



The Nobel Laureate in Economic Sciences discusses the challenges of dealing with common-pool resources and how to approach collective action dilemmas.

Thought Leader Interview:

Elinor Ostrom

by Karen Christensen

'Social dilemmas' include everything from traffic jams to runs on scarce goods to maintaining trust in relationships. What do these things have in common?

In each scenario, there is a temptation for some people not to cooperate with others. So in traffic jams, there is a temptation to try to pass everybody or to run a red light. One of the ways we deal with this is to have enforced traffic laws. Solving social dilemmas entails agreement on some set of norms or rules, monitoring of some sort, and people trusting one another in order to achieve optimal outcomes for all.

Whenever actions taken by individuals or organizations benefit a larger group, there is always a risk that some of the participants will 'free-ride' on the efforts of others and not contribute their share. For example, the actions of millions of people affect the amount of CO₂ emitted into the atmosphere. If everyone were to

reduce their emissions over time, the threat of global warming would decrease substantially. While everyone would be better off if everyone contributed to correcting the situation, any one individual or corporation would also be better off if others took on this task while they continued with their normal activities. We refer to these effects as 'nested externalities', and they occur whenever actions taken within one decision-making unit simultaneously generate costs or benefits for other units at different scales.

Unfortunately, at the moment many governmental and private entities are substantially increasing their greenhouse gas emissions – particularly in the developing world – without adopting any policies to reduce emissions. Since there is no single governmental unit established for regulating the use of the atmosphere (and other large-scale resources), some scholars believe that social dilemmas at these scales are impossible to solve. I disagree.



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For those not familiar with the terms, what are 'global public goods' and 'common pool resources' (CPRs)?

Averting massive climate change is a global public good because millions of actors affect the global atmosphere, and everyone will benefit from reduced emissions. The problem is that people can benefit whether or not they pay any of the costs. Thus far our leaders have failed to reach agreement at the global level on efficient and enforceable reductions of greenhouse gas emissions. Worse yet, many people appear to be waiting around for these to appear without investing in efforts at multiple scales.

Now for CPRs. With private goods, all aspects of the good involved can be excluded from actors who would like to use them. Common-pool resources, on the other hand, are any kind of resource where it is difficult to exclude anyone from using the resource, and where my consumption withdraws from the 'pool' that is potentially available to others. For example, with a fishery, the fish that I remove from the system, you can't catch. At the same time, it's difficult to exclude anyone from using a CPR, and people will benefit from it whether or not they contribute to it. These two characteristics of CPRs are related in many ways, and when people talk about 'the commons', this is what they are referring to.

You believe that climate change is the largest collective-action dilemma the world has ever knowingly faced. What is the best approach to solving such dilemmas?

There is a widespread presumption that any problem that has global effects must be solved at a global level. I don't agree. Many global problems are themselves the result of inadequate solutions at a micro level of interactive commons problems. For example, consider the contribution of deforestation to global climate change. Deforestation may be the result of conversion from lower-valued to higher-valued uses of particular forest products; but it may also be the result of ill-defined property rights where the transaction costs of gaining clear property rights are very high. Problems like deforestation will deteriorate further until more effective institutional arrangements can be devised at local levels. Given the variety of physical environments that exist with-

in even one country, no single set of rules will create appropriate incentive systems for all individuals whose decisions affect the regeneration of forests over time.

You have found that several design principles are shared by effective CPR systems. Please describe a couple.

My team and I studied hundreds of CPR systems, and I took a sabbatical to try to isolate specific rules that made a difference to their success or failure. When I wasn't able to do this, I moved up a level of generality, and found that instead of specific rules, there are *design principles* that are generally present in most robust CPR institutions (see **Figure One**). I believe that many of the design principles that characterize long-surviving CPRs at a small scale can be applied at a larger scale. Indeed, working 'upwards' may enable solutions to be reached faster than starting from the global level and working downwards.

The design principles we have identified include *clearly-defined boundaries* as to who has the right to withdraw resource units from the CPR; *collective choice arrangements*, whereby most individuals affected by the operational rules can participate in modifying them; and *monitoring*, whereby the monitors who actively audit CPR conditions and participant behaviour are accountable to the participants – or *are* the participants. My colleagues and I are now refining these principles to provide a sound basis for institutional design in a wide variety of contexts.

While you believe that the micro environment can inform the macro environment, you are cautious about making analogies; why is that?

