

Maurer School of Law: Indiana University Digital Repository @ Maurer Law

Articles by Maurer Faculty

Faculty Scholarship

2019

Combining the IAD and SES Frameworks

Daniel H. Cole

Indiana University Maurer School of Law, dancole@indiana.edu

Graham Epstein

University of Waterloo

Michael D. McGinnis

Indiana University - Bloomington

Follow this and additional works at: <https://www.repository.law.indiana.edu/facpub>

Part of the [Ecology and Evolutionary Biology Commons](#), [Place and Environment Commons](#), and the [Quantitative, Qualitative, Comparative, and Historical Methodologies Commons](#)

Recommended Citation

Cole, Daniel H.; Epstein, Graham; and McGinnis, Michael D., "Combining the IAD and SES Frameworks" (2019). *Articles by Maurer Faculty*. 2741.

<https://www.repository.law.indiana.edu/facpub/2741>

This Article is brought to you for free and open access by the Faculty Scholarship at Digital Repository @ Maurer Law. It has been accepted for inclusion in Articles by Maurer Faculty by an authorized administrator of Digital Repository @ Maurer Law. For more information, please contact wattn@indiana.edu.

Footer Logo

Combining the IAD and SES frameworks

Daniel H. Cole

School of Law and School of Public and Environmental Affairs, Indiana University, USA
dancole@indiana.edu

Graham Epstein

Environmental Change and Governance Group, School of Environment, Resources and Sustainability, University of Waterloo, Canada
graham.epstein@uwaterloo.ca

Michael D. McGinnis

Department of Political Science, Indiana University, USA
mcginnis@indiana.edu

Abstract: Elinor Ostrom’s IAD (Institutional Analysis and Development) and SES (Social-Ecological Systems) frameworks are widely used by social scientists and policy analysts, but many applications fail to take full advantage of the potential utility of either framework. The IAD framework lacks detail regarding the specific variables that influence social interactions and neglects questions of asymmetric power and collective evaluation. The SES framework, meanwhile, supports detailed variable-oriented analyses of social-ecological systems, but rarely addresses the dynamic processes that lie at the heart of the IAD framework. We outline a Combined IAD-SES (CIS) Framework that remedies these problems by combining them in a format suited both to social-ecological systems and other policy settings. Institutional analysts using this combined framework should start their analysis by identifying a set of focal action situations, learning how the relevant collective and constitutional choice arenas shaped their structures, and then thinking deeply about the processes through which those conditions have been (or might be) changed. We demonstrate the potential utility of CIS by applying it to previous research on Maine’s lobster fishery.

Keywords: IAD Framework, institutional analysis, lobster fishery, SES framework

1. Introduction

Elinor Ostrom played a pivotal role in developing two analytical frameworks used by many policy analysts and scholars: the IAD (Institutional Analysis and Development) and the SES (Social-Ecological Systems) frameworks. Both frameworks have facilitated collaborative research and communication among scholars and practitioners from a wide range of disciplinary and professional backgrounds. However, certain aspects of each can result in confusion among readers unfamiliar with the Bloomington School of Political Economy (Aligica and Boettke 2009), or result in applications that only partially realize the full potential of either framework. In this paper we aim to clear up these confusions and encourage users to pursue more sophisticated analyses based on an integrated framework, namely, the Combined IAD-SES Framework, or CIS for short.

We begin with brief summaries of the foundational components of the IAD and SES frameworks, and use elements of each framework to serve as a counterweight to problematic tendencies commonly found in applications of the other. At their core, the IAD and SES are very closely related frameworks, and our discussion highlights their fundamental similarities while attempting to overcome their separate limitations. But our aspirations are limited: we do not pretend to offer a fully developed causal theory or formal model.¹ We are nonetheless confident that the particular combination we propose here can serve as a solid foundation for advances in the study of how institutions and policy outcomes evolve in tandem.

In an effort to forestall misunderstandings, we apply this combined framework to a case familiar to many scholars interested in the origins and operation of self-organized systems of resource governance, namely, lobster fisheries off the coast of Maine. We conclude with a brief discussion of related lines of research by scholars drawing upon other frameworks, in order to locate this CIS framework within its proper context.

2. The IAD framework

The IAD framework that Elinor Ostrom developed alongside colleagues from the Workshop in Political Theory and Policy Analysis has been widely adopted by social scientists to evaluate the effects of alternative institutional arrangements, and to investigate the processes by which institutions emerge and change over time

¹ In Ostrom's vocabulary, the terms "frameworks," "theories," and "models" are terms of art. Ostrom and Cox (2010, 5) suggest that "frameworks" may best be thought of as "metatheoretical conceptual map[s]." Ostrom (2011, 8–9) describes "frameworks" as the "most generalized form of theoretical analysis," providing a general set of variables that comprise a meta-language, which is used for comparative institutional analyses of various "theories" and "models. "Theories" (e.g. economic theory or game theory) posit assumptions and hypothesized specifications of relevant variables (provided by the framework) deemed sufficient to provide adequate explanations or diagnoses of the policy setting under study. "Models" (e.g. the rational actor model or game-theory models) use more "precise assumptions about a limited set of variables and parameters to derive precise predictions about the results of combining these variables using a particular theory."

(see, e.g. Tang 1992; Rudd 2004; Andersson 2006; Ostrom 2007a; Ostrom and Cox 2010). It is widely recognized as one of the leading frameworks in the policy sciences (Weible and Sabatier 2018) and provided the analytical foundation upon which Elinor Ostrom built a collaborative research program on community-based management of natural resources, for which she was named a co-recipient of the 2009 Nobel Memorial Prize in Economic Sciences. Ostrom (1986, 1989, 2005, 2007a, 2010, 2011; see also Kiser and Ostrom 1982) envisioned this framework as a means whereby scholars from multiple disciplines could more effectively communicate with one another, regardless of their diverse perspectives, to better understand complex policy settings.

As shown in Figure 1, the IAD framework represents institutional processes by a series of boxes within which different variables or processes are located. At the heart of the IAD framework is an **action situation**, an abstraction of decision environments in which individuals and corporate actors interact with one another, making choices that jointly determine outcomes of some aspects of a policy question. Individual choices and collective outcomes are influenced by the beliefs and incentives of the relevant individuals, as shaped by the responsibilities and social expectations attached to official positions they may hold, and by the information available to them.

The specific nature of the decision problem faced by actors within a particular action situation is shaped by preexisting **contextual conditions**,² grouped for analytical purposes into three categories: (1) the “nature of the good” under consideration, including all relevant biophysical conditions; (2) “attributes of the community,” social ties and the cultural context within which individuals interact and (3) “rules-in-use,” the existing configuration of laws, regulations, rules, norms, and shared understandings held by the participants to be relevant to their deliberations. Outcomes from an action situation are evaluated by the relevant actors (some of whom may not have been involved in the original decision). Feedback from these outcomes and evaluations can reinforce or induce changes in these contextual conditions, which in turn sets the stage for future interactions.

The IAD framework differentiates among three different types (or levels) of action situations: (1) **operational-choice** settings in which actors’ choices directly impact tangible outcomes, (2) policymaking or **collective-choice** settings in which actors shape the rules that constrain actors in operational-choice arenas, and (3) settings for **constitutional-choice** in which decisions are made concerning which actors have a stand in different choice situations as well as which kinds of alternative institutional mechanisms are available to them as they

² Although in earlier versions of the IAD figure the boxes for these contextual conditions are labeled as “exogenous factors,” those factors are instead endogenous to cycles of collective action occurring (or not occurring) in many interlinked action situations. Consequently, we use the terms “contextual factors” or “pre-existing conditions” to denote the values taken on by relevant variables immediately preceding the occurrence of a focal action situation (or a network of inter-connected action situations).

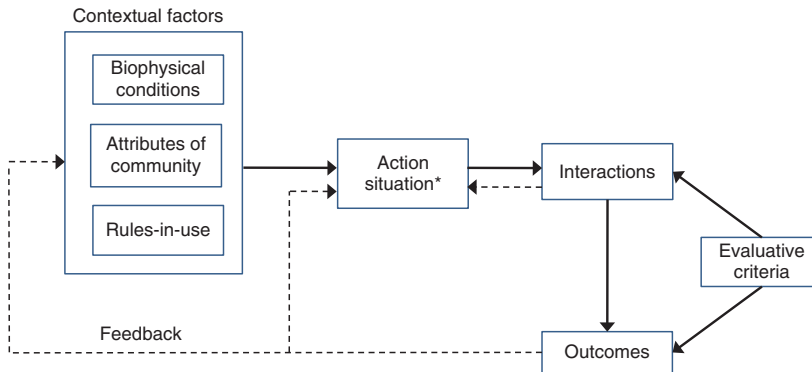


Figure 1: Basic components of the IAD framework.

Source: Adapted from Ostrom (2010, 646).

