commons. National authorities claimed the legal opportunity and responsibility to exploit the resource fully while ensuring sustainable harvesting patterns. But creating exclusive economic zones 200 miles from shore for coastal states has not yielded the economic efficiency commonly associated with partitioned resources. Where management once failed on a global scale, it now also fails on national levels[1]. National caretakers have, generally speaking, not been able to deter overfishing, overcapitalization, and the dissipation of economic rent from fisheries.

As a transboundary, fugitive resource, some fisheries have been subjected to management institutions on an international or regional level. International organizations and arrangements are uniquely positioned to govern regional fisheries. The institutional structure of international fisheries is critical to the success and failure of most fisheries. Effectiveness can be

measured by looking at how each international organization has conserved the biological resources, rationalized industrial capacity, and controlled access to the fishery. *The effectiveness of each institution depends in part on certain essential design characteristics of the arrangements which translate the actions of participants into long-term, sustainable management.* Determining why some institutions are more effective than others at analyzing and managing fishery resources provides a basis for designing effective solutions to the collective-action problems associated with fisheries and other commons.

Two prominent fisheries illustrate this: the Northeast Atlantic, under the jurisdiction of the European Union; and the South Pacific, where the Forum Fisheries Agency operates. The relationship between the institutional Characteristics of the case studies and their effectiveness in providing for the sustainable biological and economic health of the fishery indicate ”design principles” which promote relatively effective governance and relatively ineffective governance as well[2].

Evaluating Effectiveness

A quick glance at the European Community and the South Pacific regions suggests levels of institutional performance which are quite different from what actually takes place. The European Union has a well-established collective—action forum with access to a wealth of scientific knowledge of the region and advanced surveillance capabilities. The South Pacific island nations, on the other hand, are tiny outposts in a vast ocean fishery scoured by vessels originating from richer, formerly colonial powers.

Careful analysis reveals that contrary to what one might expect, management is failing in Europe and succeeding in the South Pacific. Many North Atlantic fisheries are biologically depleted and marked by conflict. The opposite is the case for the Pacific island nations. While still seeking better compliance and more revenue, the Pacific managers have successfully established a system for keeping foreign fishing vessels in line while exploiting the abundant tuna resources. Management effectiveness in both regions can be evaluated based on three aspects of fisheries in general: its biological resources (the health and harvesting of fish), socioeconomics (industry capacity, net economic returns, etc.), and its access arrangements (rules and compliance).

European Union

Postwar European integration led to the Common Fisheries Policy (CFP) in 1983. With the CFP, the European Union assumed control of fisheries management within its member states' jurisdiction.

BIOLOGY

The CFP'S regulation of the biological aspects has been guided by a vague "relative stability" principle. Under this principle, regardless of the biological status of the stock, policy makers seek to ensure that (a) the annual catches remain the same or increase, and (b) the catch rates remain the same or increase. In light of this approach, the effectiveness of the CFP can be assessed.

In European Union fisheries, most bottomfeeding and surface stocks are fished well above their maximum sustainable level. Michael Holden lists sixteen fish stocks for which analytical assessments are available[3]. For each of the cod and haddock examples listed, the (a) total catch has decreased since 1982 and the (b) catch-per—unit—effort (CPUE)[4] has declined in the last decade. "Relative stability" has not been achieved for these stocks. Moreover, most other stocks demonstrate the long-term implications of targeting increasing catches. Eleven of the sixteen stocks have undergone decreases in CPUE since 1982. When the CFP achieves its first criterion of increasing or stable catches, its success is offset by declines in CPU E. For many stocks, fleet efficiency (as well as profitability) is declining as target stocks disappear. Only one of the sixteen stocks meets both of the "relative stability" criteria.

The primary management tool of the CFP has been regulating the total allowable catch (TAC). Setting annual quotas for individual species has proven inadequate to constrain fishing behavior and improve the fishery. With remarkable consistency, the Council sets TACs above the maximum levels scientifically advised. According to the European Commission, TACSnare often set at levels higher than previous years' actual catches. After the TACs have been set, very often the actual landings exceed either the scientifically recommended or Officially designated catch levels, sometimes both. Further, quota systems promote misreporting and discarding.

To control fishing effort, European managers have looked to technical conservation measures, restrictions on fishing techniques and practices. Measures like limited days at sea, gear types, and mesh sizes are poorly

enforced and add to fishing costs. Perversely, regulations like quotas and minimum catch sizes encourage wasteful practices such as discarding. One of the fisheries most severely struck by discards is the haddock fishery. The Sea Fish Authority estimates that of the 960 million haddock caught in 1985, fishermen discarded 460 million[5]. The EU "common pond" is biologically endangered, with relative stability unachieved, TACs inadequate and inappropriate, and technical restrictions ineffective.

SOCIOECONOMIC

In the heavily industrialized European fisheries, socioeconomic considerations are paramount. The EU's drive toward a common market gives it legal competence to control the structure of the fishing industry and define access rights. EU Regulation No. 101/76 states that the Structural policy aims "to promote harmonious and balanced development of this industry within the general economy and to encourage rational use of the biological resources of the sea and of inland waters." Only recently has this topic received much attention under the CFP.

Despite dwindling biological stocks and a fleet at least twice the size necessary to fish efficiently, the EU's structural program has historically promoted an increase in the Union fleet capacity. Prior to 1983 Europe's fleets were already inefficiently large but still growing. Nonetheless, the CFP's structural program, especially in its early years, not only failed to constrain the expanding capacity of Europe's fleet; it subsidized increased fleet investment, construction, and modernization. Subsidies from national sources augmented early CFP subsidies. Today, the structural program's subsidies and buy-outs account for most Of the CFP's annual budget. A lack of restraint on fleet capacity is at the root of the CFP's difficulties. Overcapacity forces myopic decision-making by fishermen, leads to overfishing, and exacerbates problems of political management.

ACCESS

The EU has proven quite capable of restricting access to its fishery with respect to foreign (non-EU) fishermen[6]. Successes in acting as a single coastal state vis-a-vis external relations have not carried over in attempts to apply a consistent legal regime regarding fishing access by Union members. Although the principle of "equal access" exists in the EU Treaty, this ideal has yet to be

realized. In the Romkes case, the European Court of Justice decided that (to prevent all EU fishermen from racing to capture a Unionwide quota) the overexploited condition of the fisheries permits derogation from the principle of equal access in the form of TACs allocated to nations.

But the Court also ruled in the Factortame case that national governments may not restrict access to those quotas based on nationality. As a consequence of this inconsistency, many fishermen register their vessels in foreign nations and fish their quotas, thereby undermining the national quota system. The inability of the CFP to harmonize national policies to a point where access rights are Clear and consistent points to another weakness of the CFP. Access limitation implies compliance with the rules. The weak enforcement in the EU is evident in armed conflict between fishing vessels, massive illegal fishing, and a general lack of compliance. Conflict runs rampant in North Atlantic fisheries[7]. Abuse of the CFP rules is pervasive, with illegal catches estimated at half of the legitimate total[8]. According to another account, ”In practice, existing regulations within the Common Fisheries Policy are already flouted and widely ignored. It has become something of a bad joke[9].

”The EU’s ”inspectorate of the inspectors” does not make the national monitors accountable. The pan-European policing force lacks vessels of its own. Inspectors must ride as guests on national vessels. Michael Holden estimates the probability of a vessel being inspected at less than one in 120 trips, or less than once per two years[10]. Furthermore, monitoring by national agencies is unevenly distributed across the Union and is nationally biased. For example, Spain, with eight times the UK’s fleet capacity, employs only one-tenth the number of inspectors as the UK[11]. Furthermore, there is evidence of collusion to break rules between fishermen and their national authorities and among fishermen. National authorities and courts notoriously favor their countrymen.

Forum Fisheries Agency

The situation in the South Pacific is decidedly different. Sixteen Pacific island nations founded the South Pacific Forum Fisheries Agency (FFA) in 1979 to conserve and optimize the use of their fisheries resources[12]. The duties of the FFA are quite limited compared to the EU. The FFA acts as a forum for harmonizing and coordinating fisheries policies of its member states. Its most valuable role is negotiating access arrangements with the distant-water fishing nations.

BIOLOGY

The region possesses a relatively healthy fishery primarily consisting of highly migratory tuna. Currently, foreign fishing underutilizes the skipjack, yellowfin, albacore, and bigeye tuna resources. According to the UN's Food and Agriculture Organization, the major tuna stocks of the region can sustain a large increase in catches, even a doubling in the case of yellowfin[13]. This projection is even more significant in light of the doubling in tuna production in the South Pacific that has already taken place since 1980. Even as the fishing effort increases, stocks appear to be able to support it: assessments based on catch-per—unit-effort since 1978 indicate "steadily increasing trends in apparent abundance" for skipjack tuna[14].

This is not to say that all of the South Pacific is without risk. There is concern among scientists regarding the abundance of bluefin. In response, there have been dramatic reductions in the Japanese fleets licensed for the fishery, and some areas have been closed to foreigners altogether. The albacore is in danger of being overfished, posing the FFA's first major biological management challenge. Islanders and environmentalists faulted large-scale driftnetting that can cause "growth overfishing," fishing that creates excessively high mortality rates among young fish. The FFA rallied international support for banning of large-scale driftnetting by 1991. Since then there are promising signs that the albacore stock is responding to these measures, with catch rates for troll vessels increasing after a period of rapid decline[15]. The restoration of the albacore fishery as a result of international pressure can be championed as one of the successes of the FFA.

SOCIOECONOMIC

The Agency's control over the socioeconomic side of the fishery is considerable, given the constraints of the region. The islanders lack the industrial capacity to exploit their resources themselves. They have jurisdiction over those resources, however, and can extract some economic rent from them through access fees[16]. The island nations can control the number of fishermen and the amount of fishing effort by manipulating the access fee and making it unaffordable for the less efficient vessels to fish the area. The member states' ability to extract an income from their resources is limited, however. (In 1995 fees approximated $60 million, whereas the tuna harvest reportedly topped $1.66 billion)[17]. One constraint is the susceptibility

of the fishery to global market trends, such as changing tuna prices and fuel costs. Also, the islanders' lack of capacity to exploit the resource themselves puts them at a disadvantage. Another important limitation comes from the ability of the foreign nations to advantageously negotiate with individual island states. To prevent nonmembers from playing the interests of one group of islanders Off against another, the FFA acts as a chairman in negotiations.

Since the FFA began, the entire atmosphere of the negotiations has changed. The multilateral agreement signed between FFA members and the United States in 1987 obligates the U .S. to pay access fees (around $18 million annually), even for tuna fishing done in certain high-seas areas. According to the China Fisheries Association chairman, Taiwanese purse seiners are paying millions of dollars in access fees to Papua New Guinea[18]. Also, the Soviet Union agreed to pay millions of dollars annually to Kiribati and Vanuatu for access. Now the Solomon Islands gains nearly 50% of its gross domestic product through fisheries activities, and 40% of Kiribati's GDP comes from fisheries access revenue. FFA-assisted access negotiations between the Cook Islands and Korea and Taiwan yielded a 126% increase in foreign aid from 1985 to 1987.

The FFA's negotiating effectiveness is also evident in the Pacific Islanders' increasing control through "Minimum Terms and Conditions" of access. The most significant restriction has been in the form of the Regional Register of Foreign Fishing Vessels. Standardized conditions give the FFA more than cash in exchange for access—they give valuable information about fleet movements, scientific data on stock dynamics, and critical tools for controlling access.

ACCESS

Controlling access to the South Pacific fisheries presents challenging problems to the tiny islands which dot the vast ocean area. The high mobility in the fishing fleet makes tracking and placing observers aboard foreign vessels problematic because many of the vessels do not call at ports in the region. As the foreign fleets set in on the South Pacific tuna stocks, however, the small island nations turned toward cooperative efforts to try to regulate and monitor access to FFA waters.

The Regional Register of Foreign Fishing Vessels provides an effective control mechanism. The Register's effectiveness comes from its dual purpose: to blacklist Violating vessels and to improve the regional database through

reporting requirements. FFA members use the threat of blacklisting to gain compliance and substantial income from violators. In an effort to maximize their limited resources, the Forum nations allow vessels and police from neighboring nations to undertake enforcement in other nations' waters. The FFA coordinates the activities of a small fleet of surveillance vessels. The FFA also coordinates aerial surveillance with Australia and New Zealand's military operations. Australia provides assistance with upkeep and operation of patrol vessels, plus help with a communications network to improve maritime monitoring.

Under the FFA, there has been improved sanctioning and compliance with rules. Severe penalties for illegal fishing are one of the primary reasons for the Regional Register's effectiveness. There are many examples of the F FA bringing sanctions against licensed and unlicensed vessels in the region[19]. The vast South Pacific offers many opportunities to cheat on the system by under-reporting or ignoring the rules. According to former FFA head Phillip Muller, "It's easy enough to quantify how much they're under-reporting because without a certain rate of return you don't survive"[20]. Although there are still some significant problems, "the Regional Register has now been acknowledged by [distant-water fishing nations] as highly effective in ensuring compliance with license conditions, and has been adopted as a key element of the enforcement procedures"[21].

Characteristics of Effective Institutions

The disparity in management effectiveness between the European and South Pacific regions is so severe that it raises the question: What accounts for the differing performances of the management institutions?

Institutional mechanisms (or design principles) which contribute to effective, long-term policies are crucial to the overall success of a regional cooperative organization. The different institutions in the EU and the FFA produce different incentives and management success. The following incomplete list of principles suggests some critical components of effective international fishery management institutions[22].

Regime Design	
Clear limits of the fishery	Scope of the fishery (including management authority and access rights) clear and limited
Conflict resolution	Low-cost arenas for resolving disputes over compliance and rules
Monitoring and sanctioning by beneficiaries	
Decision-making rights for fishermen	Collective Choice arrangements represent fishery beneficiaries and participants.
Coordinated levels of governance	Integrated levels of governance, each with authority commensurate with its responsibilities
Management Paradigm	
Integrating approach	Congruence between socioeconomics and biology in management

Two aspects of central importance to international fisheries management organizations are the regime and the paradigm. The ”regime” relates to the organizational structure and rules for participation. Miles concludes that the international system requires a management regime, because ”wherever stocks are shared, either between neighboring coastal states or between coastal states and the high seas, regional organizations, or at least continuing agreement between the parties concerned, are a necessity”[23]. The second aspect of the fishery encompasses the particular management paradigm. The methods and policies of the managers determine how fishermen interact with the resource.

Regime Design and Institutional Effectiveness

Clearly delineating the extent of a fishery, in terms of resource size and eligible participants, is a fundamental political problem. Even if all participants are known, ambiguous or disputed boundaries can lead to overfishing. For example, the physical boundaries of the waters off the British coast are hardly in question, but inconsistent access rules for those fishing grounds frustrates management. Until the CFP resolves this issue, management will continue to invite overfishing and poor compliance based on nationality. South Pacific

nations face boundary problems in achieving recognition of their jurisdiction over the highly migratory tuna stocks on the high seas as well 'as in their national waters. So long as there is open access on the high seas, a threat to the health of the tuna stocks persists and resources are wasted.

Effective management regimes rely on functional, low-cost mechanisms for resolving disputes among management officials and fishermen and among fishermen. In the European Community, evidence suggests that the system for resolving conflicts between fishermen is wholly inadequate. As a direct result of EU policy, violent conflict runs rampant. European Court of Justice rulings are usually hollow, for the national governments largely responsible for enforcement of decisions have an incentive to Shirk and support their own nationals. Members of the Forum Fisheries Agency fare much better. Access negotiations serve as a useful conflict resolution mechanism. International negotiations, however, are usually very slow, for the negotiating forum is undeveloped. In cases where diplomatic negotiations rove inadequate, national courts have jurisdiction to give rulings. National authorities benefit from reasonable rulings through better negotiating relations and better compliance with and commitment to rules.

Effective monitoring and sanctioning present a fundamental challenge for any common-pool resource manager. Because the benefits of punishing violators are shared by all beneficiaries of the fishery, effective monitors must be low cost and accountable to those beneficiaries. The EU’s inability to monitor and to sanction violators is due in part to the minimal accountability of its monitors (i.e., national navies) to the resource’s beneficiaries (i.e., fishermen and European public). Without Union-level policing and punishing, it is doubtful that sufficient commitment can ever be generated to ensure compliance with the CFP. The FFA monitors, on the other hand, are held accountable to the beneficiaries of the fishery: all of the member nations. Allowing a foreign vessel to violate the rules serves neither the individual interests of an FFA member state nor their collective interests.

Fishermen can fish most efficiently when given the freedom to make those decisions and to devise arrangements for collective decision making. For rules to be appropriate and sustainable in the long term, modification must take place by those who have a vested interest in the well being of the fishery. European fishermen, the ones with the most intimate knowledge of local fishery dynamics, find themselves at the mercy of EU directives issued from Brussels on all manner of fishing activities. Quite often this negotiating process

is characterized by political horse-trading and dealings based on issues entirely separate from fisheries[24].

