American Economic Review 100 (June 2010): 641–672
http://www.aeaweb.org/articles.php?doi=10.1257/aer.100.3.641

Beyond Markets and States: Polycentric Governance of Complex Economic Systems[†]

By Elinor Ostrom*

Contemporary research on the outcomes of diverse institutional arrangements for governing common-pool resources (CPRs) and public goods at multiple scales builds on classical economic theory while developing new theory to explain phenomena that do not fit in a dichotomous world of "the market" and "the state." Scholars are slowly shifting from positing simple systems to using more complex frameworks, theories, and models to understand the diversity of puzzles and problems facing humans interacting in contemporary societies. The humans we study have complex motivational structures and establish diverse private-for-profit, governmental, and community institutional arrangements that operate at multiple scales to generate productive and innovative as well as destructive and perverse outcomes (Douglass C. North 1990, 2005).

In this article, I will describe the intellectual journey that I have taken the last half century from when I began graduate studies in the late 1950s. The early efforts to understand the polycentric water industry in California were formative for me. In addition to working with Vincent Ostrom and Charles M. Tiebout as they formulated the concept of polycentric systems for governing metropolitan areas, I studied the efforts of a large group of private and public water producers facing the problem of an overdrafted groundwater basin on the coast and watching saltwater intrusion threaten the possibility of long term use. Then, in the 1970s, I participated with colleagues in the study of polycentric police industries serving US metropolitan areas to find that the dominant theory underlying massive reform proposals was incorrect. Metropolitan areas served by a combination of large and small producers could achieve economies of scale in the production of some police services and avoid *dis*economies of scale in the production of others.

These early empirical studies led over time to the development of the Institutional Analysis and Development (IAD) framework. A common framework consistent with game theory enabled us to undertake a variety of empirical studies including a meta-analysis of a large number of existing case studies on common-pool resource systems around the world. Carefully designed experimental studies in the lab have enabled us to test precise combinations of structural variables to find that isolated, anonymous individuals overharvest from common-pool resources. Simply allowing communication, or "cheap talk," enables participants to reduce overharvesting and increase joint payoffs contrary to game theoretical predictions. Large studies of irrigation systems in Nepal and forests around the world challenge the presumption that governments always do a better job than users in organizing and protecting important resources.

[†] This article is a revised version of the lecture Elinor Ostrom delivered in Stockholm, Sweden, on December 8, 2009, when she received the Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel. This article is copyright © The Nobel Foundation 2009 and is published here with the permission of the Nobel Foundation.

* Ostrom: Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, IN 47408 (e-mail: ostrom@indiana.edu) and Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ. I wish to thank Vincent Ostrom and my many colleagues at the Workshop who have worked with me throughout the years to develop the research program that is briefly discussed herein. I appreciate the helpful suggestions given me by Arun Agrawal, Andreas Leibbrandt, Mike McGinnis, Jimmy Walker, Tom Wisdom, and by the Applied Theory Working Group and the Experimental Reading Group, and the excellent editing skills of Patty Lezotte. Essential support received over the years from the Ford Foundation, the MacArthur Foundation, and the National Science Foundation is gratefully acknowledged.

Currently, many scholars are undertaking new theoretical efforts. A core effort is developing a more general theory of individual choice that recognizes the central role of trust in coping with social dilemmas. Over time, a clear set of findings from the microsituational level have emerged regarding structural factors affecting the likelihood of increased cooperation. Due to the complexity of broader field settings, one needs to develop more configural approaches to the study of factors that enhance or detract from the emergence and robustness of self-organized efforts within multilevel, polycentric systems. Further, the application of empirical studies to the policy world leads one to stress the importance of fitting institutional rules to a specific social-ecological setting. "One size fits all" policies are not effective. The frameworks and empirical work that many scholars have undertaken in recent decades provide a better foundation for policy analysis. With this brief overview, let us now discuss the journey itself.

I. The Earlier World View of Simple Systems

In the mid-twentieth century, the dominant scholarly effort was to try to fit the world into simple models and to criticize institutional arrangements that did not fit. I will briefly review the basic assumptions that were made at that time but have been challenged by scholars around the world, including the work of Herbert A. Simon (1955) and V. Ostrom (2008).

A. *Two Optimal Organizational Forms*

The market was seen as the optimal institution for the production and exchange of private goods. For nonprivate goods, on the other hand, one needed "the" government to impose rules and taxes to force self-interested individuals to contribute necessary resources and refrain from self-seeking activities. Without a hierarchical government to induce compliance, self-seeking citizens and officials would fail to generate efficient levels of public goods, such as peace and security, at multiple scales (Thomas Hobbes [1651] 1960; Woodrow Wilson 1885). A single governmental unit, for example, was strongly recommended to reduce the "chaotic" structure of metropolitan governance, increase efficiency, limit conflict among governmental units, and best serve a homogeneous view of the public (William Anderson and Edward W. Weidner 1950; Luther Gulick 1957; H. Paul Friesema 1966). This dichotomous view of the world explained patterns of interaction and outcomes related to markets for the production and exchange of strictly private goods (Armen A. Alchian 1950), but it has not adequately accounted for internal dynamics within private firms (Oliver E. Williamson 1975, 1986). Nor does it adequately deal with the wide diversity of institutional arrangements that humans craft to govern, provide, and manage public goods and common-pool resources.

B. *Two Types of Goods*

In his classic definitional essay, Paul Samuelson (1954) divided goods into two types. Pure private goods are both excludable (individual A can be excluded from consuming private goods unless paid for) and rivalrous (whatever individual A consumes, no one else can consume). Public goods are both nonexcludable (impossible to keep those who have not paid for a good from consuming it) and nonrivalrous (whatever individual A consumes does not limit the consumption by others). This basic division was consistent with the dichotomy of the institutional world into private property exchanges in a market setting and government-owned property organized by a public hierarchy. The people of the world were viewed primarily as consumers or voters.

C. *One Model of the Individual*

The assumption that all individuals are fully rational was generally accepted in mainstream economics and game theory. Fully rational individuals are presumed to know (i) all possible strategies available in a particular situation, (ii) which outcomes are linked to each strategy given the likely behavior of others in a situation, and (iii) a rank order for each of these outcomes in terms of the individual's own preferences as measured by utility. The rational strategy for such an individual in every situation is to maximize expected utility. While utility was originally conceived of as a way of combining a diversity of external values on a single internal scale, in practice it has come to be equated with one externalized unit of measure—such as expected profits. This model of the individual has fruitfully generated useful and empirically validated predictions about the results of exchange transactions related to goods with specific attributes in a competitive market but not in a diversity of social dilemmas. I will return to a discussion of the theory of individual behavior in Section VIIA.

II. Early Efforts to Develop a Fuller Understanding of Complex Human Systems

The mid-twentieth-century worldviews of simple systems have slowly been transformed as a result of extensive empirical research and the development of a framework consistent with game theoretical models for the analysis of a broad array of questions.

A. *Studying Polycentric Public Industries*

Undertaking empirical studies of how citizens, local public entrepreneurs, and public officials engage in diverse ways of providing, producing, and managing public service industries and common property regimes at multiple scales has generated substantial knowledge that is not explained by two models of optimal organizational forms. V. Ostrom, Tiebout, and Robert Warren (1961) introduced the concept of polycentricity in their effort to understand whether the activities of a diverse array of public and private agencies engaged in providing and producing of public services in metropolitan areas were chaotic, as charged by other scholars—or potentially a productive arrangement.

> *"Polycentric" connotes many centers of decision making that are formally independent of each other. Whether they actually function independently, or instead constitute an interdependent system of relations, is an empirical question in particular cases. To the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts, the various political jurisdictions in a metropolitan area may function in a coherent manner with consistent and predictable patterns of interacting behavior. To the extent that this is so, they may be said to function as a "system." (V. Ostrom, Tiebout, and Warren 1961: 831–32)*

Drawing on the concept of a public service industry (Joe S. Bain 1959; Richard Caves 1964; V. Ostrom and Elinor Ostrom 1965), several studies of water industry performance were carried out in diverse regions of California during the 1960s (V. Ostrom 1962; Louis F. Weschler 1968; Warren 1966; E. Ostrom 1965). Substantial evidence was found that multiple public and private agencies had searched out productive ways of organizing water resources at multiple scales contrary to the view that the presence of multiple governmental units without a clear hierarchy was chaotic. Further, evidence pointed out three mechanisms that increase productivity in polycentric metropolitan areas: (i) small to medium sized cities are more effective than large cities in monitoring performance of their citizens and relevant costs, (ii) citizens who are dissatisfied with service provision can

"vote with their feet" and move to jurisdictions that come closer to their preferred mix and costs of public services, and (iii) local incorporated communities can contract with larger producers and change contracts if not satisfied with the services provided, while neighborhoods inside a large city have no voice.

In the 1970s, the earlier work on effects of diverse ways of organizing the provision of water in metropolitan areas was extended to policing and public safety. These studies directly addressed whether substantial economies of scale existed in the production of police services for urban neighborhoods as asserted in calls for reform (Daniel L. Skoler and June M. Hetler 1970). Not a *single* case was found where a large centralized police department outperformed smaller departments serving similar neighborhoods in regard to multiple indicators. A series of studies was conducted in Indianapolis (E. Ostrom et al. 1973), Chicago (E. Ostrom and Gordon P. Whitaker 1974), and St. Louis (E. Ostrom and Roger B. Parks 1973; E. Ostrom 1976) and then replicated in Grand Rapids, Michigan (Samir IsHak 1972) and Nashville, Tennessee (Bruce D. Rogers and C. McCurdy Lipsey 1974).

We found that while many police departments served the 80 metropolitan areas that we also studied, duplication of services by more than one department to the same set of citizens rarely occurred (E. Ostrom, Parks, and Whitaker 1978). Further, the widely held belief that a multiplicity of departments in a metropolitan area was less efficient was *not* found. In fact, the "most efficient producers supply more output for given inputs in high multiplicity metropolitan areas than do the efficient producers in metropolitan areas with fewer producers" (E. Ostrom and Parks 1999: 287). Metropolitan areas with large numbers of autonomous direct service producers achieved higher levels of technical efficiency (ibid.: 290). Technical efficiency was also enhanced in those metropolitan areas with a small number of producers providing indirect services such as radio communication and criminal laboratory analyses. We were able to reject the theory underlying the proposals of the metropolitan reform approach. We demonstrated that complexity is not the same as chaos in regard to metropolitan governance. That lesson has carried forth as we have undertaken further empirical studies of polycentric governance of resource and infrastructure systems across the world (Krister Andersson and E. Ostrom 2008; E. Ostrom, Larry Schroeder, and Susan Wynne 1993).

B. *Doubling the Types of Goods*

Studying how individuals cope with diverse public problems in the world led us to reject Samuelson's twofold classification of goods. James Buchanan (1965) had already added a third type of good, which he called "club goods." In relation to these kinds of goods, it was feasible for groups of individuals to create private associations (clubs) to provide themselves with nonrivalrous but small-scale goods and services that they could enjoy while excluding nonmembers from participation and consumption of benefits.

In light of further empirical and theoretical research, we proposed additional modifications to the classification of goods to identify fundamental differences that affect the incentives facing individuals (V. Ostrom and E. Ostrom 1977).

(i) Replacing the term "rivalry of consumption" with "subtractability of use."

(ii) Conceptualizing subtractability of use and excludability to vary from low to high rather than characterizing them as either present or absent.

(iii) Overtly adding a very important fourth type of good—common-pool resources—that shares the attribute of subtractability with private goods and difficulty of exclusion with

		Subtractability of Use	
		High	Low
Difficulty of excluding potential beneficiaries	High	*Common-pool resources*: groundwater basins, lakes, irrigation systems, fisheries, forests, etc.	*Public goods*: peace and security of a community, national defense, knowledge, fire protection, weather forecasts, etc.
	Low	*Private goods*: food, clothing, automobiles, etc.	*Toll goods*: theaters, private clubs, daycare centers

FIGURE 1. FOUR TYPES OF GOODS

Source: Adapted from E. Ostrom 2005: 24.

public goods (V. Ostrom and E. Ostrom 1977). Forests, water systems, fisheries, and the global atmosphere are all common-pool resources of immense importance for the survival of humans on this earth.

(iv) Changing the name of a "club" good to a "toll" good since many goods that share these characteristics are provided by small scale public as well as private associations.

Figure 1 provides an overview of four broad types of goods that differentially affect the problems individuals face in devising institutions to enable them to provide, produce, and consume diverse goods. These four broad types of goods contain many subtypes of goods that vary substantially in regard to many attributes. For example, a river and a forest are both common-pool resources. They differ substantially, however, in regard to the mobility of the resource units produced, the ease of measurement, the time scale for regeneration, and other attributes. Specific common-pool resources also differ in regard to spatial extent, number of users, and many other factors.

When one engages in substantial fieldwork, one confronts an immense diversity of situations in which humans interact. Riding as an observer in a patrol car in the central district of a large American city at midnight on a Saturday evening, one sees different patterns of human interaction than in a suburb on a weekday afternoon when school is letting out. In both cases, one observes the production of a public good—local safety—by an official of a local government. Others, who are involved in each situation, differ in regard to age, sobriety, why they are there, and what they are trying to accomplish. And this context affects the strategies of the police officer one is observing.

Contrast observing the production of a public good to watching private water companies, city utilities, private oil companies, and local citizens meeting in diverse settings to assess who is to blame for overdrafting their groundwater basin causing massive saltwater intrusion, and what to do next. These individuals all face the same problem—the overdraft of a common-pool resource—but their behavior differs substantially when they meet monthly in a private water association, when they face each other in a courtroom, and when they go to the legislature and eventually to the citizens to sponsor a Special Replenishment District. These and many other situations observed in irrigation systems and forests in multiple countries do not closely resemble the standard models of a market or a hierarchy.

III. Developing a Framework for Analyzing the Diversity of Human Situations

The complexity and diversity of the field settings we have studied has generated an extended effort by colleagues associated with the Workshop in Political Theory and Policy Analysis (the Workshop) to develop the IAD framework (V. Ostrom 1975; Larry L. Kiser and E. Ostrom 1982; Michael McGinnis 1999a, b, 2000; E. Ostrom 1986, 2005). The framework contains a nested

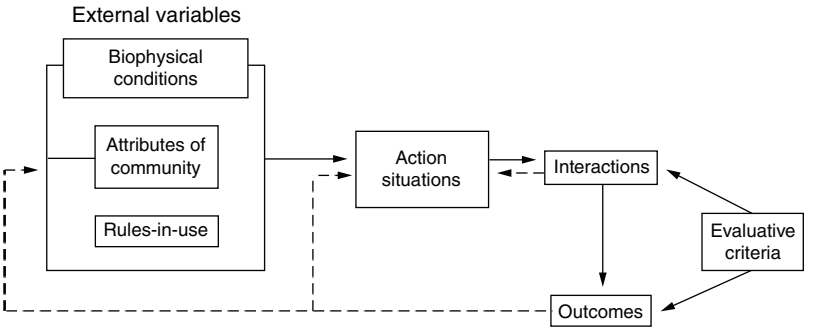

FIGURE 2. A FRAMEWORK FOR INSTITUTIONAL ANALYSIS

Source: Adapted from E. Ostrom 2005: 15.

set of building blocks that social scientists can use in efforts to understand human interactions and outcomes across diverse settings. The IAD builds on earlier work on *transactions* (John R. Commons [1924] 1968), *logic of the situation* (Karl R. Popper 1961), *collective structures* (Floyd H. Allport 1962), *frames* (Irving Goffman 1974), and *scripts* (Roger C. Schank and Robert P. Abelson 1977). The approach also draws inspiration from the work of Arthur Koestler (1973) and Simon (1981, 1995) who both challenged the assumption that human behavior and outcomes are entirely based on a small set of irreducible building blocks.

While the terms frameworks, theories, and models are used interchangeably by many scholars, we use these concepts in a nested manner to range from the most general to the most precise set of assumptions made by a scholar. The IAD *framework* is intended to contain the most general set of variables that an institutional analyst may want to use to examine a diversity of institutional settings including human interactions within markets, private firms, families, community organizations, legislatures, and government agencies. It provides a metatheoretical language to enable scholars to discuss any particular theory or to compare theories.

A specific *theory* is used by an analyst to specify which working parts of a framework are considered useful to explain diverse outcomes and how they relate to one another. Microlevel theories including game theory, microeconomic theory, transaction cost theory, and public goods/common-pool resource theories are examples of specific theories compatible with the IAD framework. *Models* make precise assumptions about a limited number of variables in a theory that scholars use to examine the formal consequences of these specific assumptions about the motivation of actors and the structure of the situation they face.

The IAD framework is designed to enable scholars to analyze systems that are composed of a cluster of variables, each of which can then be unpacked multiple times depending on the question of immediate interest. At the core of the IAD framework is the concept of an action situation affected by external variables (see Figure 2). The broadest categories of external factors affecting an action situation at a particular time include:

(i) Biophysical conditions, which may be simplified in some analyses to be one of the four types of goods defined in Figure 1.

(ii) Attributes of a community, which may include the history of prior interactions, internal homogeneity or heterogeneity of key attributes, and the knowledge and social capital of those who may participate or be affected by others.

(iii) Rules-in-use, which specify common understanding of those involved related to who must, must not, or may take which actions affecting others subject to sanctions (Sue E. S. Crawford and E. Ostrom 2005). The rules-in-use may evolve over time as those involved in one action situation interact with others in a variety of settings (E. Ostrom 2008; E. Ostrom and Xavier Basurto forthcoming; Robert Boyd and Peter J. Richerson 1985) or self-consciously change the rules in a collective choice or constitutional-choice setting.

The set of external variables impacts an action situation to generate patterns of interactions and outcomes that are evaluated by participants in the action situation (and potentially by scholars) and feed back on both the external variables and the action situation.

The internal working parts of an action situation are overtly consistent with the variables that a theorist uses to analyze a formal game.[1] This has meant that colleagues have been able to use formal game theory models consistent with the IAD framework to analyze simplified but interesting combinations of theoretical variables and derive testable conclusions from them (see James M. Acheson and Roy Gardner 2005; Gardner et al. 2000; Franz Weissing and E. Ostrom 1993) as well as agent-based models (ABMs) (Wander Jager and Marco A. Janssen 2002; Janssen 2008). It is not feasible to develop a formal game (or even an ABM) to analyze the more complex empirical settings with many variables of relevance affecting outcomes and of importance for institutional analysis. It is possible, however, to use a common set of structural elements to develop structured coding forms for data collection and analysis. And one can design experiments using a common set of variables for many situations of interest to political economists and then examine why particular behavior and outcomes occur in some situations and not in others.

To specify the structure of a game and predict outcomes, the theorist needs to posit the:

(i) characteristics of the actors involved (including the model of human choice adopted by the theorist);

(ii) positions they hold (e.g., first mover or row player);

(iii) set of actions that actors can take at specific nodes in a decision tree;

(iv) amount of information available at a decision node;

(v) outcomes that actors jointly affect;

(vi) set of functions that map actors and actions at decision nodes into intermediate or final outcomes; and

(vii) benefits and costs assigned to the linkage of actions chosen and outcomes obtained.

These are also the internal working parts of an action situation as shown in Figure 3. As discussed below, using a common framework across a wide diversity of studies has enabled a greater cumulation of understanding of interactions and outcomes in very complex environments. The IAD framework overtly embeds a particular situation of interest in a broader setting of external variables, some of which can be self-consciously revised over time.

[1] I am much appreciative of the many hours of productive discussions that I had with Reinhard Selten in the early 1980s as we started to develop the IAD framework about the internal working parts of a formal game that could be used in the framework.

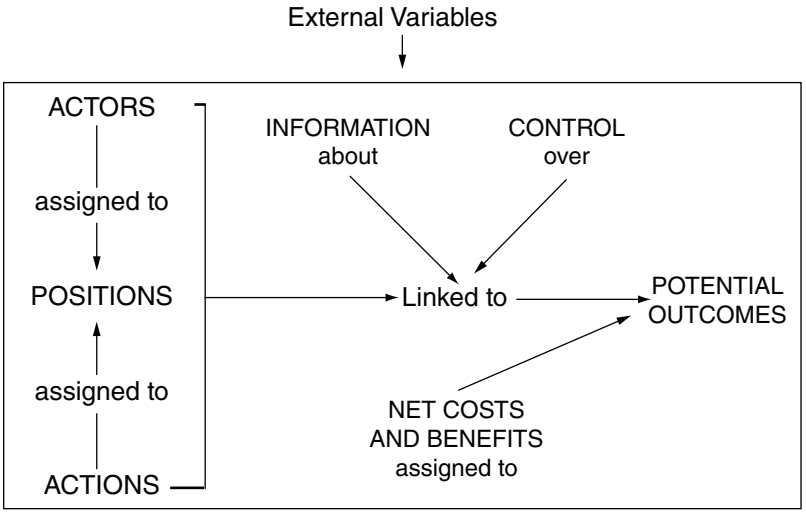

FIGURE 3. THE INTERNAL STRUCTURE OF AN ACTION SITUATION

Source: Adapted from E. Ostrom 2005: 33.

