TITLE: STUDYING POWER WITH THE SOCIAL-ECOLOGICAL SYSTEM FRAMEWORK

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ABSTRACT

A long-standing divide exists among social scientists regarding power and its effects on the sustainability of social-ecological systems (SESs). In some disciplines, such as political ecology, power is given a place of prominence and seen as having a significant impact on social-ecological processes and outcomes. In contrast commons theory, a new institutionalist strand of environmental research, deliberately sidelines power to focus on the relationship between institutions and sustainability. Historically, there has been little constructive interaction between these power-centered and institution-centered approaches. Therefore we apply the SES framework, a tool explicitly designed to confront interdisciplinary puzzles, to ask whether it can be used to bridge the gap between these two traditions of social-ecological research. The chapter outlines a systematic approach to integrate diverse conceptualizations of power with the SES framework and then applies this to study the relationship between power and social-ecological outcomes. The analysis suggests that the SES framework is a promising tool for social science integration, but also that important questions remain concerning the validity of classifications, measurement, and statistical tests. We conclude with a call for greater interdisciplinary attention to questions of power with the SES framework to better understand its normative and positive implications for sustainable and equitable governance of SESs.

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INTRODUCTION

There is no concept that has captivated philosophers, historians, geographers, and political scientists, quite like *power*. Scholars have long posed theoretical questions concerning the existence, origins, and manifestations of power without settling on anything resembling consensus (Machiavelli [1532] 1988; Hobbes [1651] 2010). Normative questions regarding who should rule, under what conditions, and for what purposes have similarly been mired in centuries of debate that offer perspectives and insights, but no clear answers (Wilson 1887; Waldo 1948; V. Ostrom 2008).

Differential treatments of power also lie at the heart of a long-standing divide among social scientific traditions in the study of social-ecological systems (SESs). Power is central in the interdisciplinary field of political ecology, where it is understood as a core driver of social-ecological outcomes (Lebel et al. 2010). In contrast, the "Bloomington School" of new institutionalists (grounded in the work of Vincent and Elinor Ostrom, et al.) deliberately moved away from the focus on power that dominated twentieth-century political science—a focus they felt to be "extreme and limiting" (Aligica and Boettke 2011, p. 30). Instead, they directed their attention to institutions and how they affect the prospects for self-organized governance of common-pool resources (Ostrom 1990).

Institutions refer to the formal and informal rules, norms, and shared strategies (or conventions) that structure human interactions at all levels of social organization (Ostrom 2005). They are linguistic statements that specify what actions must, must not, or may be taken given certain conditions, and as such, they may exist in written form, in the minds of individuals, or both (Crawford and Ostrom 1995). New institutionalists focus on how groups can create credible commitments to limit individual selfishness and obtain greater benefits for the collective (Dietz et al. 2002). When groups are able to communicate and develop trust, they are sometimes able to extricate themselves from predicted tragedies by forming institutions that prescribe cooperative behavior (Ostrom et al. 1994). This approach tends to assume that the outcomes of collective action benefit the group as a whole and that members of a group share a common understanding of desired outcomes. These assumptions give this work an air of equality and symmetry that often overshadows the importance of power and distributional inequalities. As a result, the new institutionalist view that social-ecological sustainability is primarily a function of implementing the "right kinds" of institutions is often seen as overly optimistic and simplistic (Agrawal 2003; Clement 2010).

In recent years, new institutional theories and frameworks—inclusive of common-pool resource (CPR) theory, the institutional analysis and development (IAD) framework and social-ecological system (SES) framework—have faced increasing criticism for failing to adequately attend to issues of power, politics, and inequality and how they affect environmental governance processes (Agrawal 2013). For example, Mosse (1997, p. 470) has argued that "historically-specific structures of power, rather than simply calculated pay-offs (or traditional wisdom) underlie the norms and conventions of collective resource use, and account for the occurrence and persistence of local institutions of resource use." Agrawal (2003) has similarly suggested that commons research does not adequately attend to intragroup politics, power, and resistance. He argues that

the relationship between power and rights to access and use natural resources should complement the narrow focus of new institutionalist scholars on internal institutions and rules.

This chapter takes these critiques as a point of departure to begin to develop a systematic approach to integrate power with institutional studies of SESs. Our main goal is to assess whether the concepts of power can be explored and analyzed with the SES framework and whether such an endeavor is potentially fruitful. To this end, we structure our study in four stages. First, we provide an overview of the SES framework, which aims to enhance cross-disciplinary theory-building by providing "the most general set of variables [or attributes] that should be used to analyze all types of [SES] settings" (Ostrom 2005, p.28). Second, we outline a process for operationalizing various concepts of power through this framework. Third, we illustrate how this process may be used to test a hypothesis—in this case, that power affects SES outcomes. Toward this end, we review how some new institutionalists have thought about, defined, and studied power and then classify these definitions using existing attributes in the SES framework. We then identify operational indicators of these attributes using data from a collaborative forest governance database—International Forestry Resources and Institutions (IFRI)—and use these to conduct an illustrative quantitative analysis of the effects of power on a combined social-ecological outcome. Although we use quantitative data analysis techniques in our illustration, qualitative, quantitative, and mixed-methods approaches all stand to make distinct and complementary contributions to understand the role of power in resource governance. Fourth, we reflect on this analysis and its conclusions to consider the extent to which the SES framework can be used to integrate power with institutionally-oriented approaches.

This chapter contributes four main arguments relevant to scholars interested in bridging power-centered and institution-centered approaches. First, power is, and always has been, a core feature of new institutionalist thinking, although the term power is rarely invoked explicitly. Second, if the SES framework is to provide a metatheoretical structure for interdisciplinary, systematic, and diagnostic studies of sustainability as it intends, then this structure must be able to account for power. Third, the SES framework can be used to integrate power-centered approaches with institutional analysis, at least with regards to institutional forms of power. Lastly, however, there remains a need to consider more diverse conceptions of power and to determine whether greater integration between these two traditions is possible, and what if any implications this has for the SES framework and the study of sustainability.

Thinking about power and SESs across disciplines

Perhaps the primary challenge in incorporating power into an analysis is grappling with the many competing and overlapping conceptualizations of power that exist across disciplines. Incorporating power into an understanding of human-environment relations is, thus, without a doubt an interdisciplinary endeavor. While the range of conceptualizations of power may at first seem overwhelming, and reviewing them in detail is indeed beyond the scope of this chapter, it is nonetheless helpful to delineate some broad categories. For example, one branch of political ecology emphasizes the primacy of materialist conceptions of power, drawing on ideas rooted in the scholarship of Marx. The focus here is on differing control over and access to natural resources and the influence of material conditions on social and ecological outcomes. As

Robbins (2004) asserts, no explanation of environmental change is complete, therefore, without serious attention to who profits from changes in control over resources, and without exploring who takes what from whom, (52). Other researchers and theorists are more concerned with discursive forms of power, or those ways of talking about, representing, and generating knowledge about the world that influence human-environment relations. Discourses can both create and limit the realm of possibility for how humans may think, act, and behave with regards to the natural world. Post-structural approaches to power, such as Foucault, conceive of a discourse that includes not just the way actors talk about and represent nature and nature's governance, but also the everyday institutions and activities that shape actors' perceptions of themselves, their desires, and their relationships with the world around them.

