

# Institutional Failure in Resource Management

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## Abstract

Many of the world's natural resources are in a state of crisis. The solution to this crisis is to develop effective management institutions, but there is no consensus on what those institutions are. Some economists favor solving resource-management problems through the institution of private property; others advocate central government control; and many anthropologists see local-level management as the solution. In this review, I argue that all these governance structures fail under certain conditions. However, the factors contributing to failure in each of these institutional forms differ radically, and the causes of that failure are not always predicted on the basis of existing theory. This chapter contains a review of the literature on the factors identified as causing the failure of private-property regimes, government-controlled resources, and local-level management. We will have to learn to match the resource problems with governance institutions and specific management techniques if we are to manage resources effectively. We also will have to understand the complex biosocial factors influencing sustainability.

## INTRODUCTION

Over the past 50 years it has become increasingly apparent the world is facing a resource management crisis. Large numbers of marine fisheries have been seriously depleted. Forests are being harvested at unsustainable levels; acid rain and smog are problems in widespread parts of the industrialized world; soil erosion threatens vast areas; parts of Africa and the Middle East are returning to desert; industrial waste dumps make life hazardous for large numbers of humans and other animals; many rivers and estuaries are polluted; and virtually every large lake in the world is in a precarious state.

There is increasing consensus that the cause of resource degradation is institutional. If we get the right rules and governance structures, natural resources will be used wisely and conservation goals will be met. Unfortunately, we clearly have not gotten those rules right. That so many resources are in such dire straits indicates we are witnessing widespread institutional failure.

Although there is agreement that institutions are needed to solve resource problems, there is no agreement as to what institutions would do the job best. At this point, it is generally agreed that three possible governance structures exist: private property, government management, and local community management. Each of these structures has strong advocates (Ostrom 1990).

A number of economists from the late 1950s to the 1970s, working on what became known as the common property problem, concluded that the primary cause of the destruction and inefficient use of natural resources was the absence of property rights. The solution was to put resources in private hands or to simulate private-property rights, for example, by establishing licenses or limiting entry schemes (Cheung 1970, Gordon 1954, Johnson 1972, Posner 1977, Scott 1955). Their insights have had no small effect on the management of natural resources.

Hardin (1968) advocated government management in his article "The Tragedy of the Commons." Many bureaucrats and environmentalists share Hardin's advocacy of strong and possibly repressive government action, and they have persuaded the U.S. Congress to enact a number of important conservation laws, including the Clean Air Act, the Clean Water Act, the Environmental Protection Act, and the Endangered Species Act.

Since the 1980s, many anthropologists and other social scientists have come to advocate management by local-level communities. They have buttressed their arguments by pointing to the large number of cases in which resources were managed well at the local level by communities around the world or by communities in partnership with governments (i.e., co-management) (Anderson & Hill 2004, Baland & Platteau 1996, Berkes 1989, McCay & Acheson 1987, Ostrom 1990, Pinkerton & Weinstein 1995).

Social scientists and others tend to lionize one of these solutions to resource dilemmas. I argue none of these is a general solution. All these different kinds of governance structures have succeeded in conserving natural resources in some instances, but they have all had their share of failures as well. In this review, I concentrate on the failures. Focusing on cases where these governance structures did not work gives some unusual insights into the resource-management problems we currently face. As discussed below, many institutions have failed to conserve resources, and the reasons for those failures are not always predicted on the basis of existing theory.

There is no well-developed literature on institutional failure because analysts far prefer to write about successful resource-management ventures rather than the failures. Nevertheless, there is a good deal of scattered information on cases where mismanagement occurred and the reasons for it.

One general cause of resource depletion is that people may not recognize that resources are being depleted or even that they are under

stress, particularly in the first stages of overexploitation. The factors influencing changes in resources' stocks are so complex that genuine uncertainty may exist about the role of human activities on stock sizes (Berkes & Folke 1998, Wilson 2002). In aboriginal societies, where game is thought to be provided by spirits or other supernatural forces, the idea that shortages of fish and game could be a result of overexploitation may not even occur (Anderson 1996, p. 101; Brightman 1993). However, even in cases where people recognize the problem, they can fail to conserve. The primary reason for conservation failure is that they cannot devise effective institutions or rules.

Assessing institutions is difficult because several different criteria can be used to measure the success or failure of institutions designed to conserve renewable resources, ranging from economic efficiency and equity (Fehr & Gächter 2000) to adaptability and accountability. However, in this review I assess institutional failure in terms of resource sustainability. Although there are problems with this definition (see Singleton 1998, pp. 15–16), I do not believe we can judge rules to conserve renewable resources as being successful if the resource is not maintained in the long run. Before I discuss institutional failure, information is needed on some basic concepts and their application to resource management.