Participation in the decision-making process in the South Pacific takes place in a much lower-order institutional level, leading to more flexible collective-choice arrangements. Controls over how the vessels operate, even if they were enforceable, are currently very limited. With the exception of the ban on driftnetting, fishermen are permitted great freedom to choose how, when, where, and for what they fish. Even at the international level, decisions are made largely by ”fisheries practitioners” in the region rather than by agriculture ministers or other national politicians[25].

Organizational structure is the last key ingredient to a successful fisheries management regime. In large, complex fisheries, the more local governmental jurisdictions can be nested within the larger ones.[26] Institutional effectiveness is partly determined by the way in which these levels interact and whether decision-making responsibilities are commensurate with that level’s powers. Analysis of the EU’s top-down governing superstructure supports Miles’s assertion that what ”seems to be more important than centralization of decision-making is that lines of authority and the competence to decide be commensurate with responsibilities”[27]. The South Pacific takes a decidedly different tack to organizing the different levels of governance, emphasizing a bottom-up approach. While diplomats and technocrats in Brussels contemplate satellite monitoring systems, Forum administrators prefer simple tools and close relationships with fishermen. For example, FFA tagging projects rely on incentives such as T-shirts to entice fishermen to report catches. Different management functions are carried out at different levels, with the lines of authority clear between each of the organizations and each with power commensurate with its responsibilities.

Management Paradigms and Institutional Effectiveness

Different management approaches range from open access to individual transferable quotas, with varying results. Regardless of institutional structure, a flawed or inappropriate management paradigm creates serious problems for the fishery. For any institution to manage successfully in the long term requires that the policies are appropriate to the local conditions of the fishery. Effective institutions demonstrate a congruence between the principles regulating fishing effort and capacity and the principles for providing long—

term resource health. Management methods which incorporate biological models with socioeconomic models tend to be much more effective.

The relative ineffectiveness of the CFP owes much to its management paradigm, a seemingly ad hoc blend of biologically based quotas, restrictions on fishing techniques, and incentive programs for industry. Basing TACs on biological constraints ignores the economic and industrial aspects of the fishery. Technical conservation measures likewise neglect the economic elements[28].

The management approach which emphasizes ”relative stability”— (a) constant or increasing catch levels and (b) constant or increasing catch rates— is an excellent example of the incongruity between ecology and economy in the EU. Fishermen would naturally embrace promises that their production will increase along with their efficiency. Unfortunately, in the real world of scarce fisheries resources, these two criteria work against each other in the long term[29]. As utilization of the fish stock increases, more and more effort is needed to increase the yield because the stock biomass is being depleted. Once the long—term potential yield of the fishery is reached, any increase in effort actually results in a decrease in the harvest. Thus, eventually, increasing catch levels will cause lower catch rates.

On the other hand, by focusing on effort control while monitoring the sustainable catch limits, the FFA has successfully institutionalized a management approach which integrates the biological and the economic aspects of the fishery. Efficiency in the socioeconomic sense is tied to ecological sustainability in the islanders’ desire for long-term, stable revenues from their collective fisheries. This paradigm aligns efforts to increase profitability among the fishermen and efforts to conserve the resource. By raising or lowering their fees, the FFA member states can effectively control the fishing effort. If practices endanger a fish stock, the FFA has an incentive to change the license conditions and prohibit certain fishing levels or destructive technologies. Furthermore, basing fees on ”expected” landings rather than actual ones reduces the incentive to under-report and play one jurisdiction off against the other. Market mechanisms provide important feedback to both managers and fishermen, leading to adjustments in the amount of fishing effort in the area. Effort control, rather than technical measures or quotas, simultaneously addresses the industrial, biological, and economic aspects of the South Pacific fishery—an important characteristic of successful instiutions.

Conclusion

The South Pacific Forum Fisheries Agency and the European Union are a world apart geographically and as fisheries management institutions. Nations in both regions have ceded a significant responsibility to an international body for management purposes, with very different degrees of effectiveness. The EU exhibits overfishing, overcapacity, and disgruntled fishermen. The scramble for fish leads to pervasive rules violations and exploitation rates far beyond scientifically recommended levels. The EU's CFP has engineered a system of perverse incentives and continued stock depletion. The EU's top—down system fails owing to an institutional structure ill equipped to manage flexibly and rationally.

Conversely, the South Pacific tuna fishery is characterized by sustainable yields, rationalized industry, and constant access fee negotiations. The Pacific island nations have institutionalized a regime where fishing effort is controlled by market forces and responsible national authorities. The foreign fishers exploit stocks as quickly as they can profit from them, while FFA member states capture rental income and mandate sustainable practices. The FFA's bottom-up authority structure has implemented highly appropriate policies promoting compliance in the short as well as the long term.

International organizations can be useful tools in dealing with transboundary CPRs like fisheries. Institutional mechanisms are crucial to the overall success of a regional collective management organization. The different principles affect incentives in their respective fisheries and consequently affect the effectiveness of the institution.

The two case studies presented here suggest some features of an "ideal" type of international fisheries management institution. These guidelines, although incomplete, provide useful building blocks. They indicate that effective institutions should have authority filtered up through integrated levels of governance, making sure that functions such as enforcement are carried out by responsible agents and that biological and socioeconomic policies are harmonized. There should be little doubt as to which fishermen are eligible to fish, what they are eligible to fish for, and where they can fish. Low-cost decision-making and collective choice arenas for parties with vested interests should be at the heart of the institution. At each integrated level of governance, power to make and implement decisions should be commensurate to the responsibility and accountability of each level. Lastly,

the management paradigm ideally incorporates all aspects of the fishery into its rules, demonstrating congruence between ecology and economics.

In a world rapidly shrinking before the increasing productive and consumptive capacity of industrialized societies, management of the commons must now take place with a new sense of urgency. Different systems meet with varying degrees of success in managing those resources. A discussion of features needed for successful control of these fisheries not only speaks to the management of other fisheries on a regional and a global scale but also relates to common-pool resource management in general. Institutional design principles structure efforts to conserve a variety of other CPRs such as airsheds, the ozone layer, forests, organizational budgets, and even genetic resistance. Principles such as these represent a continuation of efforts to integrate multidisciplinary approaches to understanding commons and to examine key institutional elements in specific contexts.

[1] The UN's Food and Agriculture Organization estimates that 13 of the world's 17 major fisheries are depleted. FAO, *Agriculture Towards the Year 2010*, 27th Session (Rome, November 1993).
[2] Elinor Ostrom introduces the idea of "design principle" as "an essential element or condition that helps to account for the success of these institutions in sustaining the CPRs and gaining the compliance of generation after generation of appropriators to the rules in use." Elinor Ostrom, *Governing the Commons* (New York: Cambridge University Press, 1990), p. 90.
[3] Michael Holden, *The Common Fisheries Policy: Origin, Evaluation and Future* (Oxford: Fishing News Books, 1994), pp. 157, 128—50.
[4] CPUE is one popular measure of the relationship between the biological abundance of the fishery resource and the economics of the fishing industry.
[5] Yann Huei Song, "The EC's Common Fisheries Policy in the 19905," *Ocean Development and International Law* 26 (Winter 1995): 42.
[6] The EC retains sole competence in the external relations in fisheries matters, including dispute resolution, treaty negotiation, and access limitations for distant- water fishing nations. There has been little dispute over the great effectiveness of this policy.
[7] John Baden with Douglas Noonan, "Democracies Don't Fight—Unless It's about Fish," *Seattle Times*, 27 November 1996.
[8] Michael Wigan, "Outdoors: Europe's Fishing Fleets Prepare for War," Financial Times, 17 December 1994.
[9] Lorna Siggins, "Fish Industry Says Deal Is a Shallow Victory," *Irish Times*, 24 December 1994.
[10] Holden, 161—64.
[11] Christopher Booker, "Fishing in Troubled Waters," *Daily Telegraph*, 26 November 1992.
[12] Its members are Australia, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu, and Western Samoa. Collectively, their jurisdiction encompasses about twenty-nine million square kilometers of ocean space and is home to almost half of the world's tuna production.
[13] FAO, *World Review of Highly Migratory Species and Straddling Stocks*, FAQ Technical Paper, no. 337 (Rome: Food and Agriculture Organization of the United Nations, 1994), 30.
[14] FAQ, *Interaction of Pacific Tuna Fisheries*, FAQ Technical Paper, ed. Richard Shomura, Jacek Majkowski, and Sarah Langi, no. 336/1 (Rome: Food and Agriculture Organization of the United Nations, 1994), 34.
[15] Tim Lawson, *Status of Tuna Fisheries in the SPC Area during 1990*, with AnnualCatches since 1952, Tuna and Billfish Assessment Programme Technical Report, no. 27 (Noumea, New Caledonia: South Pacific Commission, 1991), p. 21.
[16] "Control of the number of vessels to reduce costs can create a surplus profit or economic rent in the fishery, increasing the true value of the resource and the economic benefits it can provide to its owners." Forum Fisheries Agency, *Report of Proceedings: High Level Meeting on Regional Co-Operation in Fisheries Management and Development* (Honiara, Solomon Islands: FFA, 1985), p. 8.
[17] Kalinga Seneviratne, "South Pacific-Asia: Tokyo Trade Office to Boost Trade Links," *Inter Press Service*, 19 February 1996.
[18] Robin Bromby, "South Pacific Tuna No Longer Going for a Song," *Business Times*, 30 March 1993.
[19] In 1984, an American tuna boat was caught illegally fishing in Solomon Island waters. In 1987, Kiribati fined a US. tuna boat $108,000 for stealing fish from Kiribati waters. In 1992, the FFA suspended two Taiwanese and seven Korean purse seiners for fishing without licenses, leading to $1.15 million in settlement payments. FFA member states have confiscated violators' vessels and re-registered them as their own patrol boats.

[20] Quoted in *National Business Review*, "Pacific Rim: Asian Fleets Tagged Over 'Bogus' Tallies," 2 August 1990.
[21] Neroni Slade, "Forum Fisheries Agency and the Next Decade: The Legal Aspects," in *The Forum Fisheries Agency: Achievements, Challenges and Prospects*, ed. Richard Herr (Honaira, Solomon Islands: University of the South Pacific, 1990), p. 304.
[22] The idea Of design principles is discussed in Ostrom, p. 90; Margaret McKean, "Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management," *Journal of Theoretical Politics* 4 (1992): 247—82; Elinor Ostrom, Roy Gardner, and James Walker, *Rules, Games, and Common-Pool Resources* (Ann Arbor: University of Michigan Press, 1994); and Margaret McKean, "Common Property: What Is It, What Is It Good For, and What Makes It Work?" Forest, Trees and People Programme Phase II Working Paper I—24 (Indiana University, 1996).
[23] Edward L. Miles, ed., *Management of World Fisheries: Implications of Extended Coastal State Jurisdiction* (Seattle: University of Washington Press, 1989),
[24] For example, Spain threatened to veto the accession of Austria, Finland, and Sweden to the EU if their fisheries demands were not met.
[25] *National Business Review,* "Pacific Rim: Tuna Resources Enrich Outsiders," 15 May 1990.
[26] F. Berkes attributes the success of Japanese resource management in fisheries to just such integration. F. Berkes, *Common Property Resources: Ecology and Community-Based Sustainable Development* (London: Belhaven Press, 1987), p. 167
[27] Miles, p. 295.
[28] Holden, pp. 189, 207.
[29] This relationship is graphically displayed in what is called the "strange productivity curve," where more and more effort is needed for a marginal increase in catch levels. Given a "bell-shaped," yield-per—effort curve, the change in catch rate is the slope of the yield curve. On this curve, the Slope is greatest when the fish stock is the most underutilized. Adapted from US. Department of Commerce, *Our Living Oceans: Report on the Status of US Living Marine Resources*, 1993 (Silver Spring, Md.: National Marine Fisheries Service, NOAA, 1993), p. 6.

Part Four

PROBLEMATIC CONCEPTIONS OF THE COMMONS ALTERNATIVE PERSPECTIVES

12

The Tragedy of the Scenic Commons

RANDAL O'TOOLE

Peter Stein designs second homes for wealthy Californians and first homes for retirees and telecommuters who have decided to move to Montana. From his storefront office in the tiny town of Gallatin Gateway, a few miles from Bozeman, the architect can look out on ridge tops throughout the Gallatin River valley and see new homes springing up. Across the street from Stein's office is a nineteenth-century-style home that looks as if it predates the rest of the town, which flourished in the 19205 and 19305. Actually, the home was recently designed and built by Stein for one of his Clients.

"I wish all of my clients would be content to live in a small town such as Gallatin Gateway," laments Stein. But when he gently suggests that other residents might not be happy to see another house near major recreation areas, they get angry. "They say it is their property and they can do with it what they want," relates Stein. That attitude fits in well with Montana's independent spirit. But as more and more ranches get carved into twenty acre ranchettes, even some Montanans are beginning to wonder whether unchecked development will force them to give up their proud claim that "Montana is what America was."

Through most of its history, the United States has become increasingly urbanized, as each successive census reveals a smaller percentage of people living in rural areas. But the 1990 census found that Montana and its southern neighbor Wyoming were bucking this trend: a larger share of both states' populations was rural in 1990 than in 1980. For the most part, the new rural residents were not farmers or ranchers but "exurbanites": urban residents at heart who were fleeing the cities.

As baby boomers begin to retire and telecommuting becomes ever easier, exurbanization will become increasingly important throughout the rural West: northern California, western Colorado, Idaho, New Mexico, eastern Oregon and Washington, and Utah. The construction of more second and first homes in these places will be accompanied by growing political demands for controls on new developments. To respond to these demands, it is important to precisely understand exurbanization.

Understanding the Problem of Exurbanization

First of all, exurbanization is nota threat to prime farm land. While some land use planners, particularly in Oregon, have decreed that prime farm land should be protected from development at any cost, this is an unrealistic and unnecessary goal. The Natural Resources Conservation Service says that the United States has over a billion acres of agricultural lands. Of these, about 465 million are classified as ”croplands.” But only about 70 percent of the croplands are actively used for growing crops in any given year. The remainder are used for pasture or are idle.

The US. inventory of croplands has remained fairly constant for more than seventy years. Although the population has more than doubled in that time, farmers have fed more people by growing more per acre, not by dedicating new acres to farms. While some farms have been developed for residences, they have been easily replaced by shifting pasture or other low intensity acres to cropland uses.

In any case, urban areas are not a significant threat to farms. All the developed land in the United States amounts to less than 5 percent of the country, and only about half of this is urban—the rest is rural roads and railroads. The percentages in the West are only about half of the country as a whole. So exurbanization is not likely to make much of a dent in the nation’s farm inventory.

Nor does exurbanization pose a significant threat to local infrastructure and taxpayers. Unlike suburban developments, which must be supported by new roads, schools, water, and sewage facilities, houses on twenty-acre ranchettes are not going to significantly increase any of those costs. If anything, the more expensive homes will pay more taxes than the costs they impose on local governments. When infrastructure costs and congestion become significant, the problems are by definition urban rather than exurban.

Exurbanization may pose a threat to a few species of wildlife. But the breakup of fields once planted with monocultural crops into five- to forty-acre units is more likely to increase the diversity of wildlife habitat as each new owner emphasizes different vegetation to suit their personal taste. Whether a particular rare species benefits or is harmed by exurbanization will depend strictly on local circumstances.

But there is a valuable resource threatened by exurbanization—the scenic value of an area. Scenery is clearly a common-property resource, since the cost each new home or development imposes on the scenery is shared by everyone who enjoys the Scenery, not just those who will live in the new homes. Indeed, an urbanite who moves to or builds a second home in a rural area is likely to enjoy huge scenic gains, while the scenic costs are imposed solely on others.

People generally agree that the scenic value of a landscape is greater if mountains, forests, fields, and valleys are broken by only one or two native farm buildings than if the ridges and valleys are dotted with log homes and other houses spaced every 933 feet or so (the average distance between the centers Of twenty—acre ranchettes). It is not for the economist to question why this is so, but to ask whether existing institutions are likely to produce the ”optimal” amount of scenic quality and, if not, how those institutions can be improved.

The Economics of Scenery

The economic analysis might proceed this way: Everyone who enjoys a scenic landscape has some dollar amount that they are willing to pay to see that landscape. Building a fancy new house in the viewshed might reduce the amount they are willing to pay by a fractional amount. The total scenic cost of the house is the sum of all the reductions in the viewers’ willingness to pay (with proper discounting of future values). The scenic benefit is the amount the new occupants of the house are willing to pay to be able to enjoy the scenery in the area.

Can we determine what people are willing to pay for viewing developed as contrasted with undeveloped landscapes? What benefits do people get from building in scenic areas? Some economists say they can calculate the former using travel cost or contingent value methods; others say they can calculate

the latter using econometric analyses of land prices. But such calculations are only approximations and the former especially may be highly misleading.

We can expect, however, that when the first house is built the benefits probably outweigh the costs if only because there aren't very many other viewers of the landscape. When many houses have been built, the scenic cost mounts as each new home is imposed on the viewshed of all the previous homes. Meanwhile, as the area begins to look increasingly urbanized, the scenic benefits to the owners of each new house get smaller. An economist would say that the net scenic value is optimized when home construction stops after the benefits of the last house just equal the costs to other viewers.

