

**Bridging the Qualitative-Quantitative Divide:  
Strategies for Building Large-N Databases Based on Qualitative Research**

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# **Bridging the Qualitative-Quantitative Divide: Strategies for Building Large-N Databases Based on Qualitative Research**

Amy R. Poteete and Elinor Ostrom

## **Abstract**

The trade-offs between qualitative and quantitative research methods are well known. Qualitative research promises high internal validity and the ability to disentangle causal processes. Given the costs of conducting in-depth research, however, it is difficult to obtain the large number of qualitative observations required to establish external validity. We elaborate upon these challenges and discuss the relative merits and shortcomings of three strategies for building large-N databases using qualitative research: large-N field-based studies conducted by one or a few researchers, meta-databases constructed from existing qualitative studies, and large-N field-based studies conducted by research networks. Examples are drawn from research on collective action to manage natural resources.

The trade-offs between case studies and large-N studies are well known (Campbell 1975; Coppedge 1999; Gerring 2004; King, Keohane, and Verba 1994). Case studies offer opportunities to test the logic of causal hypotheses by carefully tracing causal processes and examining multiple implications of alternative explanations within tightly controlled settings. Examination of multiple dimensions of a case helps make sense of complex situations and untangle complex concepts (Coppedge 1999). The author's in-depth knowledge about cases can generate high quality data and build confidence in the internal validity of the analysis. But the generality or external validity of findings from case studies can be evaluated only through analysis of a large number of observations.

Large-N empirical research confronts three major practical obstacles. First, the key variables must be consistently conceptualized and measured across observations. Inconsistent terminology and measurements may obscure consistent patterns or suggest patterns where none exist. Inconsistency in conceptualization and measurement can be a huge problem, depending on the data sources and the methods of collecting data. Second, comparable data

are scarce, especially for phenomena below the level of the nation-state. Data compiled by the Organization for Economic Cooperation and Development (OECD), the United Nations (UN), and the World Bank do not address many issues at the sub-national level, such as the conditions for collective action and its survival. Third, and very importantly, causal inferences are difficult to establish with large-N studies, especially when the data is collected for a single time period.

In the absence of readily available comparative data of high quality, researchers face tough choices about how to evaluate the generality of relationships suggested by case studies. This paper compares two strategies for addressing these challenges: meta-databases (or systematically analyzing case studies written by multiple researchers) and large-N databases of new field research. To provide focus for the discussion, we look at the contributions of each strategy to the study of collective action for natural resource management.

A well-defined component of the broader stream of research on collective action, research on collective action for natural resource management emerged from the disparate responses to Hardin's (1968) essay on the tragedy of the commons. Following the National Research Council's Panel on Common Property Resource Management, efforts to synthesize earlier work and define an agenda for future research accelerated (National Research Council, 1986; McCay and Acheson 1987; Ostrom 1990). Much of the earliest work reported on one or a few case studies. As case studies accumulated, scholars increasingly turned to other strategies for empirical research—including meta-analyses and large-N field studies—to discover and analyze general patterns. This shift from a reliance on case studies to synthetic analyses parallels developments in any scientific enterprise (Stern et al. 2002). This research tradition offers several examples of each strategy for conducting empirical research.

Although the particular examples of conceptual ambiguity and choices in empirical measurement are specific to this research area, they are representative of challenges confronted by empirical research on any topic.

Two research methods can be used to complement case studies and further test hypotheses beyond a single case. The first is a meta-analysis of case studies conducted by multiple researchers. The second is large-N field studies. Neither meta-analyses nor large-N field studies offers a perfect solution. The choice between these strategies involves trade-offs between consistency in data and the flexibility to learn, as well as in the number of cases, severity of missing data problems, control over sampling, and costs of data collection.

Moreover, our systematic review of articles published within this area between 1990 and 2004 found that, in practice, scholars also make trade-offs between the number of observations and both the scale and scope of analysis; most large-N studies collect and analyze data from individual or household respondents within a sub-national study area. Consequently, increases in the number of observations often do not deliver any increased external validity since they are frequently observations at a different scale or unit of analysis. Analyses of survey data, regardless of the number of observations, do not directly address important questions that concern the prospects for collective action by a group of individuals who share common-pool resources. Studies that focus on units of (potential) collective action or shared resources, however, rarely achieve the number of observations needed for confidence in the validity of findings. In practice, cross-national research is rare and expensive, whatever the unit of analysis, number of observations, or methodological approach.

We consider the prospects for overcoming these methodological challenges through broader collaborative efforts. We find only limited evidence of collaborative partnerships and networks within this area of research. To date, research partnerships and networks have not been systematically more likely than individuals or some groups of researchers to produce large-N research that focuses on units (or objects) of collective action. We look more closely at the experiences of scholars working with the International Forestry Resources and Institutions (IFRI) research network. We argue that research networks such as IFRI have the potential—albeit not yet fully realized—to bridge the qualitative and quantitative divide that hinders the accumulation of knowledge on topics concerning sub-national units of analysis such as collective action in natural resource management.

We begin with a review of the contributions and limitations of case studies to research on collective action in natural resource management. Second, we evaluate the data and methods used in articles on collective action in natural resource management published between 1990 and 2004. Third, we describe two strategies for bridging the qualitative and quantitative divide in empirical research—meta-databases and large-N field studies—and provide examples of each. We highlight a number of collaborative efforts at field research, ranging from small partnerships to formal networks. We then discuss how researchers using each strategy have addressed the challenges of conceptual consistency and empirical measurement in the study of collective action. Despite the progress made, scholars continue to struggle with conceptual consistency and the difficulty of analyzing complex processes.

### **Lessons from and Limitations of Case Studies**

Garrett Hardin made two claims in his 1968 article in *Science*: (1) resource users are stuck in an inexorable tragedy of overuse of resources, and (2) sustainable resource use

requires either state or private property. His highly visible and articulate article prompted a large number of scholars to study common property arrangements around the world (e.g., Baland and Platteau (2000 [1996]); Bromley et al. 1992; McCay and Acheson 1987; Ostrom 1990). The deterministic formulation of Hardin's claim lent itself to rebuttal through case studies. When a relationship is hypothesized to be invariant rather than probabilistic, demonstrating that it does not hold in even a single case provides grounds for dismissal or modification (Dion 1998; Gerring 2004, 349; Mahoney 2003).<sup>1</sup> In the case of the tragedy of the commons, scholars identified numerous counterexamples. Communities have avoided the tragedy of the commons in the management of fisheries (Berkes 1992; Singleton 1999; Acheson, 2003), forests (McKean 1992; Schoonmaker Freudenberger 1993), grazing lands or pastures (Gilles, Hammoudi, and Mahdi 1992; Netting 1981; Nugent and Sanchez 1999), water (van Steenberg 1995), and wild plants and animals (Dyson-Hudson and Smith 1978).<sup>2</sup> These case studies demonstrated that, contrary to theoretical predictions, collective action *is* possible (Feeny et al. 1998 [1990]; McKean and Ostrom 1995). Moreover, collective management of natural resources by a community of organized users achieves more sustainable outcomes than either state management or privatization<sup>3</sup> in many (but not all) cases. Case studies revealed, but could not explain, considerable diversity in outcomes.

Studies of successful collective management of natural resources highlighted problems with the tragedy of the commons hypothesis. First, Hardin equated the commons with the absence of property rights (Feeny et al. 1998 [1990]). Case studies repeatedly

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<sup>1</sup> Debates exist about the ability to disprove even invariant hypotheses, especially in light of the fallibility of observation. See the discussion of falsification in Kuhn (1970, 13-19) and Lakatos (1970, 95-102).

<sup>2</sup> Many of these studies include instances of failures as well as successes or analyze arrangements for communal management that were successful for some time before faltering.

<sup>3</sup> Although more than one person may be the recipient of property rights through privatization, privatization is generally equated with individualization in both popular and academic discourse. Unless otherwise specified, privatization refers to the allocation of property rights to an individual or a private firm.

demonstrate that property rights can exist and function well when held by communities rather than individuals. Overuse is far more likely if neither a well-defined group nor an individual holds clear property rights.<sup>4</sup> Second, Hardin assumed that the incentives for managing collective resources approximate a Prisoner's Dilemma. Yet, empirical studies reveal a variety of incentive structures. Wealthy Barabaig pastoralists in Tanzania, for example, created social incentives that encouraged cooperation in management of the range (Ruttan and Borgerhoff Mulder 1999).<sup>5</sup> The variety of incentive structures for collective management of natural resources helps account for variation in outcomes (Ostrom, Gardner, and Walker 1994).

Hardin argued for privatization or centralized regulation to avoid overexploitation, but neither guarantees sustainable management. Under some circumstances, communal management of natural resources leads to better outcomes, in terms of efficiency, equity, and risk-spreading, than other options. Nationalization often undermines effective systems of local communal management and *creates* situations of de facto open access (e.g., Berkes 1992; Richards 1997; Schoonmaker Freudenberger 1993).<sup>6</sup> Comparisons of forest management under individual and community ownership in Guatemala and Honduras detected no significant difference in resource condition (Gibson, Lehoucq, and Williams 2002; Tucker 1999).<sup>7</sup> Privatization also entails costs. The expectation that privatization

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<sup>4</sup> Clear and secure property rights do not prevent depletion of renewable resources under all circumstances (e.g., Baland and Platteau 2000 [1996] 18-23, 294-96).

<sup>5</sup> Ruttan and Borgerhoff Mulder (1999) develop a formal model that shows how the incentive structure varies with inequality, cost of movement, and the availability of wet-season grazing. Cf., Runge's (1981) formal model showing that management of a shared pasture is better depicted as an assurance game and Ostrom, Gardner, and Walker (1994), who identify multiple formal games, including the Prisoner's Dilemma, that represent some of the diverse incentive systems.

<sup>6</sup> Cf., Seabright (1993), who argues that *privatization* can lead to individually and collectively worse outcomes even for property holders.

<sup>7</sup> Tucker and Southworth (2005) have now completed an over-time study from 1987-2000 using both on-the-ground field methods and remotely sensed images and found many factors affecting patterns of deforestation

occurs in response to increases in resource value recognizes that defense of property is costly (Alchian and Demsetz 1973); decreases in the cost of defense, as through technological innovation, also affect the timing of privatization (Anderson and Hill 1998 [1977]). But privatization also brings losses in flexibility and risk management that may be extremely important in highly variable environments (Nugent and Sanchez 1999; Western 1982). Moreover, the allocation of private rights over land-based resources to an individual often dispossesses people with overlapping rights to resources on the same parcel of land—including women and youth within the property owners' households as well as economically or politically marginal groups (Hitchcock 1980; Kipuri 1991; Seabright 1993).

Case studies of natural resource management helped reset the terms of debate about collective action.<sup>8</sup> The ample evidence of successful collective action and of benefits associated with collective action suggested new questions. Scholars began to look for explanations for variation in collective action, both in achieving initial success and in sustaining collective action over longer periods. Case studies suggest that market pressures and demographic change threaten the viability of all types of institutions for managing common property (Harrison 1993; Schoonmaker Freudenberger 1993), although there are instances of remarkable institutional resilience (McKean 1992; Netting 1981; Acheson 2003; Richards 1997). Case studies offer only limited possibilities for testing hypothesized explanations for such variation. The challenge is significant. Research on collective action for natural resource management has identified more than 30 potential explanatory factors (Agrawal 2001). Exclusion of any of these variables potentially introduces biases from

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and reforestation. The tenure systems did not have as strong an impact on dynamic trends as broader economic and political factors.