### **COMMON-POOL RESOURCES, COMMUNAL ACTION DILEMMAS, AND PROPERTY RIGHTS**

The root of the resource-management problem, according to many social scientists, lies in the common-pool nature of many of our most important natural resources. Common-pool resources (such as water, air, grasslands, forests, and stocks of fish and wildlife) have two characteristics, which in combination cause serious problems. First, they are subtractable, which means the amount of the resource used by one person cannot be used by

another. Second, it can be difficult to exclude people from using these resources (Ostrom et al. 1994). As a result, oceans, rivers, lakes, air, parks, and wildlife can be exploited by large numbers of people, who, after a time, deplete the resource.

The solution to managing common-pool resources is to establish rules curtailing resource use in the interest of long-term sustainability. Such rules would presumably benefit everyone by preventing overexploitation of the resource and/or its complete destruction. However, even though such rules bring favorable results, there is no guarantee they will be provided. Olson (1965) first recognized this problem: He pointed out that even if rules or other public goods would benefit all, they would only be provided if special incentives exist. The basic problem, he argued, was that individuals have no incentive to voluntarily help to produce a public good because they will have the benefit of it regardless of whether they help to produce it. Because it is rational for everyone to free ride on the efforts of others, no one cooperates, and the rule or public good is not provided. Everyone is worse off than if they had cooperated, even though everyone has acted rationally.

More recently, the problem has been phrased in terms of a collective-action dilemma. This is a situation in which there is a divergence of what is in the interests of the individual and what is optimal for the community or larger group. In collective-action dilemmas, rational behavior by individuals leads them “to behave in ways that are collectively disastrous” (Elster 1989, p. 17; Taylor 1990). In the case of common-pool resources, it can be all too rational to refuse to cooperate in conserving natural resources, even though cooperation would have benefited everyone.

Collective-action dilemmas have received a good deal of attention from social scientists because they describe many of the most vexing problems facing humans. In fact, Taylor states, “politics is the study of ways of solving collective action problems” (Taylor 1990, p. 224.)

However collective-action dilemmas have not received much attention in anthropology. One exception is the work of Hawkes (1992), who uses concepts from rational-choice theory to study sharing among hunters and gatherers, and I use collective-action dilemmas to understand rule development in the Maine lobster industry (Acheson 2003).

Adding to the difficulty of managing common-pool resources is that two different kinds of rules must be put in place to solve two different kinds of collective-action dilemmas. First, property rights must be devised and enforced. If everyone is permitted to harvest a resource (i.e., open access), the resource is almost certain to be overexploited by all comers because there is little incentive to maintain it. Second, those permitted to exploit the resource have to agree to establish rules curbing their exploitation rate (i.e., management mechanisms). Doing one without the other will not suffice. From this perspective, effective management means that a group must solve a two-tier collective-action problem (Hechter 1990). Institutional failure is a situation in which a group cannot solve one, or both, of these collective-action problems.

Generally, two different kinds of rules can be used to control effort. The first kind are rules that limit how the resource is harvested, i.e., rules governing the time, place, and techniques that can be used (Acheson & Wilson 1996). The second kind are rules specifying how much of the resource may be taken (i.e., a quota). Currently, individual transferable quotas (ITQs), a solution that combines quotas with market-based solutions, are much in vogue (Rose 2002).

Property rights can be held by a wide variety of organizations (Acheson 1984, Hann 1998). Furthermore, rules giving access, management, inheritance, and exclusion rights can be combined in different configurations (Schlager & Ostrom 1993). In the resource-management literature, it is standard to see property as owned or affected by local com-

munities, governments, or private individuals (Berkes 1989, p. 9). In this review, I follow this convention.

## PRIVATE PROPERTY

The effect of private-property rights on natural resources was explored in some detail by economists working from the 1950s to the 1980s (Acheson 1989, Gordon 1954, Scott 1955), who made a distinction between private property (called sole owner in some of the literature) and common property. They concluded that owners of private property have an incentive to protect and make investments in it because they can be assured that they, and only they, receive the benefits. Common-property resources, by way of contrast, are overexploited because no one has any incentive to invest in those resources or conserve them for the future. Why conserve when the resource will likely be taken by someone else—perhaps in a matter of a few hours (Acheson 1989, Gordon 1954, Hardin 1968)? Ciriacy-Wantrup & Bishop (1975) challenged this analysis by pointing out that it was open-access resources that were subject to abuse and that communally owned resources could be managed quite well. No one has challenged the idea that complete private-property rights help to conserve resources, and it will be helpful to review what these economists claim are the benefits of sole ownership.