There are substantial differences in the range of actors involved in many global problems. For instance, in many micro studies, the actors involved are people whose livelihood depends on solutions to use a resource system more efficiently over time. In many cases, these individuals devise ingenious arrangements that enable them to make productive use of fragile resources over long periods of time. Once we move to the problem of the global commons, in addition to the millions of individuals who are making choices, we add corporate actors to the mix. While understanding

1. **Clearly-defined boundaries:** Individuals or households who have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself.
2. **Congruence between appropriation and provision rules and local conditions:** Appropriation rules restricting time, place, technology and/or quantity of resource units are related to local conditions and to provision rules requiring labour, material and/or money.
3. **Collective-choice arrangements:** Most individuals affected by the operational rules can participate in modifying the operational rules.
4. **Monitoring:** Monitors, who actively audit CPR conditions and appropriate behaviour, are accountable to the appropriators or *are* the appropriators.
5. **Graduated sanctions:** Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on seriousness/context of the offense) by other appropriators, by officials accountable to these appropriators, or both.
6. **Conflict-resolution mechanisms:** Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7. **Minimal recognition of rights to organize:** The rights of appropriators to devise their own institutions are not challenged by external government authorities.

For CPRs that are part of larger systems:

8. **Nested enterprises:** Appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organized in multiple layers of nested enterprises.

the behaviour of these ‘agents’ is more complex, similar decision models apply to agents as well as individuals acting on their own behalf. Indeed, the extensive research on principle-agent relations provides a key link in our argument: no matter how complex an organization becomes, some individual is ultimately responsible for implementing any decision or action taken in its name. As a result, understanding the incentives facing the relevant agents is a critical step in any analysis.

Since corporations and governments can reasonably be expected to exist for long periods of time, at least some of their agents face compelling incentives to establish rules of behaviour that will reduce future levels of uncertainty. For instance, forestry management may not be sustainable unless local citizens whose livelihood is directly affected by the continued viability of these resources are involved in the monitoring process. Any effort to rely solely on government officials runs the risk that the official will face incentives to shirk responsibility. Indeed, none of our design principles can operate effectively if the incentives of the relevant agents are poorly aligned.

Your design principles are based on an underlying process of ‘collective management’. How important is this to solving complex problems?

In nearly all of the cases we’ve studied, aspects of community-based organization have been critical to success. In general, com-

munity organizations have several advantages over other types of organizations: a sense of belonging, social pressure for conformity, access to social capital, transmission of culture from one generation to the next and a solid base of local knowledge. All five of these advantages are directly or indirectly manifested in the dynamic operation of the design principles.

As we ‘scale up’ to tackle global issues, what are some of the key challenges to your design principles?

There are many. Take the principle of ‘clearly-defined boundaries’. Of course, boundaries become more diffuse at higher scales, but this is precisely why a larger-scale regime is required. Boundaries between relatively isolatable activities or resources are the very foundation of effective organization, at all scales. If the dynamic operation of a resource cannot be partitioned into smaller chunks, then it is necessary to devise a management scheme at a more appropriate scale. The important thing is that all the essential actors are included within the scope of the management scheme. In other words, the challenge in moving to a larger scale lies not primarily in the increasingly-diffuse nature of the boundaries, but rather with the need to craft a management scheme that can cope with resources that happen to have diffuse boundaries.

Now look at the third design principle, which deals with the participation of relevant actors in the design and management of processes of collective choice within a given regime. As you scale

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up, the relevant actors are frequently large corporations or other collective entities rather than individual farmers or fishermen, but the sheer number of key actors is not necessarily larger. The critical factor is that the replacement of individual actors by collective ones generates several complications. For one, participation must be via the agents of these organizations, rather than by individuals acting solely in their own interests. While this is inevitable, participation via representatives is, at best, an imperfect substitute for direct participation. Especially important is the extent to which the interests of these agents have been aligned with the interests of their constituent members. A sense of a shared community of values between members and agents helps mitigate enduring dilemmas of relations between principals and agents. Thus, not only must the full array of organizations participate in the design and implementation of management schemes, these organizations themselves must be arranged so that the agents can honestly represent the interests of their own stakeholders. As you can imagine, this can be especially problematic at the global level.

Faced with today's complex problems, you have said that "there is no way that one can analyze the entire 'spaghetti plate' of variables" in a single analysis. What approach do you recommend?

Clearly, with most of today's problems, multiple variables are working together and while most people recognize this, the preference for simple solutions to complex problems remains strong. The conceptual structure of complex problems is a rugged landscape with lots of peaks and valleys. Finding higher peaks when the number of potential solutions is drastically reduced to a few 'optimal' strategies is grossly inadequate for reaching creative solutions to challenging problems. One can become fixated on a low 'hill' by trying to optimize specific variables while overlooking better solutions involving ignored variables.