Since we don't precisely know either the benefits or the costs, we can't calculate that point. But because scenery is a commons, we have no reason to expect that construction will stop at the optimal point. Despite much previous construction, the owners of a new home in the Gallatin Valley may still enjoy huge scenic benefits over their former home in Los Angeles or Denver. Their house may impose scenic costs on hundreds of other residents that are cumulatively significant but individually so small that people looking at the new home do little more than privately grumble and, perhaps, think about moving to the next, less crowded valley.

Our existing institutions make good account Of scenic benefits but little or none of scenic costs. The scenic value of a homesite is built into the land price. A house lot with an unobstructable view of a mountain or ocean may sell for $200,000. A lot with a good view but one marred by other homes or developments may sell for $100,000. A lot with a poor view may sell for $50,000, while a lot with no view at all may sell for only $20,000. Of course, scenery is only one of the factors in the price of land, and it may be difficult to precisely calculate the influence scenery has on land prices. But the market for scenery is clearly working on the benefit side.

It is on the cost side that the market breaks down. So the next question is, what institutions can prevent the tragedy of the scenic commons?

Land-Use Planning to Protect Scenery

The two most common ways proposed to protect scenery are land-use planning and land trusts. Land-use planning and zoning require government coercion but provide no guarantee that they will protect scenic values. Since

planners have no better idea than anyone else What the precise values of scenery are, they cannot insure scenic optimization.

In actual practice, planners soon find that placing any limits on development requires a consensus of major political players. Planners also discover that scenery is a poor way of motivating people to reach that consensus, so they turn to such things as ”saving prime farm land” instead. For example, scenery plays almost no formal role in Oregon’s land-use planning process. But most planners and many Oregon political leaders believe that most farm land designated ”prime” by the USDA should be forever barred from development—no matter what the land’s actual worth as a farm or its relative value as developed property. For some people, ”prime farm land” is simply a euphemism for scenery, but as it is interpreted on the ground it becomes something very different.

Planning also produces highly inequitable results. A political consensus to protect scenic values through zoning and regulation is not likely to develop until many people have already subdivided and developed their farms or ranches. When zoning is put in place, it decreases the value of the undeveloped land and increases the value of the developed homesites thus rewarding the people who damaged the scenery and penalizing the ones who protected it. Knowing this, landowners expecting zoning will feel pressure to engage in a ”land rush,” subdividing their land before zoning forbids them from doing 50.

Such inequities combined with the political nature of planning and the tendency to use simpleton rules such as ”no development on prime farm land” make planning a poor method for solving the tragedy of the scenic commons.

Zoning was originally created not as a way for governments to impose their will on property owners but as a way for property owners in urban neighborhoods to protect themselves from unwanted intrusions. As Robert Nelson notes in *Zoning and Property Rights* (MIT Press, 1977),

> Zoning has in effect split the rights traditionally associated with property ownership into two components. One set of rights is held by the personal owner and another set is held collectively. Although nominally the collective rights are public rights, for most practical purposes they can be considered the private rights of either the neighborhood or the community residents.

These ”collective rights” recognize that the actions of one landowner can influence the property values of adjacent landowners. Someone who builds a tannery in a high-income neighborhood detracts from the value of that

neighborhood. More pertinently, someone who builds an apartment house in a high-income neighborhood of single-family homes will probably earn more rent than if the apartments are located in an area of other apartments. Thus, the builders not only bring down the value of adjacent properties, they take advantage of the adjacent property values to enhance the value of their own development.

But zoning, Nelson argues, is an inefficient way of protecting property values because it does not allow for an orderly transition from one land use to another. Instead, it is Often circumvented by government planning authorities, prompted by political or financial pressure, overriding local neighborhood preferences. As an alternative, Nelson points to the system of protective covenants and neighborhood associations used in Cities such as Houston, which has no zoning. Based on these examples, ”private-tenure institutions resembling condominium ownership should be developed to replace neighborhood zoning in protecting neighborhood quality,” Nelson concludes. ”These institutions would formally establish collective property rights to control matters affecting the neighborhood residents.”

In Houston, covenants and neighborhood associations developed spontaneously as developers realized that such institutions would enhance the value of homes in their subdivisions. But outside of a few large second-home resorts, similar institutions have rarely, if ever, Spontaneously developed in rural viewsheds. The closest examples are the land trusts, and these have almost never succeeded in comprehensively protecting scenic values Without significant government or other outside assistance.

Land Trusts for Protecting Scenery

Land trusts are on the opposite extreme of the coercive-voluntary scale from zoning. In the United States, scores if not hundreds of land trusts rely entirely on voluntary transactions to protect scenic and other open space values in various parts of the country. Some of these buy land outright, but many more buy or negotiate the transfer of development rights or ”conservation easements.”

The problem is that land trusts fail to solve the free-rider problem. Any property owner who gives up development rights significantly enhances the value of adjacent properties for development, since those properties will have views that are certain to remain undeveloped. A group of landowners who

agree to voluntarily give up their development rights to preserve their scenic views are prey to the ”holdout” problem, where one landowner refuses to agree and capitalizes on everyone else’s gullibility by subdividing his or her property. The holdout problem might be overcome if the number of landowners is small—under ten or twelve—but is not likely to be overcome with a larger number of properties.

On the other hand, someone determined to pay fair market value for conservation easements faces formidable costs. In areas that are becoming popular for their scenery, the development rights often form a high percentage of the value of the land. Moreover, each successive purchase drives up the development values of adjacent properties, because the easements guarantee them better views, and therefore the cost of purchasing further easements increases.

Ironically, once all of the development rights in a particular viewshed have been purchased, the actual property values in that viewshed may be only slightly diminished. The fact that all existing houses in the viewshed are certain to have no further developments within their views makes up for most of the lost value in giving up development rights. But the free-rider and holdout problems make it difficult for someone to achieve this result without paying much more than the ultimate shrinkage in property values.

For example, suppose a viewshed has twenty properties each worth a million dollars. The development rights for one of those properties might cost a half million. Buying development rights for all twenty properties is thus likely to cost at least $10 million, if not much more because the last property owners are likely to demand more than the first. But once all development rights are secured, individual properties their views protected by easements on all adjacent properties—may sell for somewhere around $900,000 or more. Because all twenty properties are protected by easements, the true cost of easements to individual landowners was only $100,000, for a total of $2 million—a fifth or less than the cost of buying the easements.

This suggests that strictly voluntary methods for protecting scenery are no more likely to be equitable or successful than the coercive tools of planning and zoning. Some combination of coercion and voluntary means may be needed to efficiently and equitably protect scenic values.

Solving the Tragedy of the Scenic Commons

As an alternative that is less coercive than zoning but potentially more successful and equitable than either zoning or voluntary land trusts, governments could create the equivalent of ”neighborhood associations” in rural viewsheds. Each association would be given the authority to establish collective property rights and to control matters affecting the viewshed residents.

The association would have coercive power, but it would be disaggregated to a very local level. An association board of trustees could be selected by property owners in the viewshed, thus ensuring that their powers would not be abused. Under certain conditions, groups of property owners might even be given the power to opt out of an existing viewshed association to form their own association if they want to impose more or less stringent rules on themselves than the existing association.

Associations could also be given the authority to collect a real estate transfer tax. Since scenic values are contained within land prices, this would effectively tax people’s willingness to pay for scenery. The tax revenues could be used to improve the scenic viewshed, such as by buying conservation easements that go beyond the general association rules.

This formula minimizes the coercive and inequitable aspects of zoning while it solves the free-rider and holdout problems faced by land trusts. While no system is perfect, it seems likely that only a system which combines the protective covenants of urban neighborhood associations with the voluntary nature of land trusts is likely to protect scenic values in places such as the Gallatin Valley views that Peter Stein sees from his office.

13

Internet Decentralization, Feedback, and Self-Organization

DOUGLAS 5. NOONAN

In the past decade, technological advancement and entrepreneurial innovation have created an unprecedented economic, social, and cultural phenomenon: the Internet. By linking together a wide variety of computers in a borderless network via telecommunications technologies (the ”information superhighway”), the Internet represents a dynamic and powerful resource for obtaining, disseminating, and manipulating data. It also represents a powerful resource for coordinating activities, creating and maintaining relationships, and providing data-processing capabilities to users in a flexible manner.

In addition to its many practical, information-processing values, the Internet provides users other significant benefits. The Internet is highly resilient, developed from a Department of Defense project to devise a decentralized computer network of networks capable of surviving local network failures. If, for example, part of the network in Seattle crashes, the remainder of the network can still function. The Internet’s decentralization and ”anything goes” freedom in ”cyberspace” also foster its rapid growth and development. Furthermore, because it is a network of networks, experimentation by individual components doesn’t risk the entire system, and

relatively low costs to entry for users and providers enable flexible and speedy global implementation of successful innovations. Another invention, the World Wide Web (WWW), developed from a communication tool for academics into a dominant interface for millions of Internet users. It demonstrates the powerful evolutionary capabilities of the Internet. Moreover, because the Internet is primarily a ”cyber” resource whose chief constraints are not the typical physical-world constraints of space, material, and energy costs, the limits to development at the margins are nearly nonexistent.

The Internet is a unique political phenomenon as well. Its anarchic, voluntary basis is a natural fit for libertarian ideologies. Modem technologies dramatically affect sovereignty through activities such as electronic currency exchanges and can potentially reshape democracy as we know it[1].

Although the Internet is a valuable resource, it is not privately owned; nor is it owned by any state or club. The Internet is a commons (or several commons[2]); it meets both criteria of (1) nonexcludability and (2) rivalrous consumption. Excluding users from the Internet is technically impossible or prohibitively expensive. Certain subsets of the Internet are amenable to limited entry rules (such as America Online’s proprietary services), but on the whole, anyone with the inclination and the technology could become a user[3]. The second aspect of common-pool resources, subtractibility or rivalrous consumption, is also evident in the Internet. The metaphor of ”information superhighway” is particularly apt here, because both resources present commons prone to ”traffic jams.” Too many users can overload different inks in the network Chain, reducing the value of other transmissions congested at that point. This infrastructure problem poses collective-action dilemmas in both allocating scarce ”bandwidth” (the technological capacity Of the Internet to transmit data) and providing for existing and future bandwidth. Until these collective-action problems are resolved, decreased performance, overloaded systems, and even the mythical ”collapse of the Internet” are real possibilities.

In spite of its commons nature, or perhaps because of it, the Internet has undergone dramatic development in just a few years and promises even greater changes in coming years. In the early 19905, e—mail was a novelty predominantly used by universities. WWW sites were almost nonexistent. Currently, e-mail and WWW sites are commonplace as over 40 million users in 13.5 million households worldwide tap into the Internet. By some estimates, Internet ”traffic” has been doubling every six months, while users have been doubling only once per year. Similarly, the Internet’s capacity to handle that traffic is 10,000 times greater today than ten years ago. Availability of data,

like the number of users, is also expanding at phenomenal speeds. Internet standards for communication continue to evolve, becoming more versatile and powerful to include interactive applications and realtime video and audio.

The Internet users and resources are no longer limited to academics and military. Takuma Amano and Robert Blohm assert that ”the single most important factor behind [America’s recent] economic performance is the Internet”[4]. A burgeoning Internet industry, adding $200 billion in value to the economy, accounts for robust growth and low inflation. Today, primetime television advertisements regularly include Internet addresses below companies’ or products’ names. Letterheads and business cards increasingly contain e-mail and WWW addresses. Newspapers and magazines, booksellers and other retailers, even commercial airlines are discovering new markets on the Internet for providing low-cost, high-value services and information. General Motors began marketing $500 million in bonds via the Internet in September 1996, signaling the dawn of a new era of ”cybernomics.” That year the Clinton Administration promised $500 million to bring the Internet to schoolchildren. Top 1996 news stories in computing and telecommunications industries revolved around ”Internet wars.”

The Internet, though unpredictable, will continue to reshape data-processing and communications as well as general commercial activities. The Internet has universal communication protocols. This means that data processing resources, from games to desktop publishing to business accounting, can be tapped by multiple users regardless of their specific computer platforms or physical location. This decentralization of information processing marks a fundamental change in the way people manipulate data. With Internet resources, users can do their banking or monitor a factory’s realtime effluent emissions; they can remotely buy and sell goods and services and even raise venture capital. Regulating and taxing this sort of ”invisible” market may prove an impossible political challenge.

But for the Internet to continue creating new value, it must remain robust and functional—and not fall victim to its commons status. Up to now, the pressures on the Internet infrastructure have been relatively light, but the staggering growth in use leads to justifiable concern about ”managing the commons.” The Internet currently has ingredients for tragedy: open access, rivalrous use, and rising value and decreasing costs of access to users. Limiting access to the Internet is highly problematic because of its abstract, global nature, and open access is integral to the Internet’s Character. Infinitesimal marginal costs of use make metering use difficult; charging

access fees, for instance, is often more costly than the access itself. If nothing changes, some might reasonably expect the Internet to eventually crash (unless incidentally saved by technological advancement continually augmenting the resource so as to preclude system stress from overuse). Avoiding this requires addressing problems of overuse (appropriation) and undermaintenance (provision).

Many of the appropriation issues on the Internet today can be described as ”signal-to—noise” issues, i.e., the ratio of high-value transmissions to lowvalue ones. Increased traffic on the information superhighway has results similar to automobile traffic congestion. Individual users impose externalities on other users. Factual, useful, and constructive information (signal) becomes less valuable when hidden in a morass of data (noise). Users frequently complain of unwanted information wasting their time and have developed limited customary mechanisms to control the signal—to-noise ratio, such as stigmatizing senders of ”Spam” (the electronic equivalent of ”junk mail”)[5].

More than inconvenience, the rising significance of traffic issues on the Internet points to a phenomenon typical of overexploited commons: dissipation of economic benefits. What kind of and how much information should optimally be transmitted on the Internet? Currently, the answer is ”any and all.” The low cost of data provision (including easily protected anonymity) leads to ”pollution” of the information commons with unauthorized, inaccurate, and offensive material[6]. Open access tends to invit additional users of the resource arriving until costs of using the resource equal the benefits of using it. Many online discussion groups experience this in the following cycle: interesting and valuable discussion group forms, high value entices others to join, newcomers ”water down” valuable dialogue, and discussion degrades into series of Spams and rants.

Provision problems can be broken down into two areas: technical and legal issues and bandwidth-related problems. Maintaining sufficient bandwidth to accommodate the rapid growth of the Internet is a primary chore of resource providers. The many networks that the Internet comprises are prone to free—riding. The decentralized and unmeterable nature of the Internet makes it difficult to provide incentives to produce and maintain the many and varied components of the Internet necessary to process just a single transmission.

Nonbandwidth problems challenge Internet providers to develop technical and legal standards capable of maintaining the integrity and value of online resources. As publication and republication costs drop precipitously

for electronic media, copyright protections play an essential role in protecting intellectual property value. Enforcement and sanctioning issues quickly follow. Continued growth and development of the Internet also relies on mechanisms for devising and implementing new standards. Evolving technical standards for issues like privacy and security greatly affect the value of Internet resources. By adapting standards, conflicts over and shortages of WWW addresses, for example, can be resolved more easily or avoided altogether.

Challenges to users and infrastructure providers of the Internet resemble other commons. Users and providers have been able to rapidly introduce changes in technology to expand transmission capabilities to keep pace with the explosive growth in use. New user interfaces are dramatically improving in terms of flexibility and efficiency, thereby conserving network resources. Additionally, other software developments (like the Java language) have great potential for reducing wasteful uses of the Internet and expanding the scope of the Internet without actually increasing infrastructural stress. Plans for an Internet II, a more limited system, indicate that alternative resources could replace or supplement the Internet. With new techniques like tagging packets (the base unit of data transmitted) with equivalents to Zip codes, packet routing can be made more efficient. Adding bandwidth and processing capabilities to the Internet remains an important technical and technological issue, one certain to witness profound changes in coming years[7].

All of these trends are taking place despite (and perhaps because of) the anarchy that is the Internet. Thus far, Internet users and providers have devised their own solutions in a high-stakes race to head off a depleted, polluted, and congested Internet. Other participants may keep developing other networks outside of or in conjunction with the Internet's original framework. As is increasingly seen in business, "intranets" are developing within companies and partnerships, providing similar resources as the Internet in a more localized and specialized network. For intranets the beneficiaries, users, and providers are generally one in the same—a corporate entity. And here we would not expect the same commons issues.

The Internet may become a prominent example of a modern, self-organizing commons capable of resisting "the tragedy." To do that, the Internet must institutionalize mechanisms to constrain depletion and dilution. Over the long run, technological fixes may not suffice[8].

Institutional reform can foster more optimal production and allocation of the Internet's economic benefits by developing appropriate incentives. In *Bionomics*, Michael Rothschild tells the story of Xerox's SPAWN software, a

solution to network performance problems[9]. SPAWN successfully instituted an open-auction market for network users to efficiently allocate network resources and maximize productivity of each network component. When users and producers have accurate feedback about the stresses and opportunities they create for others in the resource system, as Rothschild writes, ”a flexible and efficient use of resources spontaneously emerges”[10].