In addition to conservation, economists pointed out that private-property rights have a number of other virtues. Private ownership promotes efficient use because the owners of those resources are free to use them in ways that grant them the highest income and to reject less productive options. Owners of agricultural land, for example, can grow crops, lease the land, enter into an arrangement with a sharecropper, or sell the land outright—whichever choice is to their advantage. Users of open-access resources, conversely, cannot enter into any exchanges regarding resources

they do not own. Their only recourse is to harvest the resource themselves as quickly as possible (Acheson 1989).

In addition, private property is said to promote efficient use of capital. Open-access resources are subject to overcapitalization, a situation where far more firms enter the industry with more equipment than is needed to harvest the resource, a situation that can facilitate overharvesting. Private property also lowers transaction costs by making it relatively easy for an owner to go to court and gain compensation if the property is damaged or destroyed by another person. Private-property rights make it possible to solve a number of resource problems by entering into market exchanges. Eggertsson (1993, p. 2) summarizes the deleterious effects of the absence of property rights: "It is obvious that the nature of control matters for economic actors: short-term control shortens the time horizon; uncertain control discourages potentially profitable projects; lack of control incites costly races for possession; restricted control allocates assets to inferior uses."

Because these economists see private property as having many advantages, they have long advocated solving resource-management problems by effecting private-property rights or by simulating such rights with mechanisms such as licensing or quotas (Acheson 1989). Contrary to what the theory suggests, the potential for managing natural resources by privatizing them is much more limited than assumed by the economists advocating this solution. If privatization is going to solve resource-management problems, property rights have to be complete and well defined, efficient markets for those resources have to exist, and enforcement of property rights must be possible at low cost. In the real world, some important resources, such as migratory species of fish, cannot be privatized. Moreover, market inefficiency and market failure are common (North 1990). There is no market for some resources such as air. The primary cause of market failure is incomplete property rights, which result in ex-

ternalities (Bates 1994). Negative externalities exist when firms are allowed to pass some of their production costs to others external to the firm (e.g., a polluter who damages the property of others downstream or downwind). Positive externalities exist when owners cannot capture all the benefits of their own productive activity (e.g., the owner of a beehive who cannot charge farmers for pollination services). (For a more complete discussion of these problems, see Baland & Platteau 1996, pp. 37-47). Privatization will not solve resource problems in many cases.

More important, even where complete property rights to a resource exist and markets are efficient, private-property rights do not always result in resource conservation. Under certain circumstances, people can and will overexploit resources they own privately, even when property rights are secure. The literature on pastoralists, farmers, and loggers shows that "resource conservation is not always ensured by the private property status of the resource" (McCay & Acheson 1987, p. 9). The dust-bowl conditions of the 1930s, soil erosion in more modern times, and depletion of industrial forests all underline the fact that at times private landowners are no more responsible than users of open-access resources. Such cases are not all that rare. What conditions make it rational for owners to overexploit their own resources? Four such circumstances are mentioned in scattered parts of the literature.

First, Clark (1973) has advanced the most widely known explanation of the failure of private property to conserve resources. He argues that "[a] corporate owner of property rights in a biological resource might actually prefer extermination to conservation, on the basis of maximization of profits" (p. 630). This occurs when the growth rate of the resource is less than the discount rate. It does not make sense to borrow money from the bank at 8% interest to invest in a resource that increases in value at only 4% per year. This would not be a rational investment. Under these circumstances, it would only be sensible to deplete

the resource as fast as possible and invest the money where it will give higher returns.

Second, long time horizons—in and of themselves—make it rational to overexploit privately owned resources. Forests are an excellent example. Economic analyses of forests demonstrate that forests grow so slowly that money invested in them would get a far better return put into other industries. Regardless of what discount rate is used, the future value of forests is quite low (Mass & Vicary 1991).

Baskerville (1995) advances a closely connected time-horizon argument. He argues it is illogical to invest in slow-maturing resources if there are two, three, or more generations between resource investment and harvest. He points out that in the case of New Brunswick forests, there is a strong tendency to make decisions with the interests of the current generation in mind. This same point can be made of other resources. Most people—including most owners of firms—figure there is little sense investing in a resource that someone else is going to harvest far into the future.

Third, uncertainty about resource availability can lead to overexploitation. Forests and stocks of fish and wildlife are harvested in a complex and even chaotic environment, so rapid, unpredictable fluctuations occur owing to, for example, disease, predation, and weather (Wilson 2002). When biological systems are unpredictable, the incentive for people to invest in such stocks or curb their own exploitive behavior is reduced because of the uncertainty that these activities will result in any payoff.

Fourth, economic pressures also can force resource owners to overexploit them. With regard to the Third World, Baland & Platteau (1996, p. 46) state, “for people in ‘extreme poverty’ . . . all that matters is consumption today.” Similar pressures can exist in industrialized countries. The economic situation of some private-property owners might be so precarious that they are forced to forego optimal strategies (e.g., selective cutting, crop rotation) in an effort to stay in business in

the short run, even though this degrades their property in the long run.