IV. Are Rational Individuals Helplessly Trapped in Social Dilemmas?

The classic assumptions about rational individuals facing a dichotomy of organizational forms and of goods hide the potentially productive efforts of individuals and groups to organize and solve social dilemmas such as the overharvesting of common-pool resources and the underprovision of local public goods. The classic models have been used to view those who are involved in a prisoner's dilemma game or other social dilemmas as always trapped in the situation without capabilities to change the structure themselves. This analytical step was a retrogressive step in the theories used to analyze the human condition. Whether or not the individuals, who are in a situation, have capacities to transform the external variables affecting their own situation varies dramatically from one situation to the next. It is an empirical condition that varies from situation to situation rather than a logical universality. Public investigators purposely keep prisoners separated so they cannot communicate. The users of a common-pool resource are not so limited.

When analysts perceive the human beings they model as being trapped inside perverse situations, they then assume that other human beings external to those involved—scholars and public officials—are able to analyze the situation, ascertain why counterproductive outcomes are reached, and posit what changes in the rules-in-use will enable participants to improve outcomes. Then, external officials are expected to impose an optimal set of rules on those individuals involved. It is assumed that the momentum for change must come from outside the situation rather than from the self-reflection and creativity of those within a situation to restructure their own patterns of interaction. As Richard Sugden has described this approach:

> *Most modern economic theory describes a world presided over by* a government (*not, significantly, by governments*)*, and sees this world through the government's eyes. The government is supposed to have the responsibility, the will and the power to restructure society in whatever way maximizes social welfare; like the US Cavalry in a good Western, the government stands ready to rush to the rescue whenever the market "fails," and the*

> *economist's job is to advise it on when and how to do so. Private individuals, in contrast, are credited with little or no ability to solve collective problems among themselves. This makes for a distorted view of some important economic and political issues.*
>
> — (Sugden 1986: 3; emphasis in original)

Garrett Hardin's (1968) portrayal of the users of a common-pool resource—a pasture open to all—being trapped in an inexorable tragedy of overuse and destruction has been widely accepted since it was consistent with the prediction of no cooperation in a prisoner's dilemma or other social dilemma games. It captured the attention of scholars and policymakers across the world. Many presumed that all common-pool resources were owned by no one. Thus, it was thought that government officials had to impose new external variables (e.g., new policies) to prevent destruction by users who could not do anything other than destroy the resources on which their own future (as well as the rest of our futures) depended.

A. *Scholars from Diverse Disciplines Examine Whether Resource Users are Always Trapped*

Dramatic incidents of overharvested resources had captured widespread attention, while studies by anthropologists, economic historians, engineers, historians, philosophers, and political scientists of local governance of smaller to medium scale common-pool resources over long periods of time were *not* noticed by many theorists and public officials (see Robert McC. Netting 1972; Bonnie J. McCay and Acheson 1987; E. Walter Coward 1980). Cumulation of the knowledge contained in these studies did not occur, due to the fact that the studies were written by scholars in diverse disciplines focusing on different types of resources located in many countries.

Fortunately, the National Research Council (NRC) established a committee in the mid-1980s to assess diverse institutional arrangements for effective conservation and utilization of jointly managed resources. The NRC committee brought scholars from multiple disciplines together and used the IAD framework in an effort to begin to identify common variables in cases where users had organized or failed to organize (Ronald J. Oakerson 1986; NRC 1986). Finding multiple cases where resource users were successful in organizing themselves challenged the presumption that it was *impossible* for resource users to solve their own problems of overuse. The NRC report opened up the possibility of a diversity of studies using multiple methods. The NRC effort also stimulated an extended research program at the Workshop that involved coding and analyzing case studies of common-pool resources written by other scholars.

B. *Meta-Analyses of Common-Pool Resource Cases*

In an effort to learn more than just the existence of multiple cases where resource users had self-organized, colleagues at the Workshop undertook a meta-analysis of existing case studies that were identified as a result of the activities of the NRC panel.[2] Because of our prior studies of complex urban systems and the development of a framework and common language for linking the parts of complex systems, we could use the framework to help organize our efforts. The IAD framework became the foundation for designing a coding manual that was used to record a consistent set of variables for each common-pool resource study.

This was an immense effort. More than two years was devoted to developing the final coding manual (E. Ostrom et al. 1989). A key problem was the minimal overlap of variables identified by case study authors from diverse disciplines. The team had to read and screen over 500 case

[2] This meta-analysis effort is described in chapter 4 of Amy Poteete, Janssen, and E. Ostrom (2010).

studies in order to identify a small set of cases that recorded information about the actors, their strategies, the condition of the resource, and the rules-in-use. [3] A common set of variables was recorded for 44 subgroups of fishers who harvested from inshore fisheries (Edella Schlager 1990, 1994) and 47 irrigation systems that were managed either by farmers or by a government (Shui Yan Tang 1992, 1994).

Of the 47 irrigation systems included in the analysis, 12 were managed by governmental agencies of which only 40 percent ($n = 7$) had high performance. Of the 25 farmer-managed, over 70 percent ($n = 18$) had high performance (Tang 1994: 234). Rule conformance was a key variable affecting the adequacy of water over time (Tang 1994: 229). None of the inshore fishery groups analyzed by Schlager were government managed and 11 (25 percent) were not organized in any way. The other 33 subgroups had a diversity of informal rules to define who was allowed to fish in a particular location and how harvesting was restricted (Schlager 1994: 260).

In addition to finding significant levels of cooperation, we found some support for earlier theoretical predictions of no cooperation in particular settings.

> *In CPR dilemmas where individuals do not know one another, cannot communicate effectively, and thus cannot develop agreements, norms, and sanctions, aggregate predictions derived from models of rational individuals in a noncooperative game receive substantial support. These are sparse environments and full rationality appears to be a reasonable assumption in them.*
>
> — (E. Ostrom, Gardner, and James A. Walker 1994: 319)

On the other hand, the capacity to overcome dilemmas and create effective governance occurred far more frequently than expected and depended upon the structure of the resource itself and whether the rules-in-use developed by users were linked effectively to this structure (William Blomquist et al. 1994). In all self-organized systems, we found that users had created boundary rules for determining who could use the resource, choice rules related to the allocation of the flow of resource units, and active forms of monitoring and local sanctioning of rule breakers (ibid.: 301). On the other hand, we did not find a single case where harvesters used the "grim trigger" strategy—a form of punishment that was posited in many theoretical arguments for how individuals could solve repeated dilemmas (Prajit K. Dutta 1990: 264).

C. *The Bundles of Property Rights Related to Common-Pool Resources*

Resource economists have used the term "common property resource" to refer to fisheries and water resources (H. Scott Gordon 1954; Anthony D. Scott 1955; Frederick W. Bell 1972). Combining the term "property" with "resource" introduced considerable confusion between the nature of a good and the absence or presence of a property regime (Siegfried V. Ciriacy-Wantrup and Richard C. Bishop 1975). A common-pool resource can be owned and managed as government property, private property, community property, or owned by no one (Daniel W. Bromley 1986). A further reason for the lack of awareness about property systems developed by local users was that many scholars presumed that unless users possessed alienation rights—the right to sell their property—they did not have any property rights (Alchian and Harold Demsetz 1973; Terry L. Anderson and Peter J. Hill 1990; Richard Posner 1975).

[3] Scholars across disciplines tend to use very different vocabularies and theoretical frameworks when they describe empirical settings. Other scholars, who have used meta-analysis, have also needed to screen many publications to obtain consistent data about human-used resource systems. Adcharaporn Pagdee, Yeon-Su Kim, and P.J. Daugherty (2006) report screening over 100 articles in order to analyze 31 cases related to forest management. Thomas K. Rudel (2008) reported that he had screened nearly 1,200 studies for a meta-analysis of 268 cases of tropical forest cover change.

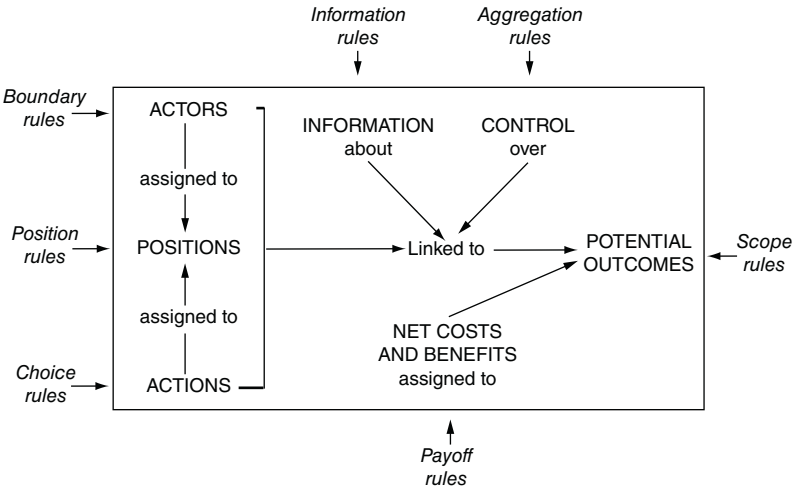

FIGURE 4. RULES AS EXOGENOUS VARIABLES DIRECTLY AFFECTING THE ELEMENTS OF AN ACTION SITUATION

Source: Adapted from E. Ostrom 2005: 189.

Schlager and E. Ostrom (1992) drew on the earlier work of Commons ([1924] 1968) to conceptualize property rights systems as containing *bundles* of rights rather than a single right. The meta-analysis of existing field cases helped to identify five property rights that individuals using a common-pool resource might cumulatively have: (i) access—the right to enter a specified property,[4] (ii) withdrawal—the right to harvest specific products from a resource, (iii) management—the right to transform the resource and regulate internal use patterns, (iv) exclusion—the right to decide who will have access, withdrawal, or management rights, and (v) alienation—the right to lease or sell any of the other four rights. Conceiving of property rights bundles is now widely accepted by scholars who have studied diverse property rights systems around the world (David J. Brunckhorst 2000; P. Degnbol and McCay 2007; Jouni Paavola and W. Neil Adger 2005; Paul B. Trawick 2001; James A. Wilson et al. 1994).

D. *Linking the Internal Parts of an Action Situation to External Rules*

Actors who have specific property rights to a resource also face more fundamental rules that affect the structure of the action situations they are in. In our meta-analysis, we found an incredible array of specific rules used in different settings (e.g., who could withdraw how many resource units at what location and time, what information was required of all users, what costs and benefits were attached to which actions, etc.). As we attempted to find a consistent way of coding and analyzing this rich diversity of specific rules described by case authors, we turned again to the IAD framework. Since we had identified seven working parts of a game or action situation itself, it seemed reasonable to think of seven broad types of rules operating

[4] The concept of access rights has puzzled some scholars. An everyday example of an access right is the buying of a permit to enter a public park. This assigns the holder of a permit the right to enter and enjoy hiking and other nonharvesting activities for a defined period of time.

as external variables affecting the individual working parts of action situations (see Figure 4). The seven types of rules are:

(i) Boundary rules that specify how actors were to be chosen to enter or leave these positions;

(ii) Position rules that specify a set of positions and how many actors hold each one;

(iii) Choice rules that specify which actions are assigned to an actor in a position;

(iv) Information rules that specify channels of communication among actors and what information must, may, or must not be shared;

(v) Scope rules that specify the outcomes that could be affected;

(vi) Aggregation rules (such as majority or unanimity rules) that specify how the decisions of actors at a node were to be mapped to intermediate or final outcomes; and

(vii) Payoff rules that specify how benefits and costs were to be distributed to actors in positions (Crawford and E. Ostrom 2005).

A useful way of thinking about institutional rules is to conceptualize what part of an action situation is affected by a rule (see Figure 4).

Conceptualizing seven broad types of rules (rather than one or two) has been upsetting to scholars who wanted to rely on simple models of interactions among humans. In addition to finding seven broad types of rules, however, we also found multiple variants of each type. For example, we found 27 boundary rules described by case study authors as used in at least one common-pool resource setting (E. Ostrom 1999: 510). Some rules specified diverse forms of residence, organizational memberships, or personal attributes that are ascribed or acquired. Similarly, we found 112 different choice rules that were usually composed of two parts—an allocation formula specifying where, when, or how resource units could be harvested and a specific basis for the implementation of the formula (such as the amount of land held, historical use patterns, or assignment through lottery) (ibid.: 512).

E. *Long Surviving Resource Institutions*

After working for several years with colleagues to code cases of successful and failed systems, I thought my next task would be to undertake careful statistical analysis to identify which specific rules were associated with successful systems. I had not yet fully absorbed the incredible number and diversity of rules that the team had recorded. In 1988, I spent a sabbatical leave in a research group organized by Reinhard Selten at the Center for Interdisciplinary Research at Bielefeld University. I struggled to find rules that worked across ecological, social, and economic environments, but the specific rules associated with success or failure varied extensively across sites. Finally, I had to give up the idea that *specific* rules might be associated with successful cases.

Moving up a level in generality, I tried to understand the broader institutional regularities among the systems that were sustained over a long period of time and were absent in the failed systems. I used the term "design principle" to characterize these regularities. I did not mean that the fishers, irrigators, pastoralists, and others overtly had these principles in their minds when they developed systems that survived for long periods of time. My effort was to identify a set of

core underlying lessons that characterized the long sustained regimes as contrasted to the cases of failure (E. Ostrom 1990).[5]

Since the design principles are described extensively in E. Ostrom (1990, 2005), I will mention only a brief updated list as developed by Michael Cox, Gwen Arnold, and Sergio Villamayor-Tomás (2009):

1A. *User Boundaries*: Clear and locally understood boundaries between legitimate users and nonusers are present.

1B. *Resource Boundaries*: Clear boundaries that separate a specific common-pool resource from a larger social-ecological system are present.

2A. *Congruence with Local Conditions*: Appropriation and provision rules are congruent with local social and environmental conditions.

2B. *Appropriation and Provision*: Appropriation rules are congruent with provision rules; the distribution of costs is proportional to the distribution of benefits.

3. *Collective Choice Arrangements*: Most individuals affected by a resource regime are authorized to participate in making and modifying its rules.

4A. *Monitoring Users*: Individuals who are accountable to or are the users monitor the appropriation and provision levels of the users.

4B. *Monitoring the Resource*: Individuals who are accountable to or are the users monitor the condition of the resource.

5. *Graduated Sanctions*: Sanctions for rule violations start very low but become stronger if a user repeatedly violates a rule.

6. *Conflict Resolution Mechanisms*: Rapid, low cost, local arenas exist for resolving conflicts among users or with officials.

7. *Minimal Recognition of Rights*: The rights of local users to make their own rules are recognized by the government.

8. *Nested Enterprises*: When a common-pool resource is closely connected to a larger social-ecological system, governance activities are organized in multiple nested layers.

The design principles appear to synthesize core factors that affect the probability of long term survival of an institution developed by the users of a resource. Cox, Arnold, and Villamayor-Tomás (2009) analyzed over 100 studies by scholars who assessed the relevance of the principles as an explanation of the success or failure of diverse common-pool resources. Two-thirds of these studies confirm that robust resource systems are characterized by most of the design principles and that failures are not. The authors of some studies that found the design principles inadequate tended to interpret them very rigidly and felt that successful systems were characterized by more flexibility. In three instances, the initial wording of the design principles was too general and did not distinguish between ecological and social conditions. Thus, I have adopted the improvements to principles 1, 2, and 4 suggested by Cox and coauthors.

[5] The term "design principle" has confused many readers. Perhaps I should have used the term "best practices" to describe the rules and structure of robust institutions.

V. Conducting Experiments to Study Common-Pool Resource Problems

The existence of a large number of cases where users had overcome social dilemmas in order to sustain long term use of common-pool resources successfully challenged the presumption that this was impossible. Many variables simultaneously affect these outcomes in the field. Developing game theoretical models of common-pool resource situations (Weissing and E. Ostrom 1993; E. Ostrom and Gardner 1993) has been one strategy we have used to assess the theoretical outcomes of a set of variables we have observed in the field. We have also thought it was important to examine the effect of precise combinations of variables in an experimental setting.

A. *Common-Pool Resource Experiments in University Laboratories*

Roy Gardner and James Walker joined me in an extended effort to build and test well specified, game theoretical models consistent with the IAD framework (see E. Ostrom, Walker, and Gardner 1992; E. Ostrom, Gardner, and Walker 1994). The initial CPR experiments started with a static, baseline situation that was as simple as could be specified without losing crucial aspects of the appropriation problems facing harvesters in the field. We used a quadratic payoff production function based on Gordon's (1954) classic model. The initial resource endowment ω for each of eight subjects was a set of tokens that the subject could allocate between Market 1 (which had a fixed return) and Market 2 (which functioned as a common-pool resource with a return affected by the actions of all subjects in the experiment). Subjects received aggregated information so they did not know each individual's actions. Each subject i could invest a portion x_i of his/her endowment in the common resource (Market 2) and the remaining portion would then be invested in Market 1. The payoff function we used (E. Ostrom, Gardner, and Walker 1994: 110) was:

$$u_i(x) = we \qquad \text{if } x_i = 0 \tag{1}$$

$$w(e - x_i) + (x_i/\Sigma x_i)F(\Sigma x_i) \qquad \text{if } x_i > 0. \tag{2}$$

The baseline experiment was a commons dilemma in which the game-theoretic outcome involved substantial overuse of a resource while a much better outcome could be reached if subjects were to reduce their joint allocation. The prediction from noncooperative game theory was that subjects would invest according to the Nash equilibrium—8 tokens each for a total of 64 tokens. Subjects could earn considerably more if they reduced their allocation to a total of 36 tokens in the common-pool resource. Subjects in baseline experiments with multiple decision rounds substantially overinvested—they invested even more tokens than predicted, so the joint outcome was worse than the predicted Nash equilibrium.[6]

Building off prior public goods research (Isaac and Walker 1988), we then conducted a series of face-to-face communication experiments in which the same payoff function was retained. After an initial ten rounds without communication, subjects were told they could communicate

[6] In simple, repeated public goods experiments, subjects initially tended to contribute at a higher level than predicted by the Nash equilibrium (R. Mark Isaac et al. 1984, 1985, 1994; Isaac and Walker 1988; Gerald Marwell and Ruth E. Ames 1979) and outcomes slowly approach the predicted Nash equilibrium from a higher level. In common-pool resource games, on the other hand, subjects initially achieved outcomes that were much worse than the Nash equilibrium that they then slowly approached from below (see also Marco Casari and Charles R. Plott 2003).

with each other in a group setting before returning to their terminals to make their own private decisions. This provided an opportunity for "cheap talk." The same outcome was predicted in these experiments as in the baseline since a subject could promise to cooperate but no external "third party" ensured that the promise was fulfilled.

Subjects used face-to-face communication to discuss strategies to gain the best outcomes and then to agree—if possible—on what each subject should invest. They learned about their aggregate investments after each round, but not the decision of individual subjects. This gave them information as to whether the total investments were greater than agreed upon. In many rounds, subjects kept their promises to each other. In other rounds, some defections did occur. Subjects used information about the aggregate investment levels to scold their unknown fellow subjects if the total investment was higher than they had agreed upon. The opportunity for repeated face-to-face communication was extremely successful in increasing joint returns. Findings from communication experiments are consistent with a large number of studies of the impact of face-to-face communication on the capacity of subjects to solve a variety of social dilemma problems (see E. Ostrom and Walker 1991; John M. Orbell, Alphons van de Kragt, and Robyn M. Dawes 1988; David Sally 1995; Daniel Balliet 2010).