For users and providers who scramble to capture private gains from the Internet, prices provide important information for their decisions, just as with other resources. Ultimately, prices guide individuals to either free ride on the Internet when the price is zero or contribute to it when the benefits exceed the price. As Spam is essentially free, we find it overproduced. Bob Metcalfe, a founding father of the Internet, claims that failing to balance supply and demand, to meter use, and to compensate those who provide the infrastructure will lead to a tragedy of the commons[11]. Effective feedback loops address persistent commons problems. Information pollution could be reduced if all information was priced and users faced a mechanism which passed rewards to those who produce or identify ”signal” rather than ”noise”.

Users and providers will increasingly invest in opportunities which permit them to capture the best return on their investment. Individual actions imposing costs on others (externalities) diminish and inhibit that investment. We might expect property rights institutions to develop when the benefits to be gained by devising and implementing them outweigh the costs of the externalities[12]. For the Internet, such rights might take the form of privatized, proprietary, secure intranets, enmeshed in a broader public Internet framework. The Internet may become more a web of linked corporate intranets or alternative internets, with metered access for a fee. No matter its future form. The Internet’s destiny will likely be determined from within, from ”the competitive/cooperative intelligence of many minds engaged in fervish experimentation”[13].

As systems and technologies for pricing evolve, some provision and appropriation problems will be lessened, and new problems will arise. When resource providers can charge users for access, they will have incentives to continue to provide and improve resources. Thus far, the Internet has demonstrated its resilience, thanks in part to advancing technologies and thanks in part to freedom for users to adapt the system. The development of potent (though limited) customary law and cultural standards, especially among newsgroups and e—mail users, evidences this. Unfettered or unthreatened by exogenous control, users and providers will continue

innovating solutions and adapting practices to maintain such a valuable resource. In its brief history, the Internet has been a spectacular example of a self- organizing commons, valuable both economically and as a model of commons management.

[1] Peter Huber describes how modern telecommunications thwarts borders, transforming the international system into a sort of marketplace where governments are forced to compete for the best regulations, wisest fiscal policy, etc. With the emergence of the modem and online activities, Huber argues, ”citizens now vote continually, with London, Bonn and Tokyo on the ballot, too” (”Cyberpower,”Forbes, 2 December 1996, p. 147). Jason Fry cites another important manifestation of cyber—democracy: ”Robert Dole ended the first presidential debate by telling viewers, ’If you really want to get involved, just tap into my home page.’ The Dole-Kemp ’96 World Wide Web site then recorded two million hits within 24 hours” (”The Age of Internet Politics,” *Wall Street Journal*, 7 November 1996).

[2] For an examination of the ”multi-level complexity” of the Internet, see Charlotte Hess, ”Untangling the Web: The Internet as a Commons,” Workshop in Political Theory and Policy Analysis, Indiana University. March 1996.

[3] While control over who, when, and how users access the Internet is currently almost nonexistent, continued evolution of Internet standards (allowing practices such as prioritizing and pricing different transmission types) and technologies (such as parallel, private networks offering quality transmissions for a higher fee) may permit increased controls on entry. For a description of possible changes, see The Economist, ”Too Cheap to Meter?” and ”Why the Net Should Grow Up,” 10 October 1996.

[4] Takuma Amano and Robert Blohm, ”The Internet Economy,” *Wall Street Journal*, 17 October 1996.

[5] Thomas Petzinger, Jr., ”A Morality Tale from the Wild World of the Internet,” *Wall Street Journal*, 1 November 1996.

[6] Hess, p. 19.

[7] Other possible mutations of the Internet include a systemwide prioritization standard for message types, where, say, video transmission would receive high priority whereas e-mail would be low priority. Such an identification scheme moves the Internet closer to a pricing mechanism for allocating resources among users. This could provide information about the information on the Internet, 50 Spam does not preempt urgent medical data. Refining data transmission and identification may soon permit practical metering of marginal Internet use, thereby hurdling one of the major obstacles to linking the provision of the resource with its users.

[8] Based on ”laws” of technological innovation, many observers assert that the
Internet can resist tragedy by growing faster than the rate of depletion. Regardless of the implicitly condoned waste in this argument, technological fixes to one of the Internet’s problems may still make other problems more acute. For instance, improving accessibility and security on the network could lead to even greater information pollution as sites proliferate.

[9] Michael Rothschild, *Bionomics* (New York: Henry Holt, 1990), pp. 264—268.

[10] Ibid., p. 266.

[11] George Gilder, ”Feasting on the Giant Peach,” *Forbes ASAP* 26 August 1996.

[12] As Terry L. Anderson and P. J. Hill argue in ”From Free Grass to Fences,” chap. 8 in this volume.

[13] Michael Rothschild argues that central planning cannot be applied to the Information Age and the Internet specifically in ”The Fear of Letting Go,” *American Enterprise* 6 (1995): 82.

14

Environmental versus Political Pollution

DWIGHT R. LEE

It is widely accepted that the use of private property in the pursuit of private advantage has led to excessive pollution. It is as widely accepted that the solution to this problem requires an expansion of government control over market decisions. Both views are completely at variance with fact. Pollution is excessive not because of too much reliance on private property but because of too little. Furthermore, attempts to control pollution with direct government control over polluting activities are badly flawed, for they are not guided by the information that can be provided only when property is privately owned. In fact, the problem with government attempts to reduce pollution is completely analogous to the problem that leads to excessive pollution in the first place.

The problem of environmental pollution cannot be adequately understood until it is recognized as fundamentally an economic problem; that is, a problem of scarcity. Our resources simply are not sufficient to satisfy all our demands. We want clean air, pure water, and unspoiled landscapes in order to sustain life and health, and indulge our aesthetic sensitivities. But equally important for maintaining life and enhancing its quality is the use of our environment as a waste-sink. Every productive act we engage in whether breathing in and out, growing wheat, or generating electricity creates

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unwanted by-products that have to be discharged, in one form or another, into the environment. One of the costs of producing more manmade goods is sacrifice of some environmental quality. Similarly, the cost of a cleaner environment has to be reckoned in terms of the resulting sacrifice of some manmade goods. To say that we all value a cleaner environment gives no guidance in deciding whether or not the environment should be a little bit cleaner, or a little bit dirtier. Although we want a cleaner environment, we also want more housing, entertainment, medical research, schooling, fine wines, fast-acting detergent, warmth in the winter, air conditioning in the summer, convenient and safe transportation, attractive clothing, etc. The relevant question is, what is the appropriate combination of environmental purity and all the other desirable things we enjoy, given that we can have more of one only at the cost of sacrificing some of the others?

Honest Communication and Consideration for Others

In an ideal world (ideal except for scarcity), every resource decision would be guided by information on the value of the resource in all possible employments. One way of realizing this ideal, at least conceptually, would be first to arrange for everyone to communicate with everyone else the value they place on different resource uses. In addition, we would have to ensure that people communicate with each other honestly and that no one would give greater weight to personal benefits than to the benefits of others. Under these circumstances, resources would be directed into their highest valued employments. If someone communicated to you that a particular resource was worth more to him than to you, you would know this was an honest statement and, in your concern for his interest, you would let him have the resource.

Of course, what we have here may appear to be nothing more than a utopian dream. It would be hard even to imagine the technological advances necessary to allow all users and potential users of a particular resource to communicate simultaneously with each other. And even if the technological problems of communication were solved, we would still be left with the moral or ethical problems of motivating people to communicate honestly and to give the interests of others consideration equal to their own. If avoiding the horrors of Hell and achieving the ecstasy of Heaven have not been sufficient motivation to ensure honesty and brotherly love, there is little reason to

believe that the mundane goal of efficient resource allocation will inspire the realization of these noble virtues.

But as utopian as it may appear, we should not completely dismiss the idea that resources can be allocated efficiently as a consequence of people communicating their values to each other, both honestly and with full regard for the interests of others. Indeed, this is a quite accurate description of exactly what happens with most of the resources we use. For a wide range of our resource-using activities, this system of information and consideration is coordinating our actions and interests with the actions and interests of literally millions of others in such a way that an amazingly efficient pattern of resource use emerges. In addition, this system of communication and consideration works so smoothly that few have either awareness of, or appreciation for, the truly astonishing task that is being performed.

Interestingly, the social institution upon which the system of communication and consideration is based is private property, an institution that has long been criticized by people who Often claim great concern with promoting social communication and cooperation. The fact that private property can be the source of enormous private wealth is surely seen by some as a major problem. To the economist, however, it is the fact that individuals can profit from private property that explains one of its major advantages. When individuals own resources and are thus able to capture most, if not all, of the value from their use, they have a strong motivation to
use them carefully and to direct them into their most productive employments. People use resources they own more wisely than resources that are commonly owned. If you want to find graffiti on a bathroom wall, you are well-advised to look in public restrooms, not privately owned bathrooms.

But if you are interested in efficient resource allocation, it is not enough to have individuals simply putting the resources they own into those uses they value most. The best use the owner had for a resource may be less valuable than the best use someone else has for it. How can each individual be informed as to the value of his resources to others, and then be motivated to take this value fully into consideration? The answer is provided by an activity that is made possible by private ownership—exchange.

Only when people have well-defined and enforced ownership rights in resources is exchange possible. No one is going to pay you for a resource unless you have a transferable property right entitling you to control and use that resource. Not until transferable property rights exist in a resource will a market develop in which the resource can be bought and sold. A market price

will emerge. The price will reflect the fact that if you want to purchase the resource you will have to pay at least as much as it is worth to the owner, and this can be no less than the value others place on the resource and are therefore willing to pay the owner. In other words, market exchange results in resource prices that honestly communicate to everyone the value of those resources to others. This is a communication process that not only provides an enormous amount of information, but provides it in such a way that all relevant decision-makers are motivated to take it fully into consideration.

Whether you already own a resource or will have to purchase it, its market price reflects its cost to you. If you already own it and retain it, the market price reflects the value you have to forgo in not selling it, just as it would if you had to purchase the resource. People will be motivated to use resources that are privately owned and easily exchanged only as long as these resources are worth at least as much to them as they are to others. In other words, people are motivated to make economic decisions as if they considered the interests of Others as their own.

This discussion of resource allocation through a system of communication and consideration, and the examination of the institutions or property rights and market exchange necessary for this system to function properly, may seem something of a digression from our main focus on the problem of environmental pollution. But having looked carefully at the allocative efficiencies that result from a properly functioning system of communication and consideration, it is possible to better understand the problems that arise when such a system is not working properly. This leads us back to the pollution problem.

Too Little Private Property—Too Much Pollution

We are now in a position to explain why pollution is excessive. Those environmental resources, such as waterways and airsheds, that, among other things, necessarily serve as repositories for pollutants, are not easily parceled out to individuals as privately owned and controlled property. Because these receptor resources are not privately owned, market exchange does not govern the uses to which they are put. All of us make use of commonly owned receptor resources for dumping our waste, and we do so in the absence of the information and consideration that guide most of our resource-use decisions. The institutional foundation of the system of information and consideration

that serves us so well in most of our economic activities is defective when it comes to using many of our environmental resources, because these resources are not subject to private ownership.

Consider, for example, your decision to drive your car to work. Doing so requires the use of resources that are valued by others, such as oil, gasoline, and the labor required for automotive upkeep. But because these resources are privately owned and easily exchanged on markets, you give full consideration to the value of these resources to others in the prices you pay. This is not the case with the clean air you use to vent your exhaust into as you drive. The value that others place on the clean air you foul is not made known to you, because clean air is not rationed by market exchange. There is no price on clean air that informs you of its value to others. And even if somehow you did know this value, in the absence of a price you have to pay there would be little motivation to take it into consideration. The harmful effects generated by your polluting activity are imposed almost entirely on others. Not surprisingly, it can be expected that you will put much greater weight on the benefits of your pollution than on its costs.

With privately owned resources, people have the information and motivation to employ more of each resource only so long as the value it provides to them is at least as great as the value it would otherwise provide to others. With commonly owned receptor resources, people are motivated to employ these resources as waste—sinks as long as the value to them of doing so is positive, regardless of the value that others forgo as a consequence. From the perspective of the efficient allocation of our resources, our receptor resources are over-used as waste-sinks relative to their use for providing environmental quality. Pollution is excessive.

Creating Private Property Rights

Before discussing the approach that most economists recommend for solving the problem of excessive pollution, it would be useful to identify just what it is that the ideal solution would accomplish. First, and most obviously, we want pollution reduced to that level consistent with the efficient allocation of our resource, the allocation which maximizes the value generated by our resources. Put differently, we want to reduce pollution as long as reducing pollution by one more unit provides more value in improved environmental quality than it costs in terms of the value of sacrificed manmade goods.

A second objective is to reduce pollution as cheaply as possible. There are two separate considerations here. Each pollution source has to be abated at minimum cost. There are many ways to cut back a given amount on pollution, but in general there will be only one least-cost way. But even if all polluters are abating pollution as cheaply as possible, it is not necessarily the case that pollution overall is being reduced at least cost. How far do the individual sources go in abating pollution? The least-cost pattern of pollution abatement will find the cost of reducing pollution by one more unit (the marginal abatement cost) the same for all polluters? Since some polluters will be more efficient at pollution reduction than others, the least-cost pattern of pollution abatement will require different abatement levels for different polluters.

A third objective of a pollution management program is to establish incentives that will motivate advances in pollution abatement technology. This dynamic aspect of pollution control is as important as the point-in-time, or static, considerations discussed in the previous two paragraphs.

These three objectives—(1) achieving the efficient level of pollution, (2) achieving the least-cost pattern of pollution reduction, and (3) motivating advances in the technology of pollution control—probably will never be fully realized. This is particularly true of the first objective. Not being able to own and control identifiable and isolated portions of the atmosphere, for example, no one is in a position to let a polluter foul his, and only his, clean air in exchange for a claim on other desirable things (this claim generally being money). Without such exchange possibilities, prices do not spring up that reflect the value people place on clean air, and without this information there is no way of determining the efficient level of air pollution.

Likewise, private ownership of identifiable and isolated portions of water in our lakes, rivers, and oceans is not possible, and thus there is no accurate way of determining the efficient level of water pollution. With it impossible to determine the efficient level of pollution through the information provided by market exchange, we have to rely upon the political process for this determination. In a democratic political order, there is the presumption that the information provided by voting and lobbying will keep the political process responsive to the preferences of the citizens. There is some hope, then, that political decision makers will arrive at a level of pollution that is not too far removed from the efficient level.

Assuming that the politically acceptable level of pollution has been determined, the last two objectives of a pollution control program have to be

considered. It is possible to move a long way in realizing these objectives by having the government create and enforce a system of property rights in the use of the environment as a waste-sink. The essential idea is simply to have the government issue transferable pollution rights which give the holder the right to discharge one unit of pollution each week, for example. The total number of rights issued would conform to the targeted level of pollution as determined by the political process. This scheme, assuming adequate enforcement, would serve to limit pollution to the acceptable level. Also each polluter, having to reduce pollution to the level allowed by the number of rights held, will be motivated to do so at the minimum cost. But the crucial advantage in the pollution rights approach comes from the fact that the rights are transferable.

Because the pollution rights would be transferable, a market would develop for them, and the resulting exchanges would determine a market price for rights. The cost of discharging another unit of pollution per week would then equal the price of a pollution right—the value others place on the ability to increase their pollution. People would be motivated to increase their use of the environment as a waste-sink only if the additional pollution benefits them at least as much as it would benefit others. A pattern of polluting activities results that maximizes the value realized from the allowable level of pollution. Another way of stating this is that the reduction in pollution necessary to realize the acceptable level is achieved with the least cost (minimum sacrifice in valuable alternatives) pattern of abatement.

Faced with a positive price for pollution rights, each polluter has every motivation to discover the cheapest way to reduce pollution and to apply it. Each polluter will be motivated also to reduce pollution as long as the cost of reducing one more unit is less than the price of a pollution right. With all polluters facing the same market price for pollution rights, the cost of abating one more unit of pollution will be the same for all polluters[i]. This is another way of stating the requirement for the least-cost abatement pattern. The information and incentives generated by private ownership and market exchange automatically lead to the desirable pattern of pollution abatement.

The pollution rights approach also creates an incentive for polluters to develop improved abatement technologies. History is full of examples of technological development allowing more manmade output to be produced with less land and labor. Conspicuously absent have been technological improvements designed to conserve on the use of the environment as a waste-sink. Market prices on land and labor have always provided a strong

incentive to conserve these resources. The absence of prices for the use of our atmosphere and waterways however, made it privately unprofitable to worry about conserving on their use. Marketable pollution rights would remedy this neglect.

Political Pollution

Despite the advantages of a pollution rights approach, the political response to our environmental concerns has been to embrace direct government regulation and controls in the effort to reduce pollution. There are reasons for the political popularity of directly regulating pollution sources that have nothing to do with environmental concerns. In some cases, environmental concerns are simply a convenient vehicle for promoting hidden agendas that can actually result in a reduction in environment quality. It will be helpful in providing a general understanding of such nefarious political practices to examine a deficiency in the political decision-making process. This deficiency is closely analogous to the problem that explains excess pollution in private market settings.

Government programs, expenditures, and protections Often convey benefits that are largely focused on particular industries, occupation associations, or social groups. Agricultural price supports, imports of shoes, and protecting the Maritime Union with the Jones Act against competition are a few of a large number of examples. Benefiting groups will have a strong motivation to become involved politically for the purpose of protecting and, if possible, expanding their particular program.