Any one of these four circumstances can motivate owners of natural resources to overexploit or fail to maintain resources at optimal levels. When two or more of these circumstances occur together, strong incentives to degrade privately owned resources can be created.

In Maine, many of these circumstances exist in the pulp and paper industry, which owns a large percentage of the northern part of the state (Acheson 2000). In all the northern counties of the state, the rate of cutting is not sustainable. Recent studies found that the cut-to-growth ratio was 2 to 1 or higher, indicating at least twice as much wood was being cut as was growing back. In Piscataquis County, the ratio was 3.6 to 1. As a result, the quality of stands has decreased, while the amount of land in hardwoods and saplings has increased greatly (Gadzik et al. 1998, pp. 3–4; McWilliams 1997).

Why are companies in this industry in the process of destroying their own forests? First, the paper industry faces a variety of economic pressures that reduce profits to low levels. All forest landowners contend with economic returns on investment that are no more than 6%, given the low rates of forest growth. Second, the pulp and paper companies have cut-throat price competition from more modern mills built in the southern part of the United States and in foreign countries, lowered demand for paper products, and volatile prices (Legasse 1997, McDonald 1997).

To keep profits at an acceptable level, the paper companies have reacted to this situation by keeping costs low, keeping capital equipment as long as possible, and running their mills continually. They have successfully lobbied the state government for a variety of services, such as fire control, spruce budworm spraying, and low land taxes. Most important, the paper companies are cutting their own forests heavily, using low-cost techniques such as clear cutting and poor-quality partial

cuts. These strategies avoid the full costs of investing in sustainable forests. In this case, it is private owners who are degrading their own forests.

## GOVERNMENT

Governments do wonderful things. We have come to depend on them for a huge variety of services and goods. In the past few decades, we in the United States have come to see the government as our primary bulwark against environmental pollution and degradation.

Governments generally attempt to preserve resources in two ways: First they buy large amounts of land and resources to create parks, national forests, and biosphere reserves; second, they pass laws and regulations designed to protect resources. They generally have not been doing either for long. In the United States, the first national parks were established in the early twentieth century. Virtually all our important environmental legislation (including the Clean Air Act, the Clean Water Act, and the Fisheries Conservation and Management Act) was enacted in the 1970s. During most of our history, resource management has not been a primary goal of the government. I believe this is still the case in many, but not all, of the countries of the Third World, and in countries in the ex-Soviet block.

There is little question that these government efforts have borne fruit. Our environment is much cleaner now than it was a few decades ago. There are many people in the United States—especially professional managers and the conservation community—who assume resources can be managed only by the government.

But government can also fail in the resource area—sometimes massively. Some 70% of all marine fisheries are depleted or endangered. Countries such as Haiti, Bangladesh, Thailand, Pakistan, and the Philippines have lost over 40% of their forests in the past 20 years alone (Ascher 1995, pp. 3–4). Many of these resources have

been under scientific management choreographed by central governments for decades (McGoodwin 1990). Wunsch (1999, p. 244) summarizes the situation by saying, “the centralized, hierarchical, bureaucratic administrative model has failed.” Durrenberger & King (2000, p. 4) echo this conclusion by pointing out that “centralized management systems themselves can cause ‘tragedies’.” The government record in Third World countries is far worse. Baland & Platteau (1996, p. x) write of the “absolutely appalling record of most of the national governments of the poorest countries.”

When discussing government failure, an important distinction exists between the destruction of resources in cases where governments do not perceive of natural resource conservation as a primary goal and cases where governments have accepted the responsibility for resource conservation. There are different kinds of government failure involved in each. Here I focus on cases where the government has tried to conserve natural resources and has failed.

There is a large body of literature on policy failure and government failure. On the whole, it does not provide an adequate explanation for the failure of government resource-management policy.

Why do so many government efforts to manage resources fail so miserably? In some cases, the problem lies in the open-access nature of the resources. Air, for example, is not owned, and this has made regulation difficult. But governments have property rights over many resources, including oceans in the exclusive economic zone and national forests and parks. In these cases, resource abuse is a result of the mismanagement of state-owned property, resulting from policy failure (Marchak 1987). For a variety of reasons, government agents cannot or will not generate effective management rules.

The literature on government failure mentions agency problems as the most important reason that the government works poorly. That is, the problems of governments stem, in

the main, from the behavior of politicians and government officials who opt to serve their own interests rather than those of the public (Cook & Levi 1990, p. 411; Moberg 1994; Shleifer & Vishny 1998, p. 4). These activities can range from voting for the interests of constituents in ways that do not serve the public at large to outright bribery. Corruption is a particularly serious problem in Third World countries (Wade 1982, 1985). Baland & Platteau (1996, p. x) write of the people of rural communities as “oppressed and repressed by the autocratic leaders and kleptocratic civil and military officers of those countries.”