*Note: Earlier versions divided an action situation into actors and an action arena.

make their collective deliberations and operational-level choices (Ostrom 2005, 58–62). In all types of action situations, biophysical, legal-institutional, and socio-cultural factors interact in complex ways to shape patterns of interactions and outcomes.

Each action situation describes a nexus in which a group of decision makers jointly confront important decisions related to some policy concerns. Potential outcomes are differentially valued by actors with partial control over the final determination of results. Ostrom (1986, 2005) explicitly frames an action situation as a generalization of standard game models. To define a game, modelers must specify the actors involved, the information available to them, their options and the outcomes their choices can jointly generate. Similarly, an action situation is configured by interlocking “working components,” related in the following manner:

Participants, who can either be individuals or any of a wide diversity of organized entities, are assigned to *positions*. In these positions, they choose among *actions* in light of their *information*, the *control* they have over *action-outcome linkages*, and the *benefits and costs* assigned to actions and outcomes. (Ostrom 2005, 188; italics added)

The specific nature of each of these italicized components will have been determined by processes occurring previously or simultaneously in other strategic interactions, that is, in other action situations occurring at any of the three levels of choice.

The strength of the IAD framework stems from “its systematic theoretical focus on the impact of rules and norms on individual incentives in complex systems, its emphasis on empirical analysis of outcomes and consideration

of multiple dynamic systemic processes that jointly affect those outcomes” (Rudd 2004). In short, the IAD framework recognizes the complexity of the world, but provides researchers with a tool to cope with this complexity and integrate knowledge across multiple studies and methods. The framework is sufficiently general to explore collective action problems of all kinds, but its greatest influence has been in the area of environmental policy where it was used to uncover the institutional foundations of sustainable community-based natural resource management (Ostrom 1990; Gibson et al. 2000; Cox et al. 2010). Nonetheless the framework has also been used, albeit to a lesser extent, to explore the processes by which institutions for common-pool resource management emerge (Ostrom 1990, Chapter 4; Lubell et al. 2002; Grossman 2019), and understand the factors influencing the delivery of public services in metropolitan areas (Bushouse 2011; Oakerson and Parks 2011).

Although most published applications of the IAD framework include a version of Figure 1, that figure inappropriately conveys the image of an atomistic action situation, which is not how Ostrom intended this framework to be understood. Her writings clearly stress that no action situation exists in total isolation from others (see Kiser and Ostrom 1982; Ostrom 1986, 1989, 2005). Figure 2 shows how a single action situation can be connected to a series of “adjacent” action situations, each of which has the effect of setting the values for one or more of the working components that define that focal action situation. In general, no single action situation can be fully understood without careful consideration of the web within which it resides.

A close examination of the “canonical” IAD representation of Figure 1 reveals an implicit clue that points towards the necessary involvement of at least one more action situation beyond the one being represented. Evaluative criteria do not come out of nowhere, but must have been determined by actors establishing the relevance of alternative evaluative criteria to particular situations. Presumably, individual actors in the focal action situation will engage in various forms of evaluation as they consider their next choices. In addition, for any single (type of) action situation, there must exist at least one corresponding collective choice arena in which actors have, either individually or as a group, selected a list of criteria they deem appropriate for evaluation of its outcomes.

Figure 2 does not indicate that each action situation is associated with its own unique categories of contextual conditions. Instead, it is more useful to presume that many of the same biophysical conditions, community attributes, and rules-in-use may apply to multiple nodes in any network of adjacent action situations. Implicitly, then, all factors within a given category that are deemed to be relevant to at least one action situation in that network could, for analytical purposes, be collected together into a comprehensive list of relevant variables within that category. Then, the specific contextual conditions applying to any particular action situation would be a subset of factors drawn from these comprehensive lists. This same idea was incorporated into the SES framework.

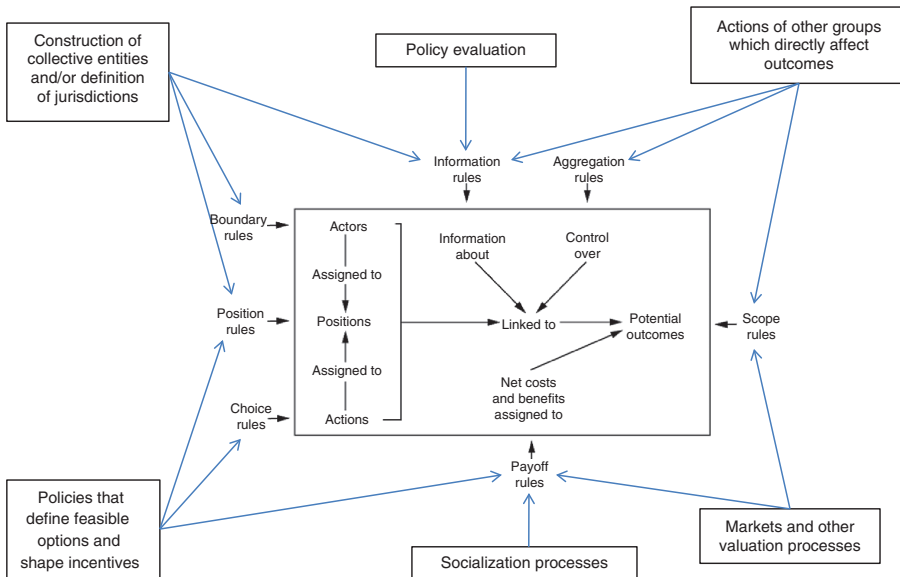


Figure 2: Action situations adjacent to a focal action situation.

Source: McGinnis (2011, 54); Interior figure based on Ostrom (2005, 189).

3. The SES framework

The IAD framework was promoted as an interdisciplinary research tool with which social and natural scientists could build knowledge concerning the sustainability of social-ecological systems. However, after many years of criticism and complaints that the IAD framework paid insufficient attention to the diversity and complexity of natural systems and processes (Berkes and Folke 1998; Young 2002; Agrawal 2003; Ostrom and Cox 2010, 6) and to alternative social science theories (such as Young 2002), Ostrom and her colleagues began developing a framework specifically designed for the analysis of closely-coupled social-ecological frameworks (Anderies et al. 2004; Ostrom 2007b, 2009; Ostrom et al. 2007; Ostrom and Cox 2010; McGinnis and Ostrom 2014).

Figure 3 shows the basic components of the SES framework, as modified by Epstein et al. (2013). It includes seven categories of attributes of any social-ecological system: Resource Systems (RS), Resource Units (RU), Governance Systems (GS), Actors (A), Related Social, Economic and Political Systems (S), Ecological Rules (ER), and Related Ecosystems (ECO). Those first-tier components are further decomposable into second-, third-, and in some cases even fourth-tier variables (as in Table 1). This nested structure supports finely-grained analyses of social and ecological conditions, which is the chief strength of the SES framework.

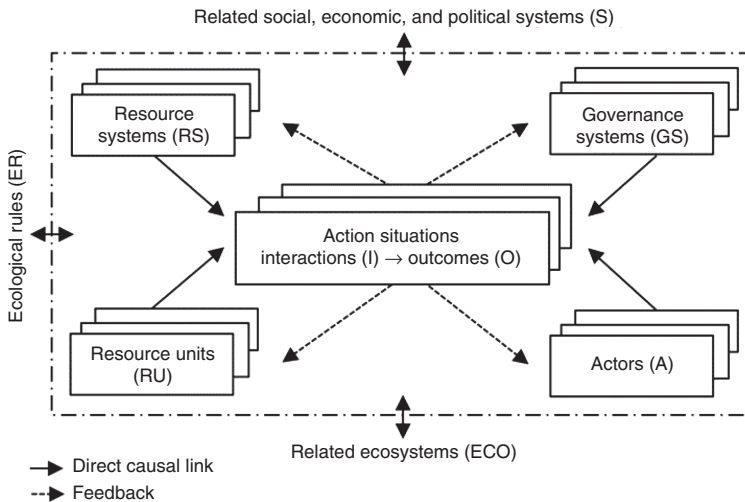


Figure 3: The SES framework.

Source: Adapted from Ostrom and Cox (2010) and Epstein et al. (2013).

The SES framework has not been applied to as wide a range of policy settings as IAD (Schlager and Cox 2018), but nonetheless has been used to investigate the governance of forests, fisheries, irrigation and rangelands (i.e. Ostrom and Cox 2010; Fleischman et al. 2010; Gutierrez et al. 2011; Addison and Greiner 2016). Although it was intended to facilitate consistent data coding for purposes of assessments across numbers of cases (see, e.g. Ostrom and Cox 2010, 9; Fleischman et al. 2014; Ban et al. 2017), considerable difficulties remain to coordinate the collection and coding of data by different research teams (Thiel et al. 2015; Frey 2017; Gari et al. 2018; Partelow 2018).