<sup>8</sup> Contributions in other fields of study, especially works on social movements and voting behavior, also helped redirect the questions asked about collective action.

missing variables. Inclusion of such a large number of variables in analysis, however, increases the difficulty of assessing causal relationships given the limited availability of comparable data (Poteete and Ostrom 2004a). Comparisons of multiple cases are needed to evaluate equally plausible causal arguments and assess the relative importance of explanatory variables.

### **Data and Methods in Fifteen Years Worth of Research**

So, how are scholars addressing these challenges? Are scholars still predominantly relying on case studies, or did the meta-analyses and anthologies of the late 1980s and early 1990s represent a larger shift toward explicitly comparative research? To answer these questions, we conducted a bibliographic search using terms frequently found in studies of collective action in natural resource management.<sup>9</sup> We focused on the 15-year period, 1990–2004. This period immediately followed publications by McCay and Acheson (1987) and Ostrom (1990) that drew increased attention to the study of collective action in natural resource management and identified the need for more comparative analysis as an important research goal.<sup>10</sup> A search of the Academic Search Premier (Ebsco) database retrieved 257 articles with one or more of the following terms appearing in the abstract or as keywords or subject terms: common pool resource, commons, community management, community-based management, collective action, common resource management, forest management, irrigation, groundwater management, fishery management, management of fisheries, public land, grazing system, and pasture management.

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<sup>9</sup> We gratefully acknowledge the competent research assistantship of Agnes Koós, who conducted the bibliographic search and compiled the meta-database used in this section.

<sup>10</sup> Bromley et al. (1992) also reflected and contributed to this surge of interest in collective management of natural resources.

We first identified all of the field-based, empirical studies. Of the 255 articles for which we had sufficient information about data sources, 188 (73.7%) were field-based empirical studies. The other 67 articles were either non-empirical or did not report on field-based research. These included syntheses of existing literature, theoretical analyses, experimental studies, simulations, and analyses of published databases. Next, following the widely used rule of thumb based on the central limit theorem, we classified studies with 30 or more observations for the main unit of analysis as large-N studies.<sup>11</sup> Good research often draws on multiple types of data collected for observations at more than one scale of analysis. For each field-based empirical study, we identified the main unit of analysis based on how the author(s) organized their presentation of data. Thus, we treated policy units as the main unit of analysis where data were organized around countries, states, districts, or other political jurisdictions; case studies as the main unit of analysis where data were organized around geographic cases or ecological systems (e.g., watershed, fishery); and individual respondents as the main unit of analysis when the organization of data focused on individual respondents.

Although most articles published during the 1990–2004 period involved some degree of comparative analysis, less than a third analyzed a sufficiently large number of observations to count as large-N studies. Of the 188 empirical field-based studies of natural resource management, 129 (68.6%) analyzed fewer than 30 observations of the main unit of analysis. More than half (75) of the small-N studies—and 39.9% of *all* field-based studies—are presented as single case studies; an additional 16 articles analyzed two case studies. Fully

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<sup>11</sup> Note that the central limit theorem is based on the assumption that the underlying population is normally distributed. Although it is not obvious that the normality assumption makes sense for the distribution of outcomes of interest related to collective action, the 30-observation rule of thumb offers an attractive—and relatively obtainable—point of reference.

107 articles—56.9% of all articles based on empirical field-based research—relied on data for 5 or fewer cases. Only 59 articles (31.4% of all field-based studies) published over this 15-year period analyzed 30 or more observations and can be considered large-N studies. Only 34 reported findings for analysis of 100 or more observations for the main unit of analysis.

[Insert Table 1 here]

The number of observations closely corresponds to the main unit of analysis. The small-N studies focus almost exclusively on either units of potential collective action, such as user groups and ecological systems (60.5%) or policy-making units (38.6%). Likewise, almost all large-N studies treat individual respondents as the main unit of analysis (79.7%).

[Insert Table 2 here]

Published research on collective action for natural resource management generally has a limited geographic scope. The vast majority of articles (64.7% of empirical studies and 74.5% of all articles) published during the 1990–2004 period address natural resource management at the sub-national level. Cross-national analyses are extremely rare, accounting for only 14.1% of all field-based articles. In fact, geographic scope is strongly and inversely related to the quantity of data used in the analysis. Almost all (89.8%) large-N empirical studies published during this period and more than two-thirds (67.4%) of the small-N empirical studies were sub-national in scope. Interestingly, 26 of the 36 articles (72.2%) that took a cross-national approach are either not empirical or not field-based; these are generally literature reviews and other synthetic works. Although some syntheses may rely on meta-

databases, the use of meta-databases is rarely mentioned explicitly and it is likely that many conclusions are based on less structured assessments of findings in the literature.<sup>12</sup>

[Insert Table 3 here]

One reason for the inverse relationship between the quantity and scope of data may be that most large-N studies analyze survey or interview data, and almost all field-based studies based on individual respondents (93.6%) draw on sub-national samples. Although large-N studies are promoted in part as a way to enhance the ability to generalize beyond the scope of a particular study, the inverse correlation between the number of observations and geographic scope means that the conclusions of many large-N studies cannot be extended beyond a very limited geographic context. To the extent that there is a trade-off between sample size and geographic scope, increasing sample size does not offer a straightforward way to identify more general patterns.

[Insert Table 4 here]

The relative paucity of cross-national analyses is not surprising given the obstacles to large-scale data collection on sub-national phenomena. Nonetheless, the near non-existence of cross-national field-based empirical research should be cause for concern. Apparent patterns at one scale of analysis may not hold at other scales of analysis (Gibson, Ostrom, and Ahn 2000). Worse, analysis based on non-systematic samples—such as literature reviews—is vulnerable to selection bias and may be misleading. Moreover, given theoretical arguments and mounting evidence that institutions as well as ecological structure strongly influence outcomes, good science requires comparisons across a variety of institutional and ecological settings.

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<sup>12</sup> See discussion of meta-databases and other forms of meta-analysis below.

Scholars interested in conducting large-N field-based empirical studies of sub-national phenomena with national or cross-national coverage face immense hurdles. Careful research on institutions at the sub-national level takes time. Local knowledge brings substantial advantages but is difficult to cultivate for more than a handful of locations. It is not surprising that relatively few scholars have compiled or analyzed large-N datasets on collective action for natural resource management. Collaboration offers opportunities to increase the number of observations or geographic scope of analysis—or both. We looked at two indicators of collaboration: the number of authors and whether the article explicitly mentioned a larger research project.

The probability that a study has 30 or more observations increases as the number of authors increases from one to four or more. Whereas only 17.5% of single-authored articles could be categorized as large-N studies, 25.8% of all articles with two or more authors had 30 or more observations. With single-authored studies accounting for nearly half (44.7%) of the articles published between 1990 and 2004, it seems that opportunities for increasing the quantity of data analyzed through collaboration have not been fully exploited. A larger number of authors does not imply that a study is more likely to have broader geographic coverage. In fact, there is no discernible relationship between the number of authors and geographic scope of analysis. It seems that collaboration is more common among scholars who share an interest in a particular country than across scholars working on similar questions across geographic contexts—at least among scholars working on natural resource management.<sup>13</sup>

[Insert Table 5 here]

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<sup>13</sup> The lack of cross-national collaboration is somewhat surprising in light of the growth of the International Association for the Study of Common Property (IASCP) and the opportunities for cross-regional networking offered through its biennial meetings.

Studies explicitly identified as products of larger research projects account for a very small fraction (6.6%) of the articles published during this 15-year period. Larger projects include partnerships between organizations (usually two or more universities or research centers—2.0%), larger networks (all of these studies are products of the International Forestry Resources and Institutions (IFRI) research network—2.7%), and projects sponsored by either a national government or international organization (2.0%). There is no relationship between participation in a larger research project and analysis of field-based empirical data, the number of observations, or the geographic scope of the study. Either authors are not giving due credit to the partnerships and networks underlying their research or, more likely, researchers interested in collective action in natural resource management have not yet fully tapped the possibilities offered by partnerships and networks. The lack of a clear relationship between participation in a larger project and either the quantity or scope of the data cautions against any expectation that partnerships and networks offer easy ways to accumulate a larger number of observations over a broader geographic area. Nonetheless, the obvious physical limits to what any single researcher can achieve working independently make the possibilities offered by partnerships and networks extremely attractive.

[Insert Tables 6 and 7 here]

### **Strategies for Comparative Empirical Research**

In the rest of this paper, we examine more closely the opportunities for bridging the quantitative and qualitative divide through the use of meta-databases and participation in research networks—and we highlight the challenges in realizing those opportunities. We focus on a series of research programs initiated by scholars associated with the Workshop in Political Theory and Policy Analysis at Indiana University: the Common-Pool Resource

(CPR) research program, the Nepal Institutions and Irrigation Systems (NIIS) research program, and the International Forestry Resources and Institutions (IFRI) research program. All three programs were designed explicitly to build large cross-national samples of comparable data on collective action in natural resource management while retaining the internal validity associated with qualitative research. The CPR research program developed a pure meta-database based on existing studies; NIIS adopted a hybrid approach, mixing meta-analysis with field-based data; and IFRI is a collaborative network of research centers engaged in field-based research. We compare the meta-database developed for the CPR research program with Baland and Platteau's (2000 [1996]) meta-analysis. Our survey of articles published between 1990 and 2004 turned up no networks comparable to IFRI. The Consultative Group on International Agricultural Research (CGIAR) and its components, such as the Collective Action and Property Rights (CAPRI) system-wide program, encourage collaborative research but have not developed common research protocols or a common database. The three other research partnerships represented in our survey have a relatively limited geographic scope (Oerlemans and Assouline 2004; Quinn et al. 2003; Sarch 1996). The successes and ongoing challenges encountered by these research programs offer insights into how scholars can better overcome the quantitative-qualitative divide.

Many variables that are expected to influence collective action take complex forms in empirical settings. As we discuss elsewhere (Poteete and Ostrom 2004a, 2004c), identifying groups with the potential for collective action or successful collective action in a field setting is a non-trivial task. Substantial investments in fieldwork are required to obtain reliable data. As a result, scholars have been hard-pressed to build databases for the study of common-pool resources large enough to analyze the many potential independent variables. There are two

main strategies to balance the costs of collecting high quality data about sub-national phenomena with the need for larger databases of comparable data: meta-databases of case studies and large-N field-based studies.