In this chapter, we choose to focus on operationalizing and measuring institutional conceptions of power, which are distinct from yet always interrelated with materialist and discourse approaches. We chose to focus on institutional conceptions of power for two reasons. First, the fact that power is an integral aspect of institutions is almost always underemphasized in the current literature. Second, due to the SES framework's disciplinary proximity to institutionalism, testing institutional forms of power is a reasonable first step. Only after showing that institutional forms of power can be taken into account by the SES framework, might we move forward in conceptualizing how an analysis of materialist, discursive, or post-structural accounts of power might be applied within the framework.

INCORPORATING POWER WITHIN THE SES FRAMEWORK

The SES framework is a particularly noteworthy addition to the set of frameworks, theories, and models used for the study of sustainability (Ostrom 2007, 2009). However, the SES framework, like its predecessor the IAD framework, appears mostly silent on questions of power with the notable absence of terms such as "power" or "politics." Though not explicitly included, several key potential indicators of institutional power, such as the operational rules governing the system, *are* included. These attributes can be employed to ask questions concerning how different levels of access and control over resources are shaped by institutional characteristics of the system and how, in turn, these relationships may influence social-ecological outcomes. Before turning to this question, we briefly describe the SES framework, and then consider how it may be used to study the effects of power on sustainability (for a more comprehensive description, we refer readers to Ostrom 2007; Basurto and Ostrom 2009; Ostrom and Cox 2010).

Overview of the SES framework

The SES framework explicitly aims to bridge disciplinary and methodological boundaries while facilitating the synthesis of disparate studies by providing a common classificatory framework containing potentially important SES attributes and relationships. Derived from the IAD framework, the SES framework retains the action situation (Figure 1), a general game-theoretic model of interdependent choice, and carries with it much of the intellectual history of the Bloomington School (Kiser and Ostrom 1982; Ostrom et al. 1994; Crawford and Ostrom 1995; Ostrom 2005). In general, outcomes are understood to be the aggregate result of individual interactions and decisions in action situations structured by attributes of four core components:

resources (RU), resource systems (RS), governance systems (GS), and actors (A). Although this simple model is thought to encompass and explain diverse outcomes in SESs, analytical complexity emerges from the wide range of attributes that collectively define each component and their interactions within action situations. The most recent elaboration of the SES framework (Epstein et al. 2013) includes more than thirty potentially influential attributes pertaining to the four core components of SESs (Table 1). Since the SES framework is structured as a multi-tiered classificatory system, each of these attributes can be further unpacked into types and subtypes such that the full suite of potentially relevant conditions is effectively unknown (Ostrom and Cox 2010).

(Figure 1 and Table 1 here)

To date, the SES framework has been used to study a wide range of systems, including forests, fisheries, irrigation systems, and nature-based tourism (Fleischman et al. 2010; Blanco 2011; Gutierrez et al. 2011; Basurto and Nenadovic 2012; Cinner et al. 2012; Basurto et al. 2013). In adopting a common framework, these studies may advance knowledge more rapidly by generating observations on a common set of attributes that can be readily compared or integrated for large-n analysis. Alternatively, individual case studies may be used to add diagnostic pieces to the overall puzzle of sustainability (Basurto and Ostrom 2009).

The structure of the framework is somewhat flexible, allowing for the integration of additional concepts and attributes to improve the study of SESs. Although no studies of power have been derived from engagement with the SES framework, we do not rush to add attributes here. Given the wide range of conceptualizations of power from different fields and strands of literature, adding a single attribute, "power," would likely create considerable confusion regarding how such an attribute could be operationalized or measured, working contrary to the goal of providing a common classificatory system for SES research. Instead, close examination of various conceptualizations of power reveals that many indicators thereof are already included among the existing attributes of the framework. Thus, our analysis focuses on the extent to which the existing attributes of the SES framework, whether individually or in combination, can be used to operationalize and measure power. We then apply these measures to test the general hypothesis that "power matters" with regards to SES outcomes.

Operationalizing research on the role of power in social-ecological systems

Building on Adock and Collier (2001), this section explicates a four-step process for operationalizing studies of power using the SES framework (Figure 2). This process is designed to help quantitative and qualitative researchers avoid or at least be more aware of threats to validity that emerge in the transition from theory to measurement and on to evaluation or causal inference. While these insights are broadly relevant, they are worth highlighting here given the historic lack of attention to these important issues in the study of SESs.

(Figure 2 here)

The first step is to explicitly adopt particular definitions or theories of power relevant to an SES puzzle. The critique that "power matters" is an authoritative comment regarding a relationship

between a condition and an outcome. However, it is also quite vague given the diverse ways in which power has been defined. Although a few studies of SESs have attempted to bring power-centered and institution-centered theories into constructive conversation (Clement 2010; Gruby and Basurto 2013), these initial efforts reflect a small subset of the diverse ways in which social scientists have thought about, defined, and studied power. Lacking agreement on what power is it seems unlikely that any one test of a theory that "power matters" can produce the types of evidence required to support or reject such a general hypothesis. The challenge then for scholars seeking to bridge these two approaches is to answer which of the many conceptualizations of power matter and under which conditions.

The second step in this process is to either classify the chosen definition in terms of one or more attributes of the SES framework, or add attributes that appear to be missing. In cases where definitions directly map onto attributes, this process is straightforward; in others (i.e., definitions of power); the classification process typically involves a number of assumptions that must be made explicit. For example, Clement (2010) attempts to explain variations between policy intentions and outcomes by "politicizing" the IAD framework and adding two classes of attributes, namely "discourse" and "political-economic context." While she develops a convincing argument that "power matters" and illustrates its effect through a qualitative case study, her addition of "discourse" to the IAD framework reflects only one of many possible classifications of this concept. In fact, one of the core goals of the SES framework is to systematically organize concepts and their definitions such that results are driven by empirical relationships rather than competing definitions or measures (Ostrom 2007).