The core element of the IAD framework—action situations—lies at the very heart of later versions of the SES figures to which Ostrom contributed directly (Ostrom and Cox 2010; McGinnis and Ostrom 2014). This potentially gives the SES a deeply dynamic orientation. Unfortunately, most applications of the SES framework generate long lists of factors that may have contributed to one or more outcomes (Basurto and Ostrom 2009; Fleischman 2010; Blanco 2011; Gutierrez et al. 2011; Ban et al. 2017). Although this approach could be used to identify combinations of SES attributes associated with the full range of relevant outcomes, these lists of variables can provide no basis for understanding the process by which these social, institutional and ecological factors combined to shape collective-choice and operational processes to generate those outcomes, let alone predicting or prescribing changes to social-ecological conditions over time. As a result, scholars are left to choose between a finely-detailed but ultimately static analysis with the SES framework or a more dynamic but underspecified analysis with the IAD framework.

Table 1: Second- and third-tier SES variables.

Resource systems	Resource units	Governance systems	Actors	Action situations
1) Sector	1) Resource unit mobility	1) Rules	1) Group size	1) Process
2) Boundary clarity	2) Replacement rate	a) Operational	2) Socioeconomic attributes	a) Monitoring
3) Size	3) Interactions	b) Collective-choice	a) Economic	i) Environmental
a) Area	a) Strong to weak	c) Constitutional	b) Cultural	ii) Social
b) Volume	b) Predatory or symbiotic	2) Property-rights regime	3) History of use	b) Sanctioning
4) Infrastructure	4) Economic value	a) Private	4) Location	c) Conflict resolution
5) Productivity	5) Size	b) Public	5) Leadership	d) Provision
6) Equilibrium properties	a) Large to small	c) Common	6) Social capital	i) Informational
a) Recharge dynamics	b) Trophic level	d) Mixed	7) Knowledge of SES	ii) Infrastructural
b) Recharge rate	6) Distinctive markings	3) Network structure	8) Resource dependence	e) Appropriation
c) Number of equilibria	7) Distribution	a) Centrality	9) Technology used	f) Policymaking
d) Feedbacks	a) Spatial heterogeneity	b) Modularity		
i) Positive	b) Temporal heterogeneity	c) Connectivity		
ii) Negative		d) Number of levels		
7) Predictability				
8) Storage capacity				
9) Location				

Source: Ostrom and Cox (2010).

SES improves upon IAD by expanding the number of categories of relevant and decomposable, contextual variables. A close comparison of Ostrom's two frameworks reveals that many, and perhaps all, of the SES variables are contained, if only implicitly, within the IAD framework. Two IAD categories are directly analogous to first-tier SES categories: "attributes of the community" include the attributes of actors (and their connections) and the term "rules-in-use" has often been used to encompass all aspects of a governance system. Furthermore, the IAD category of biophysical conditions (a generalization of the initial "nature of the good" label) could be divided into two parts, one referring to specific resource units and the other to the resource system as a whole. In this way, each of the first-tier categories of the SES framework closely match the "Biophysical Conditions," "Community Attributes," and "Rules-in-Use" boxes of the IAD framework. Finally, the remaining categories for other social or ecological processes in the SES framework can be seen as holders for the potential effects of action situations remote from focal action situations that lie at the heart of any empirical analysis.

Yet, with a few exceptions (Cox 2014b; Vogt et al. 2015; McCord et al. 2017) most applications of the SES framework fail to attend to the critical importance of identifying and analyzing sets of focal action situations. As shown in Table 1, the variables listed under the Action Situation column on the right are not comparable to those listed in the columns corresponding to high-level categories of contextual or explanatory variables. Instead, a range of functionally different types of action situations are listed, without any attention to how these action situations are likely to differ from one another, or to the density of connections amongst them. The core attributes of an action situation are the working components, as shown in Figure 2, but that aspect of the IAD toolbox is generally missing from SES-based applications.

The literature on institutional analysis of social-ecological systems is currently dominated by two strands of research: (1) variable-oriented research which identifies configurations of social-ecological attributes associated with outcomes; and (2) process-oriented descriptive case studies that describe how institutions emerge and change, influencing behaviour and outcomes with very little interplay between the two approaches. This paper can, and in at least one case already has (McCord et al. 2017), help to address this gap by encouraging variable-oriented researchers to be more attentive to processes, and vice versa. But our help can only take us so far, because the purpose of a framework is not to explain outcomes, but to provide a tool for identifying, categorizing and organizing variables and processes for analysis. The CIS framework can help scholars to organize and integrate insights from variable-oriented research (i.e. most applications of the SES framework) and process-oriented research involving networks of action situations, but it does not in and of itself provide tools for inference.

4. An overview of the combined IAD-SES framework

We argue that anyone using the SES framework should carefully examine all action situations directly germane to the operation of that system and the values of the working components (see the interior part of Figure 2) that comprise it. They should also dig more deeply into the system to identify how these situations are interlinked, with particular attention to locating adjacent action situations that are responsible for the functional components within a focal action situation. The combined framework we outline here is primarily intended to help SES researchers make more effective use of the analytical strengths of the IAD framework by shifting the focus towards the analysis of action situations rather than variables.

Although Ostrom did not use the term “action situation” in her initial versions of SES (Ostrom 2007, 2009), she responded positively to suggestions by colleagues in the informal “SES Club” to explicitly add that term (see McGinnis and Ostrom 2014). Her original figures had placed interactions and outcomes at the center of the SES framework, but when she added the action situation term, she collapsed action situations, patterns of interactions, and outcomes (each of which had its own separate box in the IAD) into a single entity. By applying the same aggregation to the IAD framework of Figure 1, we end up with a much simpler version of the IAD which helped inspire the combined framework we offer here.

The canonical form of the IAD framework has multiple paths through which feedbacks can occur, with many of those feedback paths connecting outcomes and interactions to action situations and outcomes to potential changes in the pre-existing contextual conditions. All but the last of these feedback paths would lie within a single box, if we were to follow the SES expedient of aggregating action, interactions, and outcomes together in a single amalgam. This one link between outcomes and contextual conditions is worth careful consideration because this is the path through which the contextual conditions are endogenously determined within the broader network of adjacent action situations.

The simplicity of this one tie-back to contextual conditions enables us to rearrange the overall figure in a way that more directly represents the natural temporal order of before, during, and after the operation of action situations within the SES-style amalgam. That is, we can locate a network of action situations between an array of boxes on the left, representing the context from which those action situations emerged, and a similar list of the same boxes on the right, to denote how those variables had been changed by feedback from the actions, interactions, and outcomes occurring in that network. Figure 4 shows this simple arrangement of a set of contextual factors setting the stage for a network of interconnected strategic action, interactions, and outcomes, with the outcomes of those interactions feeding forward to reset conditions for the next iteration of the relevant action situations. This seems a much more natural representation of the temporal sequence of before, during, and after.

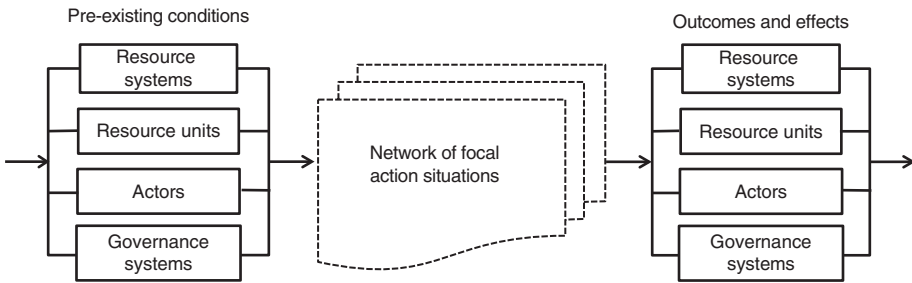


Figure 4: Generic representation of combined IAD-SES framework.

Source: Authors.

As we argued above, the evaluative action situations in which the evaluative criteria were determined should also be included, where possible, within a network of focal action situations. There are two potential pathways through which this feedback or, more appropriately, “feed forward” into the next iteration, can occur. Feedback that has been shaped by the application of existing evaluative criteria can be interpreted as following a more indirect path than would feedback that directly changes the values of contextual factors. Such direct effects need not involve conscious intervention on the part of the humans involved in this system and could instead operate independently of human agency. We argue that in many cases it is useful to explicitly separate direct (unmediated) and indirect (through some evaluative process) pathways of change in conditions shaping future interactions.

As the SES framework already expresses feedback paths from an integrated action-interaction-outcome amalgam to each of the four categories of potentially relevant contextual variables, it too could be easily rearranged to fit the obvious temporal sequence of before, during, and after the operation of the dynamic processes occurring within that amalgam. The distinction between direct and indirect (human-mediated) paths of feedback are especially relevant for the types of policy settings to which the SES framework was designed to be most applicable. As emphasized by Epstein et al. (2013), the SES framework as originally conceptualized did not allow for the operation of ecological processes that remain untouched by human agency, even though that possibility can hardly be denied when considering micro-level biological, physical or chemical processes that occur over time spans too short for human intervention, as well as macro-level processes of global change that may be extraordinarily difficult for any analyst to fully observe with a single human lifespan.