Buchanan & Tullock (1962), Olson (1965), and Becker (1983) see the source of government failure in the interest groups or winning majorities that pressure the government into redistributing goods and services to them at enormous cost to the public. Others see the problem in terms of rent seeking, which occurs when an interest group “colonizes a government bureau so that the bureau promotes the specific interests of the organized group at the expense of the public as a whole” (Bickers & Williams 2001, p. 194; Yandle & Dewees 2003).

Others argue the organization of bureaucracies contains the seeds of failure. Bureaucratic incentives can make it difficult for agencies to cooperate (Sproule-Jones 2002) or even to work against each other (Gibson 1999). A number of authors, including Miller (1992, pp. 140–42), Williamson (1970, pp. 25–27), and Tullock (1965, pp. 142–93), have argued that all bureaucracies, including those of the government, have problems with asymmetrical information. That is, as information is transmitted from the bottom of a hierarchy to the top, it is simplified and distorted, resulting in top executives making decisions based on faulty information. Some eminent social scientists say government inefficiency can be the product of deliberate design. Moe (1990) argues politicians deliberately design government institutions to be inefficient to avoid having an efficient invention of their own making used against them when they

are out of power. North (1990, p. 59) points out that sometimes it serves the interests of rulers to allow inefficient institutions to exist, including monopolies, barriers to entry, and featherbedding rules.

However, I believe two additional factors play important roles in the failure of governments to effectively manage their resource: problems with science and top-down management. Neither has been given adequate attention.

### Problems with Science and Engineering

In large numbers of cases, government efforts to manage resources fail because of the mistakes made by scientists and engineers. In the modern world, an aura of certainty and infallibility has come to surround science and scientists. Their advice is sought on all kinds of matters, and it is usually accepted because it is difficult for laypeople to challenge them. Unfortunately, the science involved in resource management is plagued with problems, making scientists all too fallible. When those advising government policy makers make mistakes, the results can be disastrous.

Scientific and engineering problems produce different kinds of problems in different resources. For example, reforestation attempts have failed, in part, because government foresters have imported foreign, fast-growing trees, which do not grow well or have been killed off owing to disease, insect infestations, and inadequate soil or water (Ascher 1995, p. 9).

Government-sponsored irrigation efforts have been plagued with errors. Irrigation officials and engineers have a penchant for large-scale projects, even when small projects are more cost efficient (Ostrom 1992, p. 6). In some cases, these poorly planned projects lost massive amounts of money or could not be sustained at all (Ostrom 1992, pp. 2–3); in others, they did not deliver adequate amounts of water to farmers who were forced to obtain water by illegal means (Chambers 1980).

In other projects, poor design problems were compounded by the unwillingness of governments to provide adequate money for maintenance. Interestingly, farmers are often blamed for the problems stemming from inadequate design (Freeman & Lowdermilk 1985).

Fisheries' scientists are not able to measure stock sizes accurately or understand the reasons that stocks change because of serious conceptual problems and problems in gathering data (Acheson 2003, Durrenberger 1996). Wilson (2002, p. 329) reports that when measuring stock size, "errors of measurement on the order of 30 to 50% are common." All too often, the advice of scientists falls far off the mark and leads to serious consequences. In the New England groundfishery, for example, scientists overestimated the stock size, which exacerbated the overfishing problem in the 1980s and 1990s. In the lobster fishery, scientific problems led fishery administrators to recommend the elimination of management measures that were effective (Acheson 2003). Fishermen are fully aware of these inadequacies, and as a result, they often give little support to fisheries management plans. This, in turn, increases enforcement problems.

### Top-Down Management

In the past decade, there has been a litany of criticism of centralized government efforts to manage resources. Decentralized management efforts generally appear to work better in managing forests (Ascher 1995, p. 10; Gibson et al. 2000, p. 3), irrigation systems (Lam 1998, Ostrom 1992), and fisheries (Pinkerton & Weinstein 1995).

Centralized, hierarchical government units have a number of traits that in the long run work against effective resource management. Government agencies have a strong penchant for regulatory uniformity. As a result, central governments are apt to promulgate one set of rules for large areas that do not take into account variations in the local ecology. Agencies are invested with a good deal of power, which they often

use to ride roughshod over the wishes of local government units. This can result in a lot of hostility and opposition from local government officials (Ascher 1995).