Upon classification of a definition, the third step is to choose how to operationalize or measure that attribute for empirical analysis. This can be as simple as establishing the presence or absence of some attribute, or involve more complex multivariate measures or qualitative descriptions. Finally, the fourth step is to analyze the effects of measured attributes on the outcomes of interest. Qualitative researchers might analyze these effects by using multiple pieces of evidence to systematically evaluate the claims of competing hypotheses, such as process tracing (George and Bennett 2005; Collier 2011). Quantitative researchers may examine data by using some form of significance test and statistical model. In any case the preceding discussion highlights the complexity inherent in testing a hypothesis that "power matters." It demonstrates the importance of being deliberate and explicit about the necessary and potentially value-laden choices concerning definitions, classifications, and measurement, not to mention those imposed by the choice of inferential methods.

ANALYZING POWER WITHIN THE SES FRAMEWORK

In this section, we seek to illustrate how the SES framework may be used to organize a rigorous, broad research agenda on the effects of power by proceeding through each step of the research process. Our analysis is divided into three main subsections, each of which proceeds through all four steps for specified institutional conceptualizations of power. More specifically, within each subsection, we discuss (1) the distinct institutional definition(s) of power that we are seeking to test, (2) the author(s) associated with that definition, and (3) how that definition may be classified within the SES framework. Finally, we use the IFRI database to operationalize the

attribute(s) and test whether there is a statistically significant relationship between each measure of power and a social-ecological outcome.

The IFRI database is perhaps the single most influential and contemporary source of information with which commons scholars develop and test hypotheses concerning the interactions of people, the environment, and institutions in small-scale SESs. The database is composed of a variety of continuous, categorical, and descriptive variables—including a wide range of attributes present in the SES framework—that are collected using a consistent case-study approach (Wertime et al. 2007). The database is a great enabler of multiple-methods research, although in recent years, as the number of case studies have increased to include more than 400 forests and 600 user groups, IFRI scholars have increasingly turned to large-n quantitative studies that have historically been absent in the commons literature (Andersson and Agrawal 2011; Chhatre and Agrawal 2008, 2009; Persha et al. 2011; Coleman 2009; Coleman and Fleischman 2012). Due to its rigor and its resonance with the SES framework, the IFRI database was chosen for this analytical exercise. A comparable database for the study of large scale systems is the International Regimes database which asks questions concerning the formation, boundaries, and processes of international regimes in response to a wide variety of social, economic and ecological problems (Breitmeier et al. 2006; Young and Zürn 2006). Although certainly useful for a quantitative study of power, the international regimes database, because of its emphasis on international-scale processes, is less suited to respond to specific critiques from political ecology that tend to emphasize the effects of power on individuals and communities.

The sample used in this study was constructed in the following way. First, we selected the user group as the unit of analysis. Next, we dropped cases in the following order: (1) repeat observations of a user group, (2) groups found in the United States, and (3) those with missing data on any of the dependent variables. The omission of the US cases is common, as they differ substantially from the other countries in terms of economic development and the ways in which forest resources are used. Finally, we randomly dropped duplicate observations of user groups that use multiple forests, as well as forests containing multiple user groups, in order to generate a sample including a maximum of one observation per forest and user group. The dependent variable measures social-ecological benefits and is constructed by summing two multifactor indexes that measure social and ecological benefits, respectively. Social or livelihood benefits are measured by performing a factor analysis based on the contributions of a forest to the fuelwood, fodder, and timber needs of a group similar to that of Chhatre and Agrawal (2009). Ecological benefits, on the other hand, are measured by performing a factor analysis on the polychoric correlation matrix of (1) a forester's perception of vegetation density, (2) a forester's assessment of species diversity, and (3) user group perceptions of the condition of the forest. These attributes were similarly used in Andersson and Agrawal (2011), although they simply averaged these figures.

The results are compiled in Table 2 which records the one-way relationship between a particular measure of power and the dependent variable, combined social-ecological benefits. In most cases we report differences in means between groups that possess and lack power. However, polyserial and pairwise correlations are used for Ostrom's and North's definitions given that they are measured using continuous and ordinal indicators, respectively. We generally predict a positive relationship between the power of a group and the dependent variable.

(Table 2 Here)

Institutional power

The conceptualizations of power discussed in this section, while distinct from each other, share a common assumption that institutions—rules, norms, and shared strategies—carry within their particular form and structure the ability to influence societal outcomes. During the first half of the 20th century, an important theoretical innovation of "old" institutionalism was to highlight the distinction between institutional and non-institutional aspects of social phenomena. Institutional factors are those that the policy process can directly influence through laws, rules, and regulations, while non-institutional factors can only be influenced indirectly by means of the particular institutions that are created (e.g., economic or demographic conditions) (V. Ostrom 1976). Embedded within this distinction is an opportunity to study the influence of the former on the latter, or of the ability of institutions to make a difference on a range of existing conditions.

For example, John R. Commons, a particularly prominent "old" institutionalist, proposed an institutional theory of markets that sought to explain the ways in which economic power resulting from the accumulation of wealth, uneven access to resources, and/or monopolies on the means of production could be mitigated by what he referred to as *working rules*. These working rules are scripts that tell individuals what they may or may not, must or must not do as they transact with others (Commons, 1931). Through an emphasis on working rules, Commons (1924, p. 6) examined the "principles of collective control of transactions through associations and governments, placing limits on selfishness, that are more recently included in economic theory" to build a foundation for understanding how the social injustices of laissez-faire capitalism might be mitigated. For Commons, institutions were embodiments of power and thus carried with them the possibility of rectifying what he saw as the problems of the day. Since then, multiple institutional theories have been proposed that each point to the central role that institutions play in allowing individuals and groups to make and adhere to choices in complex environments. Nonetheless, Commons's typically positive view of institutional power has receded as scholars such as Riker (1980) lament the democratic implications of an institutional theory of political processes. The most notable of these implications is that political outcomes are not only the result of the will or "tastes" of the people but also of the institutions that are used to make decisions and the political skills or "artistry" of those who seek to manipulate agendas and exploit opportunities for their own ends. In other words, institutional power may be used and manipulated by individuals or groups in pursuit of their own interests, and thus can serve as the source of, as well as the solution to, social problems.