Figure 4 may be a deceptively simple representation of our proposed CIS framework, and it’s worth reviewing how we constructed it by rearranging component parts each of these frameworks into a coherent whole that highlights their complementary strengths.

From the IAD we take the realization that contextual factors set the stage for any nexus of strategic interaction among actors seeking to effect or forestall changes in some policy setting, and that the patterns of interactions and outcomes that emerge from those action situations can in turn re-shape the values of these same contextual variables, and thereby open up new opportunities, or impose additional restrictions, on subsequent choices and events.

We depart from the traditional understanding of the IAD framework in three important ways. First, we insist that no action situation stands in complete isolation, and that our scope of analysis must encompass a broader network of adjacent action situations whose outcomes mutually shape the contextual conditions under which other nodes in this network operate. Second, we insist that evaluation can be seen as a distinct mode of collective action, worthy of being treated as an action situation in its own right. Third, by incorporating sites of evaluative interactions into this network representation, we distinguish between direct effects and indirect pathways mediated by individual or collective evaluations and reactions, both of which contribute to the ways in which the outcomes of action situations shape their own future operation as well as the concurrent (and subsequent) operations of other action situations to which it is connected.

From the SES framework we adopt its assertion that processes operating at the level of resource units and resource systems are equally important, increasing the number of categories of relevant contextual conditions to four (from the three in IAD). However, in doing so we redirect our analytic attention away from these variables themselves to focus instead on the dynamic processes through which those conditions are determined, and through which they might be changed by conscious design. Although the multiplicity of relevant action situations is alluded to in later versions of the SES, we prefer an explicitly networked interpretation.

We also simplify some aspects of the SES framework which have not proven to be critical in many applications. For example, Figure 3 indicates that the four categories of contextual factors should also be expected to occur in multiple variants, to depict the simultaneous influences of distinct resource systems or governance systems, or diverse resource units and actors within those systems (McGinnis and Ostrom 2014). We prefer to represent this multiplicity instead in the networks of action situations located at the center of Figure 4. We realize that multiple resources and resource systems are present in all policy settings, but they are typically interconnected in some systematic manner, and those interconnections can be more effectively studied by focusing on the network of interconnected action situations through which those conditions are shaped. We suggest that analysts collect all the relevant contextual factors from different manifestations of systems, units, or actors into comprehensive lists, from which analysts focusing on any action situation can draw out a subset of those factors most directly relevant to its operation, instead of requiring that each action situation has its own associated list.

In addition, Figure 4 does not include any reference to the “related” ecosystems or social-economic-political systems that bracket the core SES box in Figure 3. Nor do we include a separate category for “ecological rules,” as suggested by Epstein et al. (2013). We do, however, acknowledge that there remain some ecological or physical process that lie outside the scope of direct human intervention, either because of the current limits on our scientific knowledge or a lack of instruments through which we might effect change directly into those processes. But these might be better understood as dynamic processes that have not yet been incorporated within a network of action situations in which human agency can be realized.

Thus, further scientific research might move some of these hidden processes within the realm of human intervention. Demographers, economists, and other social scientists have identified the operation of dynamic processes that operate on human society in ways that are not directly observable by individuals, as well as deep and hidden structures of power that shape human society in ways that are not easily discerned by the humans operating within those structures (Lukes 2005). When such hidden processes or structures become more fully understood, then they may prove amenable to change via collective action. Or, in other cases, particularly powerful actors may have the capacity to prevent significant change. Our combined framework should provide a way of dealing with that contingency as well.

Clement (2010), for instance, expands the IAD framework in a natural manner by adding two additional categories of contextual variables to highlight the potential consequences of social-economic foundations for political power and the ways in which public discourse can be shaped to favor the interests of influential actors. Kashwan (2016), meanwhile, illustrates how power asymmetries and differential access to institutional arenas in a network of adjacent action situations can fundamentally shape policy outcomes in the particular context of forestry governance in India. Both of these analyses highlight an important point made most clearly by Knight (1992), that when actors work together to construct any new institutional arrangement, or to revise an existing one, the result is fundamentally shaped by any asymmetries in power among those actors. He argues that all institutions have distributional consequences, and that actors’ expectations of these consequences will shape the details of that institutional arrangement. Knight’s particular model specifies that these details will work in the favor of those actors who have the stronger “outside option,” that is, those who are less directly dependent on the continuation of this relationship. We are proposing a mode of analysis that encourages analysts to identify the action situations in which those outside options are themselves determined. Any outside actors seeking to nudge the direct participants into establishing a more equitable relationship may find it more effective to intervene in those adjacent action situations, rather than insert themselves directly into the negotiation process.

Analysts working within the Bloomington School tradition tend to focus on the problem-solving aspect of policy problems and downplay the extent to which powerful actors can prevent outcomes that would significantly reduce their own power. In our proposed framework, power asymmetries can limit the ability of potential reformers to effectively participate in certain institutional arenas.³ After all, actors who control access to sites of constitutional deliberation need not be willing to listen to new voices, nor to adopt new modes of decision making.

In summary, this CIS framework borrows aspects of both the IAD and SES frameworks, while changing each in significant ways. In the next section we illustrate how this CIS framework can be applied to a specific empirical setting, as an example for researchers interested in adopting a similar mode of analysis in their own work. As we emphasize above, the purpose of a framework is not to explain outcomes, but to provide a tool for identifying, categorizing, and organizing variables and processes for analysis. The CIS framework can help scholars to organize and integrate insights from variable-oriented research (i.e. most applications of the SES framework) and process-oriented research involving networks of action situations, but it does not in and of itself provide tools for inference. In the next section we demonstrate how the CIS framework can be used to organize a body of analysis, and in that illustration we rely upon inferences drawn in well-respected peer-reviewed studies of Maine's lobster fishery.

5. An illustration of the CIS framework in action

Maine's lobster fishery has been richly described and analyzed in a series of highly regarded publications, including Acheson (1988, 1997, 2003, 2013), Acheson and Wilson (1996), and Wilson et al. (2013). To help focus the example, we draw particularly upon a specific article in which Acheson (1997) introduces a distinction between different phases of the evolution of the governance of Maine lobster fisheries from around 1940 to the time of that publication.

We recommend that scholars using the CIS framework begin with an inventory of the relevant contextual and explanatory variables emphasized in the relevant research literatures. Many of these variables should be located within one of the four primary categories of the SES (and CIS) framework, but researchers should feel free to draw explicitly upon additional conceptual categories as needed. We emphasize that any inventory of relevant variables is only the first stage of analysis. They must then look for significant changes in the values of key outcomes or contextual variables and posit a set of potential breakpoints that can be used to divide the time span under investigation into shorter periods during which a connected set of processes can be identified for further investigation. These variables

³ Although we do not have the space to explore this point fully here, our CIS framework might support a useful connection to Stephen Lukes' classic distinction among three faces of power: winning in a direct competition, exerting control over the policy-making agenda, and exerting a deeper influence over modes of rhetoric and language (see Lukes 2005; Clement 2010; Epstein et al. 2014).

should be understood as *pointers* to specific action situations within the relevant network of focal or adjacent action situations, that is, to those sites of interaction where those changes are most likely to have occurred (and thus where future policy interventions might prove especially efficacious).

Then comes the critical question of deciding which of these adjacent action situations are the most promising for subsequent analysis. These decisions should be guided by lessons gleaned from the relevant research literatures, as well as the analysts' own previous experience. All of these should be concentrated on the primary goal, namely, to identify the forces driving changes in the core network of inter-connected action situations during each period.

By comparing the values of key variables at different points in time, we can bracket times of significant changes in those and other variables throughout that time period. The values of contextual variables in effect at the beginning of each period denote a partial equilibrium that must somehow have been disrupted in a way that generated changes at the end of that period.⁴ Times when new laws are passed or new organizations established should prove especially useful candidates for potential breakpoints, but exogenous shocks, such as the introduction of a new technology or climate event, may also be particularly relevant in some circumstances. There can be no hard and fast rules about the selection of breakpoints and focal action situations, and any research should fully expect to experience multiple iterations of this search process.

For this exercise Acheson has already done most of the work for us, in his extensive evaluations of the major changes that occurred during this entire period (see especially Acheson 2003 and Acheson and Steneck 1997). We use this procedure to demonstrate how the critical locus of action changes from period to period, after new action situations have been established or existing ones start to move in new directions.