Government agencies concerned with resource management generally are staffed with well-educated engineers and scientists from urban areas who tend to have an interest only in scientific and technical aspects of their job and have little interest in the local culture. Many cannot communicate with peasants (Weeks 2000); others have contempt for local-level knowledge based on decades of experience (Ascher 1995, p. 125; Anderson 1996, p. 101; Coward 1985; Lam 1998, p. 37). Often, no attempt is made to organize the farmers, wood harvesters, or fishermen who are affected by these plans or to frame rules they will support (Freeman & Lowdermilk 1985). The plans produced by agency officials often have a negative effect on the resource and impose huge costs on the resource users as well (Takahashi 1970, p. 52). Peasants often react to this situation by working around officials in a variety of ways (Baland & Platteau 1996, pp. 238–241; Lam 1998, p. 43).

Far worse, government agents in innumerable cases have so little understanding of human social organization or behavior that they introduce changes in technology, rules, and subsidies in ways that motivate resource users to make decisions that result in disaster for the resources involved. There are many examples of such government-produced perverse incentives. Reforestation programs in many Third World countries have failed, in part, because the incentive system set up by the government did not induce people to plant trees and maintain forests (Ascher 1995, p. 8). In another example, the government of Kenya encouraged growing cattle (to provide beef for the urban markets) and having fewer goats, which are more drought resistant. When drought hit, large numbers of cattle died, putting the tribesmen into dire straights (Dyson-Hudson 1985, p. 178). Fisheries provide still more examples. In Maine and Hawaii, conservation laws

motivated skippers to put more effort on the resource than they would have otherwise (Acheson 1984, Townsend & Pooley 1995). In California, a state law designed to increase the amount of sardines packed for human consumption resulted in a large amount of the catch being turned into fish meal (see also McEvoy 1986, p. 140).

In addition to failing to conserve the resource, governments actions have produced other deleterious effects. These range from loss of autonomy and control (Apostle & Barrett 1992) to conflicts over resources (Anderson 1987, Smith 2000). In addition, government policies all too often result in the concentration of the resource in the hands of local elites or corporations (Leslie 2000, Palsson & Helgason 1997, Polioudakis & Polioudakis 2000).

Finally, and most serious, central governments often “frustrate rather than facilitate” the local level or private efforts to provide public goods, including rules to manage resources (Ostrom 2000a, p. 138; Pinkerton & Weinstein 1995, pp. 177ff). By making it impossible for local governments to experiment in solving problems, top-down management policies stifle learning and curtail adaptive responses to problem solving (Wunsch 1999).

Government programs are sometimes plagued by both scientific problems and top-down management simultaneously. When this occurs, the result can be devastating. In perhaps the best example, Scott (1998) focuses his book *Seeing Like a State* on describing the failure of state enterprises designed to better the human condition in the twentieth century and the underlying causes of that failure. He analyzes such diverse disasters as China’s great leap forward and Soviet collectivization, both of which resulted in massive starvation, along with less deadly enterprises, such as compulsory villagization in Tanzania and the planning of certain cities such as Brazilia.

Scott says four factors underlie these disastrous mistakes by governments. First, states

must make complex, diverse social and ecological phenomena “legible.” They invent, for example, tax lists, land maps, and census data to make the society they are in charge of understandable and hence controllable from the top. To do this they have to simplify complex phenomena. Second, Scott says, is “high modernism,” an uncritical and unsketched faith in science and technical progress. (Note that this is faith, not scientific practice.) The practitioners of high modernism are unwilling to admit to the high degree of uncertainty and complexity that surrounds human and ecological phenomena. Legibility and high modernism only become lethal, Scott says, when they are combined with the final two factors: a powerful, highly centralized state willing and eager to use its power to bring these high modernistic schemes into being and a “prostrate civil society lacking the capacity to resist these plans.”

Of course Scott is referring to Lenin’s Russia and Communist China, but his analysis also applies to cases in North America. One example is Canada’s failed attempts to manage groundfish (i.e., cod, haddock, pollock) in Newfoundland, which has resulted in stocks of these fish being reduced to 500-year lows. According to Finlayson (1994), this disaster can be traced to decisions of the Canadian government. To develop the poor province of Newfoundland, the Canadian government financed the construction of 170 large offshore trawlers capable of taking far more fish than had been taken historically. Government scientists said the stock could support higher catches, although industry spokesmen warned against putting a lot more pressure on them. The result was overexploitation, leading to a devastating stock failure. The causes of the Newfoundland disaster are reminiscent of Scott’s (1998) analysis. In the Newfoundland case, the roots of disaster are found in poor science in the form of an overly optimistic, politicized stock assessment used by a powerful, centralized bureaucracy determined to improve a poor and relatively weak province, with a poorly advised fleet expansion.

## LOCAL-LEVEL MANAGEMENT

Although there are many instances in which local-level communities successfully organized to conserve the resources on which their livelihood depends (e.g., Berkes 1989, Berkes & Folke 1998, Dyer & McGoodwin 1994, McCay & Acheson 1987, Ostrom 1990, Pinkerton & Weinstein 1995), there are also many cases of failure. The problem is also not confined to industrial societies. Recent work has demonstrated that people in tribal societies have done a good deal of damage to land and wildlife in many parts of the world, in some cases long before contact with Western civilization (Jackson et al. 2001, Krech 1999).