These groups will each be organized to one degree or another quite independently of their political activity and will therefore find it relatively easy collectively to confront and influence key political decision makers. Of course, these special-interest programs will impose costs on the general public in the form of higher taxes and prices. But organizing the general public for the purpose of generating political opposition to these programs will face the same problems encountered by an environmental group attempting to get all those suffering from pollution to contribute toward the purchase of pollution rights. If others are successful in controlling a special-interest program, your taxes will be lowered or your benefits raised whether or not you contributed to the effort. So when a program is being considered that benefits the few at the expense of the many, our political representatives can expect to hear from

the few but not from the many. The resulting bias in political results is not hard to predict.

We suffer from excessive *environmental pollution* because the private benefits each of us receives from polluting activities are paid for, in large part, by a defenseless public. We suffer from political pollution, or excessive government involvement in a whole host of activities, because the various private benefits received from the government programs also are paid for, in large measure, by a defenseless public. Of course, each of us also suffers from the pollution and pays for the government programs of others. Most of us would be willing to reduce our pollution and the programs we favor if everyone else would do the same. Unfortunately, this does not happen, because the political process is flawed for the same reason that the market for a clean environment is flawed: in the absence of private property and echange, people are not able to communicate their preferences to each other in such a way as to ensure honesty and reciprocity.

Conclusion

Concern over environmental quality is often used as a convenient rationale for the exercise of political power designed to favor the organized interests of the few at the expense of the unorganized interests of the many. This political pollution takes the form of higher prices, less efficient allocation of our resources between different sections of the country, and, if not more rather than less environmental pollution, certainly less pollution abatement than we are paying for. The best way of abating this political pollution, and providing the information and incentives needed seriously to combat environmental pollution, is by increasing our reliance on private property and free market exchange.

Government attempts to reduce pollution are necessarily ill advised. In the absence of private property rights in key environmental resources, market activity will lead to excessive pollution, and a properly structured government response can protect the environment to the benefit of us all. But caution is advisable before embracing the most obvious government solution to the problem of pollution: granting a government agency (or agencies) the power to regulate and control pollution sources. Political power is exercised in a setting in which the type of communication and consideration that characterizes a properly functioning system of market exchange is largely

absent. The consequence is that those who are able to position themselves politically can capture private benefits by imposing costs on others, much the same as polluters can gain private benefits by imposing costs on others. And once political power is created for the purpose of achieving some objective, no matter how noble that Objective may be, it is naive in the extreme to imagine that those with political influence will not employ this power for their own narrow purposes.

Fortunately, it is often possible to achieve worthy goals without concentrating enormous power in the hands Of a few, by having the government remedy certain market deficiencies. In the case of pollution control, the remedy involves creating and enforcing transferable property rights in the use of the environment as a waste—sink. Once such a pollution rights system is in place, private advantage in polluting activities would require reducing pollution as cheaply as possible and taking the value others place on the environment fully into consideration. Under such a policy, there would be little opportunity for a few politically influential groups to use government for their private benefit at the expense of the general public. The advantage of the pollution rights approach is that it would allow a large number of people an opportunity to influence pollution abatement decisions and would establish the incentives and information necessary for a least-cost response to our environmental concerns.

[i] If the marginal abatement costs are not the same for all polluters, then it is possible to reduce the cost of pollution abatement without increasing the level of pollution. Assume, for example, that the marginal abatement cost of polluter A is $5 and the marginal abatement cost of B is $10: reducing pollution by one more unit will cost A $5 and B $10. Obviously, if A abates one unit more and B one unit less, the level of pollution remains the same, but abatement costs are reduced by $5. The abatement costs of realizing the given level of pollution will continue to be lowered by having A increase abatement and B reduce abatement until the marginal cost of abatement is the same for both. This equality will eventually occur, making the realistic assumption that marginal abatement cost increases as abatement increases

15

The Federal Treasury as a Common-Pool Resource: The Predatory Bureaucracy as a Management Tool

JOHN A. BADEN AND DOUGLAS 5. NOONAN

Environmental activists, freedom lovers, and those preferring a smaller, less intrusive government share a common perception. They see the agency officials responsible for natural resource management as bureaucratic parasites. Rather than steward our resources ”for the greatest good, for the largest number, for the long run,” the agencies systematically advocate programs that (1) have environmental costs that exceed environmental benefits, (2) are financially wasteful, and (3) increase the command sector of the economy at the expense of voluntary exchange and coordination[1].

It’s no accident that the term bureaucrat carries a crust of derision in every language, for bureaucratic incentives ultimately produce problems. Bureaucracies tend to replace the goals that justified their creation with actions which protect their budgets. Bureaucracies are relentless. They pursue a budget-maximizing agenda with tenacity, single-mindedness, and even

occasional creativity. Supreme Court Justi Stephen Breyer, in *Breaking the Vicious Circle,* describes this fundamental bureaucratic characteristic as ”tunnel vision”[2]. While new agencies may work well for a brief period, perhaps while the reform zealots are in charge and the reform interest remains vigilant, over the long run we should expect bureaucracies to be run for the benefit of those running them and the clientele upon whom they depend for authority and budgetary appropriations. Agencies are so pathologically preoccupied with budget maximization that fifty years ago another Supreme Court Justice, William Douglas, advocated that ”all agencies be eliminated after their first ten years because they lose sight of their mission.”

Only with heroic, but unrealistic, assumptions can sponsors of state activism claim ”this time it will be different.” Since the Progressive Era of the early 905, agencies created under these slogans have clearly regressed to the mean level of incompetence, duplicity, rigidity, and self-interest characteristic of bureaucracies everywhere. We should anticipate such tendencies when planning to utilize governmental bureaucracies and budgets.

The Logic of Bureaucratic ”Irrationality”

The term *bureaucra*t is used to identify the decision makers in government administrative agencies[3]. Several generations of economists and others interested in policy analysis have noted that our public servants often produce benefits that can only serve some concentrated groups and the bureaucrats who generate those benefits. The literature on bureaucratic pathology is voluminous and growing rapidly. In its traditional form, it exists in the fields of public administration, political science, and sociology, and more recently in economics[4]. The bottom line of studies from each of these areas is consistent: bureaucrats operate to increase their discretionary control over resources. In sum, they Operate to protect and expand their budgets. Since bureaucratic outcomes frequently violate the public interest and incentives are responsible for outcomes, we contend that the incentive structures faced by bureaucrats have perverse implications. The problem, we stress, is not one of ”bad” people but rather one of faulty institutional design.

Abuse of the Treasury Commons

The elements contributing to a commons—depletable resource, nonexclusive ownership, and self-maximizing behavior of actors—justify labeling that portion of the treasury available to bureaucratic budgets as a commons. The ”tragedy of the commons” model fits nicely with the treasury as a common-pool resource[5]. Essentially, the logic as it applies to a common treasury is identical to that of the ranchers on common grazing lands. In his pioneering 1833 essay introducing the tragedy of the commons, William Forster Lloyd writes:

> Again, suppose two persons to have a common purse, to which each may freely resort. The ordinary source of motives for economy is a foresight of the diminution in the means of future enjoyment depending on each act of present expenditure. If a man takes a guinea out of his own purse, the remainder, which he can spend afterwards, is diminished by a guinea. But not so, if he takes it from a fund, to which he and another have an equal right of access. The loss falling upon both, he spends a guinea with as little consideration as he would use in spending half a guinea, were the fund divided. Each determines his expenditure as if the whole of the joint stock were his own. Consequently, in a multitude of partners, where the diminution effected by each separate act of expenditure is insensible, the motive for economy entirely vanishes[6].

Like the common purse, each bureaucrat realizes that he has access to the treasury and seeks to maximize his budgetary take. He asks the question ”What is the gain to my organization (hence, to me) of capturing another increment of the treasury?” All of the increase would go to finance his agency’s activities (hence enhancing the bureaucrat’s discretionary control of resources), while the costs of his capture are spread among the entire community of bureaucrats in terms of lost capture opportunities. Bureaucrats realize that all operate under the same calculus making it rational for each to capture additional increments of the treasury. With an incentive to increase his capture of the treasury, each bureaucrat seeks ways to increase his agency’s magnitude and scope of activity.

The willingness of individuals to pay taxes ultimately limits the size of the treasury. The beneficiaries of government programs like school lunches or timber sales are vocal in defending their interests. But the costs of such programs are diffused among broad segments of the population of taxpayers, so the incentive for taxpayers to lobby against specific programs is limited;

the portion of their taxes going to any single item is quite small. The average citizen has little incentive to become active, whereas the bureaucrats and their beneficiaries have strong reasons to fight for their programs.

This problem is the classic one of ”factions” that so concerned Madison and the founders of the United States. The temptation of politicians to concentrate benefits and disperse costs has been the ruin of democracy through the ages. As society becomes based upon transfer payments, government is transformed from an agency of order to an engine of plunder. Bureaucracies are certainly powerful agents of plunder of the national treasury, thriving in a ”transfer” environment where budgets can be created and expanded by taking from one group and giving to another. Managing treasury (and other) commons requires addressing this ”remorseless logic” of bureaucracies and special-interest groups. To this end, we propose the predatory bureaucracy.

The Predatory Bureau

A predator is an organism that captures and extracts its sustenance from other animals. Could this mode of existence be replicated and introduced in a bureaucratic environment to slow down bureaucratic growth and exploitation of the treasury commons? Conceptually the answer is ”yes”- and as a thought experiment like Hardin’s imaginary common pasture, it can reveal useful insights into managing the commons.

First imagine a bureaucracy, the Agency of Budgetary Control (ABC), established with a one—time appropriation that will carry it for two years only. This constraint is critical. After the first two years, its budget would come solely from funds gleaned from eliminated programs. It is at this point that we harness the fundamental pathology of bureaucracies—that propensity toward perpetuation and growth—for social benefit. Continued funding and hence survival and growth are dependent upon predation of other agencies’ budgetary requests. This strategy provides compelling incentives for the proposed Agency of Budgetary Control.

Such an agency would have one simple budget rule: its budget is exclusively based on the money it saves taxpayers by successfully eliminating waste inside other agencies’ budgets. Suppose, for example, that the Bureau of Reclamation requests $600 million for the Las Animas—La Plata dam building project in Colorado, estimated to produce just $50 million of value to

farmers[7]. This dam's damaging ecological consequences and economic costs likely far outweigh its benefits. Nonetheless, we would expect special interests, those who expected to benefit from subsidized irrigation, to lobby for it.

The Agency of Budgetary Control would marshal evidence against the project, employing ecologists, economists, and local residents who prefer the river as it is. Their voices would be in direct Opposition to the testimony developed by the Bureau of Reclamation and its clientele groups. In this case they would join with groups like the Wilderness Society and the National Taxpayers Union. They would advertise the dam's opportunity costs to Congress.

With the dam defeated, the ABC would receive 10 percent of the project's net expenses. That 10 percent would be taken from the "prey" agency's operating budget. In the hypothetical case, the Bureau of Reclamation would be punished $55 million and the ABC would be $55 million richer. (These figures are only suggestive and would benefit from experience.) The predatory bureaucracy would thrive only if it were successful at eliminating programs. The offending department, in this case the Bureau of Reclamation, would be punished not only by losing project funding, but also by losing an additional portion of its operating budget.

With that budgetary windfall, the predatory bureaucracy could do what all bureaucracies do: add more staff, buy expensive office equipment, and diligently pursue a bigger budget. Perhaps all those new staffers could then challenge certain US. Forest Service timber sales. They could identify all the timber sales that lost the treasury money while denuding public lands. Stopping below-cost timber sales is no easy feat, as some analysts have been arguing against them for twenty-five years, but if a predator bureaucracy stands to gain some of the $160 million the Forest Service annually loses in such sales, we might expect it to invest millions in an unprecedented campaign to bring fiscal prudence to Forest Service management.

The major advantage of this proposed system is that it counters the problem of government action that concentrates benefits while diffusing costs. Further, it builds into the appropriation process a spokesman for the public interest—more importantly, a spokesman who does good while doing well. In sum, by employing this system we rely on bureaucratic self-interest to advance the public interest. There are, of course, a few technical problems with this proposal, but they are likely to be minor when compared with the benefits[8].

Yes, we are creating another bureaucracy. Is this bad a priori? A bureaucracy is a tool of social organization to be evaluated in terms of its output. Clearly the logic of the treasury commons often leads to ”tragic” outcomes where marginal social costs exceed marginal social benefits. Here, the ABC thought experiment suggests we can harness the incentive structure of the treasury commons to counter common bureaucratic pathologies.

The ABC will kill some worthwhile programs. All medicinal drugs, especially the most useful, can as a matter of fact kill some patients. So do automobile air bags. Is the agency, however, beneficial on net? Clearly such an agency as the ABC would select as prey the programs that are the most vulnerable to attack: those whose social payoffs are demonstrably highly negative. The size of the ABC is, to put it crudely, a function of the stupidity of the prey agencies. Its size would vary just as predator numbers follow the size of prey populations. The old and bloated bureaucracies are easy prey for the ABC.

Sooner than later, other bureaucracies in Washington will wise up. A series of successful attacks is very likely to have a profound effect upon the learning curve of the various agencies. At first, successful attacks are likely to generate doubts regarding the worth of other programs. Since the agencies are uncertain regarding which of their programs may be subject to predation, they will have strong incentives to avoid proposing projects of dubious social utility. Should this be the case, agencies will become more efficient and more productive, or else the predator will eat away at their budgets. If the EPA wants to regulate wood staining at a cost of $6 billion per life saved, the predator bureau will soon pounce, costing the EPA some operating budget. This system would provide incentives for government to police itself against waste and pork-barrel projects, both by the predator and the prey, as projects are weeded out in anticipation of attack by the predator agency.

We would also expect the Agency of Budgetary Control to work toward a symbiotic relationship with ”prey” bureaus, much such as natural predators do with prey species. The ABC, for example, would likely be a vocal opponent of constitutional requirements for balanced budgets and fiscal conservatism in general. But the ABC’s operating budget would still come exclusively from the fractions of budgets it eliminates. This constrains its ability to maintain the prey bureaucracies’ ”habitat”—the treasury commons—because its funding for ”habitat” maintenance must come entirely from predation. And its predation will lead to a contracted and efficiently used commons. Hence, any success it has in promoting a political ”environment” conducive to an expanding treasury

commons will be in conjunction with more disciplined and more socially optimal appropriation from that commons. Eventually, we would expect a dynamic equilibrium to evolve, where ABC predation would be balanced with Treasury waste.

The implications of this balance are clear from the environmental metaphor. Ecosystems that lack predators become dangerously unbalanced, leading to overpopulation of prey species, and a ripple effect of ecosystem deterioration. With no predators in Yellowstone National Park, elk overpopulation has brought overbrowsing of plant life with terrible consequences for the rest of the ecosystem. Efforts to reintroduce a predator, the wolf, represent an attempt to rectify this imbalance. The introduction of a predator bureau would clearly parallel this.

The logic of bureaucracies is well known, as is their tendency to overdraw from a common treasury. So long as the treasury remains as a commons we are likely to see increasing overexploitation due to the relentless bureaucratic logic. More optimally allocating resources from the common purse, as Forster pointed out, depends on institutionalizing incentives for economy among users. The concept of a predator bureau institutes a balancing agent, a constraining force on the bureaucracy, whose own logic is as relentless and remorseless as the traditional bureaucracy. It, in effect, uses the pathology of the commons against itself.

[1] For an overview of this process, see John A. Baden and Richard Stroup, "The Environmental Costs of Government Action," *Policy Review* (Spring 1978): 23—38.
[2] Stephen Breyer, *Breaking the Vicious Circle* (Cambridge, Mass.: Harvard University Press, 1993).
[3] This argument is condensed from John A. Baden and Rodney D. Fort, "Natural Resources and Bureaucratic Predators", *Policy Review* (Winter 1980): 49—81.
[4] See Gordon Tullock, *The Politics of Bureaucracy* (Washington, DC: Public Affairs Press, 1965); William A. Niskanen, Jr., *Bureaucracy and Representative Government* (Chicago: Aldine-Atherton, 1971); Aaron Wildavsky, *The Politics of the Budgetary Process*, 3rd ed. (Boston: Little, Brown, 1979); and James Q. Wilson, *Bureaucracy* (New York: Basic Books, 1989).
[5] Garrett Hardin, "The Tragedy of the Commons," *Science* 162 (1968): 1243—1248. Reprinted as chap. 1 of this volume.
[6] William Forster Lloyd, "On the Checks to Population," in *Managing the Commons*, Garrett Hardin and John Baden, eds. (San Francisco: W. H. Freeman, 1977), p. 9.
[7] Karl Hess, "A Last Green Stand for Republicans," *Wall Street Journa*l, 25 September 1996.
[8] One such problem is the decision-making rule for determining instances of successful predation and the amount of award to the ABC. Much of this proposal's success depends on how well the rules can distinguish between socially beneficial and wasteful programs and quantifying that net waste.