Although Acheson considers several factors in marking breakpoints between different periods, we find it useful for our purpose of demonstrating the virtues of the CIS framework to focus our attention on specific years when the nature of the relevant governance processes changed in a significant manner. Our first breakpoint is 1872, when the state of Maine enacted its first laws limiting the kinds of lobsters that could legally be harvested and sold. The next major breakpoint comes in 1933, when the first double gauge law set both the minimum and maximum sizes of lobsters. In 1977 the national government became directly involved in regulating Maine lobster fisheries, with Congressional passage of the FCMA (Fisheries Conservation and Management Act). Our final breakpoint comes in 1995 with the formal establishment of a zone-based co-management regime

⁴ Equilibrium is too strong a term, because the processes occurring in all relevant action situations will continue to operate before and after each breakpoint. These breakpoints are snapshots of an ongoing dynamic process, which can help us identify which changes are most in need to further investigation, and these changes direct us to the processes through which those changes were enacted (that is, to the appropriate set of focal action situations).

involving local fishers as well as national, state, and local officials. Although the conditions of the Maine lobster industry continued to change after this time, the following overview of the periods between these breakpoints should be sufficient to illustrate how the CIS framework can be used to structure an analysis concerning dynamic institutional processes.

By selecting our breakpoints on the basis of significant changes in governance, we are positing that these were indeed consequential events that substantially changed the later evolution of that fishery and the governance system associated with it. If we were to attempt a more complete investigation of this empirical case, we would need to also consider other potential types of breakpoints, and look into the processes through which those changes were produced as well.

In Table 2 we offer an overview of our understanding of the analysis in Acheson (1997), based on our choice of specific breakpoints. The top row lists basic conditions of lobsters as a resource unit and the resource system in which they live, as well as the nature of the primary actors and the rules that govern this resource. Every second row revises these conditions or introduces new ones in order to reflect the changed conditions observed for subsequent breakpoints. Rows placed between these breakpoint rows summarize the most important patterns of interactions and outcomes observed in the focal action situations of particular importance for that period of time.

We use bold font to denote significant changes in the values of key contextual variables in effect at each of the breakpoints. Analysts should pay particular attention to the changing cast of focal action situations at different times. It is here that the most detailed analysis should be focused. We designate (in bold) those action situations which were newly established by the outcome of the breakpoint opening that period, or previously important action situations that now operate in a way much different than in the preceding period. After setting the stage by reviewing the pre-1872 condition of Maine lobster fisheries, we will highlight significant changes in each period in the remainder of this section (and in Figures 5 through 7).

5.1. Key SES variables for the pre-1872 Period

The American lobster (*Homarus americanus*) is a highly valued benthic invertebrate found along the Atlantic coast of North America between Southern Labrador and North Carolina. Lobsters are nomadic, tending to occupy partially overlapping series of home ranges, remaining within each for periods of 1–2 weeks before moving on to adjacent areas (Scopel et al. 2009). A lobster's range increases with age and size, although most lobsters occupy deeper waters at low densities during the winter months before concentrating in shallower waters in the spring and summer. All of these movements, however, tend to be fairly limited; most lobsters are recaptured within a two-mile radius of where they are tagged and released (Wilson et al. 2013).

Table 2: Overview of changing contextual factors and focal action situations in Maine lobster fisheries.

	Resource systems	Resource units and markets	Actors	Governance systems	Focal action situations
Pre-1870s	Nearshore fishery Local concentrations	Limited resource mobility Low economic value	Local fisher groups Canners start operations	Informal territorial system State licensing	Appropriation and use Licensing
<i>Focal Action Situations</i>	<ul style="list-style-type: none"> • Appropriation: fishers (in "harbor gangs") harvest lobsters for local use, cannery harvest mostly small lobsters, resource stocks begin to be depleted • Markets: Cannery developed new markets for lobster, large increase in number of cannerys, used wasteful harvesting practices • From Licensing to Formal Regulation: cannerys lobbied for regulations against taking egg-berryed lobsters, resulting in first state regulations 				
1872	Nearshore fishery Local concentrations	Limited resource mobility Live transport developed Higher economic value	Local fisher groups Cannerys still operating Live lobster trade begins	Informal territorial system Simple formal regulations (minimum size and berryed females)	Appropriation and use Regional markets Formal regulations
<i>Focal Action Situations</i>	<ul style="list-style-type: none"> • Appropriation: live traders harvested larger lobsters, resource stocks further depleted by taking of small lobsters (for consumption and trade) • Markets: Live transport expanded market, cannerys were crowded out, catch totals reduced but prices remained high, lucrative trade in small lobsters • Complex Regulation: Some seasonal restrictions, live traders lobbied for rules against taking small lobsters, but most ignored these regulations, leadership of State Commissioner Crie critical for first double gauge law 				
1933	Nearshore fishery Local concentrations	Limited resource mobility Live transport available Prices and demand very low	Local fisher groups Live lobster traders State regulators	Informal territorial system Multiple Formal regulations (double gauge in 1933)	Appropriation and use National markets Formal regulations
<i>Focal Action Situations</i>	<ul style="list-style-type: none"> • Appropriation: Economic crisis led to decline in number of lobstermen, low catch totals, catches began to recover during World War II • Markets: Canadian imports increased, as markets rebounded, internal dissension within industry on distributional consequences • Formal Regulation: double gauge law revisions complicated by divisions among fishers, general opposition to Canadian imports contributed to establishment of FCMA in 1977 • Informal norms and monitoring: rise of "conservation ethic" among fishers, V-notch norms developed, formalized into state law in 1947 				
1977	Nearshore fishery Local concentrations	Limited resource mobility Live transport routine Robust market value	Local fisher groups Live lobster traders State and National regulators Scientific experts	Informal territorial system FCMA and complex regulations Pro-conservation norms	Appropriation and use National markets Formal regulations Informal rules and norms
<i>Focal Action Situations</i>	<ul style="list-style-type: none"> • Appropriation: catches remained high throughout this period, with minor fluctuations • Markets: Lobster markets remained robust, and industry unified in support of lobbying strategies • From complex regulation to co-management regime: FCMA defines National and State jurisdictions over fisheries; competition between fishers and scientists to influence regulations (scientists feared impending depletion of lobster stock), compromise law in 1986 included positions from both sides, but fishing industry undermined agreement at state level, political impasse until formulation of zone-based co-management regime in 1995 • Informal norms and monitoring: Fishers continued to enforce V-notch laws, and doubted the utility of reforms proposed by scientists 				
1995	Nearshore fishery Local concentrations	Limited resource mobility Live transport routine Robust market value	Local fisher groups Live lobster traders State and National regulators Scientific experts	Co-management regime for defined zones Complex regulations Pro-conservation norms	Appropriation and use National markets Zone management Informal rules and norms

Lobsters reproduce annually after the summer molt. Females carry their egg broods, which can include tens of thousands of eggs, for up to a year. Fecundity tends to increase with age, so that older, larger lobsters are more prolific breeders (holding constant other factors such as temperature).⁵ Lobsters are vulnerable to predation by other marine species, including ground fish (RU3), especially in early stages of their life cycle.

Natural system boundaries (RS1) tend to be fairly distinct for lobsters as a result of their life history characteristics that confine activities to a fairly small geographical area. This facilitates the use of territoriality in the governance system, where groups (described by Acheson (1988) as “lobster gangs”) can act collectively to exclude outsiders from their respective territories, and invest in the development of formal and informal monitoring and sanctioning systems. Although individual lobsters can and do migrate across “lobster gang” boundaries, groups that invest in conservation within their respective boundaries generally can expect to benefit from those efforts.

The lobster fishers of Maine have long operated within a social environment that promotes cooperation, even as they compete for shares of each year’s catch. The life of a lobster fisher is oriented around the harbor where they and other lobster fishers ply their trade, and the larger community in which they reside. Many are second- or third-generation lobster fishers, who have been raised with the values and norms that have developed over generations in the fishery (Acheson 1988). They also possess a wealth of local knowledge. Barriers to entry in the form of licensing and informal pressure from harbor gangs helps to ensure the continuity of social norms and values. As a result, although lobster fishers compete with one another for resource units—and at times groups have experienced considerable conflict amongst themselves—user attributes have generally appeared to favor cooperation with regards to the design and implementation of conservation policies (Wilson et al. 2013).

Before the introduction of the first conservation laws in 1872, the Maine lobster fishery was effectively an open-access system. The catch rate was sufficiently low so as not to threaten depletion of the resource. However, beginning in the 1840s a lobster canning industry emerged. These cannery could use lobsters of any size, but preferred small lobsters that could be easily processed into cans for sale. As this industry grew, lobster fishers noticed a decline in the availability of lobsters of all sizes, and the cannery themselves began to lobby the state legislature to protect large lobsters, as well as restrictions on taking egged lobsters, which had clearly demonstrated their ability to produce offspring. Their lobbying had its intended effect in 1872, with the passage of the first state laws prohibiting the harvest of egg-bearing females.