### **Meta-Databases**

Large databases can be built by coding existing case studies. This strategy offers a relatively inexpensive way to tap into the wealth of data in existing case studies. As Gerring (2004, 345) notes, scholars engage in one form of meta-analysis whenever they produce a literature review. A meta-database represents a more formalized and systematic strategy for capturing and analyzing the data in existing studies. Several scholars have turned to the analysis of meta-databases to discern general patterns (Agrawal 2004; Baland and Platteau 2000 [1996]; Ostrom 1990; Schlager 1994; Schlager, Blomquist, and Tang 1994; Tang 1992).<sup>14</sup>

Two meta-databases or analyses have gained prominence for their contributions to the study of collective action for natural resource management: (1) the CPR database developed at Indiana University and (2) Baland and Platteau's (2000 [1996]) meta-analysis of theoretical and empirical studies of natural resource management by rural communities. The first one has a relatively long history. During its meetings in the middle of the 1980s, the NRC's Panel on Common Property Resource Management brought to light the existence of a fantastic number of case studies of common-pool resources around the world. Fenton Martin

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<sup>14</sup> Geist and Lambin (2002) report on a meta-database of 152 sub-national cases examining deforestation. Collective action is not a major focus of this study, but it is one of the best documented and respected meta-databases of cases closely related to the concept of collective action. They focused on proximate causes (infrastructure extension, agricultural expansion, wood extraction, and other factors) as well as underlying causes (demographic, economic, technological, policy and institutional—including property rights and cultural factors—including individual and household behavior). No single variable was a unilateral cause of deforestation, but they did find a cluster of underlying economic, political and institutional factors as underpinning proximate causes.

(1985) began the process of developing a bibliography of these cases, which rapidly grew to over 1,000 (many of which were unpublished) within a short time.<sup>15</sup> A research team at the Workshop in Political Theory and Policy Analysis at Indiana University spent two years of intensive reading and extended discussions to design a coding form that could be used across different types of resources (CIPEC 2002).<sup>16</sup>

The CPR database was in the final stages of development when Ostrom (1990) chose to examine a set of relatively small, long-surviving common-property cases to compare with known failures. From this in-depth analysis, she derived a set of design principles that characterized the long-surviving institutions (in contrast to the failures) and a flow-chart causal model of the factors affecting institutional change. Schlager and Ostrom (1992) also relied upon their reading of this large set of case studies in which users did not have the right of alienation—considered at the time by many scholars to be “the” single most important right for property rights to exist at all. Yet, in many of these cases, users did have bundles of rights and, in many cases, used these to manage a resource. Schlager and Ostrom (1992) undertook a conceptual analysis and proposed a set of nested rights that varied from access to alienability, which Schlager (1994) used in the analysis of fishery regimes. Tang (1992) and Schlager (1994) undertook statistical analysis drawing upon the irrigation and fisheries components, respectively, and Schlager, Blomquist, and Tang (1994) used the database to compare the relative difficulty of collective action across types of resources.

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<sup>15</sup> Charlotte Hess has continued the effort to keep up with the literature in this area. “The Comprehensive Bibliography of the Commons,” with some 43,200 citations can be accessed through “The Digital Library of the Commons (DLC)” website (see <http://dlc.dlib.indiana.edu/>). The DLC itself is a depository of papers on these issues; it currently contains more than a thousand papers.

<sup>16</sup> The team eventually focused on fisheries and irrigation systems with some cases on forestry.

Baland and Platteau (2000 [1996]) synthesized findings from both economic theoretical work and empirical studies.<sup>17</sup> Their meta-analysis addressed three overarching themes: the likelihood of sustainability of natural resource use under communal management, conditions affecting collective action in natural resource management, and challenges to the sustainability of collective action by rural communities.

The choice between case studies and large-N studies is often characterized as involving a trade-off between depth and breadth, and between untangling complex causal processes and discerning recurring correlations (Coppedge 1999; Gerring 2004). Ultimately, the scholarly community wants both to understand complex processes and to recognize general patterns. The cost of conducting in-depth case studies and the need to summarize information to identify and communicate general patterns, however, limits the feasibility of in-depth studies to no more than a handful of cases. The construction of a meta-database from existing case studies offers a cost-effective way to condense the depth and complexity of case studies in order to reveal general patterns. Inclusion in a meta-database makes data from case studies more readily accessible to the broader scholarly community, thus increasing the (collective) return on investments in research.

The ability to compare a large number of studies through use of a meta-database allows evaluation of the generality of causal arguments. This approach also reveals anomalous and contradictory findings, highlighting areas for further research. Baland and Platteau's (2000 [1996]) meta-analysis of theoretical economics research on collective action and empirical studies of natural resource management by rural communities identified many unanswered questions about the importance of group size and heterogeneity for collective

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<sup>17</sup> Baland and Platteau consider experimental studies in their section on theoretical developments. In future work, we will consider experiments as a strategy for empirical research that tests theory.

action. They confirmed suspicions that market pressures and government interventions pose threats to common property institutions, but also raised questions about the prospects for co-management or other forms of cooperation between local communities and national governments.

The value of a meta-database depends on the quality of the case studies upon which it is built. Case studies, no matter how well done, do not represent fully comparable data records. A narrow focus is an appropriate response to methodological problems associated with case studies and the need to get published. A “case study” refers to a study of a single unit, such as a single country (Gerring 2004, 341-42). Within that single unit, the researcher collects data on some number of analytical cases or observations: multiple locations within that country (e.g., comparisons of districts), multiple time periods, different situations or activities or events or projects or processes, and multiple people (King, Keohane, and Verba 1994; Ragin and Becker 1992; Rueschemeyer 2003). Nonetheless, the number of analytical cases is rarely very large, and the researcher is well-advised to structure data collection to control for as many confounding variables as possible. Recent work on analytical narratives should lead to a general improvement on this score (Bates et al. 1998).

The need to produce tightly focused analyses for publication also discourages authors from providing descriptive details about variables that do not enter their own analysis. Disciplinary differences create additional blind spots. Published case studies often do not elaborate on variables that are held constant. Other variables of interest for comparative analysis may be overlooked in a case study or described in a cursory manner. Variables ignored or inadequately described in published case studies become missing data in meta-

databases. Missing data inevitably limits analysis.<sup>18</sup> Some analyses become impossible because of missing data. Other analyses may be limited by biases if there are patterns in the types of scholars attentive to particular variables.

Differences in conceptualization and the empirical measurement of variables by different authors pose additional challenges for the construction and analysis of meta-databases. The move from concept to data collection leaves ample room for differences in interpretation and measurement. Many concepts are multidimensional. The existence of multiple forms of heterogeneity, for instance, feeds ongoing debates about its relationship to collective action (Baland and Platteau 2000 [1996], 302-12; Poteete and Ostrom 2004b). Unless each study clearly specified the form of heterogeneity under consideration, coding for the purposes of comparative analysis is subject to considerable uncertainty and sometimes impossible.

Scholars contest the meaning of other concepts. What counts as successful collective action, for instance, can be defined in terms of sustainability, efficiency, equity, risk-spreading, or any number of other dimensions. If all authors clearly explain what they mean, many ambiguities can be avoided and coding for meta-analysis facilitated (Ribot 2004). Even so, since the need for focus limits attention given to alternative conceptualizations, some data will be missing for virtually all cases. Clearly, these problems of conceptual inconsistency and missing data limit the possibilities for both comparative research and for analyses that evaluate alternative interpretations of key concepts. One way that we tried to reduce the problem of missing variables within the CPR database was to complete a screening form for

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<sup>18</sup> When coding the CPR database, the team frequently sent completed coding forms to authors of the cases to ask for verification and to fill in missing data if they had it in their field notes. This reduced the problem of missing values, but only marginally, since many “missing values” were about variables that were not recorded in the field in the first place due to the questions of major interest to the field researcher.

each case we read. Here, we recorded our estimate of the quality of the original case and asked whether most of the core variables in our meta-analysis were included in the database. We then coded only those cases that were written after considerable fieldwork and contained information about crucial variables.

Meta-databases also confront problems of sample bias. Ideally, one would like to have a random sample from a universe of relevant cases. A random sample requires the existence of a complete list of relevant cases from which the sample can be drawn. There is no such list of instances of potential and realized collective action for natural resource management—or for almost any phenomenon of interest to social scientists. Thus, a random sample is not an option, regardless of whether one is collecting data through original fieldwork or from existing case studies. Even a quota sample, in which one selects cases with an eye to matching the distribution of key characteristics in the world at large, is impossible if the proportions of key characteristics in the population as a whole are unknown. With field-based studies, the researcher can select cases to ensure the inclusion of *enough* cases of each type (based on independent variables) to at least allow statistical analysis. Construction of a representative sample becomes far more problematic for meta-databases. The analyst of a meta-database draws a sub-sample of cases from an existing sample represented by the body of relevant literature. Inclusion of an empirical case in the body of literature does not reflect a random sample, a quota sample, a structured sample, or any other systematic sampling technique. Rather, it reflects the interests of a set of uncoordinated researchers and the ability of those authors to get their work published.

Bias seems unavoidable when working with meta-databases. Some biases reflect the accessibility of the research, especially in terms of language. If other systematic differences

parallel the distribution of languages, those patterns will be obscured by the samples drawn from any single linguistic area. Other biases grow out of scholarly concerns. Research on common property initially paid disproportionate attention to successful cases given the predictions that resource users could not organize themselves. The difficulty of recognizing and studying cases of unrealized or failed collective action creates an imbalance in cases observed. Scholars face a selection bias, as failed systems are not present when they go out in the field to collect new data. When in the field, a researcher can take care to look for and learn about situations where collective action would have been valuable but did not occur. The analyst of meta-databases does not have that option. Analysis of biased data can be useful *if* the researcher acknowledges the bias, restricts claims of generality accordingly, and suggests adjustments for known biases (King, Keohane, and Verba 1994, 66-74; Geddes 2004, especially chapters 3 and 4).

### **Large-N Databases from Field Studies**

Field-based data collection is the most reliable way to get comparable data with external validity and the *only* way to do over-time studies. Ultimately, since there are limits to the time and financing available for data collection, a trade-off exists between the number and type of variables measured and the number of cases for which data can be collected. Careful sampling can control for some set of factors and limit the degree of bias likely in results. Nonetheless, it may not be possible to control for all variables excluded from data collection and analysis. And, controlling for variables leaves many interesting questions unaddressed.

Some researchers have collected data for relatively large sets of cases.<sup>19</sup> As we reported earlier, individuals who develop large-N databases with more than 30 cases generally conduct field studies of numerous institutions or locations, but only in one or a few countries. Sample size alone does not indicate whether a sample is representative. Random sampling increases the likelihood that a large sample reflects the characteristics of the underlying population.<sup>20</sup> A random sample can only be drawn from a complete list of the population of possible observations, however, and such lists do not exist for many sub-national entities, including those of interest for the study of collective action. It is nonetheless possible to use random sampling at least sometimes and to some extent. In our 1990–2004 survey of articles, 32 articles mentioned the use of random sampling in at least some aspect of data collection.

Random sampling is easiest and most common for the selection of individual or household respondents; 28 of the 32 articles that reported the use of random sampling involved a survey. Since studies often involve several types of data collection, it is common to have purposive selection of some observations (e.g., sites) and random sampling of others (e.g., respondents). In addition, a random sample is sometimes supplemented by purposefully selected observations (Gillingham 1999) or realized incompletely because problems of accessibility prevent the inclusion of some randomly selected observations (McCarthy and Vanderlinden 2004). Dayton-Johnson (1999, 2000) used a state registry developed to facilitate extension efforts to draw a random sample of irrigation systems within the Mexican state of Guanajuato. The sample was not truly random, however, because the state registry is

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<sup>19</sup> In addition to the 59 large-N studies published as journal articles between 1990 and 2004, a number of large-N studies have been reported in papers and books: e.g., Bardhan 2000; Lam 1998; Jodha 1990; Shivakoti and Ostrom 2002; Somanathan, Prabhakar, and Mehta 2002.