16

Living on a Lifeboat

GARRETT HARDIN

Susanne Langer[1] has shown that it is probably impossible to approach an unsolved problem save through the door of metaphor. Later, attempting to meet the demands of rigor, we may achieve some success in cleansing theory of metaphor, though our success is limited if we are unable to avoid using common language, which is shot through and through with fossil metaphors. (I count no fewer than five in the preceding two sentences.)

Since metaphorical thinking is inescapable it is pointless merely to weep about our human limitations. We must learn to live with them, to understand them, and to control them. ”All of us,” said George Eliot in *Middlemarch*, ”get our thoughts entangled in metaphors, and act fatally on the strength of them.” To avoid unconscious suicide we are well advised to pit one metaphor against another. From the interplay of competitive metaphors, thoroughly developed, we may come closer to metaphor-free solutions to our problems.

No generation has viewed the problem of the survival of the human species as seriously as we have. Inevitably, we have entered this world of concern through the door of metaphor. Environmentalists have emphasized

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Reprinted from *BioScience* 24: 10 (October 1974) with permission of the American Institute of Biological Sciences. A shorter, somewhat different version was published earlier in *Psychology Today*, under an inflammatory heading. The title I furnished the editor was “Lifeboat Ethics.” But without consultation he added a subtitle: “The Case against Helping the Poor”. Since the subtitle was in much larger type than the title, it largely determined the overwhelmingly negative response, which was in sharp contrast to the subsequent reaction to the *BioScience* version.

the image of the earth as a spaceship—Spaceship Earth. Kenneth Building[2] is the principal architect of this metaphor. It is time, he says, that we replace the wasteful ”cowboy economy” of the past with the frugal ”spaceship economy” required for continued survival in the limited world we now see ours to be. The metaphor is notably useful in justifying pollution control measures.

Unfortunately, the image of a spaceship is also used to promote measures that are suicidal. One of these is a generous immigration policy, which is only a particular instance of a class of policies that are in error because they lead to the tragedy of the commons[3]. This suicidal policies are attractive because they mesh with what we unthinkingly take to be the ideals of “the best people”. What is missing in the idealistic view is an insistence that rights and responsibilities must go together. The “generous” attitude of all too many people results in asserting the inalienable rights while ignoring or denying matching responsibilities.

For the metaphor of a spaceship to be correct the aggregate of people on board would have to be under unitary sovereign control[4]. A true ship always has a captain. It is conceivable that a ship could be run by a committee. But it could not possibly survive if its course were determined by bickering tribes that claimed rights without responsibilities.

What about Spaceship Earth? It certainly has no captain, and no executive committee. The United Nations is a toothless tiger, because the signatories of its charter wanted it that way. The spaceship metaphor is used only to justify spaceship demands on common resources without acknowledging corresponding spaceship responsibilities.

An understandable fear of decisive action leads people to embrace ”incrementalism”—moving toward reform by tiny stages. As we shall see, this strategy is counterproductive in the area discussed here if it means accepting rights before responsibilities. Where human survival is at stake, the acceptance of responsibilities is a precondition to the acceptance of rights, if the two cannot be introduced simultaneously.

Lifeboat Ethics

Before taking up certain substantive issues let us look at an alternative metaphor, that of a lifeboat. In developing some relevant examples the following numerical values are assumed. Approximately two-thirds of the world is desperately poor, and only one-third is comparatively rich. The people

in poor countries have an average per capita GNP (gross national product) of about $200 per year; the rich, of about $3,000. (For the United States it is nearly $5,000 per year.) Metaphorically, each rich nation amounts to a lifeboat full of comparatively rich people. The poor of the world are in other, much more crowded lifeboats. Continuously, so to speak, the poor fall out of their lifeboats and swim for a while in the water outside, hoping to be admitted to a rich lifeboat, or in some other way to benefit from the ”goodies” on board. What should the passengers on a rich lifeboat do? This is the central problem of ”the ethics of a lifeboat.”

First we must acknowledge that each lifeboat is effectively limited in capacity. The land of every nation has a limited carrying capacity. The exact limit is a matter for argument, but the energy crunch is convincing more people every day that we have already exceeded the carrying capacity of the land. We have been living on ”capital”——stored petroleum and coal—and soon we must live on income alone.

Let us look at only one lifeboat—ours. The ethical problem is the same for all, and is as follows. Here we sit, say 50 people in a lifeboat. To be generous, let us assume our boat has a capacity of ten more, making 60. (This, however, is to violate the engineering principle of the ”safety factor.” A new plant disease or a bad change in weather may decimate our population if we don’t preserve some excess capacity as a safety factor.)

The 50 of us in the lifeboat see 100 others swimming in the water outside, asking for admission to the boat, or for handouts. How shall we respond to their calls? There are several possibilities.

One. We may be tempted to try to live by the Christian ideal of being ”our brother’s keeper,” or by the Marxian ideal of ”from each according to his abilities, to each according to his needs.” Since the needs of all are the same, we take all the needy into our boat, making a total of 150 in a boat with a capacity of 60. The boat is swamped, and everyone drowns. Complete justice, complete catastrophe.

Two. Since the boat has an unused excess capacity of 10, we admit just 10 more to it. This has the disadvantage of getting rid of the safety factor, for which action we will sooner or later pay dearly. Moreover, which 10 do we let in? ”First come, first served?” The best 10? The neediest 10? How do we discriminate? And what do we say to the 90 who are excluded?

Three. Admit no more to the boat and preserve the small safety factor. Survival of the people in the lifeboat is then possible (though we shall have to be on our guard against boarding parties).

The last solution is abhorrent to many people. It is unjust, they say. Let us grant that it is.

"I feel guilty about my good luck," say some. The reply to this is simple: *Get out and yield your place to others*. Such a selfless action might satisfy the conscience of those who are addicted to guilt but it would not change the ethics of the lifeboat. The needy person to whom a guilt-addict yields his place will not himself feel guilty about his sudden good luck. (If he did he would not climb aboard.) The net result of conscience-stricken people relinquishing their unjustly held positions is the elimination of their kind of conscience from the lifeboat. The lifeboat, as it were, purifies itself of guilt. The ethics of the lifeboat persists, unchanged by such momentary aberrations.

This then is the basic metaphor within which we must work out our solutions. Let us enrich the image step by step with substantive additions from the real world.

Reproduction

The harsh characteristics of lifeboat ethics are heightened by reproduction, particularly by reproductive differences. The people inside the lifeboats of the wealthy nations are doubling in numbers every 87 years; those outside are doubling every 35 years, on the average. And the relative difference in prosperity is becoming greater.

Let us, for a while, think primarily of the US. lifeboat. As of 1973 the United States had a population of210 million people, who were increasing by 0.8 percent per year, that is, doubling in number every 87 years.

Although the citizens of rich nations are outnumbered two to one by the poor, let us imagine an equal number of poor people outside our lifeboat—a mere 210 million poor people reproducing at a quite different rate. If we imagine these to be the combined populations of Colombia, Venezuela, Ecuador, Morocco, Thailand, Pakistan, and the Philippines, the average rate of increase of the people "outside" is 3.3 percent per year. The doubling time of this population is 21 years.

Suppose that all these countries, and the United States, agreed to live by the Marxian ideal, "to each according to his needs," the ideal of most Christians as well. Needs, of course, are determined by population size, which is affected by reproduction. Every nation regards its rate of reproduction as a

sovereign right. If our lifeboat were big enough in the beginning it might be possible to live for a while by Christian-Marxian ideals. *Might*.

Initially, in the model given, the ratio of non-Americans to Americans would be one to one. But consider what the ratio would be 87 years later. By this time Americans would have doubled to a population of 420 million. The other group (doubling every 21 years) would now have swollen to 3,540 million. Each American would have more than eight people to share with. How could the lifeboat possibly keep afloat?

All this involves extrapolation of current trends into the future, and is consequently suspect. Trends may change. Granted: but the Change will not necessarily be favorable. If—as seems likely the rate of population increase falls faster in the ethnic group presently inside the lifeboat than it does among those now outside, the future will turn out to be even worse than mathematics predicts, and sharing will be even more suicidal.

Ruin in the Commons

The fundamental error of the sharing ethics is that it leads to the tragedy of the commons. Under a system of private property the man or group of men who own property recognize their responsibility to care for it, for if they don't they will eventually suffer. A farmer, for instance, if he is intelligent, will allow no more cattle in a pasture than its carrying capacity justifies. If he overloads the pasture, weeds take over, erosion sets in, and the owner loses in the long run.

But if a pasture is run as a commons open to all, the right of each to use it is not matched by an operational responsibility to take care of it. It is no use asking independent herdsmen in a commons to act responsibly, for they dare not. The considerate herdsman who refrains from overloading the commons suffers more than a selfish one who says his needs are greater. (As Leo Durocher says, "Nice guys finish last.") Christian-Marxian idealism is counterproductive. That it sounds nice is no excuse. With distribution systems, as with individual morality, good intentions are no substitute for good performance.

A social system is stable only if it is insensitive to errors. To the Christian-Marxian idealist a selfish person is a sort of "error." Prosperity in the system of the commons cannot survive errors. If everyone would only restrain

him-self, all would be well; but it takes only one less than everyone to ruin a system of voluntary restraint. In a crowded world of less than perfect human Beings and we will never know any other—mutual ruin is inevitable in the commons. This is the core of the tragedy of the commons.

One of the major tasks of education today is to create such an awareness of the dangers of the commons that people will be able to recognize its many varieties, however disguised. There is pollution of the air and water because these media are treated as commons. Further growth of population and growth in the per capita conversion of natural resources into pollutants require that the system of the commons be modified or abandoned in the disposal of ”externalities.”

The fish populations of the oceans are exploited as commons, and ruin lies ahead. No technological invention can prevent this fate: in fact, all improvements in the art of fishing merely hasten the day of complete ruin. Only the replacement of the system of the commons with a responsible system can save oceanic fisheries.

The management of Western range lands, though nominally rational, is in fact (under the steady pressure of cattle ranchers) often merely a government-sanctioned system of the commons, drifting toward ultimate ruin for both the rangelands and the residual enterprisers.

World Food Banks

In the international arena we have recently heard a proposal to create a new commons, namely an international depository of food reserves to which nations will contribute according to their abilities, and from which nations may draw according to their needs. Nobel laureate Norman Borlaug has lent the prestige of his name to this proposal[5].

A world food bank appeals powerfully to our humanitarian impulses. We remember John Donne’s celebrated line, ”Any man’s death diminishes me.” But before we rush out to see for whom the bell tolls let us recognize where the greatest political push for international granaries comes from, lest we be disillusioned later. Our experience with Public Law 480 clearly reveals the answer. This was the law that moved billions of dollars worth of US. Grain to food-short, population-long countries during the past two decades. When PL. 480 first came into being, a headline in the business magazine *Forbes*[6]

revealed the power behind it: ”Feeding the World’s Hungry Millions: How it will mean billions for US. business.”

And indeed it did. In the years 1960 to 1970 a total of $7.9 billion was spent on the ”Food for Peace” program, as PL. 480 was called. During the years 1948 to 1970 an additional $49.9 billion was extracted from American taxpayers to pay for other economic aid programs, some of which went for food and food-producing machinery. (This figure does not include military aid.) That PL. 480 was a give-away program was concealed. Recipient countries went through the motions of paying for PL. 480 food—with IOUs. In December 1973 the Charade was brought to an end as far as India was concerned when the United States ”forgave” India’s $3.2 billion debt[7].

Though all US. taxpayers lost by PL. 480, special-interest groups gained handsomely. Farmers benefited because they were not asked to contribute the grain—it was bought from them by the taxpayers. Besides the direct benefit there was the indirect effect of increasing demand and thus raising prices of farm products generally. The manufacturers Of farm machinery, fertilizers, and pesticides benefited by the farmer’s extra efforts to grow more food. Grain elevators profited from storing the grain for varying lengths of time. Railroads made money hauling it to port, and shipping lines by carrying it overseas. Moreover, once the machinery for PL. 480 was established, an immense bureaucracy had a vested interest in its continuance regardless of its merits.

Very little was ever heard of these selfish interests when PL. 480 was defended in public. The emphasis was always on its humanitarian effects. The combination of multiple and relatively silent selfish interests with highly vocal humanitarian apologists constitutes a powerful lobby for extracting money from taxpayers. Foreign aid has become a habit that can apparently survive in the absence of any known justification. A news commentator in a weekly magazine[8] in 1974, after exhaustively going over all the conventional arguments for foreign aid—self-interest, social justice, political advantage, and charity—and concluding that none of the known arguments really held [9]water, concluded: ”So the search continues for some logically compelling reasons for giving aid. ” In other words, *Act now, justify later*—if ever. (Apparently a quarter of a century is too short a time to find the justification for expending several billion dollars yearly.)

The search for a rational justification can be short-circuited by interjecting the word *emergency*. Borlaug uses this word. We need to look sharply at it. What is an ”emergency”? It is surely something like an accident,

which is correctly defined as an *event that is certain to happen, though with a low frequency*. A well-run organization prepares for everything that is certain, including accidents and emergencies. It budgets for them. It saves for them. It expects them—and mature decision makers do not waste time complaining about accidents when they occur.

What happens if some organizations budget for emergencies and others do not? If each organization is solely responsible for its own well-being, poorly managed ones will suffer. But they should be able to learn from experience. They have a chance to mend their ways and learn to budget for infrequent but certain emergencies. The weather, for instance, always varies and periodic crop failures are certain. A wise and competent government saves out of the production of the good years in anticipation of bad years that are sure to come. This is not a new idea. Joseph taught this policy to Pharaoh in Egypt more than two thousand years ago. Yet it is literally true that the vast majority of the governments of the world today have no such policy. They lack either the wisdom or the competence, or both. Far more difficult than the transfer of wealth from one country to another is the transfer of wisdom between sovereign powers or between generations.

”But it isn’t their fault! How can we blame the poor people who are caught in an emergency? Why must we punish them?” The concepts of blame and punishment are irrelevant. The question is, what are the operational consequences of establishing a world food bank? If it is open to every country every time a need develops, slovenly rulers will not be motivated to take Joseph’s advice. Why should they? Others will bail them out whenever they are in trouble.

Some countries will make deposits in the world food bank and others will withdraw from it: there will be almost no overlap. Calling such a depository-transfer unit a ”bank” is stretching the metaphor of bank beyond its elastic limits. The proposers, of course, never call attention to the metaphorical nature Of the word they use.

The Ratchet Effect

An ”international food bank” is really, then, not a true bank but a disguised one-way transfer device for moving wealth from rich countries to poor. In the absence of such a bank, in a world inhabited by individually responsible sovereign nations, the population of each nation would repeatedly

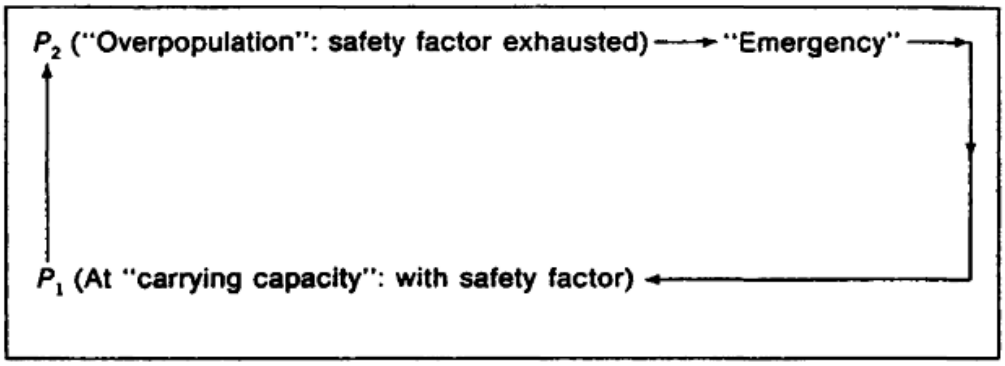

Figure 16.1. The population cycle of a nation that has no effective, conscious population control and that receives no aid from the outside. P_2 is greater than P_1.

go through a cycle of the sort shown in Figure 16.1. P_2 is greater than P_1, either in absolute numbers or because a deterioration of the food supply has removed the safety factor and produced a dangerously low ratio of resources to population. P_2 may be said to represent a state of overpopulation, which becomes obvious upon the appearance of an ”accident,” e.g., a crop failure. If the ”emergency” is not met by outside help the population drops back to the ”normal” level—the ”carrying capacity” of the environment—or even below. In the absence of population control by a sovereign, sooner or later the population grows to P_2 again and the cycle repeats. The long-term population curve[10] is an irregularly fluctuating one, equilibrating more or less about the carrying capacity.

A demographic cycle of this sort obviously involves great suffering in the restrictive phase, but such a cycle is normal to any independent country with inadequate population control. The third-century theologian Tertullian[11] expressed what must have been the recognition of many wise men when he wrote: ”The scourges of pestilence, famine, wars, and earthquakes have come to be regarded as a blessing to overcrowded nations, since they serve to prune away the luxuriant growth of the human race.”