We did not include a figure showing the focal action situations in operation before our first breakpoint, because that figure would not have been very

⁵ Acheson and Wilson (1996) characterize lobster regeneration as a stochastic process.

interesting. In effect, there was only a single focal action situation involving the appropriation and use decisions of lobster fishers. Licensing was a routine process, hardly deserving separate treatment as a form of governance. However, as the canning industry grew in size and began to lobby the state legislature for favorable regulations, we begin to see the rise of a more interesting set of interconnected action situations. As we review below, several rounds of formal and informal institutional changes contributed to a noteworthy story of successful environmental governance (Acheson 1997, 2003).

5.1.1. Phase 1: 1872–1933

The initial years of this period were characterized by a general decline in the size and quantity of lobster catches and political competition between two groups of end users, canners and live lobster traders. Canning operations dominated from the 1840s, but beginning in the 1870s they faced increasing competition from live lobster traders, who were able to serve markets along the Northeastern seaboard, using ships with circulating seawater tanks. Their customers favored large ‘dinner-sized’ lobsters, whereas canners preferred smaller lobsters that could be purchased at a lower price (Acheson 2003). By 1880, however, it was clear to all parties that lobster stocks were declining and that something needed to be done to manage the fishery. Canners and live lobster traders naturally blamed each other for the decline, and each lobbied the Maine legislature to introduce legislation that favored their interest.

The canners initially succeeded, as the legislature promulgated laws prohibiting the taking of egg-bearing (“berried”) lobsters and small lobsters between October and April. The seasonal size restriction, not coincidentally, corresponded to the periods when canners shifted operations to focus on vegetables and other products. In other words, the legislation primarily impacted live lobster traders, while allowing the canners to operate as before. However, the canners’ success was short-lived, in part for reasons of geography and political representation. Lobster traders were concentrated in vote-rich population centers, while canners were located in just two, lightly populated counties. Over time, lobster traders leveraged their electoral advantage in the Maine legislature, successfully pushing for legislation that applied minimum-size rules throughout the year. That rule effectively put the canners out of business.

Although landings continued to fall, lobster prices remained high until the Great Depression. As shown in Figure 5, the number of licensed lobster fishers declined precipitously from 1928 to 1933. Then, the Maine Department of Marine Resources and the fisheries commissioner in particular began to play a more active role in the regulation of fishing activities, most notably under the entrepreneurial leadership of Commissioner Crie. Along with lobster fishers, Crie lobbied the federal government to ban lobster imports from Canada, and to advertise local lobster products. Although these efforts mostly failed at this time, they helped secure the Commissioner’s support for new and controversial state measures. Most importantly, a double gauge law establishing minimum and maximum sizes for captured lobsters was adopted in 1933.

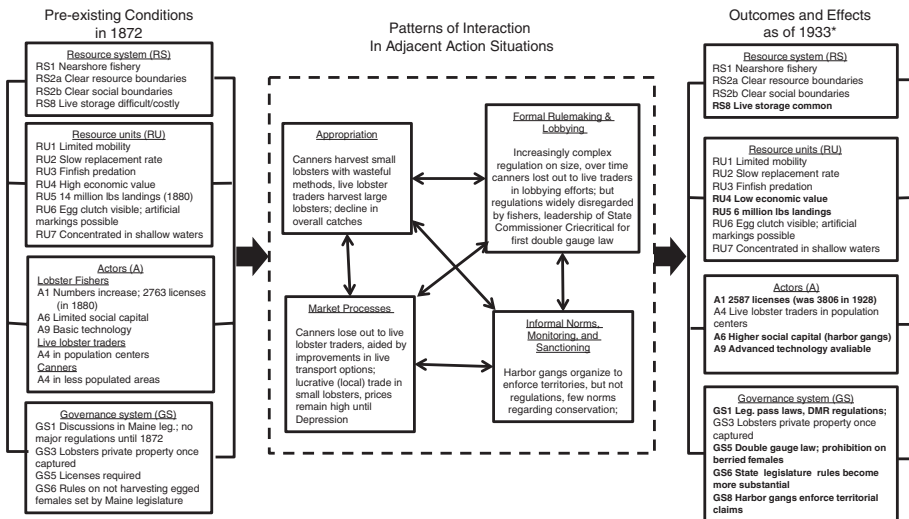


Figure 5: Maine Lobster Fishery, 1872–1933.

*Note: Significant changes in outcome variables are denoted in bold.

This phase was also characterized by increasing consolidation of harbor or lobster “gangs” comprised of local fishers who set traps in near-shore areas, from which they attempted to exclude outsiders. Although members of these gangs competed with one another, their frequent interactions in a wide array of community activities allowed them to develop mutual trust to advance their common interests against outsiders. Ultimately, they were able to self-organize and enforce informal boundary rules with a variety of mechanisms, including cutting lines of traps set by outsiders.

5.1.2. Phase 2: 1933–1977

Starting before World War II, Maine’s lobster fishery began a long-lasting recovery. Landings increased from about seven to eighteen million pounds per year by 1977, and the number of licensed fishers increased more than three-fold. Despite the increased pressure, the combination of favorable climatic conditions, the double gauge law, informal boundary rules and the addition of a V-notch law (in 1947) that helped protect the breeding stock, appeared to contribute to increased harvests (Acheson and Wilson 1996). The V-notch rule enacted in 1947 specified that fishers *could* mark a “berried” female with a V-shaped cut on the tail (which amounts to a humanly-created attribute of some resource units). Lobsters bearing a V-notch could not be sold until the notch disappeared. This innovation allowed lobster fishers to return reproductive females to maintain the lobster population, but it also became an indirect indicator of the trustworthiness of their peers (Ostrom 2009). In fact, that might have been the primary benefit, because some biologists suggested that V-notching could actually harm lobsters (Acheson 2003).

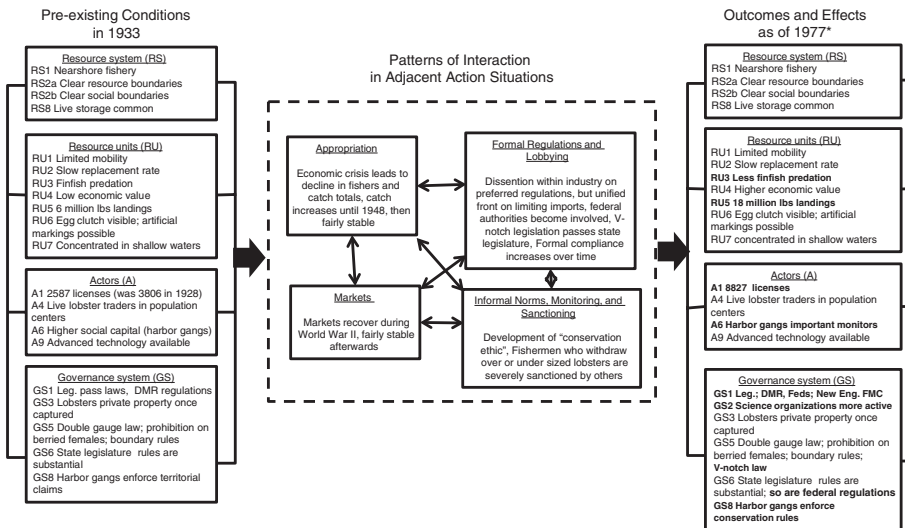


Figure 6: Maine Lobster Fishery, 1933–1977.

*Note: Significant changes in outcome variables are denoted in bold.

The ascendancy of harbor gangs during this period tailed off into the 1970s, when they became less willing to actively monitor and enforce their informal boundaries against outsiders (Acheson and Gardner 2004). Nonetheless, most harbor gangs continued to enforce what Acheson (2003) referred to as a nucleated boundary wherein defense increased with proximity to the harbor. Acheson (1997) argues that the most important change in this period is the adoption of a conservation ethic among harbor gangs and individual fishers. In that period, they began to enforce conservation rules,⁶ resulting in high levels of compliance.

5.1.3. Phase 3: 1977–1995

In 1977 the Federal government and regional fisheries management organizations intervened in the Maine lobster fishery, through a federal statute ostensibly aimed at protecting US fisheries from foreign fleets. By law, the national government was responsible for governing fisheries between 3 and 200 miles from shore, leaving the state to govern the area between the shore and the 3 mile limit. In practice the federal government and state agencies coordinated their regulations, although in some instances their policies conflicted because of the stronger influence of local fishers on state regulators, compared to the influence of biologists and conservation advocates at the national level.

⁶ Acheson (1988) notes that small violations such as taking a (very) small number of oversize lobsters for domestic consumption used to be a common practice.