In many field settings, resource users have devised a variety of formal or informal ways of sanctioning one another if rules are broken, even though this behavior is not consistent with the theory of norm-free, complete rationality (Jon Elster 1989: 40–41). It was thus important to see if subjects in a controlled experimental setting would actually use their own assets to financially punish other subjects. After subjects played ten rounds of the baseline common-pool resource game, they were told that in the subsequent rounds they would have an opportunity to pay a fee in order to impose a fine on another subject. We found much more sanctioning occurred in this design than the zero level predicted.[7] Subjects did increase gross benefits through their sanctioning but substantially reduced net returns due to the overuse of costly sanctions.[8] Sanctioning was primarily directed at those who defected, but a few sanctions appeared to be directed at low contributors as a form of revenge by those who had fined themselves. In a further design, subjects were given a chance to communicate and decide whether or not to adopt a sanctioning system of their own. Subjects who decided to adopt their own sanctioning system achieved the highest returns achieved in any of the common-pool resource laboratory experiments—90 percent of optimal after the fines related to the small number of defections were subtracted (E. Ostrom, Walker, and Gardner 1992).

The predictions of noncooperative game theory are roughly supported only when participants in a laboratory experiment do not know the reputation of the others involved in a common-pool resource dilemma and cannot communicate with them. On the other hand, when subjects communicate face-to-face, they frequently agree on joint strategies and keep to their agreements—substantially increasing their net returns. Further, communication to decide on and design a sanctioning system enables those choosing this option to achieve close to optimal returns.

B. *Studying Common-Pool Resources in Field Experiments*

A series of field experiments have now been conducted by colleagues in Colombia to assess whether experienced villagers who are dependent on resources make decisions about the "time

[7] See Joseph Henrich et al. (2006) in which field experiments were conducted in multiple countries testing whether a much broader set of participants would also use punishments in public goods experiments. See also Henrich et al. (2004) for the reports of earlier field experiments of social dilemmas in 15 small communities.

[8] Similar findings exist for public goods experiments where punishers typically punish low contributors (Toshio Yamagishi 1986; Ernst Fehr and Simon Gächter 2002).

spent in a forest" in a design that is mathematically consistent with those reported on above. Juan-Camilo Cardenas (2000) conducted field experiments in rural schoolhouses with over 200 users of local forests. He modified the design of the common-pool resource experiments without, and with, face-to-face communication so that villagers were asked to make decisions regarding "harvesting trees." The outcomes of these experiments were broadly consistent with the findings obtained with university students.

In a different design, Cardenas, John K. Stranlund, and Cleve E. Willis (2000) ran ten rounds of baseline experiments with resource users from five villages who were then given a chance to communicate face-to-face for the next set of experiments. In five additional villages, participants were told after the baseline rounds that a new regulation would go into force that mandated them to spend no more than the optimal time in the forest each round. The probability of an inspection was 1/16 per round—a low but realistic probability for monitoring rule conformance in rural areas in developing countries. If the person was over the limit imposed, a penalty was subtracted from that person's payoff, but the penalty was not revealed to the others. Subjects in this experimental condition increased their withdrawal levels when compared to the outcomes obtained when face-to-face communication was allowed and no rule was imposed. Other scholars have also found that externally imposed regulation that would theoretically lead to higher joint returns "crowded out" voluntary behavior to cooperate (see Bruno S. Frey and Felix Oberholzer-Gee 1997; Andrew F. Reeson and John G. Tisdell 2008).

Fehr and Andreas Leibbrandt (2008) conducted an interesting set of public goods experiments with fishers who harvest from an "open access" inland lake in northeastern Brazil. They found that a high percentage (87 percent) of fishers contributed in the first period of the field experiment and that contributions leveled off in the remaining periods. Fehr and Leibbrandt examined the mesh size of the nets used by individual fishermen and found that those who contributed more in the public goods experiment used nets with bigger mesh sizes. Larger mesh sizes allow young fish to escape, grow larger, and reproduce at a higher level than if they are caught when they are still small. In other words, cooperation in the field experiment was consistent with observed cooperation related to a real CPR dilemma. They conclude that the "fact that our laboratory measure for other-regarding preferences predicts field behavior increases our confidence about the behavioral relevance of other-regarding preferences gained from laboratory experiments" (ibid.: 17).

In summary, experiments on CPRs and public goods have shown that many predictions of the conventional theory of collective action do not hold. More cooperation occurs than predicted, "cheap talk" increases cooperation, and subjects invest in sanctioning free riders. Experiments also establish that motivational heterogeneity exists in harvesting or contribution decisions as well as decisions on sanctioning.

VI. Studying Common-Pool Resource Problems in the Field

Having conducted extensive meta-analyses of case studies and experiments, we also needed to undertake field studies where we could draw on the IAD framework to design questions to obtain consistent information about key theoretically important variables across sites.

A. *Comparing Farmer and Government Managed Irrigation Systems in Nepal*

An opportunity to visit Nepal in 1988 led to the discovery of a large number of written studies of farmer built and maintained irrigation systems as well as some government constructed and managed systems. Ganesh Shivakoti, Paul Benjamin, and I were able to revise the CPR coding manual so as to include variables of specific relevance to understanding irrigation systems in

a new coding manual for the Nepal Irrigation and Institutions (NIIS) project. We coded existing cases and again found numerous "missing variables" not discussed by the original author. Colleagues made several trips to Nepal to visit previously described systems in written case studies to fill in missing data and verify the data in the original study. While in the field, we were able to add new cases to the data set (Benjamin et al. 1994).

In undertaking analysis of this large dataset, Wai Fung Lam (1998) developed three performance measures that could be applied to all systems: (i) the physical condition of irrigation systems, (ii) the quantity of water available to farmers at the tail end of a system at different seasons of the year, and (iii) the agricultural productivity of the systems. Controlling for environmental differences among systems, Lam found that irrigation systems governed by the farmers themselves perform significantly better on all three performance measures. On the farmer governed systems, farmers communicate with one another at annual meetings and informally on a regular basis, develop their own agreements, establish the positions of monitors, and sanction those who do not conform to their own rules. Consequently, farmer managed systems are likely to grow more rice, distribute water more equitably, and keep their systems in better repair than government systems. While farmer systems do vary in performance, few perform as poorly as government systems—holding other relevant variables constant.

Over time, colleagues have visited and coded still further irrigation systems in Nepal. The earlier findings regarding the higher level of performance of farmer managed systems was again confirmed using the expanded database containing 229 irrigation systems (Neeraj N. Joshi et al. 2000; Shivakoti and E. Ostrom 2002). Our findings are not unique to Nepal. Scholars have carefully documented effective farmer designed and operated systems in many countries including Japan (Masahiko Aoki 2001), India (Ruth Meinzen-Dick 2007; Pranab K. Bardhan 2000), and Sri Lanka (Norman T. Uphoff 1991).

B. *Studying Forests around the World*

In 1992, Dr. Marilyn Hoskins, who headed the Forest, Trees and People Program at the Food and Agriculture Organization (FAO) of the United Nations, asked colleagues at the Workshop to draw on our experience in studying irrigation systems to develop methods for assessing the impact of diverse forest governance arrangements in multiple countries. Two years of intense development and review by ecologists and social scientists around the world led to the development of ten research protocols to obtain reliable information about users and forest governance as well as about the ecological conditions of sampled forests. A long term collaborative research network—the International Forestry Resources and Institutions (IFRI) research program—was established with centers now located in Bolivia, Colombia, Guatemala, India, Kenya, Mexico, Nepal, Tanzania, Thailand, Uganda, and the United States, with new centers being established in Ethiopia and China (see Clark Gibson, Margaret McKean, and E. Ostrom 2000; Poteete and E. Ostrom 2004; Eva Wollenberg et al. 2007). IFRI is unique among efforts to study forests as it is the only interdisciplinary long term monitoring and research program studying forests in multiple countries owned by governments, private organizations, and communities.

Forests are a particularly important form of common-pool resource given their role in climate change–related emissions and carbon sequestration (Josep G. Canadell and Michael R. Raupach 2008), the biodiversity they contain, and their contribution to rural livelihoods in developing countries. A "favorite" policy recommendation for protecting forests and biodiversity is government owned protected areas (J. Terborgh 1999). In an effort to examine whether government ownership of protected areas is a necessary condition for improving forest density, Tanya Hayes (2006) used IFRI data to compare the rating of forest density (on a five point scale) assigned to

a forest by the forester or ecologist who had supervised the forest mensuration of trees, shrubs, and groundcover in a random sample of forest plots.[9] Of the 163 forests included in the analysis, 76 were government owned forests *legally designated* as *protected forests* and 87 were public, private, or communally owned forested lands used for a diversity of purposes. No statistical difference existed between the forest density in officially designated protected areas versus other forested areas. Gibson, John Williams, and E. Ostrom (2005) examined the monitoring behavior of 178 forest user groups and found a strong correlation between the level of monitoring and a forester's assessment of forest density even when controlling for whether users were formally organized, whether the users were heavily dependent on a forest, and the level of social capital within a group.

Ashwini Chhatre and Arun Agrawal (2008) have now examined the changes in the condition of 152 forests under diverse governance arrangements as affected by the size of the forest, collective action around forests related to improvement activities, size of the user group, and the dependence of local users on a forest. They found that "forests with a higher probability of regeneration are likely to be small to medium in size with low levels of subsistence dependence, low commercial value, high levels of local enforcement, and strong collective action for improving the quality of the forest" (ibid.: 1327). In a second major analysis, Chhatre and Agrawal (2009) focus on factors that affect tradeoffs and synergies between the level of carbon storage in forests and their contributions to livelihoods. They find that larger forests are more effective in enhancing both carbon and livelihoods outcomes, particularly when local communities also have high levels of rule-making autonomy. Recent studies by Eric Coleman (2009) and Coleman and Brian Steed (2009) also find that a major variable affecting forest conditions is the investment by local users in monitoring. Further, when local users are given harvesting rights, they are more likely to monitor illegal uses themselves. Other focused studies also stress the relationship between local monitoring and better forest conditions (Rucha Ghate and Harini Nagendra 2005; E. Ostrom and Nagendra 2006; Abwoli Y. Banana and William Gombya-Ssembajjwe 2000; Edward Webb and Shivakoti 2008).

The legal designation of a forest as a protected area is *not* by itself related to forest density. Detailed field studies of monitoring and enforcement as they are conducted on the ground, however, illustrate the challenge of achieving high levels of forest regrowth without active involvement of local forest users (see Mateus Batistella, Scott Robeson, and Emilio F. Moran 2003; Agrawal 2005; Andersson, Gibson, and Fabrice Lehoucq 2006; Catherine M. Tucker 2008). Our research shows that forests under different property regimes—government, private, communal—sometimes meet enhanced social goals such as biodiversity protection, carbon storage, or improved livelihoods. At other times, these property regimes fail to provide such goals. Indeed, when governments adopt top-down decentralization policies leaving local officials and users in the dark, stable forests may become subject to deforestation (Banana et al. 2007). Thus, it is not the general type of forest governance that is crucial in explaining forest conditions; rather, it is how a particular governance arrangement fits the local ecology, how specific rules are developed and adapted over time, and whether users consider the system to be legitimate and equitable (for a more detailed overview of the IFRI research program, see Poteete, Janssen, and E. Ostrom 2010: chap. 5).

[9] Extensive forest mensuration is conducted at every IFRI site at the same time that information is obtained about forest users, their activities and organization, and about governance arrangements. Comparing forest measures across ecological zones is misleading since the average diameter at breast height in a forest is strongly affected by precipitation, soils, elevation, and other factors that vary dramatically across ecological zones. Thus, we ask the forester or ecologist who has just supervised the collection of forest data to rate the forest on a five point scale from very sparse to very abundant.

VII. Current Theoretical Developments

Given the half century of our own extensive empirical research and that of many distinguished scholars (e.g., Jean-Marie Baland and Jean-Philippe Platteau 2005; Fikret Berkes 2007; Berkes, Johan Colding, and Carl Folke 2003; Colin W. Clark 2006; Graham R. Marshall 2008; Thomas C. Schelling 1960, 1978, 1984), where are we now? What have we learned? We now know that the earlier theories of rational, but helpless, individuals who are trapped in social dilemmas are not supported by a large number of studies using diverse methods (Nicolas Faysse 2005; Poteete, Janssen, and E. Ostrom 2010). On the other hand, we cannot be overly optimistic and presume that dilemmas will always be solved by those involved. Many groups have struggled and failed (Tom Dietz, E. Ostrom, and Paul Stern 2003). Further, simple policy prescriptions to turn over resources to a government, to privatize, or more recently to decentralize, may also fail (Berkes 2007; William A. Brock and Stephen R. Carpenter 2007; Meinzen-Dick 2007).

We thus face the tough task of further developing our theories to help understand and predict when those involved in a common-pool resource dilemma will be able to self-organize and how various aspects of the broad context they face affect their strategies, the short term success of their efforts, and the long term robustness of their initial achievements. We need to develop a better theoretical understanding of human behavior as well as of the impact of the diverse contexts that humans face.

A. *Developing a More General Theory of the Individual*

As discussed earlier in Section III, efforts to explain phenomena in the social world are organized at three levels of generality. Frameworks, such as the IAD that have been used to organize diverse efforts to study common-pool resources, are metatheoretical devices that help provide a general language for describing relationships at multiple levels and scales. Theories are efforts to build understanding by making core assumptions about specific working parts of frequently encountered phenomena and predicting general outcomes. Models are very specific working examples of a theory—and they are frequently confused with being theories themselves. As Alchian (1950) pointed out long ago, what is called "rational choice theory" is not a broad *theory* of human behavior but rather a useful *model* to predict behavior in a particular situation—a highly competitive market for private goods. Predictions derived from the rational choice model are empirically supported in open markets for private goods and other competitive environments (Charles A. Holt 2007; Vernon L. Smith and Walker 1993; Debra Satz and John Ferejohn 1994). Thus, it is a useful model to retain for predicting outcomes in competitive settings related to excludable and divisible outcomes.

While it is not possible yet to point to a single *theory* of human behavior that has been successfully formulated and tested in a variety of settings, scholars are currently positing and testing assumptions that are likely to be at the core of future developments (Smith 2003, 2010). These relate to (i) the capability of boundedly rational individuals to learn fuller and more reliable information in repeated situations when reliable feedback is present, (ii) the use of heuristics in making daily decisions, and (iii) the preferences that individuals have related to benefits for self as well as norms and preferences related to benefits for others (see Poteete, Janssen, and E. Ostrom 2010: chap. 9; E. Ostrom 1998).

The assumption that individuals have complete information about all actions available to them, the likely strategies that others will adopt, and the probabilities of specific consequences that will result from their own choices must be rejected in any but the very simplest of repeated settings. When boundedly rational individuals do interact over time, it is reasonable to assume that they learn more accurate information about the actions they can take and the likely actions of other

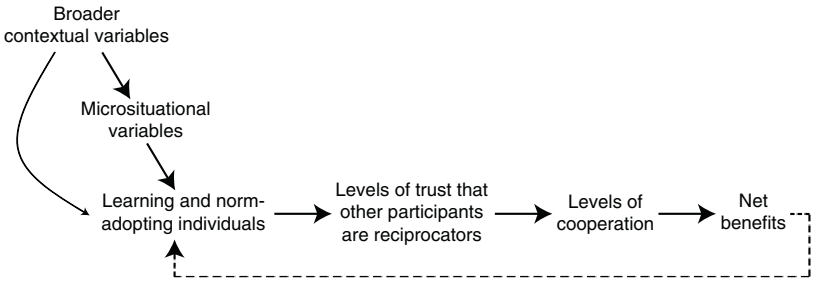

FIGURE 5. MICROSITUATIONAL AND BROADER CONTEXTS OF SOCIAL DILEMMAS AFFECT LEVELS OF TRUST AND COOPERATION

Source: Poteete, Janssen, and Ostrom 2010: 227.

individuals (Selten 1990; Simon 1955, 1999). Some highly complex common-pool resource environments, however, approach mathematical chaos (J. Wilson et al. 1994) in which resource users cannot gain complete information about all likely combinations of future events.

In many situations, individuals use rules of thumb—heuristics—that they have learned over time that work relatively well in a particular setting. Fishers end up "fishing for knowledge" (J. Wilson 1990) where using heuristics over time enables them to recognize diverse clues of environmental processes that they need to take into account when making their own decisions. When individuals do interact repeatedly, it is possible to learn heuristics that approach "best response" strategies and achieve close to local optima (Gerd Gigerenzer and Selten 2001). In eras of rapid change or sudden shocks, however, heuristics may not enable individuals to achieve high payoffs.

Individuals also learn norms—internal valuations that are negative or positive related to specific actions such as lying or being brave in particular situations (Crawford and E. Ostrom 2005). The strength of an internal commitment (Amartya K. Sen 1977) may be represented in the size of the internal weight that an individual assigns to actions and outcomes in a particular setting. Among individual norms are those related to valuing outcomes achieved by others (James Cox and Cary Deck 2005; J. Cox, Klarita Sadiraj, and Vjollca Sadiraj 2008; James Andreoni 1989; Gary E. Bolton and Axel Ockenfels 2000). Fehr and Klaus Schmidt (1999) propose that individuals dislike unequal outcomes of interactions and thus have an internal norm of "inequity aversion." Robert Axelrod (1986) posits that individuals who adopt meta norms related to whether others follow the norms that have evolved in a group increase the probability that norms will be followed. Leibbrandt, Uri Gneezy, and John List (2010) show that individuals who regularly work in teams are more likely to adopt norms and trust each other more than individuals working alone. Norman Frohlich and Joe A. Oppenheimer (1992) posit that many individuals adopt norms of fairness and justice. Not all individuals have the same norms or perceptions of a situation (Umut Ones and Louis Putterman 2007) and may differ substantially in whether they consider a way of sharing costs to be fair (Catherine Eckel and Philip J. Grossman 1996).

Simply assuming that humans adopt norms, however, is not sufficient to predict behavior in a social dilemma, especially in very large groups with no arrangements for communication. Even with strong preferences to follow norms, "observed behavior may vary by context because the perception of the 'right thing' would change" (Angela de Oliveira, Rachel Croson, and Eckel 2009: 19). Various aspects of the context in which individuals interact affect how individuals learn about the situation they are in and about the others with whom they are interacting. Individual differences do make a difference, but the context of interactions also affects behavior over time (Walker and E. Ostrom 2009). Biologists recognize that an organism's appearance and behavior are affected by the environment in which it develops.

> *For example, some plants produce large, thin leaves (which enhance photosynthetic photon harvest) in low light, and narrow, thicker leaves (which conserve water) in high light; certain insects develop wings only if they live in crowded conditions (and hence are likely to run out of adequate food in their current location). Such environmentally contingent development is so commonplace that it can be regarded as a universal property of living things.*
> — (David W. Pfennig and Cris Ledón-Rettig 2009: 268)

Social scientists also need to recognize that individual behavior is strongly affected by the context in which interactions take place rather than being simply a result of individual differences.

B. *The Central Role of Trust in Coping with Dilemmas*

Even though Kenneth J. Arrow (1974) long ago pointed to the crucial role of trust among participants as the most efficient mechanism to enhance transactional outcomes, collective action theory has paid more attention to payoff functions than to how individuals build trust that others are reciprocators of costly cooperative efforts. Empirical studies, however, confirm the important role of trust in overcoming social dilemmas (Bo Rothstein 2005). As illustrated in Figure 5, the updated theoretical assumptions of learning and norm-adopting individuals can be used as the foundation for understanding how individuals may gain increased levels of trust in others, leading to more cooperation and higher benefits with feedback mechanisms that reinforce positive or negative learning. Thus, it is not only that individuals adopt norms but also that the structure of the situation generates sufficient information about the likely behavior of others to be trustworthy reciprocators who will bear their share of the costs of overcoming a dilemma. Thus, in some contexts, one can move beyond the presumption that rational individuals are helpless in overcoming social dilemma situations.

C. *The Microsituational Level of Analysis*

Asserting that context makes a difference in building or destroying trust and reciprocity is not a sufficient theoretical answer to how and why individuals sometimes solve and sometimes fail to solve dilemmas. Individuals interacting in a dilemma situation face two contexts: (i) a microcontext related to the specific attributes of an action situation in which individuals are directly interacting and (ii) the broader context of the social-ecological system in which groups of individuals make decisions. A major advantage of studies conducted in an experimental lab or in field experiments is that the researcher designs the micro setting in which the experiment is conducted. Thus, empirical results are growing (and are summarized in Poteete, Janssen, and E. Ostrom 2010) to establish that the following attributes of microsituations affect the level of cooperation that participants achieve in social dilemma settings (including both public goods and common-pool resource dilemmas).

(i) Communication is feasible with the full set of participants. When face-to-face communication is possible, participants use facial expressions, physical actions, and the way that words are expressed to judge the trustworthiness of the others involved.

(ii) Reputations of participants are known. Knowing the past history of other participants, who may not be personally known prior to interaction, increases the likelihood of cooperation.

