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tragedy of the commons

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Abstract

'The tragedy of the commons' arises when it is difficult and costly to exclude potential users from common-pool resources that yield finite flows of benefits, as a result of which those resources will be exhausted by rational, utility-maximizing individuals rather than conserved for the benefit of all. Pessimism about the possibility of users voluntarily cooperating to prevent overuse has led to widespread central control of common-pool resources. But such control has itself frequently resulted in resource overuse. In practice, especially where they can communicate, users often develop rules that limit resource use and conserve resources.

Keywords

collective action; common-pool resources; common property; free rider problem; Hardin, G.; open-access resources; private property; social dilemmas; state property; tragedy of the commons

Article

The term 'the tragedy of the commons' was first introduced by Garrett Hardin (1968) in an important article in *Science*. Hardin asked us to envision a pasture 'open to all' in which each herder received large benefits from selling his or her own animals while facing only small costs of overgrazing. When the number of animals exceeds the capacity of the pasture, each herder is still motivated to add more animals since the herder receives all of the proceeds from the sale of animals and only a partial share of the cost of overgrazing. Hardin (1968, p. 1244) concluded:

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's article is one of the most cited publications of recent times as well as among the most influential for ecologists and environmental policy researchers. Almost all textbooks on environmental policy cite Hardin's article and discuss the problem that Hardin so graphically identified.

Hardin's article deals in general with a broad class of resources that are referred to in the more technical literature as 'common-pool resources'. Common-pool resources yield finite flows of benefits (such as firewood, fish and water) where it is difficult and costly to exclude potential users (Ostrom, Gardner and Walker, 1994). Each person's use of a resource system subtracts resource units from the quantity of units available to others, as Hardin so dramatically described. The initial theoretical studies of common-pool resources tended to analyse simple systems. It has frequently been assumed that the resource generates a predictable, finite supply of one type of resource unit (for example, cubic feet of water or tons of fish) in each time period. Users are assumed to be short-term, profit-maximizing actors who have complete information and are homogeneous in terms of their assets, skills, discount rates and cultural views. In this theory, *anyone* can enter a resource and take resource units.

Hardin thought of users as being trapped in this situation – largely because he did not envision that users could self-organize and devise institutions to extract themselves from tragic overuse. In the conventional textbook theory (Clark, 1976), scholars have tended to agree with Hardin that the users could not extract themselves from this situation. Organizing so as to create rules that specify who is an authorized user and the rights and duties of authorized users creates a public good for those involved. All users benefit from this public good, whether they contribute or not (Olson, 1965). Thus, getting 'out of the trap' is itself a second-level dilemma. Since much of the initial problem exists because the individuals are in a dilemma whereby they impose negative externalities on one another, it is not consistent with the conventional theory that individuals can solve a second-level dilemma when they are already predicted to be unable to solve the initial social dilemma. Thus, extensive free-riding is predicted in most efforts to self-organize and govern a resource as a community of users.

Because of these predictions and because many open-access resources have indeed resulted in tragic levels of overuse and sometimes destruction, many scholars and public officials have relied upon the conventional analysis to justify the need for centralized control of all common-pool resources. National legislation has been passed in many countries, and administrative responsibilities for managing natural resources have been turned over to centralized agencies. Unfortunately, the results of many of these efforts have been the opposite of what was hoped. Evidence has now been amassed that central regulation has frequently accelerated resource deterioration, complicated by several problems of corruption and inefficiency. In-depth

case analyses have documented the accelerated overharvesting of forests that occurred after national governments declared themselves to be the owners of forested land (National Research Council, 1986; Ascher, 1995). Similar problems have occurred with inshore fisheries when national agencies presumed that they had exclusive jurisdiction over all coastal waters (Finlayson and McCay, 1998).

Policy analysts tend to look for certainty and want to know whether the tragedy of the commons theory is either right or wrong. A more productive approach is to ask under what conditions it is correct and when it makes the wrong predictions. In settings where there is a large group, no one communicates, and where no rights to the resource exist, Hardin's theory is supported by considerable evidence. There are many settings in the world where the tragedy of the commons has occurred and continues to occur – ocean fisheries and the atmosphere being the most obvious.

Contrary to the conventional theory, however, multiple studies have demonstrated that users have overcome social dilemmas to craft institutions to govern their own resources (National Research Council, 1986; 2002; McCay and Acheson, 1987; Ostrom, 1990; 2005). The possibility, however, that the users would find ways to organize themselves was not mentioned in basic economic textbooks on environmental problems until recently (compare Clark, 1976, with Hackett, 1998). The design principles that characterize robust, long-lasting, institutional arrangements for the governance of common-pool resources have been identified (Ostrom, 1990) and supported by further testing (Guillet, 1992; Morrow and Hull, 1996; Weinstein, 2000).

A recent National Research Council (2002) report provides an excellent overview of the substantial research showing that many common-pool resources are governed successfully by non-state provision units and that some government and private arrangements also succeed. No simple governance system has been shown to be successful in all settings (Dietz, Ostrom and Stern, 2003). Many of the robust resource governance systems documented in the above-cited research do not resemble the textbook versions of either a government or a strictly private for-profit firm, especially when participants have constituted self-governing units. Scholars who draw on traditional conceptions of 'the market' and 'the state' have not recognized these self-organized systems as potentially viable forms of organization and have either called for their removal or ignored their existence. It is paradoxical that many vibrant, self-governed institutions have been wrongly classified or ignored in an era that many observers consider to be one of ever greater democratization.