The Bloomington School of new institutionalists does not often explicitly include power as a distinct or circumscribed concept in its frameworks and analyses. Nonetheless, for scholars interested in questions of institutional power, the Bloomington School has adopted a broad definition of institutions (Crawford and Ostrom 1995; Ostrom 2005) that can be interpreted as a potential carrier of power. First, institutions are said to include de jure (rules-in-form or rules on paper) institutions and de facto (rules-in-use) institutions, as well as social norms and shared strategies. These institutions are further organized into nested levels that govern actions in operational-, collective-, and constitutional-choice situations. In the context of resource

governance, *operational-level* institutions govern how resources are accessed and used. Such rules may state, for example, that only members of a given community—not outsiders—may access a forest, as with community forest concessions in Mexico (Alcorn and Toledo 2000; Bray et al. 2006). Other rules might determine what types of resources may be extracted, during what seasons, and using which harvesting tools. *Collective-choice* institutions, in turn, provide a framework for how—and by whom—operational-level rules are created and modified. A collective-choice institution might state that a majority of forest users are required to approve a rule change or, alternatively, that a local leader has the power to unilaterally create or alter operational rules. Operational-level and collective-choice-level rules are almost always nested in at least one more institutional level—*a constitutional level*—that sets the constraints within which collective-choice rules are determined. The US Constitution is an example of a set of constitutional-level institutions that determine the procedures through which, and the bounds within which, other rule-making procedures are themselves modified (V. Ostrom 2008). For an institutionalist concerned with power and its effect on individuals and groups, the implication is that one must explore not only the effects of operational rules but also the formal and informal institutions that affect how operational rules are chosen, as well as the configurations of actors that hold power to initiate and manipulate these processes.

We begin the analysis with the most basic definition of institutional power, which suggests that any and all institutions have the capacity to privilege some groups, at the expense of others (Riker 1980; Immergut 1998; Pierson 2000). Thus all institutions, including operational rules (GS5), property-rights systems (GS4), collective-choice (GS6) and constitutional rules (GS7), as well as monitoring and sanctioning rules (GS8) merit consideration as unique classifications of institutional power. The IFRI database is replete with such details, which allowed us to measure group-level subjective perceptions of operational rules, to determine whether users participate in collective-choice and monitoring processes, and to establish whether any member(s) of a group possess property rights over the forest commons. The assumptions tested by these measures are that the institutional power of a group is higher when (1) operational rules reflect subjective interests of the group of resource users, (2) group members participate in the rule-making process, (3) group members monitor conformance to rules, and (4) group members hold enforceable property rights. Broadly speaking the results indicate a positive relationship between social-ecological benefits and groups that possess power in the form of favorable operational rules (GS5) and participate in monitoring and sanctioning processes (GS8). Power as characterized by participation in collective-choice processes (GS6) and property-rights systems (GS4) did not have a significant relations with the dependent variable, although this is possibly the result of the bivariate analysis that fails to control for additional sources of heterogeneity.

Elinor Ostrom's definition of power

Although the Bloomington School is often criticized for the general absence of power in related studies, Ostrom (2005) offers a clear and concise definition of power in her seminal work on the IAD framework, *Understanding Institutional Diversity.* According to Ostrom:

> the "power" of an individual in a situation is the value of the opportunity (the range in the outcomes afforded by the situation) times the extent of control. Thus, an individual can have a small degree of power, even though the individual has absolute control if the

amount of opportunity in a situation is small. The amount of power may also be small when the opportunity is large, but the individual has only a small degree of control. (2005, p. 50)

This definition has several implications for power and how it can be studied. First, it suggests that a value that corresponds to power can be assigned to each actor, and does not necessarily imply a zero sum situation. Second, power also varies with the expected benefits and costs of a situation, such that the power of actors holding a small amount of control over a valuable opportunity may be equivalent or greater than that of an actor holding a large degree of control over a less valuable opportunity. For example, an individual vote among many on a very important and potentially rewarding issue may offer more power than unilateral control over a situation with a less valuable outcome. Finally, power can be measured and said to exist as a "power to" do something regardless of whether an actor chooses to make use of it.

Ostrom's (2005) definition of power could be operationalized at any of the institutional levels (i.e., operational, collective choice, constitutional), although we chose to focus on the collective-choice level. Collective-choice rules are often seen as particularly important sources of power because they allow participants to modify the rules that govern operational situations from which flow the majority of instrumental benefits and costs. For instance, when forest users operating under a set of operational rules are confronted by a new disturbance or threat, such as external poachers (Fleischman et al. 2010), participation in collective-choice processes allows them to rapidly adjust those rules to changing conditions. We measured power as the product of a binary measurement of participation in decision-making processes regarding operational rules (GS5) and an ordinal measure of the commercial value of the forest (RU4). Thus, the power of a group is highest when they participate in collective-choice processes and the commercial value of the forest is high, while it is lowest when they do not participate in collective-choice processes and the commercial value of the forest is low. Participation is just one of many potential measures of the concept of control that is indicated in Ostrom's definition of power and may not carry a strong correspondence with control over decision-making processes. The results suggest that Ostrom's definition of power has a positive but insignificant relationship with the combined social-ecological benefit measure used in this study.

Steven Lukes's three faces of power

A particularly prominent treatise on power that draws upon institutionalist thinking is Steven Lukes's (2005) *Power: A Radical View*, initially published in 1974. Lukes defines power in terms of the realized ability of one group to affect the other in a way that is contrary to their interests. A clear distinction from Ostrom's (2005) definition of power is that, for Lukes, power exists only when it is exercised and only in situations where one of those groups possesses "power over" the other. He is also particularly attentive to multiple manifestations or "faces" of power. Lukes views these "faces" of power as three distinct processes that individuals or groups use to exercise their power over others, two of which are clearly linked to institutional processes.

The first face of power is by far the easiest to identify and study, as it relies upon the observation of overt conflict between two or more groups participating in some political environment (Lukes 2005). When decisions are ultimately made that favor one group at the expense of the other,

power is said to exist. As an example, a group possessing a 50% plus one majority in a two-party legislature using majority rule could be said to hold "power over" the other group, assuming there are differences in subjective interests. While Lukes acknowledges the general validity of this view, he also points to its inadequacy for explaining situations where power is exercised by limiting the participation of some groups. This is the second face of power, wherein groups with identifiable interests or grievances are prevented from even representing their interests in political processes by virtue of the overt and covert actions of some other group. For example, one group may exercise power over another by preventing the first group from voting, or by constructing institutional barriers that increase the costs of participation in political or administrative decision-making processes (Yackee and Yackee 2006; Obar and Schejter 2010), thereby producing policies that favor the subjective interests of the dominant group. Lukes also offers a third face of power centered on the manipulation of the subjective interests of a group as described below:

> Is it not the most supreme and insidious exercise of power to prevent people, to whatever degree, from having grievances by shaping their perceptions, cognitions and preferences in such a way that they accept their role in the existing order of things, either because they can see or imagine no alternative to it, or because they see it as natural and unchangeable or because they value it as divinely ordained and beneficial? (2005, p. 28)

This conception may or may not be institutional, depending upon the ways in which one conceptualizes the relationship, if any, between institutions and "perceptions, cognitions, and preferences." While the neoclassical economic model of the individual assumes that preferences are stable, recent advances from various fields provide strong evidence that preferences and perceptions are influenced by cultural experience and participation over time in particular institutional environments (Agrawal 2005; Henrich et al. 2006). Alternatively, institutions—as prescriptive, linguistic constructs—can, in some sense, themselves be considered a type of belief. According to Crawford and Ostrom (1995), a shared strategy is a linguistic statement consisting of actions to be taken by individuals defined by some attribute(s) under certain conditions. As an example, they offer a situation where an individual who initiates a call that is disconnected will call back. This simple strategy or social convention addresses a simple coordination problem where either both parties wait for the other to call, or perhaps try simultaneously and receive busy signals by generating shared expectations. Although beliefs about others' actions are certainly representative of the type of shared strategy envisioned by Crawford and Ostrom, it is less clear that the same could be said for beliefs about policies or rules that lack a social dimension.