(iii) High marginal per capita return (MPCR). When MPCR is high, each participant can know that their own contributions make a bigger difference than with low MPCR, and that others are more likely to recognize this relationship.

(iv) Entry or exit capabilities. If participants can exit a situation at low cost, this gives them an opportunity not to be a sucker, and others can recognize that cooperators may leave (and enter other situations) if their cooperation is not reciprocated.

(v) Longer time horizon. Participants can anticipate that more could be earned through cooperation over a long time period versus a short time.

(vi) Agreed-upon sanctioning capabilities. While external sanctions or imposed sanctioning systems may reduce cooperation, when participants themselves agree to a sanctioning system they frequently do not need to use sanctions at a high volume, and net benefits can be improved substantially.

Other microsituational variables are being tested in experiments around the world. The central core of the findings is that when individuals face a social dilemma in a microsetting, they are more likely to cooperate when situational variables increase the likelihood of gaining trust that others will reciprocate.

D. *The Broader Context in the Field*

Individuals coping with common-pool resource dilemmas in the field are also affected by a broader set of contextual variables related to the attributes of the social-ecological system (SES) in which they are interacting. A group of scholars in Europe and the United States are currently working on the further development of a framework that links the IAD and its interactions and outcomes at a micro level with a broader set of variables observed in the field.[10] As illustrated in Figure 6, one can think of individuals interacting in an Action Situation generating Interactions and Outcomes that are affected by and affect a Resource System, Resource Units, Governance System, and Users who affect and are affected by Social, Economic, and Political Settings, and Related Ecosystems (see E. Ostrom 2007, 2009). Figure 6 provides an overview of the highest tier of variables that exist in all field settings. The highest tier can be unpacked several times when one is trying to analyze specific questions related to SESs in the field, but there is not enough time or space to undertake a thorough unpacking in this article.

Experimental researchers have reached a higher level of agreement about the impact of microsituational variables on the incentives, levels of trust, and behavior of individuals in dilemma situations than exists among field researchers. Few SES variables have a fully independent impact on the action situations that participants face and their likely behavior. The SES variables that are most important differ depending on which interactions (such as monitoring, conflict, lobbying, self-organization) or longer term outcomes (such as overharvesting, regeneration of biodiversity, resilience of an ecological system to human and nature induced disturbances) one wishes to predict. A set of ten variables have been identified across many field studies as impacting the likelihood of users self-organizing in order to overcome a common-pool resource dilemma (E. Ostrom 2009; Basurto and E. Ostrom 2009). These include: the size, productivity, and predictability of the

[10] Scholars at the Stockholm Environment Institute, the International Institute for Applied Systems Analysis, Delft University of Technology, the University of Zurich, the Nordland Research Institute of Bodø University College, the Potsdam Institute for Climate Impact Research (PIK), Humboldt University, Marburg University, and the EU NeWATER project located at the University of Osnabrück have had several meetings in Europe to begin plans for using a common framework (initially developed by E. Ostrom 2007) to study a variety of resource systems. Scholars at the Workshop in Bloomington and the Center for the Study of Institutional Diversity at Arizona State University will also participate in this effort. A core problem identified by these scholars is the lack of cumulation across studies on diverse natural resource systems as well as humanly engineered resources.

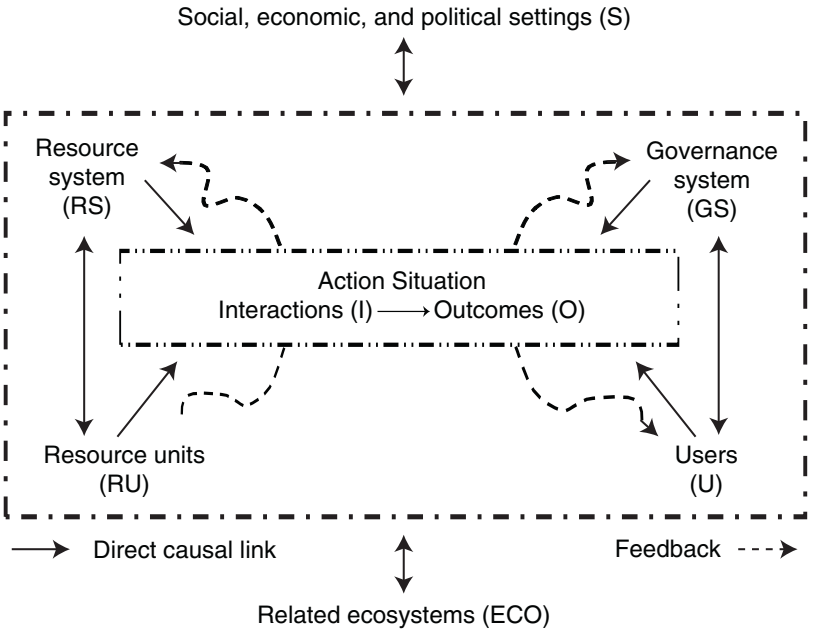

FIGURE 6. ACTION SITUATIONS EMBEDDED IN BROADER SOCIAL-ECOLOGICAL SYSTEMS

Source: Adapted from E. Ostrom 2007: 15182.

resource system, the extent of mobility of the resource units, the existence of collective choice rules that the users may adopt authoritatively in order to change their own operational rules, and four attributes of users (the number, the existence of leadership/entrepreneurship, knowledge about the SES, and the importance of the SES to the users). Linking the broader contextual variables and microcontextual variables is one of the major tasks facing scientists who work across disciplinary lines to understand how both social and ecological factors affect human behavior.[11]

VIII. Complexity and Reform

The economic and social sciences have significantly moved ahead over the past five decades since scholars posited two optimal organizational forms, two types of goods, and one model of the individual. Extensive empirical research documents the diversity of settings in which individuals solve common-pool resource problems on their own, when these solutions are sustainable over long periods of time, and how larger institutional arrangements enhance or detract from the capabilities of individuals at smaller scales to solve problems efficiently and sustainably (see, for example, Agrawal and Gibson 2001; Gibson et al. 2005; Schlager and Blomquist 2008). While there is not yet a single well developed theory that explains all of the diverse outcomes obtained in microsettings, such as the experimental lab, or broader contextual settings of fisheries, irrigation systems, forests, lakes, and other common-pool resources, considerable agreement does exist. Nor do we have a single normative theory of justice that can unambiguously be applied to all settings (Sen 2009).

[11] See James I. Stewart (2009) for an important study that links size of group, acceptance of norms of cooperation, and support of property rights in 25 mining camps in the American Southwest.

Building trust in one another and developing institutional rules that are well matched to the ecological systems being used are of central importance for solving social dilemmas. The surprising but repeated finding that users of resources that are in relatively good condition—or even improving—do invest in various ways of monitoring one another relates to the core problem of building trust.

Unfortunately, policy analysts, public officials, and scholars who still apply simple mathematical models to the analysis of field settings have not yet absorbed the central lessons articulated here. All too often a single policy prescription—such as Individual Transferable Quotas (ITQs)—is recommended for all resources of a particular type, such as all fisheries. While several ITQ systems are working successfully, the time and effort needed to tailor the broad theoretical concept of an ITQ system into an operational system in a particular location involves multiple years of hard work by the fishers involved as well as the government officials (see Clark 2006; Tracy Yandle 2007; Yandle and Christopher Dewees 2003; Thráinn Eggertsson 1990).

Other scholars propose government-owned protected areas as the "only" way to ensure that biodiversity is protected around the world (Terborgh 1999). Careful studies of protected areas have found, however, that the frequent eviction of indigenous peoples who had lived in a region for multiple centuries prior to the establishment of the park in their territory has not produced the positive results expected. Using remote sensing, Jianguo Liu et al. (2001) assessed that the rate of loss and fragmentation of high quality habitat after the Wolong Nature Reserve was established in southwestern China was much higher than before the reserve was created. Daniel Brockington and James Igoe (2006) reviewed 250 reports on protected areas and the level of evictions from them and conclude that "forced relocation inflicts considerable material and psychological harm. But it is not just damaging for its material effects, rather for the reshaping of landscape and memory it imposes" (ibid.: 246). David Barton Bray and colleagues (2004) made a detailed study of another type of reform that created a forested landscape that was inhabited and productively used. Using Landsat images, they found a very "low incidence of net deforestation, 0.01% for the 1984–2000 period, the lowest recorded deforestation rate for southeastern Mexico" (ibid.: 333) based on a reform that created common property institutions.

A positive development of recent research is that more scholars are carefully assessing diverse policies adopted for the governance of common-pool resources (Brian R. Copeland and M. Scott Taylor 2009). In light of a comparative study of private, community, and state governed common-pool resources, R. Quentin Grafton (2000) found each to be successful when well matched to local settings and involving the active participation of local users.

> *Each is capable of preventing resource degradation and ensuring the on-going flow of benefits to resource users. A comparison of the bundle of rights of the three regimes suggests that a common factor in ensuring successful governance of CPRs is the active participation of resource users in the management of the flow of benefits from the resources.*
> — (Grafton 2000: 515)

Jeremy S. Brooks et al. (2006) reviewed data generated by 124 conservation projects and found that allowing local users to harvest and sell some products and involving communities in the design and administration of a project were all important factors for successful outcomes. Moving away from the presumption that *the* government must solve all common-pool resource problems while recognizing the important role of governments is a big step forward. Hopefully, in the future, more national officials will learn to work with local and regional officials, nongovernmental organizations, and local groups of citizens.

The most important lesson for public policy analysis derived from the intellectual journey I have outlined here is that humans have a more complex motivational structure and more capability to solve social dilemmas than posited in earlier rational-choice theory. Designing institutions

to force (or nudge) entirely self-interested individuals to achieve better outcomes has been the major goal posited by policy analysts for governments to accomplish for much of the past half century. Extensive empirical research leads me to argue that instead, a core goal of public policy should be to facilitate the development of institutions that bring out the best in humans. We need to ask how diverse polycentric institutions help or hinder the innovativeness, learning, adapting, trustworthiness, levels of cooperation of participants, and the achievement of more effective, equitable, and sustainable outcomes at multiple scales (Theo Toonen 2010).

To explain the world of interactions and outcomes occurring at multiple levels, we also have to be willing to deal with complexity instead of rejecting it. Some mathematical models are very useful for explaining outcomes in particular settings. We should continue to use simple models where they capture enough of the core underlying structure and incentives that they usefully predict outcomes. When the world we are trying to explain and improve, however, is not well described by a simple model, we must continue to improve our frameworks and theories so as to be able to understand complexity and not simply reject it.

REFERENCES

Acheson, James M., and Roy Gardner. 2005. "Spatial Strategies and Territoriality in the Maine Lobster Industry." *Rationality and Society*, 17(3): 309–41.

Agrawal, Arun. 2005. *Environmentality: Technologies of Government and the Making of Subjects*. Durham, NC: Duke University Press.

Agrawal, Arun, and Clark Gibson, ed. 2001. *Communities and the Environment: Ethnicity, Gender, and the State in Community-Based Conservation*. New Brunswick, NJ: Rutgers University Press.

Alchian, Armen A. 1950. "Uncertainty, Evolution, and Economic Theory." *Journal of Political Economy*, 58(3): 211–21.

Alchian, Armen A., and Harold Demsetz. 1973. "The Property Rights Paradigm." *Journal of Economic History*, 33(1): 16–27.

Allport, Floyd H. 1962. "A Structuronomic Conception of Behavior: Individual and Collective." *Journal of Abnormal and Social Psychology*, 64(1): 3–30.

Anderson, Terry L., and Peter J. Hill. 1990. "The Race for Property Rights." *Journal of Law and Economics*, 33(1): 177–97.

Anderson, William, and Edward W. Weidner. 1950. *American City Government*. New York: Henry Holt.

Andersson, Krister P., and Elinor Ostrom. 2008. "Analyzing Decentralized Resource Regimes from a Polycentric Perspective." *Policy Sciences*, 41(1): 71–93.

Andersson, Krister P., Clark C. Gibson, and Fabrice Lehoucq. 2006. "Municipal Politics and Forest Governance: Comparative Analysis of Decentralization in Bolivia and Guatemala." *World Development*, 34(3): 576–95.

Andreoni, James. 1989. "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence." *Journal of Political Economy*, 97(6): 1447–58.

Aoki, Masahiko. 2001. *Toward a Comparative Institutional Analysis*. Cambridge, MA: MIT Press.

Arrow, Kenneth J. 1974. *The Limits of Organization*. New York: Norton.

Axelrod, Robert. 1986. "An Evolutionary Approach to Norms." *American Political Science Review*, 80(4): 1095–111.

Bain, Joe S. 1959. *Industrial Organization*. New York: Wiley.

Baland, Jean-Marie, and Jean-Philippe Platteau. 2005. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* Oxford: Clarendon Press.

Balliet, Daniel. 2010. "Communication and Cooperation in Social Dilemmas: A Meta-Analytic Review." *Journal of Conflict Resolution*, 54(1): 39–57.

Banana, Abwoli Y., and William Gombya-Ssembajjwe. 2000. "Successful Forest Management: The Importance of Security of Tenure and Rule Enforcement in Ugandan Forests." In *People and Forests: Communities, Institutions, and Governance*, ed. Clark C. Gibson, Margaret A. McKean, and Elinor Ostrom, 87–98. Cambridge, MA: MIT Press.

Banana, Abwoli, Nathan D. Vogt, Joseph Bahati, and William Gombya-Ssembajjwe. 2007. "Decentralized Governance and Ecological Health: Why Local Institutions Fail to Moderate Deforestation in Mpigi District of Uganda." *Scientific Research and Essays*, 2(10): 434–45.

Bardhan, Pranab. 2000. "Irrigation and Cooperation: An Empirical Analysis of 48 Irrigation Communities in South India." *Economic Development and Cultural Change*, 48(4): 847–65.

Basurto, Xavier, and Elinor Ostrom. 2009. "Beyond the Tragedy of the Commons." *Economia delle fonti di energia e dell'ambiente*, 52(1): 35–60.

Batistella, Mateus, Scott Robeson, and Emilio F. Moran. 2003. "Settlement Design, Forest Fragmentation, and Landscape Change in Rondônia, Amazônia." *Photogrammetric Engineering and Remote Sensing*, 69(7): 805–12.

Bell, Frederick W. 1972. "Technological Externalities and Common-Property Resources: An Empirical Study of the U.S. Northern Lobster Fishery." *Journal of Political Economy*, 80(1): 148–58.

Benjamin, Paul, Wai Fung Lam, Elinor Ostrom, and Ganesh Shivakoti. 1994. *Institutions, Incentives, and Irrigation in Nepal*. Burlington, VT: Associates in Rural Development.

Berkes, Fikret. 2007. "Community-Based Conservation in a Globalized World." *Proceedings of the National Academy of Sciences*, 104(39): 15188–93.

Berkes, Fikret, Johan Colding, and Carl Folke. 2003. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge, UK: Cambridge University Press.

Blomquist, William, Edella Schlager, Shui Yan Tang, and Elinor Ostrom. 1994. "Regularities from the Field and Possible Explanations." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 301–18. Ann Arbor, MI: University of Michigan Press.

Bolton, Gary E., and Axel Ockenfels. 2000. "ERC: A Theory of Equity, Reciprocity, and Competition." *American Economic Review*, 90(1): 166–93.

Boyd, Robert, and Peter J. Richerson. 1985. *Culture and the Evolutionary Process.* Chicago: University of Chicago Press.

Bray, David Barton, Edward A. Ellis, Natalia Armijo-Canto, and Christopher T. Beck. 2004. "The Institutional Drivers of Sustainable Landscapes: A Case Study of the 'Mayan Zone' in Quintana Roo, Mexico." *Land Use Policy*, 21(4): 333–46.

Brock, William A., and Stephen R. Carpenter. 2007. "Panaceas and Diversification of Environmental Policy." *Proceedings of the National Academy of Sciences*, 104(39): 15206–11.

Brockington, Daniel, and James Igoe. 2006. "Eviction for Conservation: A Global Overview." *Conservation and Society*, 4(3): 424–70.

Bromley, Daniel W. 1986. "Closing Comments at the Conference on Common Property Resource Management." In *Proceedings of the Conference on Common Property Resource Management*, 591–98. Washington, DC: National Academies Press.

Brooks, Jeremy S., Margaret A. Franzen, Christopher M. Holmes, Mark N. Grote, and Monique Borgerhoff Mulder. 2006. "Testing Hypotheses for the Success of Different Conservation Strategies." *Conservation Biology*, 20(5): 1528–38.

Brunckhorst, David J. 2000. *Bioregional Planning: Resource Management beyond the New Millennium*. Amsterdam: Harwood Academic.

Buchanan, James M. 1965. "An Economic Theory of Clubs." *Economica*, 32(125): 1–14.

Canadell, Josep G., and Michael R. Raupach. 2008. "Managing Forests for Climate Change Mitigation." *Science*, 320(5882): 1456–57.

Cardenas, Juan-Camilo. 2000. "How Do Groups Solve Local Commons Dilemmas? Lessons from Experimental Economics in the Field." *Environment, Development and Sustainability*, 2(3–4): 305–22.

Cardenas, Juan-Camilo, John Stranlund, and Cleve Willis. 2000. "Local Environmental Control and Institutional Crowding-Out." *World Development*, 28(10): 1719–33.

Casari, Marco, and Charles R. Plott. 2003. "Decentralized Management of Common Property Resources: Experiments with a Centuries-Old Institution." *Journal of Economic Behavior and Organization*, 51(2): 217–47.

Caves, Richard. 1964. *American Industry: Structure, Conduct, Performance*. Englewood Cliffs, NJ: Prentice-Hall.

Chhatre, Ashwini, and Arun Agrawal. 2008. "Forest Commons and Local Enforcement." *Proceedings of the National Academy of Sciences*, 105(36): 13286–91.

Chhatre, Ashwini, and Arun Agrawal. 2009. "Trade-offs and Synergies between Carbon Storage and Livelihood Benefits from Forest Commons." *Proceedings of the National Academy of Sciences*, 106(42): 17667–70.

Ciriacy-Wantrup, S. V., and Richard C. Bishop. 1975. "'Common Property' as a Concept in Natural Resources Policy." *Natural Resources Journal*, 15(4): 713–27.

Clark, Colin W. 2006. *The Worldwide Crisis in Fisheries: Economic Models and Human Behavior.* Cambridge, UK: Cambridge University Press.

Coleman, Eric A. 2009. "Institutional Factors Affecting Biophysical Outcomes in Forest Management." *Journal of Policy Analysis and Management*, 28(1): 122–46.

Coleman, Eric A., and Brian C. Steed. 2009. "Monitoring and Sanctioning in the Commons: An Application to Forestry." *Ecological Economics*, 68(7): 2106–13.

Commons, John R. 1968. *Legal Foundations of Capitalism*. Madison, WI: University of Wisconsin Press. (Orig. Pub. 1924).

Copeland, Brian R., and M. Scott Taylor. 2009. "Trade, Tragedy, and the Commons." *American Economic Review*, 99(3): 725–49.

Coward, E. Walter. 1980. *Irrigation and Agricultural Development in Asia*. Ithaca, NY: Cornell University Press.

Cox, James C., and Cary A. Deck. 2005. "On the Nature of Reciprocal Motives." *Economic Inquiry*, 43(3): 623–35.

Cox, James C., Klarita Sadiraj, and Vjollca Sadiraj. 2008. "Implications of Trust, Fear, and Reciprocity for Modeling Economic Behavior." *Experimental Economics*, 11(1): 1–24.

Cox, Michael, Gwen Arnold, and Sergio Villamayor-Tomás. 2009. "A Review and Reassessment of Design Principles for Community-Based Natural Resource Management." Unpublished.

Crawford, Sue E. S., and Elinor Ostrom. 2005. "A Grammar of Institutions." In *Understanding Institutional Diversity*, 137–74. Princeton, NJ: Princeton University Press.

Degnbol, Poul, and Bonnie J. McCay. 2007. "Unintended and Perverse Consequences of Ignoring Linkages in Fisheries Systems." *ICES Journal of Marine Science*, 64(4): 793–97.

de Oliveira, Angela C. M., Rachel T. A. Croson, and Catherine Eckel. 2009. "Are Preferences Stable across Domains? An Experimental Investigation of Social Preferences in the Field." CBEES Working Paper 2008–3.

Dietz, Thomas, Elinor Ostrom, and Paul C. Stern. 2003. "The Struggle to Govern the Commons." *Science*, 302(5652): 1907–12.

Dutta, Prajit K. 1999. *Strategies and Games: Theory and Practice*. Cambridge, MA: MIT Press.