<sup>20</sup> Collecting data for the entire population of interest is another option when that population is not unmanageably large.

incomplete and out of date. Most likely, registration with the state correlates with other characteristics of the irrigation systems, such as perhaps elaboration of institutions for managing the system. The existence of a complete list does not ensure access to all groups on the list. Working at the level of forest councils, Agrawal and Yadama (1997) received 279 complete responses to a mail survey of 600 forest councils. Although the 46.5% response rate is not bad, a systematic relationship between response rates and other characteristics of interest cannot be dismissed.

Larger numbers of cases and the use of well-designed sampling strategies increase confidence that relationships found in these studies are not idiosyncratic. Nonetheless, the expense and practical difficulties of conducting this sort of work mean that most studies include cases from only one or two countries or, frequently enough, a single region within a single country. As discussed above (see Table 4A), sub-national analyses account for 93.6% of the large-N studies in our survey. These geographic restrictions make it impossible to evaluate the generality of relationships beyond the region or country from which data are drawn.

Partnerships and networks spread the costs of data collection while retaining comparability allowing for the in-depth research associated with qualitative research. This strategy allows more comprehensive coverage either within a country or across countries and regions, depending on the breadth of the network. We consider the extent to which a number of collaborative efforts have succeeded in balancing the goals of high quality data about cases with the desire for cross-national comparability: the Nepal Institutions and Irrigation Systems (NIIS) research program, the three partnerships represented in our survey of articles,

research associated with the CGIAR network, and the International Forestry Resources and Institutions (IFRI) research program.

***NIIS: A Hybrid Approach***

A team of researchers from the U.S. and Nepal developed the Nepal Institutions and Irrigation Systems (NIIS) research program. Initially, it was to be a meta-database to contain the systematic coding of over 100 case studies that had already been written about irrigation systems in Nepal. Case material included reports, dissertations and theses, reports from Rapid Rural Appraisals, field notes from expatriate advisers, and published books and articles. A team of Nepali and U.S. researchers familiar with Nepal spent close to one year designing a coding form building on the lessons learned from the CPR meta-database and entering data from the most fully developed case studies. Upon completion of the first round of coding, they realized that the number of missing values they had to enter—even in regard to very well-crafted case studies—meant that statistical data analysis would be limited to a small set of cases for which all variables had been noted by the original case author. Consequently, they sought external funds to undertake rapid fieldwork to visit the sites where the case author had almost fully identified all of the relevant variables. While in the field, they also checked the data that had already been entered from the case. Thus, the database ended up as a hybrid—combining coding of case studies as well as new fieldwork.

Supplementation of existing studies with quick field visits greatly increased the completeness and quality of the data. Nonetheless, like the efforts of single researchers, the NIIS database contains data for a single country. Moreover, the database does not offer a random sample of irrigation systems in the country. In fact, it would be impossible to draw a random sample because records of existing irrigation systems are grossly incomplete. Priority

in conducting supplementary fieldwork went to those systems with data problems that were also relatively *accessible*. The focus on accessibility helped limited resources go further at the cost of introducing or reinforcing a bias in the data.

The NIIS research team has continued to collect new data about additional irrigation systems, with work to fill in missing data from the original case studies continuing whenever the team is in the field. At present, the NIIS database includes data on 240 separate irrigation systems in 29 of Nepal's 75 districts. Data for multiple time periods for 19 irrigation systems pushes the total number of observations up to 278. The geographic focus of some projects influenced the sample. For example, a collaborative project between the Institute of Agriculture and Animal Sciences in Chitwan and Indiana University has focused on irrigation systems in Chitwan district; 66 systems (27.5%) are located in Chitwan alone.<sup>21</sup> It is clear that some districts are overrepresented but, with no inventory of farmer-managed irrigation systems in Nepal, much less a district-by-district breakdown,<sup>22</sup> there is no way to determine how much the sample differs from the population of irrigation systems. NIIS researchers can be confident about the internal validity of their findings, but can only assess their external validity by reference to consistency with other studies elsewhere.

### ***Three Research Partnerships***

Three articles in our meta-database of articles published between 1990 and 2004 mentioned participation in larger research partnerships explicitly. Quinn et al.'s (2003) report on perceptions of risk is part of a long-term research project on the possibilities for common-pool resource management in semi-arid regions of Tanzania. This project is a joint effort of the Centre for Ecology, Law and Policy (CELP) at the University of York and the Institute

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<sup>21</sup> Personal communication, Ashok Regmi, 30 July 2004.

<sup>22</sup> Personal communication, Ashok Regmi, 30 July 2004.

for Resource Assessment at the University of Dar es Salaam.<sup>23</sup> The Traditional Management of Artisanal Fisheries (TMAF) project brought together three universities—the University of Portsmouth (UK), the University of Maiduguri (Nigeria), and The Federal University of Technology, Yola (Nigeria)—to study three fisheries in northern Nigeria (Sarch 1996). The Making Agriculture Sustainable (MAS) project involves seven organizations<sup>24</sup> in the study of 20 farmers' projects in five countries (Denmark, France, Latvia, Spain, Netherlands) (Oerlemans and Assouline 2004; Making Agriculture Sustainable (MAS) website). All three of these partnerships tackle the study of collective action for natural resource management by focusing on sub-national units of analysis: individuals within villages, fisheries, and farmers' organizations, respectively. For two of the three projects, data are drawn from a relatively small number of locations within a single country. The third project spans five countries.

Quinn et al. (2003) analyze data on individual perceptions of risks in 12 villages in 6 semi-arid districts in Tanzania. The broader project, however, involved a variety of methods, including reviews of documentary evidence, semi-structured interviews with key informants, Participatory Rural Assessments (PRA) exercises, as well as the household survey (Lovett, Stevenson, and Kiwasila 2002). The project sought to assess the current effectiveness and likely sustainability of common-pool resource management regimes as well as individual perceptions likely to affect the use of and willingness to manage natural resources. As acknowledged in the final technical report (Lovett, Stevenson, and Kiwasila 2002), the

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<sup>23</sup> The CELP website includes a description of a cross-national project on Common Pool Resources (<http://www.york.ac.uk/res/ceip/webpages/projects/cpr/cprmenu.htm>) that includes Botswana, Mexico, Nepal, Spain, and Zimbabwe as well as Tanzania. The article, however, does not mention the larger multinational project. A quick overview of links for the other countries suggests no more than loose coordination of research across components. Some components are dissertation projects.

<sup>24</sup> The MAS website lists the following organizations as participants: University of Southern Denmark; Danish Institute of Agricultural Sciences; QAP Decision Consultants; Institut Supérieur d'Agriculture Rhône-Alpes; Instituto de Estudios Sociales Avanzados de Andalucía; The Centre for Agriculture and Environment; and the Institute of Philosophy and Sociology, Baltic Studies Centre.

project involved more literature review than new data collection, and time constraints forced the team to rely on PRAs rather than more in-depth qualitative research methods. Although this partnership between two universities undoubtedly increased the number of observations in the study and the geographic scope of their coverage, the participants still felt significant resource constraints.

The TMAF project encompasses three fisheries, all in northern Nigeria, in an effort to assess the potential for improving fishery management through community-based management (Sarch 1996, 308). Sarch (1996) presents data for only one of those three sites. Data collection for the Lake Chad study area involved two rounds of interviews with key informants plus a household survey; her article focuses on links between agricultural and fishing activities revealed by the household survey (*ibid.*, 308-9). The article refers to the other study sites in Upper River Benue, Adamawa State, and Nguru-Gashua Wetlands, Yobe State, but does not indicate whether or how data collection was coordinated across sites. As with Quinn et al. (2003), Sarch (1996) achieves a large number of observations through the use of a survey while continuing to be restricted in terms of geographic scope.

Of the research partnerships represented in our meta-database, the five-country Making Agriculture Sustainable (MAS) project seems to have made the most concerted effort to bridge the qualitative-quantitative divide. According to the MAS website, project participants made a conscious effort to combine adaptive, qualitative research methods with enough structure to ensure comparability. Rather than design common research instruments or attempt to build a single integrative database, participants agreed upon a set of research tasks, defined in terms of substantive concerns (e.g., identification of barriers to the adoption of sustainable farming practices), the unit of analysis (e.g., farmers), and suitable data

sources (e.g., existing literature, interviews with particular types of respondents). For each research task, the team designed guidelines or checklists. This strategy lets collaborators adapt their questions and methods to local conditions while insisting on enough comparability to allow cross-national analysis. This relatively minimalist strategy may make comparative analysis a more labor-intensive endeavor. Although the project includes five countries, Oerlemans and Assouline (2004) present findings for a single Dutch case study.<sup>25</sup> It will be interesting to see what sort of comparative analysis comes out of the MAS project in the future.

### ***CGIAR: A Global Research Alliance***

Even MAS, the most ambitious of these partnerships, has a relatively limited cross-national scope. The Consultative Group on International Agricultural Research (CGIAR) is a truly global partnership or network. CGIAR describes itself as an “alliance” of international researchers, research centers, and programs working to support national and international agricultural science (<http://www.cgiar.org/index.html>). CGIAR members include international organizations, governments, and foundations. The alliance supports 15 international research centers that focus on particular resources or issues, e.g., the Center for International Forestry Research (CIFOR), the International Food Policy Research Institute (IFPRI), the International Livestock Research Institute (ILRI), the International Water Management Institute (IWMI), and the World Fish Center. These research centers engage in collaborative research with other national and international research centers, governments, and civil society organizations, including farmers’ associations. CGIAR promotes research around particular issues or thematic concerns through a number of system-wide initiatives.

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<sup>25</sup> The MAS website provides links to two comparative reports.

The most relevant for this paper is the system-wide program on Collective Action and Property Rights (CAPRI). CAPRI supports research on collective action and property rights within the CGIAR alliance and beyond in a variety of ways, including the organization of workshops and conference panels; the publication and dissemination of working papers, policy briefs, proceedings, and books; the compilation and dissemination of bibliographic materials; and the provision of grants through CGIAR centers.

Scholars associated with CGIAR are well-represented in our meta-database. Three publications report on projects based at or involving CGIAR centers (Pokorny and Schanz 2003; Resosudarmo 2004; Thompson, Sultana, and Islam 2003). Others list CGIAR-affiliated authors (e.g., Kurian and Dietz 2004; Levine, Sheng, and Barker 2000; Makombe et al. 2001; McCarthy and Vanderlinden 2004; Oyono 2004a, 2004b; Pender et al. 2004; Samad and Vermillion 1999). CGIAR scholars, with the encouragement and support of the CAPRI system-wide program, are making important contributions to the study of collective action in natural resource management. Thus far, however, no component of CGIAR has embarked on an effort to use the alliance's networks to build a cross-national database of comparable data. Rather, scholars and centers prefer less-structured initiatives that encourage research on particular themes but do not define the content or methods for data collection. CGIAR's thematic approach maximizes possibilities for matching research design to local context and adaptation in response to prior research, but at the cost of overlooking comparative patterns (cf., Poteete and Ostrom 2004a, 2004c).