Lukes's (2005) three faces of power provide three different conceptualizations, two of which we are able to operationalize in this study. Lukes's third face of power was not operationalized due to the difficulty of analyzing outcomes based on belief systems and an inability to distinguish between subjective and objective interests using the data stored in the IFRI database. Lukes's first face of power focuses on subjective perceptions of policy outcomes or operational rules (GS5) between two or more groups that participate in collective choice venues (GS6). This was operationalized by distinguishing between groups that participate in rule-making processes that fail to produce rules that align with their subjective interests and all other groups, with the

assumption that the former lacks, or is subject to, the power of another group. The results indicate that the first face of power has little impact on the combined social-ecological outcome.

The second face of power refers to groups whose subjective interests are not met by operational rules (GS5), but who also do not participate in collective-choice processes (GS6). This is operationalized by distinguishing between groups where operational rules are perceived to be unfair and do not participate in rulemaking, and all other combinations. As opposed to the first face of power, Lukes's second face has a statistically significant and negative relationship with the combined social-ecological outcome. There is, however, an important caveat to this claim. Lukes clearly situates his definitions of power in relative terms, where one group is able to affect another in a way that is contrary to the second group's interests. This analysis assumes the existence of that other group, be it the state or another user group, ignoring the possibility that the lack of participation and dissatisfaction with rules is a result of other factors, most notably intragroup processes or a collective failure to self-organize.

Douglass North and the institutional matrix

While both Ostrom's and Lukes's new institutionalist conceptualizations of power can be easily abstracted from any particular situation, some institutional political economists embed conceptualizations of power within historically contingent contexts that are difficult to account for in quantitative approaches. For example, Douglass North (1990), the economic historian, asked why the economies of some countries performed better than others, and why those countries that fared worse did not simply adopt institutions that enhanced performance. The answer, according to North, is a set of institutions that resists change via a variety of structural and active processes. The most commonly cited process is increasing returns, wherein institutions generate a positive feedback process that favors movement in the same direction of prior decisions by virtue of some combination of benefit flows and increasing exit costs (Pierson 2000; Arthur 1989). Power enters the discussion of increasing returns when institutions privilege some members of a group or society with a greater share of the benefits and greater institutional control that enhances their ability to bargain in collective-choice settings. Pierson (2000) draws upon the community power debate and Lukes (2005) to discuss how, over time, increasing returns processes may transform power from an overt expression of wills to a latent and then hidden conflict as the institutional matrix reinforces itself:

> Increasing returns processes can transform a situation of relatively balanced conflict, in which one set of actors must openly impose its preferences on another set ("the first face of power"), into one in which power relations become so uneven that anticipated reactions ("the second face of power") and ideological manipulation ("the third face") make open political conflict unnecessary. Thus, positive feedback over time simultaneously increases power asymmetries and renders power relations less visible. (Pierson 2000, 259)

These path-dependent processes suggest that the greatest indicator of power may not be found in individual institutions or their simple interactions but rather in the continuity of a particular form of organization to manage transactions or resolve a policy problem. Pierson (1996), for instance, discusses how, once the welfare state has been established in democracies, it tends to persist

because it generates a set of incentives that make change particularly costly for politicians. North (1990), in a more negative light, suggests that the lack of economic development in some countries is the result of inefficient forms of economic organization that persist because those that have invested in that form of organization generate increasing returns and greater bargaining power to ensure its continuity. In any case, both point to the time dimensions or historicity of institutions as an important indicator of their power.

Path-dependent forms of power bound up in institutional matrices are perhaps the most abstract of our definitions of power. We classify path-dependent power in terms of a user group's history of use (A3), although we recognize that this attribute relates to several potentially influential dimensions of use. Nonetheless, we assume that the longer a group has existed in a recognizable form using a particular resource, the more likely they will have built up a set of institutions, or an institutional matrix that creates power for the group against other groups and the state. In contrast, a user group that lacks power is unlikely to be able to maintain a recognizable form, and would instead be characterized by the formation and decay of different groups in the same geographical area. This follows North's argument that the persistence of organizations (i.e., formal and informal groups) in a given environment is tied to their bargaining power. Thus, power can be measured indirectly by considering the length of time that a group has been organized in a recognizable form. This classification was fairly easy to operate with the IFRI database, which allows us to measure the approximate age of the user group that participates in rule-making processes. The results show that this path-dependent form of institutional power is associated with positive social-ecological outcomes (Table 2).

DISCUSSION

The measures of power used in this study reflect a pragmatic attempt to evaluate whether institutional forms of power matter. Some of our findings appear straightforward. For instance, our results indicate that groups with power, as exercised through operational rules and monitoring and sanctioning processes, are associated with better social-ecological outcomes. In addition, we find that Lukes's (2005) second face of power is associated with a particularly large and negative social-ecological outcome. That is, groups that are dissatisfied with operational rules but are unable to enter collective-choice situations and modify those rules, are less likely to develop long-term sustainable patterns of use. These results are not entirely surprising given that they correspond to Ostrom's (1990) design principles and continue to receive support from various sources (Chhatre and Agrawal 2008; Coleman 2009; Cox et al. 2010). Notwithstanding the patterns of association found in this study, important questions remain as to whether power is accurately captured by the classifications and measures that were used, and the extent to which the evidence presented provides a basis for causal inference. This section engages in self-critique to examine some potential limitations of the analysis.