Eckel, Catherine C., and Philip J. Grossman. 1996. "The Relative Price of Fairness: Gender Differences in a Punishment Game." *Journal of Economic Behavior and Organization*, 30(2): 143–58.

Eggertsson, Thrainn. 1990. *Economic Behavior and Institutions*. Cambridge, UK: Cambridge University Press.

Elster, Jon. 1989. *Solomonic Judgements: Studies in the Limitations of Rationality*. Cambridge, UK: Cambridge University Press.

Faysse, Nicolas. 2005. "Coping with the Tragedy of the Commons: Game Structure and Design of Rules." *Journal of Economic Surveys*, 19(2): 239–61.

Fehr, Ernst, and Simon Gächter. 2002. "Altruistic Punishment in Humans." *Nature*, 415(6868): 137–40.

Fehr, Ernst, and Andreas Leibbrandt. 2008. "Cooperativeness and Impatience in the Tragedy of the Commons." IZA Discussion Paper 3625.

Fehr, Ernst, and Klaus M. Schmidt. 1999. "A Theory of Fairness, Competition, and Cooperation." *Quarterly Journal of Economics*, 114(3): 817–68.

Frey, Bruno S., and Felix Oberholzer-Gee. 1997. "The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding-Out." *American Economic Review*, 87(4): 746–55.

Friesema, H. Paul. 1966. "The Metropolis and the Maze of Local Government." *Urban Affairs Review*, 2(2): 68–90.

Frohlich, Norman, and Joe A. Oppenheimer. 1992. *Choosing Justice: An Experimental Approach to Ethical Theory*. Berkeley, CA: University of California Press.

Gardner, Roy, Andrew Herr, Elinor Ostrom, and James A. Walker. 2000. "The Power and Limitations of Proportional Cutbacks in Common-Pool Resources." *Journal of Development Economics*, 62(2): 515–33.

Ghate, Rucha, and Harini Nagendra. 2005. "Role of Monitoring in Institutional Performance: Forest Management in Maharashtra, India." *Conservation and Society*, 3(2): 509–32.

Gibson, Clark C., Margaret McKean, and Elinor Ostrom, ed. 2000. *People and Forests: Communities, Institutions, and Governance*. Cambridge, MA: MIT Press.

Gibson, Clark C., John T. Williams, and Elinor Ostrom. 2005. "Local Enforcement and Better Forests." *World Development*, 33(2): 273–84.

Gibson, Clark C., Krister Andersson, Elinor Ostrom, and Sujai Shivakumar. 2005. *The Samaritan's Dilemma: The Political Economy of Development Aid*. Oxford: Oxford University Press.

Gigerenzer, Gerd, and Reinhard Selten, ed. 2001. *Bounded Rationality: The Adaptive Toolbox*. Cambridge, MA: MIT Press.

Goffman, Erving. 1974. *Frame Analysis: An Essay on the Organization of Experience*. Cambridge, MA: Harvard University Press.

Gordon, H. Scott. 1954. "The Economic Theory of a Common-Property Resource: The Fishery." *Journal of Political Economy*, 62(2): 124–42.

Grafton, R. Quentin. 2000. "Governance of the Commons: A Role for the State?" *Land Economics*, 76(4): 504–17.

Gulick, Luther. 1957. "Metropolitan Organization." *The ANNALS of the American Academy of Political and Social Science*, 314(1): 57–65.

Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science*, 162(3859): 1243–48.

Hayes, Tanya M. 2006. "Parks, People, and Forest Protection: An Institutional Assessment of the Effectiveness of Protected Areas." *World Development*, 34(12): 2064–75.

Henrich, Joseph, Robert Boyd, Samuel Bowles, Colin Camerer, Ernst Fehr, and Herbert Gintis, ed. 2004. *Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-Scale Societies*. Oxford: Oxford University Press.

Henrich, Joseph, Richard McElreath, Abigail Barr, Jean Ensminger, Clark Barrett, Alexander Bolyanatz, Juan-Camilo Cardenas, et al. 2006. "Costly Punishment across Human Societies." *Science*, 312(5781): 1767–70.

Hobbes, Thomas. 1651. *Leviathan or the Matter, Forme and Power of a Commonwealth Ecclesiasticall and Civil*. Ed. Michael Oakeshott. Oxford: Basil Blackwell, 1960.

Holt, Charles A. 2007. *Markets, Games, and Strategic Behavior*. Boston: Pearson Addison Wesley.

Isaac, R. Mark, and James M. Walker. 1988. "Communication and Free-Riding Behavior: The Voluntary Contribution Mechanism." *Economic Inquiry*, 26(4): 585–608.

Isaac, R. Mark, Kenneth F. McCue, and Charles R. Plott. 1985. "Public Goods Provision in an Experimental Environment." *Journal of Public Economics*, 26(1): 51–74.

Isaac, R. Mark, James M. Walker, and Susan H. Thomas. 1984. "Divergent Evidence on Free Riding: An Experimental Examination of Possible Explanations." *Public Choice*, 43(2): 113–49.

Isaac, R. Mark, James M. Walker, and Arlington W. Williams. 1994. "Group Size and the Voluntary Provision of Public Goods: Experimental Evidence Utilizing Large Groups." *Journal of Public Economics*, 54(1): 1–36.

IsHak, Samir. 1972. "Consumers' Perception of Police Performance: Consolidation vs. Deconcentration: The Case of Grand Rapids, Michigan." PhD diss. Indiana University.

Jager, Wander, and Marco A. Janssen. 2002. "Using Artificial Agents to Understand Laboratory Experiments of Common-Pool Resources with Real Agents." In *Complexity and Ecosystem Management: The Theory and Practice of Multi-Agent Systems*, ed. Marco A. Janssen, 75–102. Cheltenham, UK: Elgar.

Janssen, Marco A. 2008. "Evolution of Cooperation in a One-Shot Prisoner's Dilemma Based on Recognition of Trustworthy and Untrustworthy Agents." *Journal of Economic Behavior and Organization*, 65(3–4): 458–71.

Joshi, Neeraj N., Elinor Ostrom, Ganesh P. Shivakoti, and Wai Fung Lam. 2000. "Institutional Opportunities and Constraints in the Performance of Farmer-Managed Irrigation Systems in Nepal." *Asia-Pacific Journal of Rural Development*, 10(2): 67–92.

Kiser, Larry L., and Elinor Ostrom. 1982. "The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches." In *Strategies of Political Inquiry*, ed. Elinor Ostrom, 179–222. Beverly Hills, CA: Sage.

Koestler, Arthur. 1973. "The Tree and the Candle." In *Unity through Diversity: A Festschrift for Ludwig von Bertalanffy*, ed. William Gray and Nicholas D. Rizzo, 287–314. New York: Gordon and Breach Science Publishers.

Lam, Wai Fung. 1998. *Governing Irrigation Systems in Nepal: Institutions, Infrastructure, and Collective Action*. Oakland, CA: ICS Press.

Leibbrandt, Andreas, Uri Gneezy, and John List. 2010. "Ode to the Sea: The Socio-Ecological Underpinnings of Social Norms." Unpublished.

Liu, Jianguo, Marc Linderman, Zhiyun Ouyang, Li An, Jian Yang, and Hemin Zhang. 2001. "Ecological Degradation in Protected Areas: The Case of Wolong Nature Reserve for Giant Pandas." *Science*, 292(5514): 98–101.

Marshall, Graham R. 2008. "Nesting, Subsidiarity, and Community-Based Environmental Governance beyond the Local Level." *International Journal of the Commons*, 2(1): 75–97.

Marwell, Gerald, and Ruth E. Ames. 1979. "Experiments on the Provision of Public Goods I: Resources, Interest, Group Size, and the Free Rider Problem." *American Journal of Sociology*, 84(6): 1335–60.

McCay, Bonnie J., and James M. Acheson. 1987. *The Question of the Commons: The Culture and Ecology of Communal Resources*. Tucson, AZ: University of Arizona Press.

McGinnis, Michael D., ed. 1999a. *Polycentric Governance and Development: Readings from the Workshop in Political Theory and Policy Analysis*. Ann Arbor, MI: University of Michigan Press.

McGinnis, Michael D., ed. 1999b. *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis*. Ann Arbor, MI: University of Michigan Press.
McGinnis, Michael D., ed. 2000. *Polycentric Games and Institutions: Readings from the Workshop in Political Theory and Policy Analysis*. Ann Arbor, MI: University of Michigan Press.
Meinzen-Dick, Ruth. 2007. "Beyond Panaceas in Water Institutions." *Proceedings of the National Academy of Sciences*, 104(39): 15200–05.
National Research Council. 1986. *Proceedings of the Conference on Common Property Resource Management*. Washington, DC: National Academies Press.
Netting, Robert McC. 1972. "Of Men and Meadows: Strategies of Alpine Land Use." *Anthropological Quarterly*, 45(3): 132–44.
North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge, UK: Cambridge University Press.
North, Douglass C. 2005. *Understanding the Process of Economic Change*. Princeton, NJ: Princeton University Press.
Oakerson, Ronald J. 1986. "A Model for the Analysis of Common Property Problems." In *Proceedings of the Conference on Common Property Resource Management*, 13–30. Washington, DC: National Academies Press.
Ones, Umut, and Louis Putterman. 2007. "The Ecology of Collective Action: A Public Goods and Sanctions Experiment with Controlled Group Formation." *Journal of Economic Behavior and Organization*, 62(4): 495–521.
Orbell, John M., Alphons van de Kragt, and Robyn M. Dawes. 1988. "Explaining Discussion-Induced Cooperation." *Journal of Personality and Social Psychology*, 54(5): 811–19.
Ostrom, Elinor. 1965. "Public Entrepreneurship: A Case Study in Ground Water Basin Management." PhD diss. University of California, Los Angeles.
Ostrom, Elinor. 1976. "Size and Performance in a Federal System." *Publius: The Journal of Federalism*, 6(2): 33–73.
Ostrom, Elinor. 1986. "An Agenda for the Study of Institutions." *Public Choice*, 48(1): 3–25.
Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press.
Ostrom, Elinor. 1998. "A Behavioral Approach to the Rational Choice Theory of Collective Action." *American Political Science Review*, 92(1): 1–22.
Ostrom, Elinor. 1999. "Coping with Tragedies of the Commons." *Annual Review of Political Science*, 2: 493–535.
Ostrom, Elinor. 2005. *Understanding Institutional Diversity*. Princeton, NJ: Princeton University Press.
Ostrom, Elinor. 2007. "A Diagnostic Approach for Going beyond Panaceas." *Proceedings of the National Academy of Sciences*, 104(39): 15181–87.
Ostrom, Elinor. 2008. "Developing a Method for Analyzing Institutional Change." In *Alternative Institutional Structures: Evolution and Impact*, ed. Sandra S. Batie and Nicholas Mercuro, 48–76. New York: Routledge.
Ostrom, Elinor. 2009. "A General Framework for Analyzing the Sustainability of Social-Ecological Systems." *Science*, 325(5939): 419–22.
Ostrom, Elinor, and Xavier Basurto. Forthcoming. "Crafting Analytical Tools to Study Institutional Change." *Journal of Institutional Economics*.
Ostrom, Elinor, and Roy Gardner. 1993. "Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work." *Journal of Economic Perspectives*, 7(4): 93–112.
Ostrom, Elinor, and Harini Nagendra. 2006. "Insights on Linking Forests, Trees, and People from the Air, on the Ground, and in the Laboratory." *Proceedings of the National Academy of Sciences*, 103(51): 19224–31.
Ostrom, Elinor, and Roger B. Parks. 1973. "Suburban Police Departments: Too Many and Too Small?" In *The Urbanization of the Suburbs*, ed. Louis H. Masotti and Jeffrey K. Hadden, 367–402. Beverly Hills, CA: Sage.
Ostrom, Elinor, and Roger B. Parks. 1999. "Neither Gargantua nor the Land of Lilliputs: Conjectures on Mixed Systems of Metropolitan Organization." In *Polycentricity and Local Public Economies: Readings from the Workshop in Political Theory and Policy Analysis*, ed. Michael D. McGinnis, 284–305. Ann Arbor, MI: University of Michigan Press.
Ostrom, Elinor, and James Walker. 1991. "Communication in a Commons: Cooperation without External Enforcement." In *Laboratory Research in Political Economy*, ed. Thomas R. Palfrey, 287–322. Ann Arbor, MI: University of Michigan Press.
Ostrom, Elinor, and Gordon P. Whitaker. 1974. "Community Control and Governmental Responsiveness:

The Case of Police in Black Neighborhoods." In *Improving the Quality of Urban Management*, ed. Willis Hawley and David Rogers, 303–34. Beverly Hills, CA: Sage.

Ostrom, Elinor, Roy Gardner, and James Walker. 1994. *Rules, Games, and Common-Pool Resources.* Ann Arbor, MI: University of Michigan Press.

Ostrom, Elinor, Roger B. Parks, and Gordon P. Whitaker. 1978. *Patterns of Metropolitan Policing.* Cambridge, MA: Ballinger.

Ostrom, Elinor, Larry Schroeder, and Susan Wynne. 1993. *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*. Boulder, CO: Westview Press.

Ostrom, Elinor, James Walker, and Roy Gardner. 1992. "Covenants with and without a Sword: Self-Governance Is Possible." *American Political Science Review*, 86(2): 404–17.

Ostrom, Elinor, Arun Agrawal, William Blomquist, Edella Schlager, and S. Y. Tang. 1989. *CPR Coding Manual*. Bloomington, IN: Indiana University, Workshop in Political Theory and Policy Analysis.

Ostrom, Elinor, William Baugh, Richard Guarasci, Roger B. Parks, and Gordon P. Whitaker. 1973. *Community Organization and the Provision of Police Services.* Beverly Hills, CA: Sage.

Ostrom, Elinor, Thomas Dietz, Nives Dolšak, Paul C. Stern, Susan Stonich, and Elke U. Weber, ed. 2002. *The Drama of the Commons.* Washington, DC: National Academies Press.

Ostrom, Vincent. 1962. "The Political Economy of Water Development." *American Economic Review*, 52(2): 450–58.

Ostrom, Vincent. 1975. "Language, Theory and Empirical Research in Policy Analysis." *Policy Studies Journal*, 3(3): 274–82.

Ostrom, Vincent. 2008. *The Intellectual Crisis in American Public Administration*. 3rd ed. Tuscaloosa, AL: University of Alabama Press.

Ostrom, Vincent, and Elinor Ostrom. 1965. "A Behavioral Approach to the Study of Intergovernmental Relations." *The ANNALS of the American Academy of Political and Social Science*, 359(1): 137–46.

Ostrom, Vincent, and Elinor Ostrom. 1977. "Public Goods and Public Choices." In *Alternatives for Delivering Public Services: Toward Improved Performance*, ed. Emanuel S. Savas, 7–49. Boulder, CO: Westview Press.

Ostrom, Vincent, Charles M. Tiebout, and Robert Warren. 1961. "The Organization of Government in Metropolitan Areas: A Theoretical Inquiry." *American Political Science Review*, 55(4): 831–42.

Paavola, Jouni, and W. Neil Adger. 2005. "Institutional Ecological Economics." *Ecological Economics*, 53(3): 353–68.

Pagdee, Adcharaporn, Yeon-Su Kim, and P. J. Daugherty. 2006. "What Makes Community Forest Management Successful: A Meta-Study from Community Forests throughout the World." *Society & Natural Resources*, 19(1): 33–52.

Pfennig, David W., and Cris Ledón-Rettig. 2009. "The Flexible Organism." *Science*, 325(5938): 268–69.

Popper, Karl R. 1961. *The Poverty of Historicism*. New York: Harper & Row.

Posner, Richard. 1975. "Economic Analysis of Law." In *Economic Foundation of Property Law*, ed. Bruce A. Ackerman. Boston, MA: Little, Brown and Co.

Poteete, Amy R., and Elinor Ostrom. 2004. "In Pursuit of Comparable Concepts and Data about Collective Action." *Agricultural Systems*, 82(3): 215–32.

Poteete, Amy R., Marco Janssen, and Elinor Ostrom. 2010. *Working Together: Collective Action, the Commons, and Multiple Methods in Practice*. Princeton, NJ: Princeton University Press.

Reeson, Andrew F., and John G. Tisdell. 2008. "Institutions, Motivations and Public Goods: An Experimental Test of Motivational Crowding." *Journal of Economic Behavior and Organization*, 68(1): 273–81.

Rogers, Bruce D., and C. McCurdy Lipsey. 1974. "Metropolitan Reform: Citizen Evaluations of Performance in Nashville-Davidson County, Tennessee." *Publius: The Journal of Federalism*, 4(4): 19–34.

Rothstein, Bo. 2005. *Social Traps and the Problem of Trust.* Cambridge, UK: Cambridge University Press.

Rudel, Thomas K. 2008. "Meta-Analyses of Case Studies: A Method for Studying Regional and Global Environmental Change." *Global Environmental Change*, 18(1): 18–25.

Sally, David. 1995. "Conservation and Cooperation in Social Dilemmas: A Meta-Analysis of Experiments from 1958 to 1992." *Rationality and Society*, 7(1): 58–92.

Samuelson, Paul A. 1954. "The Pure Theory of Public Expenditure." *Review of Economics and Statistics*, 36(4): 387–89.

Satz, Debra, and John Ferejohn. 1994. "Rational Choice and Social Theory." *Journal of Philosophy*, 91(2): 71–87.

Schank, Roger C., and Robert P. Abelson. 1977. *Scripts, Plans, Goals, and Understanding: An Inquiry in Human Knowledge Structures*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Schelling, Thomas C. 1960. *The Strategy of Conflict.* Oxford: Oxford University Press.

Schelling, Thomas C. 1978. *Micromotives and Macrobehavior.* New York: Norton.

Schelling, Thomas C. 1984. *Choice and Consequence: Perspectives of an Errant Economist*. Cambridge, MA: Harvard University Press.

Schlager, Edella. 1990. "Model Specification and Policy Analysis: The Governance of Coastal Fisheries." PhD diss. Indiana University.

Schlager, Edella. 1994. "Fishers' Institutional Responses to Common-Pool Resource Dilemmas." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 247–65. Ann Arbor, MI: University of Michigan Press.

Schlager, Edella, and William Blomquist. 2008. *Embracing Watershed Politics*. Boulder, CO: University Press of Colorado.

Schlager, Edella, and Elinor Ostrom. 1992. "Property-Rights Regimes and Natural Resources: A Conceptual Analysis." *Land Economics*, 68(3): 249–62.

Scott, Anthony. 1955. "The Fishery: The Objectives of Sole Ownership." *Journal of Political Economy*, 63(2): 116–24.

Selten, Reinhard. 1990. "Bounded Rationality." *Journal of Institutional and Theoretical Economics*, 146(4): 649–58.

Sen, Amartya K. 1977. "Rational Fools: A Critique of the Behavioral Foundations of Economic Theory." *Philosophy and Public Affairs*, 6(4): 317–44.

Sen, Amartya K. 2009. *The Idea of Justice*. Cambridge, MA: Harvard University Press.

Shivakoti, Ganesh, and Elinor Ostrom, ed. 2002. *Improving Irrigation Governance and Management in Nepal*. Oakland, CA: ICS Press.

Simon, Herbert A. 1955. "A Behavioural Model of Rational Choice." *Quarterly Journal of Economics*, 69(1): 99–188.

Simon, Herbert A. 1981. *The Sciences of the Artificial*. 2nd ed. Cambridge, MA: MIT Press.

Simon, Herbert A. 1995. "Near Decomposability and Complexity: How a Mind Resides in a Brain." In *The Mind, the Brain, and Complex Adaptive Systems*, ed. Harold J. Morowitz and Jerome L. Singer, 25–44. Reading, MA: Addison-Wesley.

Simon, Herbert A. 1999. "The Potlatch between Economics and Political Science." In *Competition and Cooperation: Conversations with Nobelists About Economics and Political Science*, ed. James E. Alt, Margaret Levi, and Elinor Ostrom, 112–19. New York: Russell Sage Foundation.

Skoler, Daniel L., and June M. Hetler. 1971. "Government Restructuring and Criminal Administration: The Challenge of Consolidation." In *Crisis in Urban Government. A Symposium: Restructuring Metropolitan Area Government*. Silver Springs, MD: Thomas Jefferson.

Smith, Vernon L. 2003. "Constructivist and Ecological Rationality in Economics." *American Economic Review*, 93(3): 465–508.

Smith, Vernon L. 2010. "Theory and Experiment: What Are the Questions?" *Journal of Economic Behavior and Organization*, 73(1): 3–15.