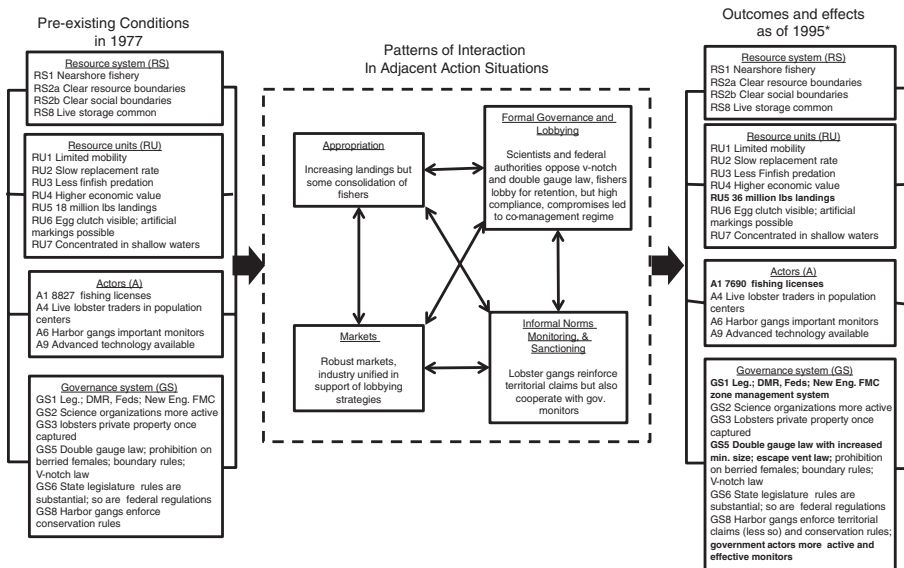


Figure 7: Maine Lobster Fishery: 1977–1995.

*Note: Significant changes in outcome variables are denoted in bold.

In this period, lobster catches increased again after a long period of stable catches since the 1950s. The rules governing the lobster fishery remained largely intact, the only major change being the introduction of a law requiring escape-vents to allow undersized lobsters to escape traps. That law was later modified to include requirements for biodegradable panels to ensure that lost traps would not continue capturing fish indefinitely (Acheson 1997).

The most surprising result from this period might be the Maine lobster fishers' largely successful effort to resist federal modifications of their operational rules. Opinions varied on the utility of the V-notch laws, which codified an informal practice lobster fishers had adopted on their own initiative. Biologists and environmental activists questioned their appropriateness as public policy, and raised concerns that the practice of notching could result in infection (Acheson and Gardner 2011). But lobster fishers vehemently defended the widespread practice as a proven means of protecting breeding stock by greatly facilitating direct monitoring of the behavior of both fishers and merchants. The V-notch and maximum size limits were ultimately retained, although the minimum size limit was increased to align them with neighboring states.

The respective roles of national and state officials and local fishery communities continued to evolve during this period, eventually resulting in the establishment of a complex regime of zone-based co-management. This is an important innovation in resource governance (Acheson 2003), but it serves as the endpoint

of our illustration of how this combined framework might help analysts track the changing foci of dynamic changes across different action situations.

5.2. Case overview

In sum, this illustrative case overview demonstrates that the CIS framework can help condense the rich contextual landscape of Maine's lobster fishery into a more manageable set of relevant variables, while maintaining a tight analytical focus on the key processes through which changes occur over time (that is, on focal action situations). The key sites of change shifted over time, in ways that can be interpreted using a single analytical perspective and multiple models of institutional change.

The first round of changes appears to have been driven by new market opportunities, first in the canning industry and later in the live lobster trade. Competition between these two segments of the lobster industry was not direct, as canners preferred to harvest small lobsters and live lobster traders needed larger, dinner-sized lobsters for their customers, but their needs did conflict, because heavy harvesting of small lobsters by canners meant fewer large lobsters would be available for harvest. This competition spilled over into the state legislature, with the live lobster traders ultimately prevailing, in part because of their stronger demographic position near population centers.

Continued dissension within the industry created an opportunity for Commissioner Crie to demonstrate public entrepreneurship, including the passage of the first double-gauge law in 1933. But a significant trade in small and large lobsters continued throughout the initial periods, with most of this catch being consumed by fishers and their families. It was only with the emergence of the "conservation ethic," identified by Acheson (1997), along with increasing social ties within harbor gangs, that fishers began to develop and share new practices (most notably the V-notch), which helped protect the breeding stock via a mechanism that was easily monitored by the fishers. Beliefs regarding the efficacy of v-notching and other management measures (Acheson and Gardner 2011) developed through a range of individual and collective evaluative processes have helped to reinforce the conservation ethic since World War II, and times were very good for Maine lobster fishers.

However, biologists and conservationists continued to raise concerns about what they considered to be excessive levels of harvesting, and all parties were concerned by pressures from foreign fishers. Consequently, federal agencies began to regulate the industry. Out of this long process of political contention emerged a co-management regime that was explicitly based on a zone-based system of territorial claims, which was well-suited to the nature of lobsters as a relatively immobile resources and a highly concentrated fishing industry.

As we did not posit explicitly evaluative action situations in our case figures, despite the prominence we gave evaluation in our earlier comments, we would like to emphasize how the locus of key evaluative settings shifted over this period

of time. Initially the key evaluations were those of local fishers or manufacturers, who were exploring alternative market products for lobster. As competing producer groups lobbied the state legislature for rules benefiting their own members, those legislators began to rely on policy evaluations provided by interest groups or studies by independent scholars. Beliefs regarding the efficacy of v-notching and other management measures (Acheson and Gardner 2011), which are developed through a range of individual and collective evaluative processes, have helped to reinforce the conservation ethic since World War II, and times were very good for Maine lobster fishers. By the time national regulatory institutions began to get more directly involved, evaluations provided by scientific organizations and individual scholars began to play important roles. It is worth noting that James Acheson, the scholar upon whose work our overview is based, participated in several hearings, and contributed in other ways through his own research, teaching, and service activities. Clearly, the big picture would have been lost if we had tried to capture the complexity of evaluative processes in this case in its entirety.

Although governance institutions evolved incrementally over several years, they settled along a particular path set out by initial conservation laws. Prohibitions against taking berried females and minimum size restrictions continue to be central features of lobster management in Maine. Declining catches provided windows of opportunity for institutional change, including the double gauge and V-notch rules, and increases in minimum size limits appear to have coincided with periods of relative decline (see Acheson 1997).

There continue to be controversies and concerns about potential overharvesting. Nevertheless, the history of the Maine lobster fishery demonstrates the utility of the CIS framework for a well-integrated analysis encompassing biological, economic, social, and political dynamics.

6. Discussion and further extensions

The CIS framework effectively leverages the dynamism of the IAD framework, while incorporating the details of the SES framework to analyze important questions about institutional development and change. The detailed listing of key characteristics of this resource system in different time periods highlights those factors most important in marking the transition from one phase to the next. To implement this framework, institutional analysts should look for significant institutional or ecological changes and identify candidate action situations to which these changes might reasonably be attributed.

Other scholars are exploring modes of research that seem very much in the same spirit of the CIS framework. To begin with works clearly located within the Ostrom tradition, McCord et al. (2017) draw explicitly upon an earlier version of the ideas we present here to organize their investigation of Kenyan water governance. Mincey et al. (2013) use a network of adjacent action situations to examine conditions under which forests can contribute to sustainable urban ecosystems. Lubell et al. (2014) examine the complexity of water management through the

application of the “ecology of games” approach, which is closely related in spirit to the idea of a network of action situations, but with a more concentrated focus on the strategic logics of collective choice in inter-related games (Lubell 2013).

Some research teams have devised more explicitly dynamic frameworks for the study of social-ecological systems. Villamayor-Tomas et al. (2015) represent food and energy production processes as “value chains” that effectively consist of sequences of action situations of resource extraction, production, distribution and consumption. In an analysis of Maine lobster fisheries, Webster (2015) introduces an “action cycle” in which a problem generates signals which may or may not trigger a response on the part of the policy makers. We find that representation to be overly simplistic in requiring all policy responses to have either positive or negative effects on the sustainability of that resource, but the explicit sequence of challenge and response is worthy of further elucidation.

Other scholars frame their research methods as offering a means of diagnosing problems in social-ecological systems. In a recent work, Heikkila and Andersson (2018) emphasize the importance and value of clearly specifying action situations of interest and taking a diagnostic approach for contextually-specific institutional design. They make the important point that even though the possibility of sustainable self-governance is more viable than generally realized, it is not always the best solution.