Although some definitions of power, particularly those that refer to specific institutions, were readily classified, it is not certain that their operationalization accurately reflects the power of a group. For instance, with regards to institutional control, groups are assumed to hold greater power if operational rules are perceived to be fair, if they participate in rulemaking, or if they own the forest commons. There is, however, considerable room for debate as to whether a group

could be said to be powerful if it possesses one of these attributes but not others. In addition, North's (1990) view of bargaining power as an output of early choices that generate a process of increasing returns and path dependence is equally problematic. According to our results using North's conceptualization of power, groups that manage to persist in a recognizable form over an extended period of time are more likely to be associated with positive social-ecological outcomes. The proposed explanation is that groups develop a matrix of supportive institutions that set them on a distinct historical trajectory (North 1990; Pierson 2003). However, while a group can be seen as an informal organization whose survival depends upon its ability to generate a continuous stream of benefits to its members, measures of its age may be prone to suffer from idiosyncratic measurement error or measure concepts completely unrelated to power, or even its inverse. India's caste system, for instance, has for centuries been used to define groups; however, it systematically assigns power to some of these groups while withholding it from others. In other words, a group may persist precisely because it finds itself on the less powerful side of socially, politically, or institutionally entrenched power inequities.

Finally, as definitions become more specific to involve interactions among attributes and measures, important questions concerning the level of measurement must be considered. For instance, Ostrom's (2005) definition involving the extent of control (presumably varying between 0 and 1) and value of opportunity (presumably a continuous variable) was operationalized using a binary and ordered variable, respectively. The way in which Ostrom's definition of power was operationalized reflects the availability of data, but also draws attention to the potentially confounding role of measurement of the dependent and independent variables.

Even if one accepts the general validity and assumptions related to definitions, classifications, and measurements offered in this study, there are several reasons why one might still reject the evidence provided. To begin with, most causal inference in the positivist paradigm rests upon the general validity of three attributes of an analysis: (1) association between a cause and an outcome, (2) isolation of potential causes from other attributes of the environment, and (3) the direction of effects (Bollen 1989). Association is generally the least controversial, and in this study were measured using standard methods such as difference of means and correlations. Isolation and direction are typically more problematic, as they ask the researcher to separate causes from all other attributes that may bias estimates and establish whether the "cause" is in fact responsible for producing the "effect." Randomization, matching, or quasi-experiments are often considered the best means with which to isolate factors (Holland 1986; Shadish et al. 2002; Rubin 2005), although in some cases structural models and even linear regression may be sufficient for pseudo-isolation (Pearl 2012). Establishing the direction of causal effects from cross-sectional observational data is even more problematic. Temporal priority (i.e., a gap between the observation of a cause and the outcome), or direct manipulation in an experimental environment, are usually sufficient to infer the direction of a causal effect (Brady 2008). However, in the absence of either, most directional claims using observational data rest upon logical and theoretical understandings of the phenomena. In this case, the analysis neither seeks to isolate power from other influences, nor does the cross-sectional data allow us to infer whether a measure of power precedes the outcome, or instead whether the outcome is actually a cause of power.

A final critique of the empirical analysis is that many of the same measures already appear in the literature on the commons (Chhatre and Agrawal 2008, 2009; Coleman 2009) and have been merely recast in terms of power. Institutional control, for instance, is typically studied in isolation from its normative power-laden implications. This highlights several points that merit additional discussion. First, power is, and always has been, a feature of the commons literature, which should be self-evident from many of the design principles (Ostrom 1990). Minimal rights to organize, participation in collective-choice processes, and the accountability of monitors all concern different types of institutional power held by a group of resource users. That is far from being a power-neutral approach to the study of social-ecological phenomena; power is as an integral part of commons theory and the SES framework. However, the critiques are not entirely without merit. Whereas some traditions, such as political ecology, write about power with all of its associated deleterious implications, institutionalists soften the normative implications as they blandly speak of asymmetries that mask power behind a veil of game-theoretic terminology and a pragmatic emphasis on designing institutions that produce beneficial societal outcomes, however those may be defined. In other words, accompanying the shift in language is a sense that something meaningful is lost. Thus, bringing together multiple disciplines to study power within the SES framework compels researchers to engage explicitly with challenging and inevitable tradeoffs between critical and pragmatic approaches. Moreover, the emphasis on groups, broadly labeled resource users, likely overlooks a wide range of power relations within groups, most notably differential power between elite and non-elite members (Vedeld 2000; Iversen et al. 2006; Mwangi 2006). Finally, it is clear that, while power exists implicitly in the SES framework, it is not given a prominent position; and if trends continue, the range of theorizing and studying power in the institutionalist tradition will remain overly narrow.

CONCLUSIONS: AN INTERDISCIPLINARY AGENDA FOR THE STUDY OF POWER IN SESs

This chapter has illustrated that the SES framework holds great potential for social science integration, and may serve as a bridge between political ecology and commons theory. It further demonstrates that the SES framework is equipped with a wide range of attributes that can be used to study to several definitions or theories of power. Although the analysis presents empirical results with associated significance, the study *does not* provide definitive answers to the questions of whether any individual type of power matters, or which of the many alternatives best captures the concept of power. Instead, our primary goal was to assess whether asking such questions with the SES framework is possible and whether such an endeavor is potentially fruitful. We believe that the answer to both questions is yes, but that there remains considerable work to be done with regards to other theories of power, measurement, and evaluation before the framework could be said to facilitate such an endeavor.

The four methodological steps that we applied in this study provide guidance that other researchers can use to integrate other theories of power within the SES framework. Rather than simply assuming that power exists in some objectively observable way, researchers must attend to the ways in which (1) the values of existing SES attributes differentially affect different actors and groups and (2) different actors and groups contest and reshape the value of SES attributes. For example, instead of asking *what type of operational rules produce better social-ecological outcomes*, we asked *how the perceived fairness of operational rules influences outcomes*. We

reoriented questions about the form of collective-choice institutions to ask whether groups have the power to control the outputs of institutional decision-making processes, and what effect this has on social-ecological outcomes. If we use the SES framework to conceptualize a social-ecological system made up of the four key subsystems and the variable subsets within them, then to wrestle with the role of power within such a system is to examine the shadow that those variables cast on the material, institutional, and discursive attributes of a varied set of actors. Questions of power are investigated in a space of inquiry that is once-removed from the social-ecological system; it does not consist of the subsystems and variables within those subsystems but rather the heterogeneous effects of those variables on different groups, as well as the process through which heterogeneous actors contest those variables. In studying the effects of power, we are not posing questions about the direct relation between the variables and outcomes but about the effects that the differentiated meanings and implications of those variables for different key actors have on social-ecological outcomes. This is why we make the claim, at least regarding institutional conceptualizations of power that "power" or "politics" need not appear as attributes, themselves, within the SES framework. Rather, as we suggest, institutional conceptualizations of power are realized in the relationships between existing attributes and their implications for a specified group of actors.