Local-level efforts to conserve resources fail because the people of those communities either cannot devise rules to manage them or because the rules fail after they are established. Different sets of factors are involved in each.

There is a growing consensus that the failure to get rules is traceable in great part to the characteristics of communities. A number of characteristics are said to make the process of devising and enforcing rules easier: a sense of community, social capital, social homogeneity, dependence on the resource, leadership, and secure boundaries (North 1990, p. 12; Ostrom 1990, 2000a,b; Wade 1988). An absence of any one or a combination of these factors can result in the inability to develop effective conservation rules. (This is not to suggest there is complete agreement on the factors that predispose communities to be able to generate rules to manage natural resources. See Agrawal 2002 for good coverage of this debate.)

The reasons for the inability to get rules vary from case to case and resource to resource. In some instances, an inability to establish and enforce boundaries undermines efforts at local-level management (e.g., Ostrom 1992, 2000a; Pomeroy 1994). Where boundaries cannot be defended, outsiders can gain the benefits of any resource-management effort, making it senseless to invest time and energy in conservation. Social heterogeneity

can make it impossible to produce rules. In Nepal, for example, conflict owing to ethnic differences made it impossible to maintain and operate some of the local irrigation systems (Lam 1998, p. 68). Still other local efforts to manage resources failed owing to a decrease in the dependence on the resource. In Nepal, when rural people got other sources of income or part-time city jobs, the incentive to manage forests (Pradham & Parks 1995, p. 174) and irrigation systems (Lam 1998, p. 67) at the local level was reduced.

Singleton & Taylor (1992) note that many cases of failure are a result of an absence of a sense of community, which they stress is a key factor in solving communal action levels at the local level. A number of anthropologists suggest the inability to cooperate in peasant cultures is rooted in a complex of social and cultural factors that make it difficult for people to trust one another (Banfield 1958, Foster 1967). In some cultures, the incentive to free ride is so strong among so many groups in the community that there is no "demand for institutions to conserve resources" (Gibson & Becker 2000).

In many instances, efforts to manage resources locally fail because of a combination of such factors. A good example is the efforts of Maine lobster fishing communities to get informal trap limits at the local level. In the 1950s when the number of traps began to escalate rapidly, a high percentage of lobster fishermen came to favor trap limits (i.e., a cap on the number a single license holder could use) to reduce tangles and contain costs. When the legislature proved unable to pass a trap-limit law, large numbers of fishermen talked about getting informal trap-limit laws at the local level. The only communities able to devise such rules were five small islands, which were isolated, closely knit, with strong territorial boundaries. The other 92 harbors could not do so, and those that tried failed (Acheson 2003, chapter 3). The harbors that could not devise informal trap limits had such a large number of fishermen that they could not monitor each other. They were heterogeneous,

with both full-time and part-time fishermen with different interests; the fishermen did not interact much and had little sense of community; and these towns were not primarily dependent on the lobster industry. Most important, none of these communities had much exclusive fishing area, nor could they limit entry to the waters they did control. With no boundaries or limits on those who could fish, it made little sense to erect local trap limits because traps taken out of the water by a group agreeing to the rules would only be replaced by traps put in by people from adjacent harbors.

In some cases, local-level management efforts fail because of factors outside the community. High on this list of factors is interference by government officials who are reluctant to give power to locals (Pinkerton & Weinstein 1995). Class antagonism can also make it impossible to establish and enforce local-level management rules. In Teelin, Ireland, for example, the local priest tried to get local fishermen to form a cooperative to buy out salmon-fishing rights and manage the salmon for their own benefit. His efforts failed because of an unwillingness to sanction other community members and a long tradition of poaching well-grounded in class hatred and antagonism to authority. In Teelin, enforcing rules would not only be difficult, it would undermine local solidarity (Taylor 1987).

There are many cases in the literature where rules were established by local communities and then went out of existence. In Third World countries, Western colonial governments may undermine the power of local political authorities and the resource-management rules they had enforced (Johannes 1978, Pradham & Parks 1995). Growing population, new technology, and new markets can result in growing competition for resources and can motivate people to disobey rules, invade areas of others, or increase their exploitive efforts to the detriment of the resource (Aswani 2002, Becker & Leon 2000, McGoodwin 1994, Pradham & Parks 1995). Becoming engaged in interna-

tional markets, coupled with a weakening of traditional rules, can have an especially devastating effect (Rose 2002, p. 249).

Sometimes a number of cultural and social factors can conspire to undermine existing rules. For example, with the Orma of Kenya, social change made the elders unwilling to continue to enforce rules to control the number of cattle. This resulted in overgrazing, which Ensminger (1992, p. 151) describes as "a classic failure of collective action."