Smith, Vernon L., and James M. Walker. 1993. "Rewards, Experience and Decision Costs in First Price Auctions." *Economic Inquiry*, 31(2): 237–45.

Stewart, James I. 2009. "Cooperation When N Is Large: Evidence from the Mining Camps of the American West." *Journal of Economic Behavior and Organization*, 69(3): 213–25.

Sugden, Robert. 1986. *The Economics of Rights, Co-Operation and Welfare*. Oxford: Blackwell.

Tang, Shui Yan. 1992. *Institutions and Collective Action: Self-Governance in Irrigation*. San Francisco: ICS Press.

Tang, Shui Yan. 1994. "Institutions and Performance in Irrigation Systems." In *Rules, Games, and Common-Pool Resources*, ed. Elinor Ostrom, Roy Gardner, and James Walker, 225–45. Ann Arbor, MI: University of Michigan Press.

Terborgh, John. 1999. *Requiem for Nature*. Washington, DC: Island Press.

Toonen, Theo. 2010. "Resilience in Public Administration: The Work of Elinor and Vincent Ostrom from a Public Administration Perspective." *Public Administration Review*, 70(2): 193–202.

Trawick, Paul B. 2001. "Successfully Governing the Commons: Principles of Social Organization in an Andean Irrigation System." *Human Ecology*, 29(1): 1–25.

Tucker, Catherine M. 2008. *Changing Forests: Collective Action, Common Property, and Coffee in Honduras*. Berlin: Springer.

Uphoff, Norman T., Priti Ramamurthy and Roy Steiner. 1991. *Managing Irrigation: Analyzing and Improving the Performance of Bureaucracies*. New Delhi: Sage.

Walker, James, and Elinor Ostrom. 2009. "Trust and Reciprocity as Foundations for Cooperation." In *Whom Can We Trust?: How Groups, Networks, and Institutions Make Trust Possible*, ed. Karen S. Cook, Margaret Levi, and Russell Hardin, 91–124. New York: Russell Sage Foundation.

Warren, Robert O. 1966. *Government of Metropolitan Regions: A Reappraisal of Fractionated Political*

Organization. Davis, CA: University of California, Institute of Governmental Affairs.

Webb, Edward L., and Ganesh Shivakoti, ed. 2008. *Decentralization, Forests and Rural Communities: Policy Outcomes in South and Southeast Asia*. New Delhi: Sage India.

Weissing, Franz, and Elinor Ostrom. 1993. "Irrigation Institutions and the Games Irrigators Play: Rule Enforcement on Government- and Farmer-Managed Systems." In *Games in Hierarchies and Networks: Analytical and Empirical Approaches to the Study of Governance Institutions*, ed. Fritz W. Scharpf, 387–428. Frankfurt, Germany: Campus Verlag.

Weschler, Louis F. 1968. *Water Resources Management: The Orange County Experience*. Davis, CA: University of California, Institute of Governmental Affairs.

Williamson, Oliver E. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Williamson, Oliver E. 1986. "The Economics of Governance: Framework and Implications." In *Economics as a Process: Essays in the New Institutional Economics*, ed. Richard N. Langlois, 171–202. Cambridge, UK: Cambridge University Press.

Wilson, James A. 1990. "Fishing for Knowledge." *Land Economics*, 66(1): 12–29.

Wilson, James A., James M. Acheson, Mark Metcalfe, and Peter Kleban. 1994. "Chaos, Complexity, and Community Management of Fisheries." *Marine Policy*, 18(4): 291–305.

Wilson, Woodrow. 1885. *Congressional Government: A Study in American Politics.* Boston: Houghton Mifflin.

Wollenberg, Eva, Leticia Merino, Arun Agrawal, and Elinor Ostrom. 2007. "Fourteen Years of Monitoring Community-Managed Forests: Learning from IFRI's Experience." *International Forestry Review*, 9(2): 670–84.

Yamagishi, Toshio. 1986. "The Provision of a Sanctioning System as a Public Good." *Journal of Personality and Social Psychology*, 51(1): 110–16.

Yandle, Tracy. 2007. "Understanding the Consequence of Property Rights Mismatches: A Case Study of New Zealand's Marine Resources." *Ecology and Society*, 12(2). http://www.ecologyandsociety.org/vol12/iss2/art27/.

Yandle, Tracy, and Christopher M. Dewees. 2003. "Privatizing the Commons . . . Twelve Years Later: Fishers' Experiences with New Zealand's Market-Based Fisheries Management." In *The Commons in the New Millennium: Challenges and Adaptation*, ed. Nives Dolsak and Elinor Ostrom, 101–27. Cambridge, MA: MIT Press.

This article has been cited by:

1. Kathryn B. Janda, Susan Bright, Julia Patrick, Sara Wilkinson, Timothy J. Dixon. 2016. The evolution of green leases: towards inter-organizational environmental governance. *Building Research & Information* 1-15. [CrossRef]
2. Eduardo S. Brondizio, Karen O'Brien, Xuemei Bai, Frank Biermann, Will Steffen, Frans Berkhout, Christophe Cudennec, Maria Carmen Lemos, Alexander Wolfe, Jose Palma-Oliveira, Chen-Tung Arthur Chen. 2016. Re-conceptualizing the Anthropocene: A call for collaboration. *Global Environmental Change* . [CrossRef]
3. Erin Gallay, Lisa Marckini-Polk, Brandon Schroeder, Constance Flanagan. 2016. Place-Based Stewardship Education: Nurturing Aspirations to Protect the Rural Commons. *Peabody Journal of Education* 00-00. [CrossRef]
4. Agnes C. Rola, Corazon L. Abansi, Rosalie Arcala-Hall, Joy C. Lizada. 2016. Characterizing local water governance structure in the Philippines: results of the water managers' 2013 survey. *Water International* **41**, 231-250. [CrossRef]
5. Christoph Oberlack. 2016. Diagnosing institutional barriers and opportunities for adaptation to climate change. *Mitigation and Adaptation Strategies for Global Change* . [CrossRef]
6. Zachary Bischoff-Mattson, Amanda H. Lynch. 2016. Adaptive governance in water reform discourses of the Murray–Darling Basin, Australia. *Policy Sciences* . [CrossRef]
7. Rosaleen Duffy, Freya A. V. St John, Bram Büscher, Dan Brockington. 2016. Toward a new understanding of the links between poverty and illegal wildlife hunting. *Conservation Biology* **30**:10.1111/cobi.2016.30.issue-1, 14-22. [CrossRef]
8. Alessandro Sancino. 2016. The Meta Co-production of Community Outcomes: Towards a Citizens' Capabilities Approach. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations* **27**, 409-424. [CrossRef]
9. Bruce Christopher Glavovic. 2016. Towards deliberative coastal governance: insights from South Africa and the Mississippi Delta. *Regional Environmental Change* **16**, 353-365. [CrossRef]
10. Geeta Lakshmi. 2016. Gekko and black swans: Finance theory in UK undergraduate curricula. *Critical Perspectives on Accounting* . [CrossRef]
11. Sharmin Afroz, Rob Cramb, Clemens Grunbuhel. 2016. Collective Management of Water Resources in Coastal Bangladesh: Formal and Substantive Approaches. *Human Ecology* **44**, 17-31. [CrossRef]
12. Margot Hurlbert, Joyeeta Gupta. 2016. Adaptive Governance, Uncertainty, and Risk: Policy Framing and Responses to Climate Change, Drought, and Flood. *Risk Analysis* **36**:10.1111/risa.2016.36.issue-2, 339-356. [CrossRef]
13. Bing Wang. 2016. Public Value in Moral Market: A Case Study of Human Organ Transplantation System. *International Journal of Public Administration* **39**, 135-145. [CrossRef]
14. Meredith Frances Dobbie, Rebekah Ruth Brown, Megan Anne Farrelly. 2016. Risk governance in the water sensitive city: Practitioner perspectives on ownership, management and trust. *Environmental Science & Policy* **55**, 218-227. [CrossRef]
15. Rasmus Hundsbæk Pedersen. 2016. Access to land reconsidered: The land grab, polycentric governance and Tanzania's new wave land reform. *Geoforum* . [CrossRef]
16. Petterson Molina Vale. 2016. The changing climate of climate change economics. *Ecological Economics* **121**, 12-19. [CrossRef]
17. Debra Perrone, George Hornberger. 2016. Frontiers of the food–energy–water trilemma: Sri Lanka as a microcosm of tradeoffs. *Environmental Research Letters* **11**, 014005. [CrossRef]

18. Cameron Holley. 2016. Linking Law and New Governance: Examining Gaps, Hybrids, and Integration in Water Policy. *Law & Policy* **38**:10.1111/lapo.2016.38.issue-1, 24-53. [CrossRef]
19. Beat Weber. 2016. Bitcoin and the legitimacy crisis of money. *Cambridge Journal of Economics* **40**, 17-41. [CrossRef]
20. Ann E. Davis. 2016. Paradoxical Positions: The Methodological Contributions of Feminist Scholarship. *Cambridge Journal of Economics* bew003. [CrossRef]
21. Gonzalo EscribanoToward a Mediterranean Energy Community: No Roadmap Without a Narrative 117-130. [CrossRef]
22. Aregu Lemlem, Darnhofer Ika. 2015. Enhancing social-ecological resilience through social learning: A case study of communal pasture management in the Highlands of Ethiopia. *African Journal of Agricultural Research* **10**, 4681-4698. [CrossRef]
23. Zhivan Alach. 2015. Performance measurement and accountability in higher education: the puzzle of qualification completions. *Tertiary Education and Management* 1-13. [CrossRef]
24. Hongyu Guan, Xianchen Zhu, Ping Zhang. 2015. Rule-Inequality-Aversion Preference and Conditional Cooperation in Public Goods Experiments: Economic Experiment Evidence from China. *Group Decision and Negotiation* . [CrossRef]
25. Frans van Winden. 2015. Political economy with affect: On the role of emotions and relationships in political economics. *European Journal of Political Economy* **40**, 298-311. [CrossRef]
26. Laura Bouriaud, Mariella Marzano, Manfred Lexer, Liviu Nichiforel, Christopher Reyer, Christian Temperli, Heli Peltola, Ché Elkin, Gabriel Duduman, Philip Taylor, Stephen Bathgate, Jose G. Borges, Sandra Clerkx, Jordi Garcia-Gonzalo, Carlos Gracia, Geerten Hengeveld, Seppo Kellomäki, Georgi Kostov, Michael Maroschek, Bart Muys, Gert-Jan Nabuurs, Bruce Nicoll, Marc Palahí, Werner Rammer, Duncan Ray, Mart-Jan Schelhaas, Louise Sing, Margarida Tomé, Juergen Zell, Marc Hanewinkel. 2015. Institutional factors and opportunities for adapting European forest management to climate change. *Regional Environmental Change* **15**, 1595-1609. [CrossRef]
27. Maarten Bavinck. 2015. Fishing rights in post-war Sri Lanka: results of a longitudinal village enquiry in the Jaffna region. *Maritime Studies* **14**. . [CrossRef]
28. Philip Andrews-Speed, Xunpeng Shi. 2015. What Role Can the G20 Play in Global Energy Governance? Implications for China's Presidency. *Global Policy* n/a-n/a. [CrossRef]
29. MICHAEL R. WILLIAMS, JOSHUA C. HALL. 2015. Hackerspaces: a case study in the creation and management of a common pool resource. *Journal of Institutional Economics* **11**, 769-781. [CrossRef]
30. Chander Velu. 2015. Knowledge management capabilities of lead firms in innovation ecosystems. *AMS Review* **5**, 123-141. [CrossRef]
31. Andrea Sarzynski. 2015. Public participation, civic capacity, and climate change adaptation in cities. *Urban Climate* **14**, 52-67. [CrossRef]
32. Claire Durand, Stéphane Fournier. 2015. Can Geographical Indications Modernize Indonesian and Vietnamese Agriculture? Analyzing the Role of National and Local Governments and Producers' Strategies. *World Development* . [CrossRef]
33. Patricia Gabaldon, Stefan Gröschl. 2015. A Few Good Companies: Rethinking Firms' Responsibilities Toward Common Pool Resources. *Journal of Business Ethics* **132**, 579-588. [CrossRef]
34. Patricia Wastiau. 2015. What Does Learning Prepare for Today? Co-creating Knowledge for Action. *European Journal of Education* **50**:10.1111/ejed.2015.50.issue-4, 394-399. [CrossRef]
35. Marie Briguglio, Liam Delaney, Alex Wood. 2015. Voluntary recycling despite disincentives. *Journal of Environmental Planning and Management* 1-24. [CrossRef]

36. Raúl Prellezo, Richard Curtin. 2015. Confronting the implementation of marine ecosystem-based management within the Common Fisheries Policy reform. *Ocean & Coastal Management* **117**, 43-51. [CrossRef]

37. Carina Cavalcanti, Andreas Leibbrandt. 2015. Dry promotions and community participation: Evidence from a natural field experiment in Brazilian fishing villages. *Journal of Economic Behavior & Organization* **119**, 457-465. [CrossRef]

38. Mark Raymond, Laura DeNardis. 2015. Multistakeholderism: anatomy of an inchoate global institution. *International Theory* **7**, 572-616. [CrossRef]

39. Judith van Leeuwen. 2015. The regionalization of maritime governance: Towards a polycentric governance system for sustainable shipping in the European Union. *Ocean & Coastal Management* **117**, 23-31. [CrossRef]

40. Falk Huettmann, Moritz Sebastian Schmid, Grant Richard Woodrow Humphries. 2015. A first overview of open access digital data for the Ross Sea: complexities, ethics, and management opportunities. *Hydrobiologia* **761**, 97-119. [CrossRef]

41. Chara J. Ragland, Leigh A. Bernacchi, Tarla Rai Peterson. 2015. The role of social capital in endangered species management: A valuable resource. *Wildlife Society Bulletin* n/a-n/a. [CrossRef]

42. Sarah Whitmee, Andy Haines, Chris Beyrer, Frederick Boltz, Anthony G Capon, Braulio Ferreira de Souza Dias, Alex Ezeh, Howard Frumkin, Peng Gong, Peter Head, Richard Horton, Georgina M Mace, Robert Marten, Samuel S Myers, Sania Nishtar, Steven A Osofsky, Subhrendu K Pattanayak, Montira J Pongsiri, Cristina Romanelli, Agnes Soucat, Jeanette Vega, Derek Yach. 2015. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health. *The Lancet* **386**, 1973-2028. [CrossRef]

43. Ellis Adjei Adams, Leo Charles Zulu. 2015. Participants or customers in water governance? Community-public partnerships for peri-urban water supply. *Geoforum* **65**, 112-124. [CrossRef]

44. Xuemei Bai, Sander van der Leeuw, Karen O'Brien, Frans Berkhout, Frank Biermann, Eduardo S. Brondizio, Christophe Cudennec, John Dearing, Anantha Duraiappah, Marion Glaser, Andrew Revkin, Will Steffen, James Syvitski. 2015. Plausible and desirable futures in the Anthropocene: A new research agenda. *Global Environmental Change* . [CrossRef]

45. Kirsten Rudestam, Ruth Langridge, Abigail Brown. 2015. "The commons" as a dynamic variable in understanding strategic alliances of scale: A groundwater case study in Pajaro Valley, California. *Environmental Science & Policy* **52**, 33-40. [CrossRef]

46. Alexander William Salter. 2015. Sovereignty as exchange of political property rights. *Public Choice* **165**, 79-96. [CrossRef]

47. Milan Zafirovski. 2015. Toward Economic Sociology/Socio-Economics? Sociological Components in Contemporary Economics and Implications for Sociology. *The American Sociologist* . [CrossRef]

48. Shruti Rajagopalan. 2015. Richard H. Thaler, Misbehaving: The Making of Behavioral Economics. *The Review of Austrian Economics* . [CrossRef]

49. Lawrence W. Costa. 2015. An endogenous growth model for the evolution of water rights systems. *Agricultural Economics* **46**:10.1111/agec.2015.46.issue-5, 677-687. [CrossRef]

50. Ashutosh Sarker, Toru Ikeda, Takaki Abe, Ken Inoue. 2015. Design principles for managing coastal fisheries commons in present-day Japan. *Ecological Economics* **117**, 32-38. [CrossRef]

51. Peter J. Boettke, Jayme S. Lemke, Liya Palagashvili. 2015. Polycentricity, Self-governance, and the Art & Science of Association. *The Review of Austrian Economics* **28**, 311-335. [CrossRef]

52. Sharon B. Megdal, Andrea K. Gerlak, Robert G. Varady, Ling-Yee Huang. 2015. Groundwater Governance in the United States: Common Priorities and Challenges. *Groundwater* **53**:10.1111/gwat.2015.53.issue-5, 677-684. [CrossRef]

53. Parna Parsapour-Moghaddam, Armaghan Abed-Elmdoust, Reza Kerachian. 2015. A Heuristic Evolutionary Game Theoretic Methodology for Conjunctive Use of Surface and Groundwater Resources. *Water Resources Management* **29**, 3905-3918. [CrossRef]
54. Alexander William Salter. 2015. Calhoun's concurrent majority as a generality norm. *Constitutional Political Economy* **26**, 375-390. [CrossRef]
55. Steven J. Hoffman, John-Arne Røttingen, Julio Frenk. 2015. Assessing Proposals for New Global Health Treaties: An Analytic Framework. *American Journal of Public Health* **105**, 1523-1530. [CrossRef]
56. Kei Kajisa, Bin Dong. 2015. The Effects of Volumetric Pricing Policy on Farmers' Water Management Institutions and Their Water Use: The Case of Water User Organization in an Irrigation System in Hubei, China. *The World Bank Economic Review* lhv034. [CrossRef]
57. Maria Rosaria Marcone. 2015. Multilocalisation and the Growth of Knowledge Assets in Medium-Sized Multinationals (MSMs). *Journal of the Knowledge Economy* . [CrossRef]
58. Benjamen F Gussen. 2015. Is subsidiarity a conditio sine qua non for sustainability?. *Policy Studies* **36**, 384-398. [CrossRef]
59. Christian R Thauer. 2015. In Need of Meta-Governance: Business Networks of Transnational Governance. *Israel Law Review* **48**, 189-218. [CrossRef]
60. André Amado, Weini Huang, Paulo R.A. Campos, Fernando Fagundes Ferreira. 2015. Learning process in public goods games. *Physica A: Statistical Mechanics and its Applications* **430**, 21-31. [CrossRef]
61. Erik O. Kimbrough, Alexander Vostroknutov. 2015. The social and ecological determinants of common pool resource sustainability. *Journal of Environmental Economics and Management* **72**, 38-53. [CrossRef]
62. Anne D. Guerry, Stephen Polasky, Jane Lubchenco, Rebecca Chaplin-Kramer, Gretchen C. Daily, Robert Griffin, Mary Ruckelshaus, Ian J. Bateman, Anantha Duraiappah, Thomas Elmqvist, Marcus W. Feldman, Carl Folke, Jon Hoekstra, Peter M. Kareiva, Bonnie L. Keeler, Shuzhuo Li, Emily McKenzie, Zhiyun Ouyang, Belinda Reyers, Taylor H. Ricketts, Johan Rockström, Heather Tallis, Bhaskar Vira. 2015. Natural capital and ecosystem services informing decisions: From promise to practice. *Proceedings of the National Academy of Sciences* 201503751. [CrossRef]
63. Ingrid J Visseren-Hamakers. 2015. Integrative environmental governance: enhancing governance in the era of synergies. *Current Opinion in Environmental Sustainability* **14**, 136-143. [CrossRef]
64. Sandro Tsang. 2015. Arrow physicians: Are economics and medicine philosophically incompatible?. *Journal of Evaluation in Clinical Practice* **21**:10.1111/jep.2015.21.issue-3, 419-426. [CrossRef]
65. Fabrizio Cafaggi, Katharina Pistor. 2015. Regulatory capabilities: A normative framework for assessing the distributional effects of regulation. *Regulation & Governance* **9**:10.1111/rego.2015.9.issue-2, 95-107. [CrossRef]
66. J.J. Bos, R.R. Brown, M.A. Farrelly. 2015. Building networks and coalitions to promote transformational change: Insights from an Australian urban water planning case study. *Environmental Innovation and Societal Transitions* **15**, 11-25. [CrossRef]
67. Giovanni Belletti, Andrea Marescotti, Jean-Marc Touzard. 2015. Geographical Indications, Public Goods, and Sustainable Development: The Roles of Actors' Strategies and Public Policies. *World Development* . [CrossRef]
68. Martin Jänicke. 2015. Horizontal and Vertical Reinforcement in Global Climate Governance. *Energies* **8**, 5782-5799. [CrossRef]
69. Marina Vishmidt. 2015. Revolution at Point Zero: Housework, Reproduction, and Feminist Struggle. *Journal of Cultural Economy* **8**, 388-397. [CrossRef]