Only under a strong and farsighted sovereign—which theoretically could be the people themselves, democratically organized—can a population equilibrate at some set point below the carrying capacity, thus avoiding the pains normally caused by periodic and unavoidable disasters. For this happy state to be achieved it is necessary that those in power be able to contemplate with equanimity the ”waste” of surplus food in times of bountiful harvests. It is essential that those in power resist the temptation to convert extra food

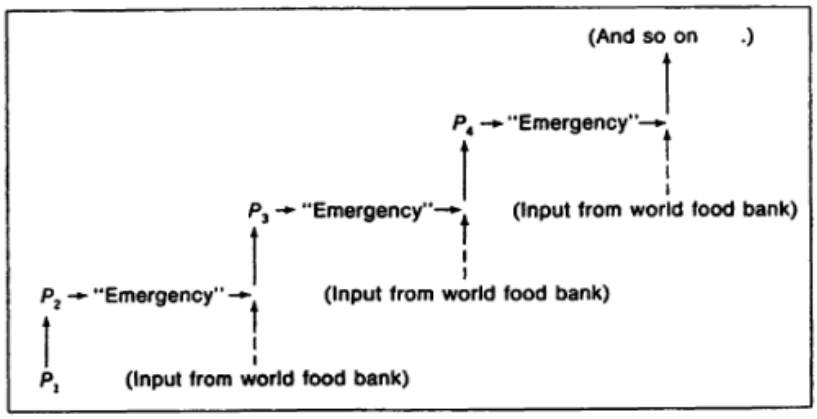

Figure 16.2. The population escalator. Note that input from a world food bank acts like the pawl of a ratchet, preventing the normal population cycle shown in Figure 16.1 from being completed. P_{n+1} is greater than P_n, and the absolute magnitude of the "emergencies" escalates. Ultimately the entire system crashes. The crash is not shown, and few can imagine it.

into extra babies. On the public relations level it is necessary that the phrase ”surplus food” be replaced by ”safety factor.”

But wise sovereigns seem not to exist in the poor world today. The most anguishing problems are created by poor countries that are governed by rulers insufficiently wise and powerful. If such countries can draw on a world food bank in times of ”emergency,” the population *cycle* of Figure 16.1will be replaced by the population escalator of Figure 16.2. The input of food from a food bank acts as the pawl of a ratchet, preventing the population from retracting its steps to a lower level. Reproduction pushes the population upward; inputs from the world bank prevent its moving down- ward. Population size escalates, as does the absolute magnitude of ”accidents” and ”emergencies.” The process is brought to an end only by the total collapse of the whole system, producing a catastrophe of scarcely imaginable proportions.

Such are the implications of the well-meant sharing of food in a world of irresponsible reproduction.

I think we need a new word for systems like this. The adjective *melioristic* is applied to systems that produce continual improvement; the English word is derived from the Latin *meliorare*, ”to become or make better.” Parallel with this it would be useful to bring in the word *pejoristic* (from the Latin *pejorare*, ”to become or make worse”). This word can be applied to those systems which, by their very nature, can be relied upon to make matters worse. A world food bank coupled with sovereign-state irresponsibility in reproduction is an example of a pejoristic system.

This pejoristic system creates an unacknowledged commons. People have more motivation to draw from than to add to the common store. The license to make such withdrawals diminishes whatever motivation poor countries might otherwise have to control their populations. Under the guidance of this ratchet, wealth can be steadily moved in one direction only, from the slowly breeding rich to the rapidly breeding poor, the process finally coming to a halt only when all countries are equally and miserably poon

All this is terribly obvious once we are acutely aware of the pervasiveness and danger of the commons. But many people still lack this awareness and the euphoria of the ”benign demographic transition” [12]interferes with the realistic appraisal of pejoristic mechanisms. As concerns public policy, the deductions drawn from the benign demographic transition are these:

1. If the per capita GNP rises the birth rate will fall, hence the rate of population increase will fall, ultimately producing ZPG (zero population growth);
2. The long-term trend all over the world (including the poor countries) is of a rising per capita GNP (for which no limit is seen);
3. Therefore all political interference in population matters is unnecessary; all we need to do is foster economic ”development”—*note the metaphor*—and population problems will solve themselves.

Those who believe in the benign demographic transition dismiss the pejoristic mechanism of Figure 16.2 in the belief that each input of food from the world outside fosters development within a poor country, thus resulting in a drop in the rate of population increase. Foreign aid has proceeded on this assumption for more than two decades. Unfortunately it has produced no indubitable instance of the asserted effect. It is, however, produced a library of excuses. The air is filled with plaintive calls for more massive foreign-aid appropriations so that the hypothetical melioristic process can get started.

The doctrine of demographic Iaissez faire implicit in the hypothesis of the benign demographic transition is immensely attractive. Unfortunately there is more evidence against the melioristic system than there is for it[13]. On the historical side there are many counterexamples. The rise in per capita GNP in France and Ireland during the past century has been accompanied by a rise in population growth. In the twenty years following the Second World War the same positive correlation was noted almost everywhere in the world. Never in world history before 1950 did the worldwide population growth reach 1 percent per annum. Now the average population growth is

over 2 percent and shows no signs of slackening.

On the theoretical side, the denial of the pejoristic scheme of Figure 16.2 probably springs from the hidden acceptance of the ”cowboy economy” that Boulding castigated. Those who recognize the limitations of a spaceship, if they are unable to achieve population control at a safe and comfortable level, accept the necessity of the corrective feedback of the population cycle shown in Figure 16.1. No one who knew in his bones that he was living on a true spaceship would countenance political support of the population escalator shown in Figure 16.2.

Eco-Destruction via the Green Revolution

The demoralizing effect of charity on the recipient has long been known. ”Give a man a fish and he will eat for a day: teach him how to fish and he will eat for the rest of his days.” So runs an ancient Chinese proverb. Acting on this advice the Rockefeller and Ford Foundations have financed a multipronged program for improving agriculture in the hungry nations. The result, known as the ”Green Revolution,” has been quite remarkable. ”Miracle wheat” and ”miracle rice” are splendid technological achievements in the realm of plant genetics.

Whether or not the Green Revolution can increase food production is doubtful[14] [15] [16] but in any event not particularly important. What is missing in this great and well-meaning humanitarian effort is a firm grasp of fundamentals. Considering the importance of the Rockefeller Foundation in this effort it is ironic that the late Alan Gregg, M.D., a much-respected Vice president of the Foundation, strongly expressed his doubts of the wisdom of all attempts to increase food production some two decades ago. (This was before Borlaug’s work—supported by Rockefeller—had resulted in the development of ”miracle wheat”) Dr. Gregg[17] likened the growth and spreading of humanity over the surface of the earth to the metastasis of cancer in the human body, wryly remarking that ”cancerous growths demand food; but, as far as I know, they have never been cured by getting it.”

”Man does not live by bread alone”—the scriptural statement has a rich meaning even in the material realm. Every human being born constitutes a draft on all aspects of the environment—food, air, water, unspoiled scenery, occasional and optional solitude, beaches, contact with wild animals, fishing, hunting. The list is long and incompletely known. Food can, perhaps, be

significantly increased; but what about clean beaches, unspoiled forests, and solitude? If we satisfy the need for food in a growing population we necessarily decrease the supply of other goods, and thereby increase the difficulty of equitably allocating scarce goods[18] [19].

The present population of India is 600 million, and it is increasing by 15 million per year. The environmental load of this population is already great. The forests of India are only a small fraction of what they were three centuries ago. Soil erosion, floods, and the psychological costs of crowding are serious. Every one of the net 15 million lives added each year stresses the Indian environment more severely. *Every life saved this year in a poor country diminishes the quality of life for subsequent generations.*

Observant critics have shown how much harm we wealthy nations have already done to poor nations through our well-intentioned but misguided attempts to help them[20]. Particularly reprehensible is our failure to carry out post-audits of these attempts[21]. Thus have we shielded our tender consciences from knowledge of the harm we have done. Must we Americans continue to fail to monitor the consequences of our external ”do-gooding”? If, for instance, we thoughtlessly make it possible for the present 600 million Indians to swell to 1,200 million by the year 2001—as their present growth rate promises—will posterity in India thank us for facilitating an even greater destruction of *their* environment? Are good intentions ever a sufficient excuse for bad consequences?

Immigration Creates a Commons

I come now to the final example of a commons in action, one for which the public is least prepared for rational discussion. The topic is at present enveloped by a great silence which reminds me of a comment made by Sherlock Holmes in A. Conan Doyle’s story ”Silver Blaze.” Inspector Gregory had asked, ”Is there any point to which you would wish to draw my attention?” To this Holmes responded:

> ”To the curious incident of the dog in the night-time.”
> ”The dog did nothing in the night-time.”
> ”That was the curious incident,” remarked Sherlock Holmes.

By asking himself what would repress the normal barking instinct of a watchdog Holmes realized that it must be the dog’s recognition of his master

as the criminal trespasser. In a similar way we should ask ourselves: what repression keeps us from discussing something as important as immigration?

It cannot be that immigration is numerically of no consequence. Our government acknowledges a net inflow of 400,000 a year. Hard data are understandably lacking on the extent of illegal entries, but a not implausible figure is 600,000 per year[22]. The natural increase of the resident population is now about 1,700,000 per year. This means that the yearly gain from immigration is at least 19 percent, and may be 37 percent, of the total increase. It is quite conceivable that educational campaigns like that of Zero Population Growth, Inc., coupled with adverse social and economic factors—inflation, housing shortage, depression, and loss of confidence in national leaders may lower the fertility of American women to a point at which all of the yearly increase in population would be accounted for by immigration. Should we not at least ask if that is what we want? How curious it is that we so seldom discuss immigration these days!

Curious, but understandable—as one finds out the moment he publicly questions the wisdom of the status quo in immigration. He who does so is promptly Charged with *isolationism, bigotry, prejudice, ethnocentrism, chauvinism, and selfishness*. These are hard accusations to bear. It is pleasanter to talk about other matters, leaving immigration policy to wallow in the cross-currents of special interests that take no account of the good of the whole—*or the interests of posterity.*

We Americans have a bad conscience because of things we said in the past about immigrants. Two generations ago the popular press was rife with references to *Dagos, Wops, Pollacks, Japs, Chinks, and Krauts*—all pejorative terms which failed to acknowledge our indebtedness to Goya, Leonardo, Copernicus, Hiroshige, Confucius, and Bach. Because the implied inferiority of foreigners was then the justification for keeping them out, it is now thoughtlessly assumed that restrictive policies can only be based on the assumption of immigrant inferiority. *This is not so.*

Existing immigration laws exclude idiots and known criminals; future laws will almost certainly continue this policy. But should we also consider the quality of the average immigrant, as compared with the quality of the average resident? Perhaps we should, perhaps we shouldn’t. (What is ”quality” anyway?) But the quality issue is not our concern here.

From this point on, *it will be assumed that immigrants and native-born citizens are of exactly equal quality*, however quality may be defined. The

focus is only on quantity. The conclusions reached depend on nothing else, so all charges of ethnocentrism are irrelevant.

World food banks move food to the people, thus facilitating the exhaustion of the environment of the poor. By contrast, unrestricted immigration moves people to the food, thus speeding up the destruction of the environment in rich countries.

Why poor people should want to make this transfer is no mystery: but why should rich hosts encourage it? This transfer, like the reverse one, is supported by both selfish interests and humanitarian impulses.

The principal selfish interest in unimpeded immigration is easy to identify: it is the interest of the employers of cheap labor, particularly that needed for degrading jobs. We have been deceived about the forces of history by the lines of Emma Lazarus inscribed on the Statue of Liberty:

> Give me your tired, your poor,
> Your huddled masses yearning to breathe free,
> The wretched refuse of your teeming shore,
> Send these, the homeless, tempest-tossed, to me:
> I lift my lamp beside the golden door.

The image is one of an infinitely generous earth-mother, passively opening her arms to hordes of immigrants who come here on their own initiative. Such an image may have been adequate for the early days of colonization, but by the time these lines were written (1886) the force for immigration was largely manufactured inside our own borders by factory and mine owners who sought cheap labor not to be found among laborers already here. One group of foreigners after another was thus enticed into the United States to work at wretched jobs for wretched wages.

At the present, it is largely the Mexicans who are being so exploited. It is particularly to the advantage of certain employers that there be many illegal immigrants. Illegal immigrant workers dare not complain about their working conditions for fear of being repatriated. Their presence reduces the bargaining power of all Mexican-American laborers. Cesar Chavez has repeatedly pleaded with Congressional committees to close the doors to more Mexicans so that those here can negotiate effectively for higher wages and decent working conditions. Chavez understands the ethics of a lifeboat.

The interests of the employers of cheap labor are well served by the silence of the intelligentsia of the country. WASPs—White Anglo-Saxon Protestants—are particularly reluctant to call for a closing of the doors to

immigration for fear of being called ethnocentric bigots. It was, therefore, an occasion of pure delight for this particular WASP to be present at a meeting when the points he would like to have made were made better by a non WASP speaking to other non-WASPs. It was in Hawaii, and most of the people in the room were second-level Hawaiian officials of Japanese ancestry. All Hawaiians are keenly aware of the limits of their environment, and the speaker had asked how it might be practically and constitutionally possible to close the doors to more immigrants to the islands. (To Hawaiians, immigrants from the other forty—nine states are as much of a threat as those from other nations. There is only so much room in the islands, and the islanders know it. Sophistical arguments that imply otherwise do not impress them.)

Yet the Japanese-Americans of Hawaii have active ties with the land of their origin. This point was raised by a Japanese-American member of the audience who asked the Japanese-American speaker: ”But how can we shut the doors now? We have many friends and relations in Japan that we’d like to bring to Hawaii some day so that they can enjoy this beautiful land.

The speaker smiled sympathetically and responded slowly: ”Yes, but we have children now and someday we’ll have grandchildren. We can bring more people here from Japan only by giving away some of the land that we hope to pass on to our grandchildren some day. What right do we have to do that? ”To be generous with one’s own possessions is one thing; to be generous with posterity’s is quite another. This, I think, is the point that must be gotten across to those who would, from a commendable love of distributive justice, institute a ruinous system of the commons, either in the form of a world food bank or that of unrestricted immigration. Since every speaker is a member of some ethnic group it is always possible to charge him with ethnocentrism.

But even after purging an argument of ethnocentrism the rejection of the commons is still valid and necessary if we are to save at least some parts of the world from environmental ruin. Is it not desirable that at least some of the grandchildren of people now living should have a decent place in which to live?

The Asymmetry of Door-Shutting

We must now answer this telling point: ”How can you justify slamming the door once you’re inside? You say that immigrants should be kept out. But

aren't we all immigrants, or the descendants of immigrants? Since we refuse to leave, must we not, as a matter of justice and symmetry, admit all others?"

It is literally true that we Americans of non-Indian ancestry are the descendants of thieves. Should we not, then, "give back" the land to the Indians, that is, give it to the now-living Americans of Indian ancestry? As an exercise in pure logic I see no way to reject this proposal. Yet I am unwilling to live by it; and I know no one who is. Our reluctance to embrace pure justice may spring from pure selfishness. On the other hand, it may arise from an unspoken recognition of consequences that have not yet been clearly spelled out.

Suppose, becoming intoxicated with pure justice, we "Anglos" should decide to turn our land over to the Indians. Since all our other wealth has also been derived from the land, we would have to give that to the Indians, too. Then what would we non-Indians do? Where would we go? There is no open land in the world on which men without capital can make their living (and not much unoccupied land on which men with capital can either). Where would 210 million putatively justice-loving, non-Indian, Americans go? Most of them—in the persons of their ancestors—came from Europe, but they wouldn't be welcomed back there. Anyway, Europeans have no better title to their lands than we to ours. They also would have to give up their homes. (But to whom? And where would they go?)

Clearly, the concept of pure justice produces an infinite regress. The law long ago invented statutes of limitations to justify the rejection of pure justice, in the interest of preventing massive disorder. The law zealously defends property rights—but only recent property rights. It is as though the physical principle of exponential decay applies to property rights. Drawing a line in time may be unjust, but any other action is practically worse.

We are all the descendants of thieves, and the world's resources are inequitably distributed, but we must begin the journey to tomorrow from the point where we are today. We cannot remake the past. We cannot, without violent disorder and suffering, give land and resources back to the "original" owners—who are dead anyway.

We cannot safely divide the wealth equitably among all present peoples, so long as people reproduce at different rates, because to do so would guarantee that our grandchildren—everyone's grandchildren—would have only a ruined world to inhabit.

Must Exclusion Be Absolute?

To show the logical structure of the immigration problem, I have ignored many factors that would enter into real decisions made in a real world. No matter how convincing the logic may be, it is probable that we would want, from time to time, to admit a few people from the outside to our lifeboat. Political refugees in particular are likely to cause us to make exceptions: we remember the Jewish refugees from Germany after 1933 and the Hungarian refugees after 1956. Moreover, the interests of national defense, broadly conceived, could justify admitting many men and women of unusual talents, whether refugees or not. (This raises the quality issue, which is not the subject of this essay.)

Such exceptions threaten to create runaway population growth inside the lifeboat, i.e., the receiving country. However, the threat can be neutralized by a population policy that includes immigration. An effective policy is one of flexible control.