Careful laboratory experiments have also shown that when a group of individuals are given unrestricted access to harvest from a common-pool resource, they substantially overuse it. What is rather striking is that in the laboratory using exactly the same parameters, but changing only one variable, namely, the capacity to communicate with one another, individuals can come to agreements and keep them to harvest very close to an optimal level (Ostrom, Gardner and Walker, 1994). This result has been replicated many times (see, for example, Casari and Plott, 2003).

Thus, Hardin opened a discourse on a fascinating and difficult puzzle of why individuals in some settings can overcome the threat to long-term sustainable use of a resource whereas other resources are so threatened. Scholars from multiple disciplines have wrestled with this question for several decades, including the creation of the International Association for the Study of Common Property (IASCP), the Scientific Committee on Problems of the Environment (SCOPE) (see Burger et al., 2001), considerable research in the field and in the experimental laboratory, and the development of sophisticated agent-based models of human-environmental relationships (Janssen, 2003).

In the decades since Hardin's article appeared, we have learned that the type of resource must be analysed separately from the type of property arrangement. Common-pool resources exist wherever natural resources or human-made facilities exist and where excluding users is costly and consumption by some subtracts from the benefits available to others. Many types of property arrangements exist in relationship to these kinds of resources, including government ownership, private property and common property. Hardin incorrectly presumed that most common-pool resources were open-access resources where property rights had not been well-defined.

It is now known that the users of a common-pool resource will:

- expend considerable time and energy devising workable institutions for governing
- and managing common-pool resources;
- follow costly rules so long as they believe that others also follow these rules;
- monitor each other's conformity with these rules; and
- impose sanctions on each other at a cost to themselves.

The likelihood that resource users themselves will develop effective institutions for regulating the use of common-pool resources is increased by the following factors:

- low discount rates (most resource users have secure tenure, and plan on using the resource for a long time into the future);
- homogeneous interests (most resource users share similar technologies, skills, and cultural views of the resource);
- the cost of communication among individuals is low; and
- the cost of reaching binding and enforceable agreements is relatively low.

Thus, in field settings where there are relatively small- to moderate-sized groups, and where there is autonomy to make their own agreements and authority to do so, many user groups have self-organized to extract themselves from the tragedy.

Large groups have more difficulty governing common-pool resources, but usually because size is negatively associated with the factors listed above. In relatively homogeneous groups in which mechanisms exist for reaching binding agreements on methods of government and management

resource use, even quite large groups are able to arrive at effective rules to limit the use of their resource. Further, when large groups are composed of smaller groups that focus on specific parts of a larger problem, such as how to regulate water distribution on a branch of an irrigation canal, smaller groups can be clustered into ever larger aggregations that may be able to address problems that affect all participants.

One of the key findings of empirical field research on collective action and common-pool resources is the multiplicity of specific rules-in-use found in successful common-pool resource regimes around the world. One of the most important types of rules is *boundary* rules, which determine who has rights and responsibilities and what territory is covered by a particular governance unit. Many different boundary rules are used successfully to control common-pool resources around the world, but an important aspect of these rules is the match between the organization of users and the resource rather than the specific rule used. The 35th anniversary of the publication of Hardin's original article was celebrated with a special issue of *Science* (Dietz, Ostrom and Stern, 2003), demonstrating that all forms of ownership could succeed or fail and that more critical than the form of ownership was the establishment of legitimate and agreed-upon boundaries that were effectively enforced.

Some governance units face considerable biophysical constraints in dealing with a natural common-pool resource such as a groundwater basin, a river or an air shed. Such resources have their own geographic boundaries, and creating a match between the boundary of those who are authorized users and the resource itself is a challenge. On the other hand, the biophysical world does not have as strong an impact on the efficacy of using diverse boundaries for governing and managing forest resources. More important is the agreement of those involved about who is to be included and the appropriate physical boundaries. Rules specifying duties as well as rules for sharing benefits are also crucial. No resource system functions well over time if all that users do is harvest from it with no investment to increase the productivity of the resource itself. Once basic rules – defining who is a legitimate beneficiary, who must contribute to the maintenance of the resource, and the actions that must or may be taken or are forbidden – have been accepted as legitimate by the users, many users will follow rules so long as they believe others are doing so.

Another lesson learned is that any effort to develop new rules for governing and managing complex resources is likely to generate unexpected results and be subject to initial errors. Thus, all technological and institutional interventions need to be approached as an adaptive process that helps generate information about errors so that those involved and others can learn from errors rather than continue to make them. No panaceas exist. Wholesale solutions imposed on many different resources in a large terrain are more likely to be ineffective than efforts that enhance the institutional environment that encourages responsible self-governance, self-monitoring, and self-enforcement.

Thus, a modified theory of the commons is slowly evolving that has identified the factors that are repeatedly mentioned in empirical studies of diverse common-pool resources.

See Also

- access to land and development
- collective action
- common property resources
- Olson, Mancur
- property law, economics and
- public goods

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