I recommend an adaptive approach – one that recognizes that you have to fit your institutional and social mechanisms to the local setting and you need to experiment in order to learn. We need to

recognize and understand complexity itself in order to identify combinations of variables that affect the incentives and actions of actors under diverse governance systems. To do this, we need to examine the nested attributes of a resource system and the resource units generated by that system that jointly affect the incentives of users within a set of rules crafted by local or nested governance systems.

Furthermore, we need to enable resource users and their officials to experiment with adaptive policies so as to gain feedback from our constantly changing social-ecological system. In an article I did for *Science* last summer, I described a very large social and ecological framework and identified a number of the variables involved in it; but you can't just put these into a mathematical model and expect that they will always be the same. Even local settings change over time, so we have to come up with adaptive solutions.

You have talked a bit about 'nested attributes': What are these?

If you look at a lake, we can talk about how big it is, the various fish living in it, which pollutants it contains, etc. We can also talk about what inputs and outputs to the lake exist – for instance, is there a river flowing into it? There's a whole series of attributes for any one resource that will be totally different from one to the next, and the same goes for people. When you're working with people, you have to pay attention to how long they've lived in an area, what issues they agree or disagree on, things of that sort. Whenever legislation is passed for a large region and the rules are the same for everyone, we are not taking nested attributes into account.

The classic *Theory of Collective Action* predicts that no one individual will change their behaviour unless an external authority imposes enforceable rules that change the incentives faced by all involved. Do you agree?

No. My research shows that this is not a universally-correct prediction. However, we haven't found that people will universally cooperate, either. There are lots of problems that people won't

end up solving, but that doesn't mean it is always necessary to have an external authority come in and tell them what to do. On the other hand, it is important for governments to authorize some capacity at a local level to do some monitoring and make sure that people are living up to what they should be doing. I use the term 'polycentricity' to describe the type of system that is most likely to be successful.

How do you define a 'polycentric system'?

A polycentric system exists when multiple public and private organizations at multiple scales jointly affect collective benefits and costs. The official definition is, "a system where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements." One of the design principles of a polycentric system is that there are nested units within it; there might be small communities that have a fair amount of autonomy but then there are larger, regional governments. In Canada, for instance, you have municipal, provincial and federal governments, and no one of them is *the* essential unit; in this way, they are polycentric.

What is the relevance of polycentric systems for the analysis of global public goods?

The initial relevance of a polycentric approach is the parallel between the one-time theoretical presumption that only the largest scale was relevant to public goods, and the more-recent presumption that only the global scale is relevant for policies related to climate change. Extensive research shows that while large-scale units are an essential part of effective governance, small and medium scale units are also necessary. Relying entirely in international efforts to solve global problems is a mistake.

In your work on management regimes you have studied the concept of 'user-level management'. What have you learned about this approach?

For some resources, user-level management makes good sense. In one study, we found that farmer-managed irrigation systems frequently outperform very expensive, top-down engineered systems. Of course, farmers who have lived in an area for a long time and have acquired indigenous skills can make that work; a bunch of strangers from urban areas that have never farmed before would not be able to do it. It takes a combination of knowledge accrued over time and some form of authority to make it work.

Research indicates that as the size of a group increases, its likelihood to achieve 'public good' decreases. Why is this?

When groups are relatively small and they engage in face-to-face communication and build norms of trust and reciprocity, they are better able to agree on a strategy to solve social dilemmas and follow through on their agreements. A key question for global governance, then, is whether mechanisms exist to enable resource users and others facing social dilemmas to scale up to a larger unit where face-to-face communication with all participants is not possible. We cannot realistically think about solving large-scale dilemmas without some organization (or network of organizations) taking on the challenge of devising rules, monitoring and enforcing those rules. What we are finding is that the impact of the size of a group varies by the problem people are trying to solve. If it is a common pool resource problem, there may be a curvilinear relationship for size: if the group is too small, there aren't enough people to accomplish what's needed. You have to link the size of group to the size of the problem.

The 'tragedy of the commons' is a famous metaphor for problems related to common pool resources. You have said that "tragedy is not inevitable." What leads you to say this?

We have lots of case studies where people have made their system work for 100 or even 500 years. For instance, the ground water basin that I studied for my dissertation was very difficult to organize a solution for, but it now has gone on successfully for 60 years. So success is possible. As I said earlier, the reverse is also true: many people have predicted inevitable failure. We can't substitute that with inevitable success, but we can substitute it with the fact that success *is possible*, and with appropriate conditions that facilitate adaptation, learning and trust, people will be able to find solutions that will last for a long time.

What is needed is a creative recombination of institutional components from the private, public and voluntary sectors to cobble together a mutually reinforcing system of governance that is appropriate for each set of policy problems. This is by no means an impossible task. One thing is certain: policies adopted at any scale can generate errors, but without trial and error, learning cannot occur. **R**

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