Suppose, for example, that the nation has achieved a stable condition of ZPG, which (say) permits 1,500,000 births yearly. We must suppose that an acceptable system of allocating birth rights to potential parents is in effect. Now suppose that an inhumane regime in some other part of the world creates a horde of refugees, and that there is a widespread desire to admit some to our country. At the same time, we do not want to sabotage our population control system. Clearly, the rational path to pursue is the following. If we decide to admit 100,000 refugees this year we should compensate for this by reducing the allocation of birthrights in the following year by a similar amount, that is, downward to a total of 1,400,000. In that way we could achieve both humanitarian and population control goals. (And the refugees would have to accept the population controls of the society that admits them. It is not inconceivable that they might be given proportionately fewer rights than the native population.)

In a democracy, the admission of immigrants should properly be voted on. But by whom? It is not obvious. The usual role of a democracy is votes for all. But it can be questioned whether a universal franchise is the most just one in a case of this sort. Whatever benefits there are in the admission of immigrants presumably accrue to everyone. But the costs would be seen as falling most heavily on potential parents, some of whom would have to postpone or forgo having their (next) child because of the influx of immigrants. The double question Who benefits? Who pays? suggests that a restriction of

the usual democratic franchise would be appropriate and just in this case. Would our particular quasi-democratic form of government be flexible enough to institute such a novelty? If not, the majority might, out of humanitarian motives, impose an unacceptable burden (the forgoing of parenthood) on a minority, thus producing political instability.

Plainly many new problems will arise when we consciously face the immigration question and seek rational answers. No workable answers can be found if we ignore population problems. And—if the argument of this essay is correct—so long as there is no true world government to control reproduction everywhere, it is impossible to survive in dignity if we are to be guided by Spaceship ethics. Without a world government that is sovereign in reproductive matters, mankind lives, in fact, on a number of sovereign lifeboats. For the foreseeable future, survival demands that we govern our actions by the ethics of a lifeboat. Posterity will be ill served if we do not.

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17

Clear Thinking about the Earth

LYNN SCARLETT

Rashomon, a celebrated Japanese film, presents four witnesses observing a single crime. Each witness perceives the situation so differently that the audience experiences what appear to be four distinct events.

Current discourse on the environment raises a *Rashomon*-like specter of competing perceptions. The world presents us with a single reality; but expositors on the environment view that world and its workings through multiple and radically different lenses. Among this medley of lenses, two perspectives predominate.

On the one hand, we have what I will call the pessimists. They see a world in trouble. They focus on the moment, see despoliation, and predict doom. They believe we can evade doom, but only through sweeping changes wrought through single-minded pursuit of an environmental imperative.

On the other hand are the optimists. They view today as one moment on a long and largely progressive landscape of human achievement, a landscape in which human action propels us forward in a never-ending problem-solving quest.

Gore's Worldview

Vice President Albert Gore fits squarely among the pessimistic visionaries. In Earth in the Balance[1], he tells us that "our children will inherent a wasteland" unless we "dramatically change our civilization and our way of thinking about the relationship between humankind and the earth" (p. 163). This is Gore's overarching vision. What are the elements of that vision?

Gore's vision is of a (relatively) static world. He purports to look far into the future, but his View of the present is static—like a snapshot of a moment. He sees current patterns of resource use, projects those patterns into the future, and labels them "unsustainable."

This snapshot View also gives rise to a basic pessimism about technology and human action. Understandably, in a snapshot worldview, technologies look like the problem rather than an evolving sequence of solutions. In Gore's snapshot focus, past ills are forgotten, leaving us to dwell only on present woes, which, in turn, are easy to blame on present technologies. His snapshot View compels us to forget that those technologies were the answer to some earlier challenge. Indeed, for Gore, change and adaptation are themselves suspect: "Our willingness to adapt," he says, "is an important part of the underlying problem. . . . Believing that we can adapt to just about anything is ultimately a kind of laziness" (p. 240).

Gore's freeze-frame worldview has three chief consequences. First, it underplays the omnipresence of trade-offs in human action. Gore tends to focus on a single problem (or set of problems) at a single point in time, which then prompts him to propose "solutions" to these problems outside of any historical context. This results in ignoring past problems whose redress may have given rise to present problems. It leads him to ignore (or at least greatly underplay) how his proposed "solutions" themselves may mitigate one problem, while giving rise to others. It results in what American Enterprise Institute economist Robert Hahn calls Gore's "kitchen sink" approach to problem—solving—throw every tool at the problem with no thought given to costs and adverse (including environmental) impacts[2].

Second, with technologies identified as the culprit for current problems, Gore is easily led to the conclusion that the only remedies to the problems before us lie in fundamental changes in our thinking. Our effort, he writes in *Earth in the Balance*, "has to involve more than a search for mechanical solutions" (p. 161). He then adds that we need to "find a way to dramatically

change our civilization and our way of thinking about the relationship between humankind and the earth" (p. 163).

Third, since technology springs primarily out of the world of industry, this View makes industry a leading offender standing in the way of a cleaner environment.

Resilience and adaptation are natural components of a dynamic world a world in which human action is a constant process of confronting problems, adjusting, and readjusting. By contrast, in a freeze-frame world, problems take on a more cataclysmic cast. Problems are "out there," the product of accumulated human actions. And "solutions" take the form of some imagined "new" picture of the world, some set of endpoints like "clean air," "clean water," protected wetlands and forests, some future Eden.

With a set of endpoints in mind, reaching that future becomes a process of prescribing new "managed" technologies, new products, new lifestyles, new mandates for action. A freeze-frame view thus often gives rise to an emphasis on prescriptive regulations and pre—defined solutions.

This freeze-frame view also nourishes a sense that "we are running out of resources." At any point in time, the mix of resources that are "out there" appears to be finite and fixed. If we are running out of resources, then recycling and reduced consumption become compelling requirements for sustainable development.

This is a tough theme to refute. lntuitively, it would seem self-evident that most of the earth's resources are finite. There are, of course, exceptions. These include resources that reproduce, such as plant matter, or those that are recreated in never-ending cycles, such as water. And they include resources that we take advantage of but do not deplete in the process, such as the sun.

However, rocks, minerals, plant matter such as old-growth forests that took eons to come to their present majesty, and fragile environments that house critters in a delicate balance—all these resources surely are finite in some real sense.

In fact, this emphasis on scarcity highlights an important constraint on human activity. Economics is all about the decisions by which we marshal scarce resources to satisfy virtually infinite desires and needs. But this scarcity in an economic sense does not imply that we are "running out of resources" in the sense set forth by so many who share Gore's apocalyptic worldview. How could this be?

Another Worldview

Looking at the environment through a different lens gives us a different interpretation of the world around us. A longer time horizon that stretches into the past and projects into the future helps nourish a more optimistic view of our resource base for several reasons.

For example, this longer time frame allows us to focus on the processes of Change—how we moved from a Stone Age to a Bronze Age to an Iron Age and eventually into the present Information Age. This focus invites two Observations.

First, this perspective underscores that it is the attributes of particular raw materials that we seek, not each stone, Chemical, or organic product per se. We seek fuel, not necessarily oil; material that can be woven, not just cotton, wool, or nylon; materials that are malleable, strong, or conductive, not copper or iron or silica per se. This opens up vast possibilities for invention, exploration, substitution, and expansion of our resource base. It is human action that turns a sow's ear into silk—or, more realistically, sewage sludge into energy, oil into usable fuel, or old plastic scrap into tennis ball fuzz.

This is not mere Speculation. In the 19705, authors of a best-selling book, *Limits to Growth*, predicted that gold, silver, mercury, Zinc, and lead would have been thoroughly depleted by the year 2000. Instead, as Harvard economist Robert Stavins points out in a 1993 article, "reserves have increased; demand has changed; substitution has occurred; and recycling has been stimulated"[3].

One dramatic example helps us to understand how, even in the face of population growth and increasing incomes, we do not appear to be "running out of resources." Consider our telecommunications system—the linchpin of the modern age. In the 19505 some doomsayers, eyeing the increasing consumption of copper to provide communications wire, presaged severe copper shortages and impending interruptions of our worldwide communications network.

What, instead, has come to pass? Today, copper wire is increasingly being replaced by fiber-optic cable. We are moving away from the relatively high value copper to abundant sand as our basic input into communications networks. The impact on resources is stunning. We consume 25 kilograms of sand to produce a cable that can carry 1,000 times the messages over its length as a cable made from one ton of copper.

This example does not settle the issue. Not all efforts at substitution yield such compelling results. Examples such as these, however, should at least cause us to ask: Under what conditions does this evolution occur; does it apply to all resources; and what are the implications for general concern about resource conservation? The historical worldview prompts questions about process and change that the freeze-frame view unwittingly neglects.

There is another point that a longer time horizon and a focus on dynamic processes make apparent. Changing circumstances give rise to changing priorities. When requirements for basic food and shelter absorbed the attention of most of humankind, it is not surprising that certain environmental values were neglected. As those more fundamental needs have been met, we naturally have developed a revised hierarchy of values, one in which environmental amenities, conservation, and long—term health concerns become top priorities. This is, however, an evolutionary, not a revolutionary, process.

It is likewise not surprising that technological innovations of earlier decades and centuries turned more toward efforts to efficiently produce food, clothing, shelter, and other tangible consumption items than toward redressing environmental problems. As our hierarchy of values has changed, however, so, too, do our innovations evolve to satisfy new goals and overcome new problems.

The apocalyptic worldview, with its shorter time frame, neither perceives nor appreciates this evolutionary and iterative process. Hence, again, problems appear cataclysmic, with their resolution depending on revolutionary alterations in human action.

Evolutionary Conditions

None of the adjustment processes described by optimists occurs by magic. This prompts us to ask under what conditions these evolutionary changes take place. One economic structure seems especially pivotal to this process of change, conservation, and resource stewardship: free-market prices.

Free-market prices emerge through the dynamic transactions of buyers and sellers. They fluctuate, depending on supply and demand, giving us information about the relative scarcities of different resources, labor, and capital. They tell us—in a relative sense—which resources are becoming

scarcer. They thus help us to conserve where it matters most at any point in time. And they provide a common denominator—a yardstick—with which we can compare and prioritize our multiple individual preferences, values, and needs. They tell us how much (in monetary terms) of a set of resources (including raw materials, energy, labor, capital, and, increasingly, environmental ”goods”) are required to satisfy our different needs.

This picture is imperfect. Not all ”costs” associated with certain activities are incorporated into pricing systems. In fact, incomplete pricing is at the heart of many current resource problems—we don’t ”pay” for the air we use, or we don’t pay the full costs for the water we drink, for example. Thus, the adjustment process only imperfectly encompasses our quest for enhancing environmental values.

There is another side issue here worth mentioning. Our ”environment” is more than simply a set of ”resources” ready and waiting for transformation into items useful for human consumption. For many, the concern about the environment goes beyond ensuring a steady supply of resources to meet tangible human needs. For example, historian Lynn White has repudiated what he calls the ”axiom that nature has no reason for existence save to serve man”[4]. White called for the ”spiritual autonomy of all parts of nature,” a theme that Gore has repeated. Gore writes in Earth in the Balance that people have lost sight of the ”intrinsic” value of nature. He states, ”so many people now View the natural world merely as a collection of resources; indeed to some people nature is like a giant data bank that they can manipulate atwill” (p.203).

While it makes no philosophical sense to talk about flora or fauna or geological formations having ”intrinsic” value, it is plausible to imagine that some of us value the earth and its living components for the aesthetic or spiritual nourishment they arouse.

”Intrinsic value” implies value outside the ”valuer”—value beyond the presence of any moral consciousness. Spiritual values, however, do exist:they emerge from the moral choices and preferences of individuals. For these kinds of values, the economic dynamics of substitution offer little solace. As the oft—repeated line puts it, ”a rose is a rose is a rose.” If that rose—or the grey whale or an alpine lake—disappears, those who derive spiritual contentment from that rose will not find consolation in the prospect that other natural wonders still exist or that substitution processes will prevent our ”running out” of those instrumental resources that we use for human consumption of tangible goods.

This leads us to the second economic structure important to the dynamic processes of change, conservation, and resource stewardship: property rights. In a pathbreaking1968 article, Garrett Hardin warned us of the perils of the ”tragedy of the commons.” Unfettered access to commonly owned resources, Hardin argued, leads us to despoliation of the environment. He wrote, ”Individuals locked into the logic of the commons are free only to bring on universal ruin”[5].

Hardin identified a fundamental environmental problem, but many later commentors on his work did not draw the obvious conclusion from Hardin’s observations about the commons. Instead of seeing the advantages of introducing property rights where they do not exist and sustaining them where they do, they saw regulations or more common ownership as the remedy.

Yet property rights, for all the negative emotional baggage and ambiguous issues they raise, establish conditions of responsibility. Property rights sustain responsibility because they directly link ”actors” to the outcomes of their actions. It is (though with many caveats) the property owner that suffers from the consequences of poor stewardship. Hence, prOperty rights promote stewardship. As Rob Stavins has pointed out, ”the reason why some resources—water, forests, fisheries, and some species of wildlife are threatened while others principally minerals and fossil fuels are not is that the scarcity of the latter group (the non renewable resources) is well reflected in market prices, while this is much less the case for the former group, which, in fact, are Characterized by being *open-access or common-property resources*[6].

Property rights also establish boundaries for individual human action by restricting the spheres within which one can act autonomously. Beyond those spheres, where individuals bump shoulders with one another, autonomous actions are circumscribed at a minimum by a ”do no harm to others” principle. But within those spheres, individuals can pursue self-defined values. This means instrumental values—for example, using land for grazing. And it means spiritual values—the ”nature—as-cathedral” values that Gore worries about.

Without property institutions, the alternative remains the give-and-take of the political process, which means the processes of coerced compromise. Or one can, like Gore, press for a religious transformation, a sort of consciousness—raising whereby we all adopt a shared appreciation of ”nature as cathedral” and environmental goals as the single organizing principle for our actions. One wonders what Gore can point to as a successful model of ”consciousness-raising” of the scope he proposes. The most far-reaching attempts (revolutionary socialism) to create a ”new human being” have been

accompanied by massive coercive efforts. The legacy of such efforts has thus mostly been loss of freedom and only dubious accomplishments toward a better world.

The Limits of World Visions

Competing world visions make dialogue about appropriate actions difficult, since different visions produce different interpretations even of what ”the problem” is. And, by definition, different world visions produce different understandings of how the world works.

Sorting out the components of competing visions can help us explore where opportunities for better communications might lie. Yet this exploration will not dissolve differences. Gore blurs two very different aspects of human thought and sentiment. World visions are all about how we think the world works; they are not about what we ”value.” To some extent, world visions can be altered by honing our powers of Observation and understanding—by taking a bird’s-eye view where we had previously looked only with feet planted on the ground.

Values, however, spring from a complex interplay of reasoned thought and human sentiment. Thus, at least part of the environmental policy debate is a tug-of—war between those who value, for example, ”freedom of human action” not for any utilitarian results it might have but because it ”feels good” to be free. The same can be said for those who embrace the ”nature as cathedral” notion. They value nature because it ”feels good” to walk in its beauty.

This is why so much talk of ”market mechanisms” to address environmental problems misses the central questions. If markets are only about finding lower cost ways to achieve predefined goals, these mechanisms simply push aside values questions. And the embrace of these market mechanisms in terms of ”problem-solving” puts these tools on a level with proposed new technologies or new regulations. All three are merely instruments to solve problems.

On the other hand, there is another way of looking at markets—a way that views markets as a set of decentralized institutions and decision processes through which individuals ”reveal” their preferences and through which they undertake mutually agreeable transactions. This is another way of saying that, through their choices among competing Options, individuals

translate their values into sets of actions. And they do so through what amounts to a give-and-take process of negotiation. Markets, thus, are about individual freedom and voluntary transactions[7].

A historical lens, with an emphasis on evolution and adjustment, permits us to see a dynamic world and to focus on process rather than particular ”freeze-frame” outcomes. The focus on process moves us away from the ”markets-as-tools” notion toward an appreciation of markets as a means by which individuals pursue their individual hierarchies of values. It is the feedback loops of decentralized market decision-making institutions that will allow individuals to pursue those values into the future. And it is those same feedback loops that will make environmental values rise higher and higher on the hierarchy as our other needs are met and as these tangible environmental and spiritual values loom larger.

[1] Al Gore, *Earth in the Balance* (Boston, Houghton Mifflin, 1992).
[2] See chap. 2 of *Environmental Gore*, ed. John A. Baden (San Francisco: Pacific Research Institute for Public Policy, 1994).
[3] Robert Stavins, "Comments on 'Lethal Model 2: The Limits to Growth Revisited,' by William Nordhaus," in *Brookings Papers on Economic Activity*, 1993.
[4] Lynn White, cited in Robert James Bidinotto, "The Green Machine," *IOS Journal*, May 1993.
[5] Garrett Hardin, "The Tragedy of the Commons," in Hardin, ed., *Managing the Commons* (New York, W. H. Freeman, 1977), p. 29. Reprinted as chap. 1 in this volume.
[6] Stavins, op. cit.
[7] This is a notion of freedom strongly at odds with that put forth by Gore. Gore claims that "freedom is a necessary condition for an effective stewardship of the environment" (p. 179). Yet by freedom he means the political empowerment demand remedies to problems.

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