## SUMMARY AND FUTURE RESEARCH NEEDS

Few generalizations can be made about the reasons humans are unable to manage natural resources, save for the fact that failure is traceable to a lack of willingness or ability to solve collective-action dilemmas to produce effective rules. As noted above, the authors of the literature on resource management and institutions have identified a large number of such factors that make it difficult to produce such rules. However, our knowledge is far from complete at this point. Our understanding of the conditions under which institutions fail is messy and poorly thought-out at best. This problem deserves far more attention than it has received to date.

In an effort to extend and modify this body of theory, I make three points about institutional failure. First, there is no universal solution to the problems of resource management. Private owners, governments, and local communities all can be effective in managing natural resources. They also can fail. Moreover, a large number of circumstances can cause that failure. For private-property institutions to work, a set of conditions are required that are not commonly found in reality. Property rights are often incomplete, so externalities abound. Even if private-property rights are secure and markets are efficient, poverty, economic competition, and problems associated with slow-growing resources can lead to overexploitation. State efforts to manage resources founder because of a wide variety

of problems, ranging from rent seeking, winning majorities, and deliberately introduced design flaws to agency problems and outright corruption. Governments of industrialized countries often are stymied by problems stemming from poor science and top-down management. Local-level management is often a precarious enterprise, at best. Efforts to manage resources at the local level are likely to fail if communities do not have the right set of characteristics.

Management will be effective only if resources are matched with governance structures and management techniques. A governance structure using a technique on one resource might succeed, whereas the same governance organization using the same technique might fail miserably when applied to another resource. For example, tradable environmental allowances have worked well in controlling air pollution (Tietenberg 2002), but such programs (e.g., ITQs) have generally not done well in managing fisheries because they have motivated fishermen to high grade (discard all fish except the most desirable) (Leal 2002), have led to a concentration in control by a small elite (Palsson & Helgason 1997), and in many cases have not conserved the fish stocks (Organization for Cooperation and Development 1997, p. 82).

To manage resources effectively, we will have to be quite imaginative. We will need to combine various elements of privatization, government control, local control, and managerial techniques (e.g., selective cutting of forests, ITQs for fisheries) in ways we have not imagined could be done. The exact combination used will have to vary with the specific resource and place.

Second, one of the basic axioms running through the literature on resource management is that failure or success is a result of one factor or a few separate factors (see Agrawal 2002). There has been little attempt to discuss factor interdependence and the way that various complex factor combinations cause resource-management attempts to fail. This seems a strange oversight, given there is a

growing consensus among environmental scientists that stocks of fish, wild animals, and other natural resources are part of complex and possibly chaotic systems (Ludwig et al. 2002). In either case these populations are subject to unpredictable changes in size in response to a complicated set of interactive factors (Acheson & Wilson 1996, Wilson 2002). If this is true, and I believe it is, the penchant of social scientists to see institutional failure in terms of single factors or a list of unconnected factors is simplistic. If we are going to modify and extend our understanding of institutional failure, we need to see such resource-management institutions as parts of complex socioenvironmental systems, and the success or failure of those institutions needs to be considered as the result of a complex of factors working in tandem. In many cases, the factors producing success or failure are quite subtle. Ostrom writes, "we have all seen in the field nearby villages facing similar circumstances sometimes succeeding in overcoming collective action problems and sometimes failing" (E. Ostrom, personal communication).

Moreover, the complex nature of these socioenvironmental systems also means it is going to be difficult to improve the science on which resource management is based. We may have to admit we cannot predict changes in the quantities of resources at all, and we may need to concentrate instead on developing ways to manage resources in the face of great uncertainty (Acheson & Wilson 1996, Ludwig et al. 2002, Wilson 2002).

Third, rules to manage resources and the enforcement of those rules are public goods. The provision of public goods is usually the purview of governments because such goods cannot be provided by markets and free rider problems abound (Ostrom et al. 1994). This means governments need to be involved in the management of many different kinds of natural resources in many parts of the world. Given the inevitability of government involvement, the failure of governments to manage many resources effectively is particularly disturbing. How can we improve the track record of

governments? One way to begin is to ask the following questions: How much government do we need? What kind of government do we need? One set of scholars has answered these questions by calling for co-management that involves managerial authority being split between government units and industry groups (Baland & Platteau 1996, Pinkerton 1989, Pinkerton & Weinstein 1995). Another suggestion is polycentric governance, utilizing the federalist principle on which the U.S. government was formed. That is, resource management would be accomplished by a hierarchy of governmental units. Authority would be given to the smallest unit in the hierarchy possible (local government, state government), but it needs to be recognized that some functions can be performed only by central governments (Ostrom 1999).

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