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Vulnerability and Polycentric Governance Systems

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In an important step, IHDP has defined vulnerability as a crosscutting priority for the future activities of all its research groups. Examining the vulnerability of social-biophysical systems to external shocks is not only an important policy question in an increasingly democratic and globally linked era, but also a stimulus to the development of better explanatory theories relevant to governance more generally. Considerable progress has been achieved in the social sciences by rigorously pursuing a static analysis of relatively simple systems. Learning about the equilibrium properties of simple systems with particular characteristics has enabled social scientists to expand their capabilities to predict and explain human behaviour in unchanging environments with strong selection mechanisms. Static analysis has not, however, prepared policy analysts with the knowledge needed to design resilient governance systems in a rapidly changing, complex, and interdependent world.

Static analysis still dominates how policy analysis is taught and applied to various aspects of global environmental change. Students of policy analysis are frequently taught an overly simplified form of "scientific management" of natural resource systems that stresses the feasibility of designing optimal governance systems for entire regions or the globe itself. This presumes that the policy analyst is able to examine how a small set of institutional rules would perform under specified and relatively unchanging environmental conditions.

A series of studies of resource governance systems in many parts of the world has identified seven broad types of institutional rules that are employed in governing the use of water systems, forests, fisheries, pastures, and the atmosphere for disposing of wastes. These include:

- Boundary rules** that specify who is allowed to use them and under what conditions.
- Position rules** that specify the broad capabilities and responsibilities of users and officials.
- Scope rules** that specify which outcomes are allowed, mandated, or forbidden.
- Authority rules** that specify the actions that participants in positions may, must or must not do.
- Aggregation rules** that affect how individual actions are transformed into final outcomes.
- Information rules** that affect the kind of information present or absent.
- Payoff rules** that affect assigned costs and benefits to actions and outcomes.

For analysts to ascertain whether an optimal set of rules has been found to regulate a particular biophysical system, they would need to examine how combinations of particular types of these seven rules affect the attributes of a specific biophysical system. If there were only five different types of rules for each of the seven components of a governance system, there would be 57, or 75,525 different governance systems to analyse. Unfortunately, even this large number is a gross simplification of the number of specific rules identified in the field. Studies have identified more than 25 boundary rules and more than 100 authority rules actually used in practice. Further, how specific rules work together in the field depends on the biophysical characteristics of a particular resource and the type of community relationships that already exist. No group of policy analysts could ever have sufficient time or resources to analyse all of the potentially relevant governance systems that could be constructed to regulate any particular biophysical systems. No computer system can be programmed to present all of the needed combinations in sufficient time to undertake any reasonably comprehensive analysis.

Instead of assuming that designing effective governance systems is a relatively simple analytical task that can be undertaken by a team of objective analysts sitting in a nation's capital or an international headquarters, it is important that we begin to understand the policy design process in democratic societies as involving an effort to experiment with a large number of component parts. As Vincent Ostrom (1997) notes in the Preface to his volume focusing on the vulnerability of democracies: ". what it means to live in a democratic society accrues as much from coping with threats to democratic ways of life as it does by being intentionally concerned about the constitution and viability of democratic societies. Understanding the vulnerability of democracies is necessary to realizing democratic potentials."

Policy changes in democratic societies need to be viewed as experiments based on more or less informed expectations about the potential outcomes and the distribution of these outcomes for participants over time and space. Given the complexity of rule systems combined with the complexity of the biophysical world that is being regulated, all such efforts to devise effective governance systems face a nontrivial probability of error. And, with systems that may be challenged by a diversity of small to large exogenous shocks, the probability of error and vulnerability to environmental disasters increases substantially.

Polycentric governance systems are frequently criticized for being too complex, redundant, and lacking a central direction when viewed from a static, simple-systems perspective. They have considerable strengths when viewed from a dynamic, complex-systems perspective, particularly one that is concerned with the vulnerability of governance systems to external shocks. Polycentric systems are the organisation of small-, medium-, and large-scale democratic units that each may exercise considerable independence to make and enforce rules within a circumscribed scope of authority for a specified geographical area. Some units may be general-purpose governments whereas others may be highly specialized. Self-organized resource governance systems within a polycentric system may be organized as special districts, non-governmental organisations, or parts of local governments. These are nested in several levels of general-purpose governments that provide civil equity as well as criminal courts. The smallest units can be viewed as parallel adaptive systems that are nested within ever-larger units that are themselves parallel adaptive systems.

The strength of polycentric governance systems in coping with complex, dynamic biophysical systems is that each of the subunits has considerable autonomy to experiment with diverse rules for using a particular type of resource system and with different response capabilities to external shock. In experimenting with rule combinations within the smaller-scale units of a polycentric system, citizens and officials have access to local knowledge, obtain rapid feedback from their own policy changes, and can learn from the experience of other parallel units. Instead of being a major detriment to system performance, redundancy builds in considerable capabilities. If there is only one governance unit for a very large geographic area, the failure of that unit to respond adequately to external threats may mean a very large disaster for the entire system. If there are multiple governance units, organized at different levels for the same geographic region, the failure of one or more of these units to respond to external threats may lead to small-scale disasters that may be compensated by the successful reaction of other units in the system.

The engineers responsible for the design of airplanes and bridges have long coped with the threat of major shocks to a physical system by building in redundancy. The Boeing 777, for example, has 150,000 distinct subsystems that are composed, in some instances, of highly complex components.

Design engineers are concerned with the costs of the systems they design - and thus with the cost of redundant systems - but also with the capacity of their systems to respond to a large number of uncertainties including turbulent weather, heavy usage patterns, and physical accidents.

Designers of data networks also focus heavily on the problems of catastrophic failure and use redundancy techniques extensively to try to ensure data integrity. Policy analysts can learn a lot from the important role that redundancy plays in the design of robust physical systems as well as by a serious study of the human immune system and its capacity to cope with external threats by the presence of a large number of seemingly redundant systems that are ready to combine and recombine in order to fight off the threat of various types of infections. Redundancy is a means of keeping systems running in the presence of external shocks or internal malfunctions.

In an earlier era, policy analysts simply criticized polycentric systems as being grossly inefficient due to excessive levels of redundancy. These criticisms were made on the basis of static theories of optimal management and not on the basis of empirical research. In both the United States and Western Europe, massive consolidation campaigns were waged during the past century to eliminate overlapping, redundant units of government, which were, however, defended by the populations they served.

In a diverse set of sectors serious empirical research has now shown that polycentric systems tend to outperform monocentric systems governing similar ecological, urban, and social systems. Empirical studies of the vulnerability of differently linked social-biophysical systems are highly likely to demonstrate that governance systems composed of multiple units at multiple scales of organisations are less vulnerable to many types of external shocks than centralized systems. Studying the vulnerability of governance systems is thus an important opportunity to build a better theory of governance based on the recognition that no social-biophysical system is itself a static system, and that to cope with external shocks one needs robust systems that possess considerable redundancy in their capacities to respond and learn from one another.

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