Similarly, future research on integrating studies of power in the SES framework need not, necessarily, add new power-attributes the framework. Rather, the process of research design and collection should carefully attend to the connections between the values of existing attributes and the implications of those values for particular groups and the resulting effects on social and ecological outcomes. Implicit in an approach that locates power not as a single, discrete attribute but as relationships between one or more attributes and a group of actors, is a claim about the the ontology of power, itself. Specifically, it suggests that power is a composite theoretical construct made up of attributes and relationships. This claim is further supported by the the existence of a wide range of distinct concpetualizations of power from across disciplines. Thus, to engage in a cross-disciplinary study of power in the context of SESs requires us to deconstruct the vague and variegated concept, *power*, and specify its component parts and the relationships among them. The SES framework is well suited for this task.

The general approach adopted in this chapter to study institutional forms of power may be used to advance the study of other conceptualizations. Many materialist approaches from political ecology, for example, suggest that power exists as a result of unequal access and control over wealth, natural resources, or the means of production. An initial glance at the SES would suggest that many of the attributes, including the economic value of the resource, socioeconomic characteristics of the resource users, resource users' dependence on the resource, and property rights regimes, may all serve as appropriate measures of materialist conceptions of power. Moreover it seems likely that the framework could be used to study discursive conceptualizations of power in terms of communicated knowledge, norms, and mental models that shape individuals' beliefs and behavior. Indeed, some attributes of the SES, such as knowledge of the SES/mental models as well as social norms, may provide an opportunity to better understand what, if any, differences exist between knowledge and discourse, and how they are transmitted across groups.

Ultimately, however, whether the SES is fully equipped in its current form to facilitate research on the role of power across all disciplines will require further theoretical, conceptual, and empirical work that is beyond the scope of this chapter. Nonetheless, this general strategy that focuses on identify existing SES attributes and the relationships among groups with respect to those attributes encourages researchers to embrace interdisciplinary approaches to power, while thinking rigourously about how to move through the research processes from conceptualization to operationalization and measurement. The SES framework was designed precisely to facilitate such interdisciplinary work and to provide a foundation upon which multiple disciplinary approaches to research may find, if not agreement, then mutual intelligibility.

Finally, further issues arise as researchers move from measurement to analysis of whether particular conceptualizations of power matter. This analysis presumed to evaluate the effects of power by positing a single causal step from an indicator to the combined social-ecological outcome. However, many scholars view power in terms of a complex web of self-reinforcing historical processes, institutions, and resources that collectively privilege some groups over others (Pierson 2000; Benjaminsen et al. 2009). Furthermore, studying some individual indicator of power in isolation from others may fundamentally conflict with the ways in which power operates to either sustain or degrade social-ecological systems. This reflects a growing debate in the social sciences concerning the ways in which attributes or variables are understood to affect social phenomena. The classic approach that corresponds to multivariate quantitative methods is to assume that variables have a conditionally independent and additive effect on a dependent variable (Freedman 1999). In contrast, many qualitative methodologists view outcomes in terms of a unique confluence of slow- and fast-moving causes that interact in complex ways to produce often unexpected results (Pierson 2003). More recently, a third perspective has emerged that seeks to strike a balance between these two extremes and suggests that outcomes depend upon the state of combinations of attributes that collectively define a case (Ragin 2000; Basurto and Ostrom 2009). In any case, the three perspectives each enjoy support from prominent researchers in the social sciences, and possess different methodological strengths and weaknesses. There is no clear objective standard to select from among these alternatives, leaving the choice mostly to one's own ontological and epistemological assumptions concerning social-ecological phenomena.

The SES framework is a bold and ambitious tool meant to serve a diverse audience of interdisciplinary scholars, many of whom focus explicitly on questions of power and inequality. It is unfortunate that the framework has yet to take greater strides in this direction, forcing scholars to develop ad hoc solutions, or, more likely, to choose alternative, more disciplinary-focused analytical tools. In perpetuating the shift toward a positive theory of environmental governance, the SES framework neglects the important normative question as to why we should care in the first place. The fields of environmental governance in particular and public policy in general exist to confront the problems of society and promote "human dignity" (Lasswell 1951). Power is an integral part of human affairs, and we believe the answer as to whether power ought to be given greater attention from institutional studies of SESs is obvious. However, such an endeavor must seek to explicate the positive and normative implications of diverse forms of power that characterize "alternatives futures" (V. Ostrom 2008).

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Table 1 The social-ecological system framework

Social, Economic, and Political Settings (S)
S1– Economic development. S2– Demographic trends. S3– Political stability.
S4– Other governance systems. S5– Markets. S6– Media organizations. S7– Technology.

(left margin, rotated) Ecological Rules (*ER*)
ER1– Physical rules. ER2– Chemical rules. ER3– Biological rules.

Resource Systems (RS)	Governance Systems (GS)
RS1– Sector (e.g., water, forests, pasture)	GS1– Government organizations
RS2– Clarity of system boundaries	GS2– Nongovernment organizations
RS3– Size of resource system	GS3– Network structure
RS4– Human-constructed facilities	GS4– Property-rights systems
RS5– Productivity of system	GS5– Operational-choice rules
RS6– Equilibrium properties	GS6– Collective-choice rules
RS7– Predictability of system dynamics	GS7– Constitutional-choice rules
RS8– Storage characteristics	GS8– Monitoring and sanctioning rules
RS9– Location	

Resource Units (RU)	Actors (A)
RU1– Resource unit mobility	A1– Number of relevant actors
RU2– Growth or replacement rate	A2– Socioeconomic attributes
RU3– Interaction among resource units	A3– History or past experiences
RU4– Economic value	A4– Location
RU5– Number of units	A5– Leadership/entrepreneurship
RU6– Distinctive characteristics	A6– Norms (trust-reciprocity)/social capital
RU7– Spatial and temporal distribution	A7– Knowledge of SES/mental models
	A8– Importance of resource (dependence)
	A9– Technologies available

Action Situations: Interactions (I) → Outcomes (O)

Activities and Processes:	Outcome Criteria:
I1– Harvesting	O1– Social performance measures
I2– Information sharing	(e.g., efficiency, equity,
I3– Deliberation processes	accountability, sustainability)
I4– Conflicts	O2– Ecological performance measures
I5– Investment activities	(e.g., overharvested, resilience,
I6– Lobbying activities	biodiversity, sustainability)
I7– Self-organizing activities	O3– Externalities to other SESs
I8– Networking activities	
I9– Monitoring activities	
I10– Evaluative activities	

Related Ecosystems (ECO)
ECO1– Climate patterns. ECO2– Pollution patterns. ECO3– Flows into and out of focal SES.

Source: Adapted from McGinnis and Ostrom (forthcoming).