70. Theresa Jedd, R. Patrick Bixler. 2015. Accountability in Networked Governance: Learning from a case of landscape-scale forest conservation. *Environmental Policy and Governance* **25**:10.1002/eet.v25.3, 172-187. [CrossRef]
71. Gonzalo Escribano. 2015. Fragmented Energy Governance and the Provision of Global Public Goods. *Global Policy* **6**:10.1111/gpol.2015.6.issue-2, 97-106. [CrossRef]
72. Jennifer Lind-Riehl, Shelly Jeltema, Margaret Morrison, Gabriela Shirkey, Audrey L. Mayer, Mark Rouleau, Richelle Winkler. 2015. Family legacies and community networks shape private forest management in the western Upper Peninsula of Michigan (USA). *Land Use Policy* **45**, 95-102. [CrossRef]
73. Ann E. Davis. 2015. The Process of Provisioning: The Halter for the Workhorse. *Journal of Economic Issues* **49**, 449-457. [CrossRef]
74. Ramesh Ananda Vaidya. 2015. Governance and management of local water storage in the Hindu Kush Himalayas. *International Journal of Water Resources Development* **31**, 253-268. [CrossRef]
75. John F. R. Harter. 2015. IS THE WIGWAM WORTH IT? A CONTINGENT VALUATION METHOD ESTIMATE FOR A SMALL-CITY SPORTS ARENA. *Contemporary Economic Policy* **33**:10.1111/coep.2015.33.issue-2, 279-284. [CrossRef]
76. Michael A. Fotos. 2015. Vincent Ostrom's revolutionary science of association. *Public Choice* **163**, 67-83. [CrossRef]
77. J. Rushton. 2015. Anti-microbial Use in Animals: How to Assess the Trade-offs. *Zoonoses and Public Health* **62**:10.1111/zph.2015.62.issue-s1, 10-21. [CrossRef]
78. Scott J. Shackelford, Eric L. Richards, Anjanette H. Raymond, Amanda N. Craig. 2015. Using BITs to Protect Bytes: Promoting Cyber Peace by Safeguarding Trade Secrets Through Bilateral Investment Treaties. *American Business Law Journal* **52**:10.1111/ablj.2015.52.issue-1, 1-74. [CrossRef]
79. Vlad Tarko. 2015. The role of ideas in political economy. *The Review of Austrian Economics* **28**, 17-39. [CrossRef]
80. Tanya Howard. 2015. Olivebranches and idiot's guides: Frameworks for community engagement in Australian wind farm development. *Energy Policy* **78**, 137-147. [CrossRef]
81. Benjamin R. Roman. 2015. On Marginal Health Care — Probability Inflation and the Tragedy of the Commons. *New England Journal of Medicine* **372**, 572-575. [CrossRef]
82. Ryan RJ McAllister, Bruce M Taylor. 2015. Partnerships for sustainability governance: a synthesis of key themes. *Current Opinion in Environmental Sustainability* **12**, 86-90. [CrossRef]
83. Mariachiara Barzotto, Giancarlo Corò, Mario Volpe. 2015. Apertura internazionale e risorse economiche locali. Un'indagine sul radicamento territoriale di imprese multinazionali1. *ARGOMENTI* 31-53. [CrossRef]
84. Daniel H. Cole. 2015. Advantages of a polycentric approach to climate change policy. *Nature Climate Change* **5**, 114-118. [CrossRef]
85. Jamie Morgan, Brendan Sheehan. 2015. The Concept of Trust and the Political Economy of John Maynard Keynes, Illustrated Using Central Bank Forward Guidance and the Democratic Dilemma in Europe. *Review of Social Economy* **73**, 113-137. [CrossRef]
86. Brian Z. Tamanaha. 2015. The Knowledge and Policy Limits of New Institutional Economics on Development. *Journal of Economic Issues* **49**, 89-109. [CrossRef]
87. Eric Baranick, Aaron Baird, Ajay Vinze. 2015. An economic framework for transitioning to capacity building. *Global Public Health* **10**, 15-27. [CrossRef]
88. Jacek P. Siry, Kathleen McGinley, Frederick W. Cubbage, Pete Bettinger. 2015. Forest Tenure and Sustainable Forest Management. *Open Journal of Forestry* **05**, 526-545. [CrossRef]

89. EMILY C. SKARBEK. 2015. Aid, ethics, and the Samaritan's dilemma: strategic courage in constitutional entrepreneurship. *Journal of Institutional Economics* 1. [CrossRef]
90. Erik Mostert. 2015. Who should do what in environmental management? Twelve principles for allocating responsibilities. *Environmental Science & Policy* **45**, 123-131. [CrossRef]
91. Tomohiko Ohno. 2015. Analytical Frameworks for the Study of the Watershed Governance. *JOURNAL OF WATER AND ENVIRONMENTAL ISSUES* **28**, 7-15. [CrossRef]
92. Elena Maggioni. 2015. Water demand management in times of drought: What matters for water conservation. *Water Resources Research* **51**:10.1002/wrcr.v51.1, 125-139. [CrossRef]
93. 2015. *Environmental Science & Policy* **52**. . [CrossRef]
94. Gonzalo Caballero. 2015. Community-based forest management institutions in the Galician communal forests: A new institutional approach. *Forest Policy and Economics* **50**, 347-356. [CrossRef]
95. Majah-Leah V. Ravago, James A. RoumassetPublic Choice and the Generalized Resource Curse 137-160. [CrossRef]
96. Gavin C. Reid. 2015. In the Field: Coase an Exemplar in the Tradition of Smith, Marshall and Ostrom. *Managerial and Decision Economics* **36**:10.1002/mde.v36.1, 16-32. [CrossRef]
97. Stergios Skaperdas. 2015. Peter T. Leeson, Anarchy unbound: why self-governance works better than you think. *Public Choice* **162**, 219-221. [CrossRef]
98. Shanshan Miao, Wim Heijman, Xueqin Zhu, Qian Lu. 2015. Social capital influences farmer participation in collective irrigation management in Shaanxi Province, China. *China Agricultural Economic Review* **7**:3, 448. [CrossRef]
99. Vitali Mindel, Lars MathiassenContextualist Inquiry into Hospital Revenue Cycle Transformation: Bridging Research and Practice 2960-2969. [CrossRef]
100. Jorge Bielsa, Ignacio Cazcarro. 2015. Implementing Integrated Water Resources Management in the Ebro River Basin: From Theory to Facts. *Sustainability* **7**, 441-464. [CrossRef]
101. George Schoneveld. 2015. The Challenge of Governing Africa's New Agricultural Investment Landscapes: An Analysis of Policy Arrangements and Sustainability Outcomes in Ethiopia and Nigeria. *Forests* **6**, 88-115. [CrossRef]
102. Cynthia GIAGNOCAVO, Silvia GEREZ, Vanessa CAMPOS i CLIMENT. 2014. PATHS TO COOPERATIVE SURVIVAL: STRUCTURE, STRATEGY AND REGENERATION OF FRUIT AND VEGETABLES COOPERATIVES IN ALMERÍA AND VALENCIA, SPAIN. *Annals of Public and Cooperative Economics* **85**:10.1111/apce.2014.85.issue-4, 617-639. [CrossRef]
103. Laurette Dubé, Srivardhini Jha, Aida Faber, Jeroen Struben, Ted London, Archisman Mohapatra, Nick Drager, Chris Lannon, P. K. Joshi, John McDermott. 2014. Convergent innovation for sustainable economic growth and affordable universal health care: innovating the way we innovate. *Annals of the New York Academy of Sciences* **1331**:10.1111/nyas.2014.1331.issue-1, 119-141. [CrossRef]
104. Maarten Bavinck, Joyeeta Gupta. 2014. Legal pluralism in aquatic regimes: a challenge for governance. *Current Opinion in Environmental Sustainability* **11**, 78-85. [CrossRef]
105. Jesper Raakjaer, Judith van Leeuwen, Jan van Tatenhove, Maria Hadjimichael. 2014. Ecosystem-based marine management in European regional seas calls for nested governance structures and coordination —A policy brief. *Marine Policy* **50**, 373-381. [CrossRef]
106. Nii A. Addy, Alain Poirier, Chantal Blouin, Nick Drager, Laurette Dubé. 2014. Whole-of-society approach for public health policymaking: a case study of polycentric governance from Quebec, Canada. *Annals of the New York Academy of Sciences* **1331**:10.1111/nyas.2014.1331.issue-1, 216-229. [CrossRef]
107. Milan Zafirovski. 2014. Rational Choice Requiem: The Decline of an Economic Paradigm and its Implications for Sociology. *The American Sociologist* **45**, 432-452. [CrossRef]

108. Chihiro Watanabe, M. Paz Salmador. 2014. Technology strategy and technology policy. *Technovation* **34**, 731-733. [CrossRef]

109. Laurette Dubé, Nii A. Addy, Chantal Blouin, Nick Drager. 2014. From policy coherence to 21st century convergence: a whole-of-society paradigm of human and economic development. *Annals of the New York Academy of Sciences* **1331**:10.1111/nyas.2014.1331.issue-1, 201-215. [CrossRef]

110. Cristiano Antonelli, Federico Barbiellini Amidei, Claudio Fassio. 2014. The mechanisms of knowledge governance: State owned enterprises and Italian economic growth, 1950–1994. *Structural Change and Economic Dynamics* **31**, 43-63. [CrossRef]

111. Laurette Dubé, Patrick Webb, Narendra K. Arora, Prabhu Pingali. 2014. Agriculture, health, and wealth convergence: bridging traditional food systems and modern agribusiness solutions. *Annals of the New York Academy of Sciences* **1331**:10.1111/nyas.2014.1331.issue-1, 1-14. [CrossRef]

112. Srivardhini K. Jha, John McDermott, Gordon Bacon, Chris Lannon, P. K. Joshi, Laurette Dubé. 2014. Convergent innovation for affordable nutrition, health, and health care: the global pulse roadmap. *Annals of the New York Academy of Sciences* **1331**:10.1111/nyas.2014.1331.issue-1, 142-156. [CrossRef]

113. Mirjam Ros-Tonen, Mercy Derkyi, Thomas Insaidoo. 2014. From Co-Management to Landscape Governance: Whither Ghana's Modified Taungya System?. *Forests* **5**, 2996-3021. [CrossRef]

114. Paivi Abernethy. 2014. Bridging conceptual "silos": bringing together health promotion and sustainability governance for practitioners at the landscape scale. *Local Environment* 1-25. [CrossRef]

115. Claudia Pahl-Wostl, Christian Knieper. 2014. The capacity of water governance to deal with the climate change adaptation challenge: Using fuzzy set Qualitative Comparative Analysis to distinguish between polycentric, fragmented and centralized regimes. *Global Environmental Change* **29**, 139-154. [CrossRef]

116. Thomas Bolognesi. 2014. The paradox of the modernisation of urban water systems in Europe: Intrinsic institutional limits for sustainability. *Natural Resources Forum* **38**:10.1111/narf.2014.38.issue-4, 270-281. [CrossRef]

117. Shui-Yan Tang, Richard F. Callahan, Mark Pisano. 2014. Using Common-Pool Resource Principles to Design Local Government Fiscal Sustainability. *Public Administration Review* **74**:10.1111/puar.2014.74.issue-6, 791-803. [CrossRef]

118. R.A. Turner, C. Fitzsimmons, J. Forster, R. Mahon, A. Peterson, S.M. Stead. 2014. Measuring good governance for complex ecosystems: Perceptions of coral reef-dependent communities in the Caribbean. *Global Environmental Change* **29**, 105-117. [CrossRef]

119. Sergio Villamayor-Tomas. 2014. Cooperation in common property regimes under extreme drought conditions: Empirical evidence from the use of pooled transferable quotas in Spanish irrigation systems. *Ecological Economics* **107**, 482-493. [CrossRef]

120. Marc van Essen, Vanessa M. Strike, Michael Carney, Stephen Sapp. 2014. The Resilient Family Firm: Stakeholder Outcomes and Institutional Effects. *Corporate Governance: An International Review* n/a-n/a. [CrossRef]

121. Karin Ingold, Philip Leifeld. 2014. Structural and Institutional Determinants of Influence Reputation: A Comparison of Collaborative and Adversarial Policy Networks in Decision Making and Implementation. *Journal of Public Administration Research and Theory* muu043. [CrossRef]

122. Matthew R. Auer. 2014. Collective Action and the Evolution of Social Norms: the principled optimism of Elinor Ostrom. *Journal of Natural Resources Policy Research* **6**, 265-271. [CrossRef]

123. Lindsay Galbraith. 2014. Making space for reconciliation in the planning system. *Planning Theory & Practice* **15**, 453-479. [CrossRef]

124. Rosolino Candela. 2014. Institutional Diversity and Political Economy: The Ostroms and Beyond. *Review of Political Economy* **26**, 670-674. [CrossRef]

125. Ashutosh Sarker. 2014. Federated rural organization for governing the commons in Japan. *Journal of Rural Studies* **36**, 42-51. [CrossRef]

126. Ying Huang, Lei Liu. 2014. Fighting corruption: A long-standing challenge for environmental regulation in China. *Environmental Development* **12**, 47-49. [CrossRef]

127. David M Dror, Lucy A Firth. 2014. The Demand for (Micro) Health Insurance in the Informal Sector. *The Geneva Papers on Risk and Insurance Issues and Practice* **39**, 693-711. [CrossRef]

128. David K. Loomis, Shona K. Paterson. 2014. The human dimensions of coastal ecosystem services: Managing for social values. *Ecological Indicators* **44**, 6-10. [CrossRef]

129. S. Abimbola, J. Negin, S. Jan, A. Martiniuk. 2014. Towards people-centred health systems: a multi-level framework for analysing primary health care governance in low- and middle-income countries. *Health Policy and Planning* **29**, ii29-ii39. [CrossRef]

130. M. Jakob, O. Edenhofer. 2014. Green growth, degrowth, and the commons. *Oxford Review of Economic Policy* **30**, 447-468. [CrossRef]

131. Eduardo Fayos-Solà, Laura Fuentes Moraleda, Ana Isabel Muñoz MazónKey Factors for Development 29-54. [CrossRef]

132. References 335-388. [CrossRef]

133. Ekaterina I. Borisova, Leonid Polishchuk, Anatoly Peresetsky. 2014. Collective management of residential housing in Russia: The importance of being social. *Journal of Comparative Economics* **42**, 609-629. [CrossRef]

134. David C. Cook, Nadiah P. Kristensen, Shuang Liu, Dean R. Paini, Peter J. Kerr, Andy W. Sheppard, W. Mark Lonsdale, Ryan R.J. McAllister, Paul J. De Barro. 2014. Plant biosecurity policy-making modelled on the human immune system: What would it look like?. *Environmental Science & Policy* **41**, 1-10. [CrossRef]

135. M. Kandori, S. Obayashi. 2014. Labor union members play an OLG repeated game. *Proceedings of the National Academy of Sciences* **111**, 10802-10809. [CrossRef]

136. Megan Anne Farrelly, Rebekah Ruth Brown. 2014. Making the implicit, explicit: time for renegotiating the urban water supply hydrosocial contract?. *Urban Water Journal* **11**, 392-404. [CrossRef]

137. Decio Zylbersztajn. 2014. Empirical Research in Agricultural Contracts: Watch your Step. *RIVISTA DI ECONOMIA AGRARIA* 27-40. [CrossRef]

138. MARCO A. JANSSEN, MILES MANNING, OYITA UDIANI. 2014. THE EFFECT OF SOCIAL PREFERENCES ON THE EVOLUTION OF COOPERATION IN PUBLIC GOOD GAMES. *Advances in Complex Systems* **17**, 1450015. [CrossRef]

139. Emily C. Skarbek. 2014. The Chicago Fire of 1871: a bottom-up approach to disaster relief. *Public Choice* **160**, 155-180. [CrossRef]

140. Zhilin Yang, Chenting Su. 2014. Institutional theory in business marketing: A conceptual framework and future directions. *Industrial Marketing Management* **43**, 721-725. [CrossRef]

141. Gary D. Libecap. 2014. Addressing Global Environmental Externalities: Transaction Costs Considerations. *Journal of Economic Literature* **52**:2, 424-479. [Abstract] [View PDF article] [PDF with links]

142. Didier Sornette, Peter Cauwels. 2014. 1980–2008: The Illusion of the Perpetual Money Machine and What It Bodes for the Future. *Risks* **2**, 103-131. [CrossRef]

143. Virinder Sharma, Victor Orindi, Ced Hesse, James Pattison, Simon Anderson. 2014. Supporting local climate adaptation planning and implementation through local governance and decentralised finance provision. *Development in Practice* **24**, 579-590. [CrossRef]

144. James Rising. 2014. Creating the Commons: Fisheries and the World Bank. *HISTORY OF ECONOMIC THOUGHT AND POLICY* 75-95. [CrossRef]

145. Gareth Walker. 2014. A Theoretical Walk through the Political Economy of Urban Water Resource Management. *Geography Compass* **8**:10.1111/gec3.v8.5, 336-350. [CrossRef]

146. Emily Boyd, Jonathan Ensor, Vanesa Castán Broto, Sirkku Juhola. 2014. Environmentalities of urban climate governance in Maputo, Mozambique. *Global Environmental Change* **26**, 140-151. [CrossRef]

147. R. L. Bish. 2014. Vincent Ostrom's Contributions to Political Economy. *Publius: The Journal of Federalism* **44**, 227-248. [CrossRef]

148. Rodolfo Baggio. 2014. Complex tourism systems: a visibility graph approach. *Kybernetes* **43**, 445-461. [CrossRef]

149. A. Libman, A. Obydenkova. 2014. Governance of Commons in a Large Nondemocratic Country: The Case of Forestry in the Russian Federation. *Publius: The Journal of Federalism* **44**, 298-323. [CrossRef]

150. Elinor Ostrom. 2014. Do institutions for collective action evolve?. *Journal of Bioeconomics* **16**, 3-30. [CrossRef]

151. Fabian Adelt, Johannes Weyer, Robin D. Fink. 2014. Governance of complex systems: results of a sociological simulation experiment. *Ergonomics* **57**, 434-448. [CrossRef]

152. Morgan Bazilian, Smita Nakhooda, Thijs Van de Graaf. 2014. Energy governance and poverty. *Energy Research & Social Science* **1**, 217-225. [CrossRef]

153. Ilona M. Otto, Frank Wechsung. 2014. The effects of rules and communication in a behavioral irrigation experiment with power asymmetries carried out in North China. *Ecological Economics* **99**, 10-20. [CrossRef]

154. Gabriele Camera, Marco Casari. 2014. The Coordination Value of Monetary Exchange: Experimental Evidence. *American Economic Journal: Microeconomics* **6**:1, 290-314. [Abstract] [View PDF article] [PDF with links]

155. Mary Louise McAllister, Patricia Fitzpatrick, Alberto Fonseca. 2014. Unstable shafts and shaky pillars: institutional capacity and sustainable mineral policy in Canada. *Environmental Politics* **23**, 77-96. [CrossRef]

156. James Acheson, Roy Gardner. 2014. Fishing failure and success in the Gulf of Maine: lobster and groundfish management. *Maritime Studies* **13**, 8. [CrossRef]

157. Olga Ulybina. 2014. Russian forests: The path of reform. *Forest Policy and Economics* **38**, 143-150. [CrossRef]

158. Thomas K. Rudel, Patrick Meyfroidt. 2014. Organizing anarchy: The food security–biodiversity–climate crisis and the genesis of rural land use planning in the developing world. *Land Use Policy* **36**, 239-247. [CrossRef]

159. F. Van Laerhoven, C. Barnes. 2014. Communities and commons: the role of community development support in sustaining the commons. *Community Development Journal* **49**, i118-i132. [CrossRef]

160. Julia Olson, Patricia Pinto da Silva. 2014. Changing boundaries and institutions in environmental governance: perspectives on sector management of the Northeast US groundfish fishery. *Maritime Studies* **13**, 3. [CrossRef]

161. Ashutosh Sarker, Tadao Itoh, Ryohei Kada, Takaki Abe, Masahiro Nakashima, Gamini Herath. 2014. User self-governance in a complex policy design for managing water commons. *Journal of Hydrology* . [CrossRef]