### ***IFRI: An International Research Network***

An inquiry in 1992 from Marilyn Hoskins—who headed the Food and Agriculture Organization's (FAO) Forest, Trees and People Program—prompted creation of the

International Forestry Resources and Institutions (IFRI) research program. IFRI built upon the theoretical framework, empirical findings, and database structure of the CPR and NIIS databases, but differs from these earlier efforts in its primary reliance on fieldwork rather than existing studies, the shift in attention to more complex and multiple product forest resource systems, and in organization as a research network. Organization as an international network of researchers and research centers circumvents problems of limited scope associated with most large-N studies of local-level arrangements for managing natural resources (Ostrom 1998; Tucker and Ostrom, 2005; Poteete and Ostrom forthcoming).

IFRI's research network includes Collaborating Research Centers (CRCs) in Africa, Asia, Latin America, and North America as well as individual scholars working in these regions. As of 2005, there are 13 IFRI CRCs in 11 countries (see <http://www.indiana.edu/~ifri/crcs.htm>). IFRI brings to the empirical study of collective action an international database of comparable studies from all over the world, with comparability ensured by the use of a common research framework and methodology (Gibson, McKean, and Ostrom 2000). Data collection for the IFRI research program encompasses biophysical measures of forest conditions, climatic and soil conditions, demographic and economic indicators about the population of forest users, and details about institutions affecting use of forest resources. IFRI represents the core, not the limits, of data collection. Many IFRI research teams collect supplemental data to address specific research questions. IFRI researchers conduct repeat studies of forest sites every three to five years. By mid-2005, data for 202 unique sites with 270 forests had been entered into IFRI's common database; the database also includes data for 43 repeat studies.<sup>26</sup> The relative breadth of

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<sup>26</sup> Updates of the common database occur periodically as new data comes in from CRCs.

variables included in the IFRI protocols and relatively large number of data points in the database enable more complex multivariate analysis than would otherwise be possible.

### **Comparing the Strategies and Drawing Implications**

As we have shown, scholars have pursued a variety of strategies for accumulating more data for a larger set of observations about collective action in natural resource management. To varying degrees, these efforts have attempted to balance the pursuit of more observations with the preservation of detailed information about particular cases of (potential or actual) collective action. We have described two meta-analyses, a hybrid of meta-analysis and field data, and a variety of research partnerships and networks. Tables 8 and 9 offer an overview of the basic characteristics of each approach and the strategies each has adopted to maintain conceptual consistency and comparable data.

[Insert Tables 8 and 9 here]

The approaches surveyed in this paper vary in the number of institutional collaborators, variety of natural resources considered, and geographic scope. The construction of sizeable meta-databases of global scope is within reach of one or a few researchers working with relatively modest resources—as demonstrated by the meta-database of articles published between 1990 and 2004 that we have analyzed in this paper. Because field research requires more resources, even relatively extensive partnerships have had difficulty achieving national, much less cross-national, coverage.

To the extent that researchers engage in large-N analyses related to collective action in natural resource management, they are typically analyzing survey data collected within a few locations within a single country. These studies often present descriptive data related to patterns of resource use or evaluate attitudes expected to affect willingness to participate in

natural resource management. Valuable though surveys are, individual and household-level responses do not have obvious implications for collective action. The interest of researchers and practitioners in the prospects for collective action can be attributed largely to the fact that we cannot assume that individual preferences or attitudes translate into collective behavior in a straightforward manner.

Research partnerships and networks have attempted to increase the scope of data collection related to units of analysis relevant for the study of collective action in natural resource management. These research programs adopt multi-method strategies for data collection and often include surveys. Affiliated researchers can approach their data from different angles, including large-N analyses of the survey data. Even with international partners, it has proven difficult to accumulate enough comparable data to support large-N analyses with policy units, ecological systems, or actual or potential units of collective action as the unit of analysis, whether at the national or cross-national level. Smaller networks find themselves pushing up against resource constraints. Collaborators in the CELP-Dar es Salaam partnership, for example, had to make trade-offs between data quantity and quality; they opted to use PRAs, despite the limitations of this method, in order to cover 12 villages in 6 districts.

Larger partnerships should be able to mobilize more resources and cover more cases with fewer compromises in the quality of data on each case. Because the resources needed are immense, any network that wants to engage in cross-national research will need to include a relatively large number of partners. As the number of partners in the network increases, however, network members face increasing challenges in reaching consensus on

concepts and methods. There is a trade-off, of course, between maintaining flexibility and ease of comparative analysis.

The CGIAR alliance, with its large number of institutional members, broad geographic reach, and access to official sources of funding, should have the ability to undertake truly international and long-term research in this area. To date, CGIAR has opted to provide general support for research on collective action through the CAPRI program rather than develop a common research strategy. As a consequence, research activities are uncoordinated, making it difficult to collate comparative results and identify cross-national patterns. Considering the diversity of researchers involved with CGIAR, it would probably be difficult to agree on even a minimal set of research protocols. The MAS program opted for a loosely structured approach. Participants agree on a set of issues to be pursued, the unit of analysis to be studied, and a minimal set of data sources. The guidelines and check lists facilitate comparative research while leaving researchers with considerable flexibility to adapt their data collection strategies to local conditions, or to supplement the basic set of issues to pursue local concerns.

IFRI is the only field-based research network of which we are aware that has accumulated a large enough quantity of sufficiently comparable data to support large-N analyses with a policy unit, ecological system, or actual or potential unit of collective action as the unit of analysis. And even then, IFRI studies often analyze a sub-sample of data from a single country (e.g., Gibson and Koontz 1998; Gibson, Lehoucq, and Williams 2002; Poteete and Welch 2004; Tucker 2004; Varughese and Ostrom 2001).<sup>27</sup> The use of common data collection protocols addresses problems of comparability in a technical sense, but does not eliminate the substantial challenges of drawing sound comparisons across cultural,

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<sup>27</sup> These studies appear in our meta-database; see Poteete and Ostrom (2004a, 227) for a more complete review.

ecological, and political contexts (Poteete and Ostrom 2004a).<sup>28</sup> In addition, scholars must exercise considerable care in working with complex, multi-leveled relational databases such as the one used by IFRI. Despite these considerable challenges, cross-national analysis of IFRI data has begun (Gibson, Williams, and Ostrom 2005; Poteete 2001, 2002; Hayes 2004; Hayes and Ostrom, 2005).

The comparison of MAS and IFRI highlights the importance of long-term financial support. MAS did not manage to accumulate enough data for large-N analysis at the level of potential or actual units of collective action. The creation of a medium-sized database with data on 20 farmer groups and networks took seven institutional partners three years with funding from the European Commission. Although the IFRI database now contains data on nearly 200 study sites, the IFRI network has been fortunate to receive support from a changing set of international donors (FAO, Ford Foundation, MacArthur Foundation, and NSF) for more than ten years. The current network of 13 research centers in 11 countries represents a three-fold expansion from the initial four centers in Bolivia, Nepal, Uganda, and the U.S.

In sum, individual researchers confront substantial challenges in their efforts to collect enough data for large-N analyses related to sub-national phenomena such as collective action in natural resource management. With no census of potential and actual units of collective action, scholars cannot organize their research around random samples. Theoretical debates about collective action stress the importance of institutional arrangements, especially informal institutions, and other contextual factors that require substantial local knowledge—

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<sup>28</sup> An example of the problems faced is using forest mensuration data for comparative analyses beyond one ecological zone. For cross-zone analyses, we have had to rely on the judgment of forest experts who have joined the field team to evaluate on a Likert scale the comparative quality of this forest to others in the region. Trying to utilize Reference Forests for this purpose is currently being considered.

of languages, culture, and practices. The collection of valid data to address these sorts of concerns requires the use of multiple methods. Familiarity with the research setting and rapport with respondents help ensure data quality, especially when conflicts exist or informal institutions are important. This sort of qualitative research requires time—limiting the number of observations that any single researcher or team can make at the level of units of potential or actual collective action. Unfortunately, the external validity of research findings is limited when based on a limited number of observations. We argue that meta-databases, partnerships, and networks offer strategies to accumulate the number of observations required for large-N analyses while retaining a foundation in rigorous qualitative data collection. None of these strategies overcomes all challenges associated with the study of collective action in natural resource management—or any other topic with a sub-national unit of analysis. Trade-offs between quality and quantity affected all of the approaches surveyed. Partnerships and networks face additional challenges of balancing local idiosyncrasies and individual research interests with the need for common research methods. Nonetheless, these strategies offer the greatest promise for identifying general patterns—and anomalies—based on quality data<sup>29</sup> about units of analysis relevant for the study of collective action.

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<sup>29</sup> Meta-databases and collaborative research *can* build on solidly collected qualitative field research. As with other forms of research, whether they do in fact build on solid field research depends on the care taken in either screening entries in a meta-database or designing mechanisms for quality control within partnerships and networks.

**Table 1: Frequency Distributions of Types of Study****A: Broad Categorization of All Studies**

<i>Type of Study</i>	<i>Frequency</i>	<i>Percent of Sub-Total</i>	<i>Percent of Empirical Studies</i>
Large-N Studies	59	23.1	31.4
Small-N Studies	129	50.6	68.6
Non-Empirical or Not Field-Based Studies	67	26.3	
Sub-Total	255	100.0	
Missing Data	2		
Total	257		

**B: Number of Observations in Empirical Studies**

<i>Number of Observations</i>	<i>Frequency</i>	<i>Percent of Empirical Studies</i>
1	75	39.9
2	16	8.5
3	8	4.3
4	4	2.1
5	4	2.1
6 – 9	6	3.2
10 – 14	2	1.1
15 – 19	10	5.3
20 – 24	2	1.1
25 – 29	2	1.1
30 – 34	3	1.6
35 – 39	3	1.6
40 – 44	6	3.2
45 – 49	1	0.5
50 – 74	4	2.1
75 – 99	5	2.7
100 – 149	9	4.8
150 – 199	4	2.1
200 – 299	8	4.3
300 – 399	3	1.6
400 – 499	2	1.1
500 – 999	6	3.2
1,000 and above <sup>a</sup>	4	2.1
Missing <sup>b</sup>	1	0.5
Total	188	100

<sup>a</sup> The largest number of observations reported for a field-based empirical study is 1,755.

<sup>b</sup> Simmons (1997) conducted a survey of 30% of households in each of eight villages in Panama, but does not report the actual sample size.