It is not clear to me how these varibles are being measured

Table 2 A preliminary assessment of the relationship between institutional power and total social-ecological benefits from forest commons. Measures for Lukes (2005) first and second face of power records whether a group lacks power; while all remaining measures refer to the power of that group. General predictions are that the relationship between total social-ecological benefits and power should be positive when a group has power and negative when it lacks power.

| Classification	Operationalization	Relationship
Institutional Control		
The power of a group depends upon their rights and responsibilities with regards to the use and management of forest resources		
GS5 Operational-choice rules	Perceived fairness of operational rules (1 = Fair; 0 = Unfair)	+0.443**
GS4 Property-rights system	Owner(s) of forest is a member of the user group (1 = Yes; 0 = No)	-0.334
GS6 Collective-choice rules	User group is responsible for rulemaking (1 = Yes; 0 = No)	-0.029
GS8 Monitoring and sanctioning rules	User group monitors use of forest commons (1 = Seasonally, Year-round; 0 = Occasionally, Never)	+0.450**
Ostrom (2005)[1]: Extent of control and value of opportunity		
The power of a group depends upon the level of control over collective choice situations and the economic value of resources		
GS6 Collective-choice rules +	User group is responsible for rulemaking (1 = Yes; 0 = No) *	+0.095
RU4 Economic value	The commercial value of forest commons (0 = Low; 4 = High)	
Lukes (2005): First face of power		
A group lacks power when they participate in collective-choice processes, but policies are not congruent with their subjective interests		
GS5 Operational-choice rules +	User group participates in rulemaking AND does not perceive the rules as fair (1); Otherwise (0)	-0.102
GS6 Collective-choice rules		
Lukes (2005): Second face of power		
A group lacks power when rules are not congruent with their subjective interests and they do not participate in collective choice processes		
GS5 Operational-choice rules +	User group is not responsible for rulemaking AND does not perceive the rules as fair (1); Otherwise (0)	-0.434**
GS6 Collective-choice rules		
North (1990)[1]: Path dependence and bargaining power		
The power of group covaries with the age of a group or organization		
A3 History of use	The age of the forest user group (years)	+0.159***

*p<0.10; **p<0.05; *** p<0.01, 1 = Correlation
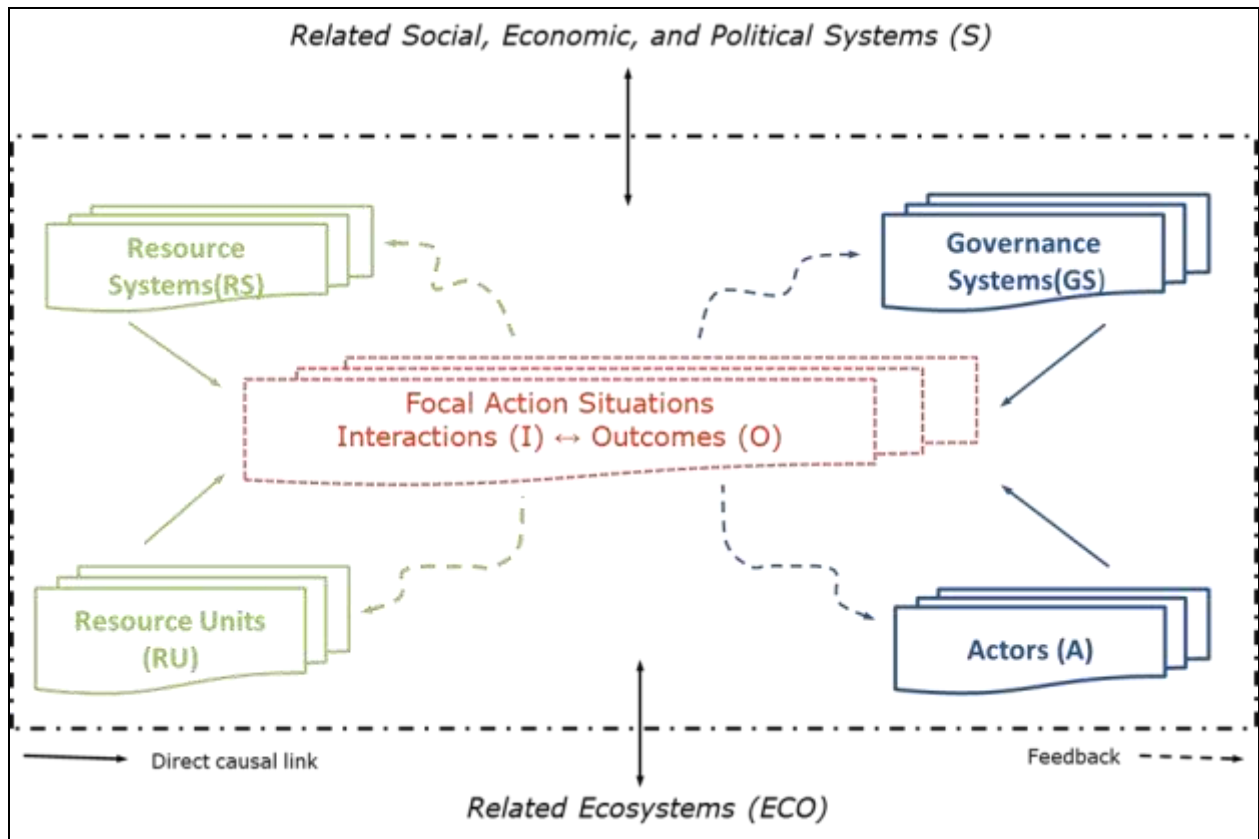
Fig. 1 Analytical structure of the social-ecological system framework. *Source*: Based on McGinnis and Ostrom (forthcoming)
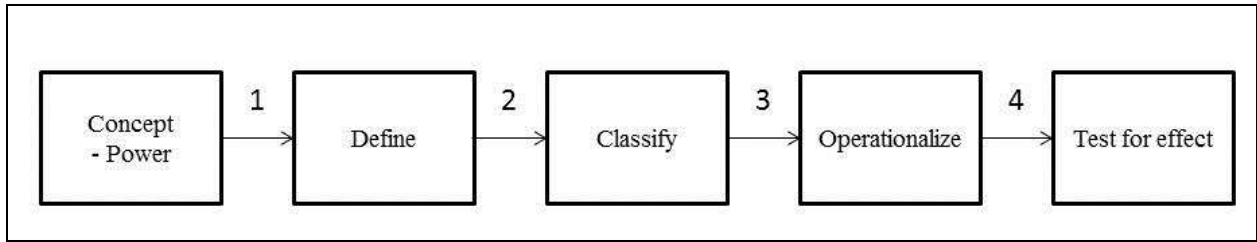
Fig. 2 Steps in testing the effects of power with the social-ecological system framework. *Source*: Elaborated from Adcock and Collier (2001)