162. T. Markussen, L. Putterman, J.-R. Tyran. 2014. Self-Organization for Collective Action: An Experimental Study of Voting on Sanction Regimes. *The Review of Economic Studies* **81**, 301-324. [CrossRef]

163. Constance Flanagan, Erin GallayAdolescents' Theories of the Commons 33-55. [CrossRef]
164. References 265-290. [CrossRef]
165. Catherine EckelEconomic Games for Social Scientists 335-355. [CrossRef]
166. Raj Aggarwal. 2013. Animal spirits in financial economics: A review of deviations from economic rationality. *International Review of Financial Analysis* . [CrossRef]
167. Riyanti Djalante, Cameron Holley, Frank Thomalla, Michelle Carnegie. 2013. Pathways for adaptive and integrated disaster resilience. *Natural Hazards* **69**, 2105-2135. [CrossRef]
168. FRANCISCO J. BELTRÁN TAPIA. 2013. Enclosing literacy? Common lands and human capital in Spain, 1860–1930. *Journal of Institutional Economics* **9**, 491-515. [CrossRef]
169. Martin Bloemendal, Theo Olsthoorn, Frank Boons. 2013. How to achieve optimal and sustainable use of the subsurface for Aquifer Thermal Energy Storage. *Energy Policy* . [CrossRef]
170. GEOFFREY M. HODGSON. 2013. Editorial introduction to the Elinor Ostrom memorial issue. *Journal of Institutional Economics* **9**, 381-385. [CrossRef]
171. PETER BOETTKE, LIYA PALAGASHVILI, JAYME LEMKE. 2013. Riding in cars with boys: Elinor Ostrom's adventures with the police. *Journal of Institutional Economics* **9**, 407-425. [CrossRef]
172. Gabriele Camera, Marco Casari, Maria BigoniExperimental Markets with Frictions 159-177. [CrossRef]
173. Jingbiao Yang, Luo Guo, Lun Yin, Dayuan XueApplication of Hani People's Traditional Knowledge on Forest Management 296-299. [CrossRef]
174. Donal Crilly. 2013. Recasting Enterprise Strategy: Towards Stakeholder Research That Matters to General Managers. *Journal of Management Studies* n/a-n/a. [CrossRef]
175. Olga Ulybina, Shailaja Fennell. 2013. Forest certification in Russia: Challenges of institutional development. *Ecological Economics* **95**, 178-187. [CrossRef]
176. PAUL DRAGOS ALIGICA, VLAD TARKO. 2013. Co-Production, Polycentricity, and Value Heterogeneity: The Ostroms' Public Choice Institutionalism Revisited. *American Political Science Review* **107**, 726-741. [CrossRef]
177. Lieske Voget-Kleschin. 2013. Employing the Capability Approach in Conceptualizing Sustainable Development. *Journal of Human Development and Capabilities* **14**, 483-502. [CrossRef]
178. Lei Zhang, Nico Heerink, Liesbeth Dries, Xiaoping Shi. 2013. Water users associations and irrigation water productivity in northern China. *Ecological Economics* **95**, 128-136. [CrossRef]
179. Candace K. May. 2013. Power across scales and levels of fisheries governance: Explaining the active non-participation of fishers in Two Rivers, North Carolina. *Journal of Rural Studies* **32**, 26-37. [CrossRef]
180. Runsheng Yin, Tianjun Liu, Shunbo Yao, Minjuan Zhao. 2013. Designing and implementing payments for ecosystem services programs: Lessons learned from China's cropland restoration experience. *Forest Policy and Economics* **35**, 66-72. [CrossRef]
181. Maria Bigoni, Gabriele Camera, Marco Casari. 2013. Strategies of cooperation and punishment among students and clerical workers. *Journal of Economic Behavior & Organization* **94**, 172-182. [CrossRef]
182. Peter Deegen. 2013. Economics of the external and the extended orders of markets and politics and their application in forestry. *Forest Policy and Economics* **35**, 21-30. [CrossRef]
183. Kaveh Madani, Ariel Dinar. 2013. Exogenous regulatory institutions for sustainable common pool resource management: Application to groundwater. *Water Resources and Economics* **2-3**, 57-76. [CrossRef]
184. Catherine E Lovelock, Ryan RJ McAllister. 2013. 'Blue carbon' projects for the collective good. *Carbon Management* **4**, 477-479. [CrossRef]

185. Mark Hartswood, Barbara Grimpe, Marina JirotkaTowards Ethical Governance of Social Machines 426-427. [CrossRef]

186. Andries Richter, Johan Grasman. 2013. The transmission of sustainable harvesting norms when agents are conditionally cooperative. *Ecological Economics* **93**, 202-209. [CrossRef]

187. Anita Kim. 2013. The Curious Case of Self-Interest: Inconsistent Effects and Ambivalence toward a Widely Accepted Construct. *Journal for the Theory of Social Behaviour* n/a-n/a. [CrossRef]

188. Grant D. Jacobsen, Matthew J. Kotchen, Greg Clendenning. 2013. Community-based incentives for environmental protection: the case of green electricity. *Journal of Regulatory Economics* **44**, 30-52. [CrossRef]

189. Pete Smith, Helmut Haberl, Alexander Popp, Karl-heinz Erb, Christian Lauk, Richard Harper, Francesco N. Tubiello, Alexandre de Siqueira Pinto, Mostafa Jafari, Saran Sohi, Omar Masera, Hannes Böttcher, Göran Berndes, Mercedes Bustamante, Helal Ahammad, Harry Clark, Hongmin Dong, Elnour A. Elsiddig, Cheikh Mbow, Nijavalli H. Ravindranath, Charles W. Rice, Carmenza Robledo Abad, Anna Romanovskaya, Frank Sperling, Mario Herrero, Joanna I. House, Steven Rose. 2013. How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals?. *Global Change Biology* **19**:10.1111/gcb.2013.19.issue-8, 2285-2302. [CrossRef]

190. Christos Makridis. 2013. A Tale of Two Countries: Markets and Transboundary Water Governance Between the United States and Mexico. *International Journal of Public Administration* **36**, 622-637. [CrossRef]

191. Gabriele Camera, Marco Casari, Maria Bigoni. 2013. EXPERIMENTAL MARKETS WITH FRICTIONS. *Journal of Economic Surveys* **27**:10.1111/joes.2013.27.issue-3, 536-553. [CrossRef]

192. Ian D. Hodge, William M. Adams. 2013. The future of public forests: An institutional blending approach to forest governance in England. *Journal of Rural Studies* **31**, 23-35. [CrossRef]

193. J.W. Stoelhorst, Peter J. Richerson. 2013. A naturalistic theory of economic organization. *Journal of Economic Behavior & Organization* **90**, S45-S56. [CrossRef]

194. David Sloan Wilson, Elinor Ostrom, Michael E. Cox. 2013. Generalizing the core design principles for the efficacy of groups. *Journal of Economic Behavior & Organization* **90**, S21-S32. [CrossRef]

195. Milan Zafirovski. 2013. What is the Main Significance of Economic for Sociological Theory?. *The American Sociologist* **44**, 177-197. [CrossRef]

196. Cody Jones. 2013. Moving Beyond Profit: Expanding Research to Better Understand Business Environmental Management. *Sustainability* **5**, 2693-2721. [CrossRef]

197. Natalie C Ban, Morena Mills, Jordan Tam, Christina C Hicks, Sarah Klain, Natalie Stoeckl, Madeleine C Bottrill, Jordan Levine, Robert L Pressey, Terre Satterfield, Kai MA Chan. 2013. A social–ecological approach to conservation planning: embedding social considerations. *Frontiers in Ecology and the Environment* **11**, 194-202. [CrossRef]

198. Qiang Wang, Xi Chen. 2013. Rethinking and reshaping the climate policy: Literature review and proposed guidelines. *Renewable and Sustainable Energy Reviews* **21**, 469-477. [CrossRef]

199. Jun Wang, Daniel G. Brown, Jiquan Chen. 2013. Drivers of the dynamics in net primary productivity across ecological zones on the Mongolian Plateau. *Landscape Ecology* **28**, 725-739. [CrossRef]

200. Christian Isendahl, Michael E. Smith. 2013. Sustainable agrarian urbanism: The low-density cities of the Mayas and Aztecs. *Cities* **31**, 132-143. [CrossRef]

201. Mark Bernard, Anna Dreber, Pontus Strimling, Kimmo Eriksson. 2013. The subgroup problem: When can binding voting on extractions from a common resource pool overcome the tragedy of the commons?. *Journal of Economic Behavior & Organization* . [CrossRef]

202. Encarna Esteban, Ariel Dinar. 2013. Cooperative Management of Groundwater Resources in the Presence of Environmental Externalities. *Environmental and Resource Economics* **54**, 443-469. [CrossRef]

203. Xiaoxi Wang, Ilona M. Otto, Lu Yu. 2013. How physical and social factors affect village-level irrigation: An institutional analysis of water governance in northern China. *Agricultural Water Management* **119**, 10-18. [CrossRef]

204. W.B. Labiosa, W.M. Forney, A.-M. Esnard, D. Mitsova-Boneva, R. Bernknopf, P. Hearn, D. Hogan, L. Pearlstine, D. Strong, H. Gladwin, E. Swain. 2013. An integrated multi-criteria scenario evaluation web tool for participatory land-use planning in urbanized areas: The Ecosystem Portfolio Model. *Environmental Modelling & Software* **41**, 210-222. [CrossRef]

205. Peter Grabosky. 2013. Beyond Responsive Regulation : The expanding role of non-state actors in the regulatory process. *Regulation & Governance* **7**:10.1111/rego.2013.7.issue-1, 114-123. [CrossRef]

206. Bruce Glavovic. 2013. Coastal Innovation Paradox. *Sustainability* **5**, 912-933. [CrossRef]

207. Anica Zeyen, Markus Beckmann, Susan Mueller, J. Gregory Dees, Dmitry Khanin, Norris Krueger, Patrick J. Murphy, Filipe Santos, Mariarosa Scarlata, Jennifer Walske, Andrew Zacharakis. 2013. Social Entrepreneurship and Broader Theories: Shedding New Light on the 'Bigger Picture'. *Journal of Social Entrepreneurship* **4**, 88-107. [CrossRef]

208. Ray Ison, Chris Blackmore, Benjamin L. Iaquinto. 2013. Towards systemic and adaptive governance: Exploring the revealing and concealing aspects of contemporary social-learning metaphors. *Ecological Economics* **87**, 34-42. [CrossRef]

209. Prakash Kashwan. 2013. The politics of rights-based approaches in conservation. *Land Use Policy* **31**, 613-626. [CrossRef]

210. David D. Dill, Maarja Beerkens. 2013. Designing the framework conditions for assuring academic standards: lessons learned about professional, market, and government regulation of academic quality. *Higher Education* **65**, 341-357. [CrossRef]

211. David Martin. 2013. A Macroeconomic Model of Biodiversity Protection. *Theoretical Economics Letters* **03**, 39-44. [CrossRef]

212. Sutti Ortiz, Susana Aparicio, Nidia Tadeo. 2012. Dynamics of Harvest Subcontracting: The Roles Played by Labour Contractors. *Journal of Agrarian Change* n/a-n/a. [CrossRef]

213. David Sloan Wilson. 2012. Consilience: Making contextual behavioral science part of the United Ivory Archipelago. *Journal of Contextual Behavioral Science* **1**, 39-42. [CrossRef]

214. Ross B. Emmett. 2012. Of talk, economics, love and innovation. *The Journal of Socio-Economics* **41**, 783-786. [CrossRef]

215. Lily Hsueh, Aseem Prakash. 2012. Incentivizing self-regulation: Federal vs. state-level voluntary programs in US climate change policies. *Regulation & Governance* **6**:10.1111/rego.2012.6.issue-4, 445-473. [CrossRef]

216. Martin Petrick, Andreas Gramzow. 2012. Harnessing Communities, Markets and the State for Public Goods Provision: Evidence from Post-Socialist Rural Poland. *World Development* **40**, 2342-2354. [CrossRef]

217. Claudia Pahl-Wostl, Louis Lebel, Christian Knieper, Elena Nikitina. 2012. From applying panaceas to mastering complexity: Toward adaptive water governance in river basins. *Environmental Science & Policy* **23**, 24-34. [CrossRef]

218. Ann E. Davis. 2012. Panglossian Economics. *Challenge* **55**, 67-87. [CrossRef]

219. Peter J. Boettke, Alexander Fink, Daniel J. Smith. 2012. The Impact of Nobel Prize Winners in Economics: Mainline vs. Mainstream. *American Journal of Economics and Sociology* **71**:10.1111/ajes.2012.71.issue-5, 1219-1249. [CrossRef]

220. Anne Musson. 2012. The build-up of local sustainable development politics: A case study of company leaders in France. *Ecological Economics* **82**, 75-87. [CrossRef]

221. Poe Yu-ze Wan. 2012. Analytical Sociology: A Bungean Appreciation. *Science & Education* **21**, 1545-1565. [CrossRef]

222. Stephen L. Vargo, Melissa Archpru Akaka. 2012. Value Cocreation and Service Systems (Re)Formation: A Service Ecosystems View. *Service Science* **4**, 207-217. [CrossRef]

223. Kaveh Madani, Ariel Dinar. 2012. Cooperative institutions for sustainable common pool resource management: Application to groundwater. *Water Resources Research* **48**, n/a-n/a. [CrossRef]

224. Brian C. Weeden, Tiffany Chow. 2012. Taking a common-pool resources approach to space sustainability: A framework and potential policies. *Space Policy* **28**, 166-172. [CrossRef]

225. Thomas Vendryes. 2012. PEASANTS AGAINST PRIVATE PROPERTY RIGHTS: A REVIEW OF THE LITERATURE. *Journal of Economic Surveys* no-no. [CrossRef]

226. Norichika Kanie, Michele M. Betsill, Ruben Zondervan, Frank Biermann, Oran R. Young. 2012. A CHARTER MOMENT: RESTRUCTURING GOVERNANCE FOR SUSTAINABILITY. *Public Administration and Development* **32**:10.1002/pad.v32.3, 292-304. [CrossRef]

227. Riyanti Djalante, Frank Thomalla, Muhammad Sabaruddin Sinapoy, Michelle Carnegie. 2012. Building resilience to natural hazards in Indonesia: progress and challenges in implementing the Hyogo Framework for Action. *Natural Hazards* **62**, 779-803. [CrossRef]

228. Bruno S. Frey, Roger Lüthi, Margit Osterloh. 2012. Community Enterprises-An Institutional Innovation. *Managerial and Decision Economics* **33**:10.1002/mde.v33.5-6, 427-439. [CrossRef]

229. Gabriele Camera, Marco Casari, Maria Bigoni. 2012. Cooperative strategies in anonymous economies: An experiment. *Games and Economic Behavior* **75**, 570-586. [CrossRef]

230. Roldan Muradian, Laura Rival. 2012. Between markets and hierarchies: The challenge of governing ecosystem services. *Ecosystem Services* **1**, 93-100. [CrossRef]

231. Philip Leifeld, Volker Schneider. 2012. Information Exchange in Policy Networks. *American Journal of Political Science* **56**:10.1111/ajps.2012.56.issue-3, 731-744. [CrossRef]

232. George Basile, Michael Bernstein, Scott G. McNall. 2012. Trust, Sustainability, and Political Innovation: A New Reality for our Future. *Sustainability: The Journal of Record* **5**, 123-126. [CrossRef]

233. Maria Alejandra Velez, John K. Stranlund, James J. Murphy. 2012. Preferences for government enforcement of a common pool harvest quota: Theory and experimental evidence from fishing communities in Colombia. *Ecological Economics* **77**, 185-192. [CrossRef]

234. W. Akpalu, P. Martinsson. 2012. Ostracism and Common Pool Resource Management in a Developing Country: Young Fishers in the Laboratory. *Journal of African Economies* **21**, 266-306. [CrossRef]

235. Samuel Garrido. 2012. Ampliación del regadío, regulación institucional y sostenibilidad en las huertas tradicionales de la España mediterránea. *Investigaciones de Historia Económica* . [CrossRef]

236. Encarna Esteban, José Albiac. 2012. Assessment of Nonpoint Pollution Instruments: The Case of Spanish Agriculture. *International Journal of Water Resources Development* **28**, 73-88. [CrossRef]

237. Jodi R. Sandfort, Laura Bloomberg. 2012. InCommons: supporting community-based leadership. *Community Development* **43**, 12-30. [CrossRef]

238. JAMES F. BOOKER, RICHARD E. HOWITT, ARI M. MICHELSEN, ROBERT A. YOUNG. 2012. ECONOMICS AND THE MODELING OF WATER RESOURCES AND POLICIES. *Natural Resource Modeling* **25**:10.1111/nrm.2012.25.issue-1, 168-218. [CrossRef]

239. Wolfgang Grassl. 2012. Hybrid Forms of Business: The Logic of Gift in the Commercial World. *Journal of Business Ethics* . [CrossRef]

240. Kaveh Madani, Ariel Dinar. 2012. Non-cooperative institutions for sustainable common pool resource management: Application to groundwater. *Ecological Economics* . [CrossRef]

241. Peter GordonSpontaneous Cities 181-209. [CrossRef]

242. Riyanti Djalante, Cameron Holley, Frank Thomalla. 2011. Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science* **2**, 1-14. [CrossRef]

243. Michael D. McGinnis, Elinor Ostrom. 2011. Reflections on Vincent Ostrom, Public Administration, and Polycentricity. *Public Administration Review* no-no. [CrossRef]

244. Graham Thiele, André Devaux, Iván Reinoso, Hernán Pico, Fabián Montesdeoca, Manuel Pumisacho, Jorge Andrade-Piedra, Claudio Velasco, Paola Flores, Raúl Esprella, Alice Thomann, Kurt Manrique, Doug Horton. 2011. Multi-stakeholder platforms for linking small farmers to value chains: evidence from the Andes. *International Journal of Agricultural Sustainability* **9**, 423-433. [CrossRef]

245. Xuemei Li, Zhongfeng LiTheory, Tools and Implications of Multifunctional Agriculture for Chongqing Municipality, Southwest China 1351-1354. [CrossRef]

246. Ray Ison, Kevin Collins, John Colvin, Janice Jiggins, Pier Paolo Roggero, Giovanna Seddaiu, Patrick Steyaert, Marco Toderi, Chiara Zanolla. 2011. Sustainable Catchment Managing in a Climate Changing World: New Integrative Modalities for Connecting Policy Makers, Scientists and Other Stakeholders. *Water Resources Management* . [CrossRef]

247. Kaveh Madani, Ariel DinarPolicy Implications of Institutional Arrangements for Sustainable Management of Common Pool Resources: The Case of Groundwater 981-989. [CrossRef]

248. S.J. van de Meene, R.R. Brown, M.A. Farrelly. 2011. Towards understanding governance for sustainable urban water management. *Global Environmental Change* . [CrossRef]

249. R. D'Souza, H. Nagendra. 2011. Changes in Public Commons as a Consequence of Urbanization: The Agara Lake in Bangalore, India. *Environmental Management* . [CrossRef]

250. Thorkil Casse, Anders Milhøj. 2011. Community Forestry and Forest Conservation: Friends or Strangers?. *Environmental Policy and Governance* n/a-n/a. [CrossRef]

251. Elinor Ostrom. 2011. Reflections on "Some Unsettled Problems of Irrigation". *American Economic Review* **101**:1, 49-63. [Abstract] [View PDF article] [PDF with links]

252. Robert N. Stavins. 2011. The Problem of the Commons: Still Unsettled after 100 Years. *American Economic Review* **101**:1, 81-108. [Abstract] [View PDF article] [PDF with links]

253. Michael D. McGinnis. 2011. An Introduction to IAD and the Language of the Ostrom Workshop: A Simple Guide to a Complex Framework. *Policy Studies Journal* **39**:10.1111/psj.2011.39.issue-1, 169-183. [CrossRef]

254. Elinor Ostrom. 2011. Background on the Institutional Analysis and Development Framework. *Policy Studies Journal* **39**:10.1111/psj.2011.39.issue-1, 7-27. [CrossRef]

255. Michael D. McGinnis. 2011. Networks of Adjacent Action Situations in Polycentric Governance. *Policy Studies Journal* **39**:10.1111/psj.2011.39.issue-1, 51-78. [CrossRef]

256. D. A. Cleveland. 2010. Who Pays the Price for Shared Social Responsibility?. *Science* **330**, 446-446. [CrossRef]

257. Edward Cartwright, Thomas SinghSocial Capital, the Culture of Trust, and Economic Development 91-108. [CrossRef]