**Table 2: Type of Study by Unit of Analysis**

<i>Type of Study</i>	<i>Unit of Analysis</i>			<i>Total (Column %)</i>
	<i>Individual or Household Respondents (Row %)</i>	<i>Collective or Ecological Units (e.g., user group, forest) (Row %)</i>	<i>Policy Units (Row %)</i>	
Large-N Study	47	9	3	59
	79.7%	15.3%	5.1%	31.4%
Small-N Study	1	78	50	129
	0.8%	60.5%	38.6%	68.6%
Total (N)	48	87	53	188
Total (%)	25.5%	46.3%	28.2%	100%

**Table 3: Type of Study by Geographic Scope**

<i>Type of Study</i>	<i>Geographic Scope</i>			<i>Total (Column %)</i>
	<i>Sub-national</i>	<i>National</i>	<i>Cross- national</i>	
Large-N Empirical	53	5	1	59
(Row %)	89.8%	8.5%	1.7%	23.1%
Small-N Empirical	87	33	9	129
(Row %)	67.4%	25.6%	7.0%	50.6%
Non-Empirical or Not Field-Based	25	16	26	67
(Row %)	37.3%	23.9%	38.8%	25.8%
<b>Total</b>	<b>165</b>	<b>54</b>	<b>36</b>	<b>255</b>
Column %	64.7%	21.2%	14.1%	100%
<b>Totals for Empirical Studies Only</b>	<b>140</b>	<b>38</b>	<b>10</b>	<b>188</b>
Column %	74.5%	20.2%	5.3%	100%

Chi-squared = 59.6183      Pr = 0.000  
 Kendall's tau-b = 0.3921      ASE = 0.049

**Table 4: Unit of Analysis by Geographic Scope****A: Large-N Studies**

<i>Unit of Analysis (Row %)</i>	<i>Geographic Scope</i>			<i>Total (Column %)</i>
	<i>Sub-national</i>	<i>National</i>	<i>Cross-national</i>	
Individual	44	3	0	47
	93.6%	6.4%	0%	79.7%
Collective or Ecological Units	8	1	0	9
	88.9%	11.1%	0%	15.3%
Policy Units	1	1	1	3
	33.3%	33.3%	33.3%	5.1%
<b>Total</b>	<b>53</b>	<b>5</b>	<b>1</b>	<b>59</b>
Column %	89.8%	8.5%	1.7%	100%

**B: Small-N Studies**

<i>Unit of Analysis</i>	<i>Geographic Scope</i>			<i>Total (Column %)</i>
	<i>Sub-national</i>	<i>National</i>	<i>Cross-national</i>	
Individual	1	0	0	1
Row %	100%			0.8%
Collective or Ecological Units	70	6	2	78
Row %	89.7%	7.7%	2.6%	60.5%
Policy Units	16	27	7	50
	32%	54%	14.0%	38.7%
<b>Total</b>	<b>87</b>	<b>33</b>	<b>9</b>	<b>129</b>
Column %	67.4%	25.6%	7.0%	100%

**C: All Empirical Studies**

<i>Unit of Analysis</i>	<i>Geographic Scope</i>			<i>Total (Column %)</i>
	<i>Sub-national</i>	<i>National</i>	<i>Cross-national</i>	
Individual	45	3	0	48
Row %	93.8%	6.3%	0.0%	25.5%
Collective or Ecological Units	78	7	2	87
Row %	89.7%	8.0%	2.3%	46.3%
Policy Units	17	28	8	53
	32.1%	52.8%	15.1%	28.2%
<b>Total</b>	<b>140</b>	<b>38</b>	<b>10</b>	<b>188</b>
Column %	74.5%	20.2%	5.3%	100%

**Table 5: Number of Authors by Type of Research**

<i>Number of Authors</i>	<i>Type of Research</i>			<i>Total (Column %)</i>
	<i>Large-N</i>	<i>Small-N</i>	<i>Non-Empirical or Not Field-Based</i>	
<b>One</b>	<b>20</b>	<b>61</b>	<b>33</b>	<b>114</b>
<b>(Row %)</b>	<b>17.5%</b>	<b>53.5%</b>	<b>28.9%</b>	<b>44.7</b>
<b>Two</b>	<b>25</b>	<b>53</b>	<b>19</b>	<b>97</b>
<b>(Row %)</b>	<b>25.8%</b>	<b>54.6%</b>	<b>19.6%</b>	<b>38.2%</b>
<b>Three</b>	<b>4</b>	<b>11</b>	<b>9</b>	<b>24</b>
<b>(Row %)</b>	<b>16.7%</b>	<b>45.8%</b>	<b>37.5%</b>	<b>9.4%</b>
Four	8	3	2	13
<b>(Row %)</b>	<b>61.5%</b>	<b>23.1%</b>	<b>15.4%</b>	<b>5.1%</b>
Five	2	1	2	5
<b>(Row %)</b>	<b>40.0%</b>	<b>20.0%</b>	<b>40.0%</b>	<b>2.05%</b>
Six	0	0	0	0
				0.0%
Seven	0	0	2	2
			100%	0.8%
<b>Four or More</b>	<b>10</b>	<b>4</b>	<b>6</b>	<b>20</b>
<b>(Row %)</b>	<b>50%</b>	<b>20%</b>	<b>30%</b>	<b>7.8%</b>
Total	59	129	67	255
<b>(Row %)</b>	<b>23.1%</b>	<b>50.6%</b>	<b>26.3%</b>	<b>100%</b>

Pearson  $\chi^2(10) = 24.3200$   
 Kendall's tau-b = -0.0792

Pr = 0.007  
 ASE = 0.060

**Table 6: Type of Research by Participation in Various Types of Larger Projects**

<i>Type of Research</i>	<i>Product of Larger Projects of Various Types</i>					<i>Total (Column %)</i>
	<i>No Larger Project</i>	<i>Partnership (up to seven organizations)</i>	<i>Network (IFRI)</i>	<i>Sponsored by Government or International Organization</i>	<i>Sub-Total for All Varieties of Larger Projects</i>	
Large-N	55	3	0	1	4	59
(Row %)	93.2%	5.1%	0.0%	1.7%	6.8%	23.1%
Small-N	119	1	6	3	10	129
(Row %)	92.2%	0.8%	4.7%	2.3%	7.8%	50.6%
Non-Empirical or Not Field-Based	64	1	1	1	3	67
(Row %)	95.5%	1.5%	1.5%	1.5%	4.5%	26.3%
Total	238	5	7	5	17	256
(Row %)	93.4%	2.0%	2.7%	2.0%	6.6%	100%

**Table 7: Geographic Scope of Research by Type of Research Project**

<i>Geographic Scope</i>	<i>Product of Larger Projects of Various Types</i>					<i>Total (Column %)</i>
	<i>No Larger Project</i>	<i>Partnership (up to seven organizations)</i>	<i>Network (IFRI)</i>	<i>Sponsored by Government or International Organization</i>	<i>Sub-Total for All Varieties of Larger Projects</i>	
Sub-national	153	4	6	3	13	166
(Row %)	92.2%	2.4%	3.6%	1.8%	7.8%	64.8%
National	51	1	0	2	3	54
(Row %)	94.4%	1.9%	0.0%	3.7%	5.6%	21.1%
Cross-National	35	0	1	0	1	36
(Row %)	97.2%	0.0%	2.8%	0.0%	2.8%	14.1%
Total	239	5	7	5	17	256
(Row %)	93.4%	2.0%	2.7%	2.0%	6.6%	100%

**Table 8: Examples of Large-N Studies of Collective Action in Natural Resource Management: Basic Characteristics****A: Meta-Databases and Hybrids**

<i>Research Program</i>	<i>Strategy</i>	<i>Resources</i>	<i>Geographic Scope of Data<sup>a</sup></i>	<i>Sampling Strategy</i>
CPR database	Meta-database	Fisheries, irrigation systems, and (a few) forestry	Cross-national: 86 case studies	Screened 1,600 case studies for quality information about a specific case; considerable time spent in field by author, and inclusion of key info on resource characteristics, management rules, user strategies, and outcomes.
Baland and Platteau (2000 [1996])	Meta-analysis	Fisheries, forestry, game, grazing, groundwater, irrigation, and land	Cross-national: 113 or more <sup>b</sup>	Survey of available socio-anthropological material based on field studies.
NIIS	Hybrid	Irrigation systems	National: 240 unique cases	Survey of available studies; accessibility of systems; proximity of systems; structured sampling of additional systems mentioned in official records.

<sup>a</sup> Revisits have been conducted at some sites in the NIIS database; these are not counted here.

<sup>b</sup> Baland and Platteau do not report the number of cases. This is an estimate based on a count of empirical studies cited in the text of Part II.

**B: Field-Based Empirical Approaches**

<i>Research Program</i>	<i>Strategy</i>	<i>Resources</i>	<i>Geographic Scope of Data</i> <sup>a</sup>	<i>Sampling Strategy</i>
TMAF	Partnership of three universities	Fisheries	Sub-national: three fisheries in northern Nigeria	Fisheries where overharvesting threatens socioeconomic losses.
CELP – University of Dar es Salaam	Partnership of two universities	Pastures and water	Sub-national: 12 villages in 6 districts in Tanzania	Semi-arid districts. Villages that reflect ethnic and ecological variation.
MAS	Partnership/network of seven universities and research centers	Land (agricultural)	Cross-national: 20 farmer projects or networks in 5 countries	Areas characterized by water contamination and the coexistence of multiple types of farming and production systems. Variation in the pace of information dissemination, organizational forms, and initiatives
CGIAR	“Alliance” of research centers, civil society organizations, and governments	Agriculture, fisheries, food, forests, genetic resources, livestock, particular crops, water	Cross-national—but not collated	No coordinated sampling strategy.
IFRI	Network of 13 research centers	Forestry	Cross-national: 202 unique cases in 15 countries	Availability of interested partners in a given country; availability of funding; research designs developed within each country or region.

<sup>a</sup> Revisits have been conducted at some sites in the IFRI database; these are not counted here.

**Table 9: Examples of Large-N Studies of Collective Action in Natural Resource Management: Strategies for Conceptual Consistency and Comparable Data**

**A: Meta-Databases and Hybrids**

<i>Research Program</i>	<i>Defining the Unit of Collective Action</i>	<i>Evidence of Collective Action</i>	<i>Measuring Independent Variables</i>
CPR database	Sub-group: those who have similar rights and responsibilities to the resource, similar dependency on the resource, and similar exposure to variations in supply, and who withdraw similar quantities of the resources.	Establishment and survival of common property resource system; effective management in terms of sustainability, resource quality, rule adherence, limitation of violence; equity, efficiency, stability, robustness of arrangements. Limits on the number of appropriators, restrictions on rights of use and appropriation, and definition of the responsibilities/duties of appropriators.	Some allowance for measuring multiple forms of some variables, such as social differentiation and heterogeneity across and within sub-groups.
Baland and Platteau (2000 [1996])	Ch. 10: members of traditional village societies, defined as “relatively closed, ... not permeated by a market logic ..., and ... to a large extent insulated from the rule of a centralized state machinery” (189). Chs. 11-12: village or group-based or local-level common-pool resource management.	The existence of conservation rules consciously designed for conservation that actually achieve conservation (188); long-term survival of local institutions (183).	Not clear whether any coding system was used. Allows for and discusses alternative interpretations of concepts. Discusses and critiques alternative conceptualizations and suggests own preference, although preferred conceptualization may not have much representation in literature surveyed.
NIIS	Sub-group: those who have same rights to water in an irrigation system. Not necessarily all farmers using the irrigation system since different farmers may have different rights.	The length and number of canals, information on flow, and the relationship of system performance to seasons and crops.	Modular approach with multiple empirical indicators of many variables.

**B: Field-Based Empirical Approaches**

<i>Research Program</i>	<i>Defining the Unit of Collective Action</i>	<i>Evidence of Collective Action</i>	<i>Measuring Independent Variables</i>
TMAF	Fishery—encompasses all fishing villages using Lake Chad	Sustainability of fishing levels; avoidance of overcapitalization	Semi-structured interviews and structured household survey.
CELP – University of Dar es Salaam	Common-pool resource management regimes	Evaluation in terms of Ostrom’s design principles for long-enduring CPRs. Adequacy of management for sustainability, effective prevention of open access.	Semi-structured interviews and PRAs guided by check lists of questions plus a structured household survey.
MAS	Farmers’ groups and networks	Network performance in terms of dissemination of information about sustainable agricultural practices.	Guidelines and checklists of questions about defined set of issues.
CGIAR	No standardized definition	No standardized definition.	No standardized list, definitions, or methods for measurement.
IFRI	User group: those with the same rights and responsibilities to a forest	Biological data and comparisons with patterns expected with optimal foraging; resource mobilization; collective activities in the forest; and the development of rules for access to and use of forest resources.	Modular approach with multiple empirical indicators of many variables.

### Works Cited

- Acheson, James. 2003. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. Hanover, NH: University Press of New England.
- Agrawal, Arun. 2001. "Common Property Institutions and Sustainable Governance of Resources." *World Development* 29(10) (October): 1623-48.
- Agrawal, Arun. 2004. "Environmental Politics and Institutional Choices: Forestry and Wildlife Policies in the Developing World, 1980–2000." Presented at the CHAOS Seminar Series, University of Washington, Seattle, June 8-9, 2004.
- Agrawal, Arun, and Gautam N. Yadama. 1997. "How do Local Institutions Mediate Market and Population Pressures on Resources? Forest Panchayats in Kumaon, India." *Development and Change* 28(3):435-65.
- Alchian, Armen, and Harold Demsetz. 1973. "The Property Rights Paradigm." *Journal of Economic History* 33(1):16-27.
- Anderson, Terry L., and P. J. Hill. 1998 [1977]. "From Free Grass to Fences: Transforming the Commons of the American West." In *Managing the Commons*, 2d ed., John A. Baden and Douglas S. Noonan, 119-34. Bloomington: Indiana University Press.
- Baland, Jean-Marie, and Jean-Philippe Platteau. 2000 [1996]. *Halting Degradation of Natural Resources: Is There a Role for Rural Communities?* New York: Oxford University Press.
- Bardhan, Pranab K. 2000. "Irrigation and Cooperation: An Empirical Analysis of 48 Irrigation Communities in South India." *Economic Development and Cultural Change* 48(4) (July): 847-65.
- Bates, Robert, Avner Greif, Margaret Levi, Jean-Laurent Rosenthal, and Barry Weingast. 1998. *Analytical Narratives*. Princeton, NJ: Princeton University Press.
- Berkes, Fikret. 1992. "Success and Failure in Marine Coastal Fisheries of Turkey." In *Making the Commons Work: Theory, Practice, and Policy*, ed. David Bromley et al., 161-82. San Francisco, CA: ICS Press.
- Bromley, Daniel W., David Feeny, Margaret A. McKean, Pauline Peters, Jere L. Gilles, Ronald J. Oakerson, C. Ford Runge, and James T. Thomson, eds. 1992. *Making the Commons Work: Theory, Practice, and Policy*. San Francisco, CA: ICS Press.
- Campbell, Donald T. 1975. "'Degrees of Freedom' and the Case Study." *Comparative Political Studies* 8(2) (July): 178-93.

- Centre for Ecology, Law and Policy, University of York. “Common Pool Resources” Accessed <http://www.york.ac.uk/res/celp/webpages/projects/cpr/cprmenu.htm> on 20 July 2005. Most recent recorded update on 14 September 2003.
- CIPEC (Center for the Study of Institutions, Population, and Environmental Change). 2002. “CPR Project.” Available on-line at <http://www.cipec.org/intranet/cprforms/>. Last updated August 15, 2002. Accessed 30 July 2004.
- Consultative Group on International Agricultural Research (CGIAR). Accessed <http://www.cgiar.org/index.html> on 20 July 2005. No record of most recent update.
- Coppedge, Michael. 1999. “Thickening Thin Concepts and Theories: Combining Large N and Small in Comparative Politics.” *Comparative Politics* 31(4) (July): 465-76.
- Dayton-Johnson, Jeff. 1999. “Irrigation Organization in Mexican *unidades de riego*: Results of a Field Study.” *Irrigation and Drainage Systems* 13:55-74.
- Dayton-Johnson, Jeff. 2000. “Choosing Rules to Govern the Commons: A Model with Evidence from Mexico.” *Journal of Economic Behavior and Organization* 42:19-41.
- Dion, Douglas. 1998. “Evidence and Inference in the Comparative Case Study.” *Comparative Politics* 30:127-45.
- Dyson-Hudson, Rada, and Eric Alden Smith. 1978. “Human Territoriality: An Ecological Reassessment.” *American Anthropologist* 80:21-41.
- Feeny, David, Fikret Berkes, Bonnie J. McCay, and James M. Acheson. 1998 [1990]. “The Tragedy of the Commons: Twenty-Two Years Later.” In *Managing the Commons*, 2d ed., John A. Baden and Douglas S. Noonan, 76-94. Bloomington: Indiana University Press. Originally published in *Human Ecology* 18(1):1-19.
- Geddes, Barbara. 2004. *Paradigms and Sand Castles: Theory Building and Research Design in Comparative Politics*. Ann Arbor: University of Michigan Press.
- Geist, Helmut J., and Eric F. Lambin. 2002. “Proximate Causes and Underlying Driving Forces of Tropical Deforestation.” *BioScience* 52(2):143-50.
- Gerring, John. 2004. “What is a Case Study and What is It Good For?” *American Political Science Review* 98(2) (May): 341-54.
- Gibson, Clark C., Elinor Ostrom, and T. K. Ahn. 2000. “The Concept of Scale and the Human Dimensions of Global Change: A Survey.” *Ecological Economics* 32(2) (February): 217-39.
- Gibson, Clark C., Margaret A. McKean, and Elinor Ostrom. 2000. *People and Forests: Communities, Institutions, and Governance*. Cambridge, MA: The MIT Press.

- Gibson, Clark C., and Tomas Koontz. 1998. "When 'Community' is Not Enough: Institutions and Values in Community-Based Forest Management in Southern Indiana." *Human Ecology* 26(4) (December): 621-47.
- Gibson, Clark C., Fabrice E. Lehoucq, and John T. Williams. 2002. "Does Tenure Matter to Resource Management? Property Rights and Forests in Guatemala." *Social Science Quarterly* 83(1) (March): 206-25.
- Gibson, Clark C., John T. Williams, and Elinor Ostrom. 2005. "Local Enforcement and Better Forests." *World Development* 33(2) (February): 273-84.
- Gilles, Jere L., Abdellah Hammoudi, and Mohamed Mahdi. 1992. "Oukaimedene, Morocco: A High Mountain *Agdal*." In *Making the Commons Work: Theory, Practice, and Policy*, ed. David Bromley et al., 229-46. San Francisco, CA: ICS Press.
- Gillingham, Mary E. 1999. "Gaining Access to Water: Formal and Working Rules of Indigenous Irrigation Management on Mount Kilimanjaro, Tanzania." *Natural Resources Journal* 39(3) (Summer): 419-541.
- Hardin, Garrett. 1968. "The Tragedy of the Commons." *Science* 162:1243-48.
- Harrison, Paul. 1993. *The Third Revolution: Population, Environment, and a Sustainable World*. New York: Penguin.
- Hayes, Tanya. 2004. "Parks, People, and Forest Protection: An Institutional Assessment of the Effectiveness of Protected Areas." Working Paper CWP-04-01. Bloomington: Indiana University, Center for the Study of Institutions, Population, and Environmental Change (CIPEC).
- Hayes, Tanya, and Elinor Ostrom. 2005. "Conserving the World's Forests: Are Protected Areas the Only Way?" *Indiana Law Review* 38(3):595-617.
- Hitchcock, Robert K. 1980. "Tradition, Social Justice and Land Reform in Central Botswana." *Journal of African Law* 24(1) (Spring): 1-34.
- International Forestry Resources and Institutions. 2005. "International Forestry Resources and Institutions Research Program." Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis. <http://www.indiana.edu/~ifri/>. Last updated 20 June 2005. Accessed 4 August 2005.
- Jodha, N. S. 1990. "Rural Common Property Resources: Contributions and Crisis." Society for Promotion of Wastelands Development, Foundation Day Lecture, May 16, 1990. [*Economic and Political Weekly*, June 30, 25(26): A65-A78.]

- King, Gary, Robert O. Keohane, and Sidney Verba. 1994. *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Princeton, NJ: Princeton University Press.
- Kipuri, Naomi Ole. 1991. "Age, Gender and Class in the Scramble for Maasailand." *Nature & Resources: Managing Our Common Resources* 27(4):10-17.
- Kuhn, Thomas S. 1970. "Logic of Discovery or Psychology of Research." In *Criticism and the Growth of Knowledge*, ed. Imre Lakatos and Alan Musgrave, 1-23. Proceedings of the International Colloquium in the Philosophy of Science, London, 1965. Cambridge: Cambridge University Press.
- Kurian, Mathew, and Tom Dietz. 2004. "Irrigation and Collective Action: A Study in Method with Reference to the Shiwalik Hills, Haryana." *Natural Resources Forum* 28(1) (February): 34-49.
- Lakatos, Imre. 1970. "Falsification and the Methodology of Scientific Research Programmes." In *Criticism and the Growth of Knowledge*, ed. Imre Lakatos and Alan Musgrave, 91-195. Proceedings of the International Colloquium in the Philosophy of Science, London, 1965. Cambridge: Cambridge University Press.
- Lam, Wai Fung. 1998. *Governing Irrigation Systems in Nepal: Institutions, Infrastructure, and Collective Action*. Oakland, CA: ICS Press.
- Levine, Gilbert, Ko Hai Sheng, and Randolph Barker. 2000. "The Evolution of Taiwanese Irrigation: Implications for the Future." *International Journal of Water Resources Development* 16(4) (December): 497-510.
- Lovett, Jon, Stuart Stevenson, and Hilda Kiwasila. 2002. "Review of Common Pool Resource Management in Tanzania." Natural Resources Systems Programme, Final Technical Report. Department for International Development, Strategy for Research on Renewable Natural Resources. Downloaded on 21 July 2001 from <http://www.york.ac.uk/res/celp/webpages/projects/cpr/tanzania/pdf/final%20report.pdf>.
- Mahoney, James. 2003. "Strategies of Causal Assessment in Comparative Historical Analysis." In *Comparative Historical Analysis in the Social Sciences*, ed. James Mahoney and Dietrich Rueschemeyer, 337-72. New York: Cambridge University Press.
- Making Agriculture Sustainable (MAS). "Making Agriculture Sustainable." Accessed <http://adm-websrv3a.sdu.dk/mas/> on 20 July 2005. Most recent recorded update on 21 September 2000.
- Makombe, Godswill, Ruth Meinzen-Dick, Stephen P. Davies, and R. K. Sampath. 2001. "An Evaluation of Bani (Dambo) Systems as a Smallholder Irrigation Development

- Strategy in Zimbabwe.” *Canadian Journal of Agricultural Economics* 49(2) (July): 203-16.
- Martin, Fenton. 1985. “Common Pool Resources: A Preliminary Bibliography.” Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.
- McCarthy, Nancy, and Jean-Paul Vanderlinden. 2004. “Resource Management under Climatic Risk: A Case Study from Niger.” *Journal of Development Studies* 40(5) (June): 120-42.
- McCay, Bonnie J., and James M. Acheson. 1987. *The Question of the Commons: The Culture and Ecology of Communal Resources*. Tucson: University of Arizona Press.
- McKean, Margaret A. 1992. “Management of Traditional Common Lands (Iriaichi) in Japan.” In *Making the Commons Work: Theory, Practice, and Policy*, ed. David Bromley et al., 367-91. San Francisco, CA: ICS Press.
- McKean, Margaret A., and Elinor Ostrom. 1995. “Common Property Regimes in the Forest: Just a Relic from the Past?” *Unasylva* 46(180):3-15.
- National Research Council. 1986. *Proceedings of the Conference on Common Property Resource Management*. Washington, D.C.: National Academy Press.
- Netting, Robert McC. 1981. *Balancing on an Alp: Ecological Change and Continuity in a Swiss Mountain Community*. New York: Cambridge University Press.
- Nugent, Jeffrey B., and Nicholas Sanchez. 1999. “The Local Variability of Rainfall and Tribal Institutions: The Case of Sudan.” *Journal of Economic Behavior and Organization* 39:263-91.
- Oerlemans, Natasia, and Gerald Assouline. 2004. “Enhancing Farmers’ Networking Strategies for Sustainable Development.” *Journal of Cleaner Production* 12(5) (June): 469-78.
- Ostrom, Elinor. 1998. “The International Forestry Resources and Institutions Research Program: A Methodology for Relating Human Incentives and Actions on Forest Cover and Biodiversity.” In *Forest Biodiversity in North, Central and South America, and the Caribbean: Research and Monitoring, Man and the Biosphere Series*, vol. 21, ed. F. Dallmeier and J. A. Comiskey, 1-28. Paris: UNESCO; New York: Parthenon.
- Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.
- Ostrom, Elinor, Roy Gardner, and James Walker. 1994. *Rules, Games, and Common-Pool Resources*. Ann Arbor: University of Michigan Press.

- Oyono, Phil René. 2004a. "The Social and Organisational Roots of Ecological Uncertainties in Cameroon's Forest Management Decentralisation Model." *European Journal of Development Research* 16(1) (March): 174-91.
- Oyono, Phil René. 2004b. "One Step Forward, Two Steps Back? Paradoxes of Natural Resources Management Decentralisation in Cameroon." *Journal of Modern African Studies* 42(1):91-111.
- Pender, John, Pamela Jagger, Ephraim Nkonya, and Dick Sserunkuuma. 2004. "Development Pathways and Land Management in Uganda." *World Development* 32(5) (May): 767-92.
- Pokorny, Benno, and Heiner Schanz. 2003. "Empirical Determination of Political Cultures as a Basis for Effective Coordination of Forest Management Systems." *Society & Natural Resources* 16(10) (November): 887-908.
- Poteete, Amy R. 2001. "The International Forestry Resources and Institutions (IFRI) Research Program and the Search for Communal Management of Forest Resources." Special issue on Non-Timber Forest Products, *EFTRN (European Tropical Forestry Research Network) News* 32 (Winter): 73-75.
- Poteete, Amy R. 2002. "Exclusion as a Strategy for Regulating the Use of Forest Resources." In *Institutions for Sustainable Management*, ed. Paul O. Ongugo, Jane W. Njuguna, and Serah W. Mwanyiky, 52-72. Proceedings of the 2<sup>nd</sup> Biennial Meeting of the International Forestry Resources & Institutions (IFRI) Research Network held at Kenya Forestry Research Institute (KEFRI), Nairobi, Kenya, June 23-28, 2002. Nairobi: Kenya Forestry Research Institute (KEFRI).
- Poteete, Amy R., and Elinor Ostrom. 2004a. "In Pursuit of Comparable Concepts and Data about Collective Action." *Agricultural Systems* 82(3) (December): 215-32.
- Poteete, Amy R., and Elinor Ostrom. 2004b. "Heterogeneity, Group Size and Collective Action: The Role of Institutions in Forest Management." *Development and Change* 35(3) (June): 437-61.
- Poteete, Amy R., and Elinor Ostrom. 2004c. "Conceptual Consistency and Data Comparability: Methodological Challenges to Empirical Research on Collective Action." Poster presented at the 100<sup>th</sup> Annual Meeting of the American Political Science Association, Palmer House Hilton, Chicago, Illinois, September 2-5, 2004.
- Poteete, Amy R., and Elinor Ostrom. Forthcoming. "An Institutional Approach to the Study of Forest Resources." In *Human Impacts on Tropical Forest Biodiversity and Genetic Resources*, ed. J. Poulsen. New York: CABI Publisher.

- Poteete, Amy R., and David Welch. 2004. "Institutional Development in the Face of Complexity: Constructing Systems for Managing Forest Resources." *Human Ecology* 32(3) (June): 279-311.
- Quinn, Claire H., Meg Huby, Hilda Kiwasila, and Jon C. Lovett. 2003. "Local Perceptions of Risk to Livelihood in Semi-Arid Tanzania." *Journal of Environmental Management* 68(2) (June): 111-19.
- Ragin, Charles C., and Howard S. Becker. 1992. *What is a Case? Exploring the Foundations of Social Inquiry*. New York: Cambridge University Press.
- Resosudarmo, Ida Aju Pradnja. 2004. "Closer to People and Trees: Will Decentralisation Work for the People and the Forests of Indonesia." *European Journal of Development Research* 16(1) (March): 110-33.
- Ribot, Jesse C. 2004. "Say What You Mean." *CPR Digest* 68 (March): 4-5.
- Richards, Michael. 1997. "Common Property Resource Institutions and Forest Management in Latin America." *Development and Change* 28 (January): 95-117.
- Rueschemeyer, Dietrich. 2003. "Can One or a Few Cases Yield Theoretical Gains?" In *Comparative Historical Analysis in the Social Sciences*, ed. James Mahoney and Dietrich Rueschemeyer, 305-36. New York: Cambridge University Press.
- Runge, C. Ford. 1981. "Common Property Externalities: Isolation, Assurance and Resource Depletion in a Traditional Grazing Context." *American Journal of Agricultural Economics* 63(4):596-606.
- Ruttan, Lore M., and Monique Borgerhoff Mulder. 1999. "Are East African Pastoralists Truly Conservationists?" *Current Anthropology* 40(5):621-52.
- Sarch, Marie-Therese. 1996. "Fishing and Farming at Lake Chad: Overcapitalisation, Opportunities, and Fisheries Management." *Journal of Environmental Management* 48(4) (December): 305-20.
- Samad, M., and Douglas Vermillion. 1999. "An Assessment of the Impact of Participatory Irrigation Management in Sri Lanka." *International Journal of Water Resources Development* 15(1/2) (March): 219-40.
- 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, 247-66. Ann Arbor: University of Michigan Press.
- Schlager, Edella, William Blomquist, and Shui Yan Tang. 1994. "Mobile Flows, Storage and Self-Organized Institutions for Governing Common-Pool Resources." *Land Economics* 70(3) (August): 294-317.

- Schlager, Edella, and Elinor Ostrom. 1992. "Property-Rights Regimes and Natural Resources: A Conceptual Analysis." *Land Economics* 68(3) (August): 249-62.
- Schoonmaker Freudenberger, Mark. 1993. "Regenerating the Gum Arabic Economy: Local-Level Resource Management in Northern Senegal." In *In Defense of Livelihood: Comparative Studies on Environmental Action*, ed. John Friedmann and Haripriya Rangan, 52-78. West Hartford, CT: Kumarian Press.
- Seabright, Paul. 1993. "Managing Local Commons: Theoretical Issues in Incentive Design." *Journal of Economic Perspectives* 17(4) (Fall): 113-34.
- Shivakoti, Ganesh P., and Elinor Ostrom. 2002. *Improving Irrigation Governance and Management in Nepal*. Oakland, CA: ICS Press.
- Simmons, Cynthia S. 1997. "Forest Management Practices in the Bayano Region of Panama: Cultural Variations." *World Development* 25(6) (June): 989-1000.
- Singleton, Sara. 1999. "Commons Problems, Collective Action and Efficiency: Past and Present Institutions of Governance in Pacific Northwest Salmon Fisheries." *Journal of Theoretical Politics* 11(3):367-91.
- Somanathan, E., R. Prabhakar, and B. S. Mehta. 2002. "Collective Action for Forest Conservation: Does Heterogeneity Matter?" New Delhi, India: Indian Statistical Institute. Available on-line at <http://www.isid.ac.in/~planning/workingpapers/dp02-01.pdf> Accessed 22 July 2004.
- Stern, Paul C., Thomas Dietz, Nives Dolšak, Elinor Ostrom, and Susan Stonich. 2002. "Knowledge and Questions after 15 Years of Research." In *The Drama of the Commons*, ed. Elinor Ostrom, Thomas Dietz, Nives Dolšak, Paul C. Stern, Susan Stonich, and Elke U. Weber, 445-86. Washington, DC: National Academy Press.
- Tang, Shui Yan. 1992. *Institutions and Collective Action: Self-Governance in Irrigation*. San Francisco, CA: ICS Press.
- Thompson, Paul M., Parvin Sultana, and Nurul Islam. 2003. "Lessons from Community Based Management of Floodplain Fisheries in Bangladesh." *Journal of Environmental Management* 69(3) (November): 307-21.
- Tucker, Catherine M. 1999. "Private Versus Common Property Forests: Forest Conditions and Tenure in a Honduran Community." *Human Ecology* 27(2):201-30.
- Tucker, Catherine M. 2004. "Community Institutions and Forest Management in Mexico's Monarch Butterfly Reserve." *Society and Natural Resources* 17(7) (August): 569-87.

- Tucker, Catherine M., and Elinor Ostrom. 2005. "Multidisciplinary Research Relating Institutions and Forests." In *Seeing the Forests and the Trees: Human-Environment Interactions in Forest Ecosystems*, ed. Emilio F. Moran and Elinor Ostrom, 81-104. Cambridge, MA: MIT Press.
- Tucker, Catherine M., and Jane Southworth. 2005. "Processes of Forest Change at the Local and Landscape Levels in Honduras and Guatemala." In *Seeing the Forests and the Trees: Human-Environment Interactions in Forest Ecosystems*, ed. Emilio F. Moran and Elinor Ostrom, 253-78. Cambridge, MA: MIT Press.
- van Steenberg, Frank. 1995. "The Frontier Problem in Incipient Groundwater Management Regimes in Bolchistan (Pakistan)." *Human Ecology* 23(1) (March): 53-74.
- Varughese, George, and Elinor Ostrom. 2001. "The Contested Role of Heterogeneity in Collective Action: Some Evidence from Community Forestry in Nepal." *World Development* 29(5):747-65.
- Western, David. 1982. "The Environment and Ecology of Pastoralists in Arid Savannas." *Development and Change* 13(2) (April): 183-211.