Moving outside the Ostrom tradition, de Loë and Patterson (2018, 567) study institutions of water governance using a *diagnostic approach*, by which they mean “a structured process of context-specific inquiry into both the biophysical and human aspects of a problem situation. Diagnostic approaches should provide systemic but strategic ways of identifying and evaluating external factors in particular situations.” They advocate the explicit adoption of a “*user-oriented perspective* (i.e. thinking [as] an analyst, who could be a research, policymaker, or practitioner), and give specific regard to the challenge of suitably capturing relevant external factors.” (568) Despite being outside the Ostrom tradition, this approach to institutional analysis is pertinent to Bloomington School concerns, especially the explicit focus on the critical problem of determining the appropriate scale at which a given policy setting should be understood, and more specifically on the problem of where to draw the boundary between core elements of a social-ecological system and exogenous effects from outside that system. As de Loë and Patterson acknowledge, there are no clear and fast rules for making boundary choices. They recommend that analysts initially should “frame” the problem as “tightly” as possible, and then “critically reflect” on the boundaries they are provisionally considering. Thus begins a process of sequential and repeated consideration of potential extensions by first “looking inward” to more fully understand the internal structure of that action situation and “spiraling outwards” to consider social and environmental factors that are closely tied to those core components. “This spiraling approach is important,” it is asserted, “because it allows for progressively expanding the scope of analysis while continuing to re-visit each key SES variable category in light of previous reasoning.” (571)

These suggestions are remarkably similar to the mode of institutional diagnosis offered by the CIS framework. As Ostrom (2005) argues, the application of the IAD framework requires analysts to “zoom in and out of inter-connected action situations.” Our suggested method of applying the CIS framework asks institutional researchers to identify significant changes in key contextual variables, and to use those observed changes as a symptom pointing towards the underlying processes, that is, to the appropriate action situation responsible for that change. Then they must diagnose the operation of that action situation by tracing its structure back to the sources that determined the operating characteristics (Ostrom’s working components) of that action situation. In short, we ask analysts to trace the relevant network of adjacent action situations in hopes of identifying critical points at which policy intervention might prove most efficacious, based on empirically-informed theory.

We admit this is an eclectic selection of research projects. Some research teams draw on specific aspects of the IAD or SES frameworks, others integrate IAD or SES components with perspectives from quite distinct research traditions, and some have no explicit connection whatsoever to any aspect of the Bloomington School. Overall, however, this variety suggests that we are in good company, since others are pursuing many of these same ideas. We are confident that other researchers will continue to draw upon the rich legacy of the IAD and SES analytical frameworks, whether or not they use the particular combination we offer here.

Although this paper highlights the potential benefits from proper utilization of a particular framework for analysis, we do not mean to downplay the critical importance of other modes of research designed to understand the outcomes of particular variables. One especially important (and frequently used) form of social scientific analysis relies on comparative case studies selected so as to allow researchers to develop and test hypotheses concerning which explanatory (or independent) variables have the strongest influence on determining the value of outcomes (or dependent variables) in those cases. The success or failure of efforts towards collective action is a dependent variable that is particularly important in the types of policy settings for which the IAD and SES frameworks are best suited. Thus, any application of our combined framework is likely to require researchers to draw upon the current state of knowledge generated by the cross-disciplinary study of the factors that facilitate successful efforts at collective action.

In *Governing the Commons*, the primary outcome variable of interest is the long-term sustainability of institutional arrangements for managing those resources. Before Ostrom (1990) could identify her famous “design principles,” she had to shift her attention away from the value of specific variables to focus instead on the overall configuration of each governance system as a whole.

Other researchers in related projects focus on identifying a reasonably small number of variables that are important determinants of the dependent variable in that analysis. For example, Agrawal (2001) lists some 30 variables as “key enabling conditions” for the successful operation of common property institutions. In the Social-Ecological Systems Meta-Analysis Database (SESMAD) project, resource management and international relations researchers worked together to organize

over 100 variables into attributes of the environment, actors, and governance systems (Cox 2014a). Specialized studies then identified the factors most conducive to successful collective action among actors engaged in different policy settings (e.g. Fleischman et al. 2014).

We acknowledge that this mode of focused analysis on particular processes and outcomes remains a critically important tool for social scientists and policy analysts. After all, the CIS framework, as a framework, can only take us so far. It can help researchers to consider a broad range of potentially relevant factors relating to their unique or iterative focal action situations. Researchers then need to draw upon theories and models of particular processes to move beyond the framework stage.

Collective action is of critical importance in all policy settings, but it is rarely (if ever) the only game in play. To fully understand any empirical policy setting, institutional analysts will need to become familiar with the forces driving particular processes of ecological change, resource appropriation, production, transportation and communication, market exchange, organizational behavior, legislative and judicial deliberation, electoral dynamics, public opinion, or the diffusion of knowledge or cultural traditions and other forms of social change. The primary contribution of this CIS framework is the focus it provides on ensuring that institutional analysts begin by identifying the full range of dynamic processes they will need to examine before their task is done.

In sum, the IAD framework is focused on the physical, social, and institutional context within which collective action occurs and outcomes are realized. It presumes that no one action situation exists in isolation, and insists that policies live within a complex ecology of strategic interactions. The SES framework explicitly incorporates the nested, multi-level complexity of ecological systems, and suggests that, to be sustainable, institutional arrangements must somehow match that complexity in a productive manner. As scientific knowledge expands, so does the range of potentially policy-relevant concerns. Also, as public entrepreneurs bring to the political agenda new issues and concerns related to the environment and the sustainability of access to needed resources, then the demands on scientific knowledge expand ever further. In effect, biophysical conditions, scientific knowledge about those conditions, human communities, and the range of public policy are complexly co-evolving. Combining the IAD and SES frameworks enables researchers to better understand that increasing complexity.

Institutional analysts seeking to use the CIS framework should start their analysis by identifying a focal action situation (or at most a few of them), learn how the relevant collective and constitutional choice arenas shaped that action situation, and then think deeply about the processes through which those conditions might be changed. Applying the CIS framework to an empirical setting is all about “zooming in and out of inter-connected action situations” (Ostrom 2005) in search for places where policy interventions could be most effective, or to identify those critical junctures which can contribute the most to deepening our understanding of the relevant processes.

Literature cited

- Acheson, J. M. 1988. *The Lobster Gangs of Maine*. Lebanon, NH: University Press of New England.
- Acheson, J. M. 1997. The Politics of Managing the Maine Lobster Industry: 1860 to the Present. *Human Ecology* 25(1):3–27.
- Acheson, J. M. 2003. *Capturing the Commons: Devising Institutions to Manage the Maine Lobster Industry*. Lebanon, NH: University Press of New England.
- Acheson, J. M. 2013. Co-Management in the Maine Lobster Industry: A Study in Factional Politics. *Conservation & Society* 11(1):60–71.
- Acheson, J. M. and R. Gardner. 2004. Strategies, Conflict, and the Emergence of Territoriality: The Case of the Maine Lobster Industry. *American Anthropologist* 106(2):296–307.
- Acheson, J. and R. Gardner. 2011. The Evolution of the Maine Lobster V-Notch Practice: Cooperation in a Prisoner's Dilemma Game. *Ecology and Society* 16(1).
- Acheson, J. M. and R. S. Steneck. 1997. Bust and Boom in the Maine Lobster Fishery: Perspectives of Fishers and Biologists, *North American Journal of Fisheries Management* 17(4):826–847.
- Acheson, J. M. and J. A. Wilson. 1996. Order out of Chaos: The Case for Parametric Fisheries Management. *American Anthropologist* 98(3):579–594.
- Addison, J. and R. Greiner. 2016. Applying the Social–Ecological Systems Framework to the Evaluation and Design of Payment for Ecosystem Service Schemes in the Eurasian Steppe. *Biodiversity and Conservation* 25(12):2421–2440.
- Agrawal, A. 2001. Common Property Institutions and Sustainable Governance of Resources. *World Development* 29:1649–1672.
- Agrawal, A. 2003. Sustainable Governance of Common-Pool Resources: Context, Methods, and Politics. *Annual Review of Anthropology* 32:234–262.
- Aligica, P. D. and P. Boettke. 2009. *Challenging Institutional Analysis and Development: The Bloomington School*. New York: Routledge.
- Anderies, J. M., M. A. Janssen, and E. Ostrom. 2004. A Framework to Analyze the Robustness of Social-ecological Systems from an Institutional Perspective. *Ecology and Society* 9:18 [online] URL: <http://www.ecologyandsociety.org/vol9/iss1/art18>.
- Andersson, K. 2006. Understanding Decentralized Forest Governance: An Application of the Institutional Analysis and Development Framework. *Sustainability: Science, Practice, & Policy* 2:25–35.
- Ban, N. C., T. E. Davies, S. E. Aguilera, C. Brooks, M. Cox, G. Epstein, L. S. Evans, S. M. Maxwell, and M. Nenadovic. 2017. Social and Ecological Effectiveness of Large Marine Protected Areas. *Global Environmental Change* 43:82–91.

- Basurto, X. and E. Ostrom. 2009. Beyond the Tragedy of the Commons. *Economia delle fonti di energia e dell'ambiente* 52:35–60.
- Berkes, F. and C. Folke, eds. 1998. *Linking Social and Ecological Systems: Management Practices for Social Mechanisms for Building Resilience*. Cambridge, UK: Cambridge University Press.
- Blanco, E. 2011. A Social-Ecological Approach to Voluntary Environmental Initiatives: The Case of Nature-based Tourism. *Policy Sciences* 44:35–52.
- Bushouse, B. K. 2011. Governance Structures: Using IAD to Understand Variation in Service Delivery for Club Goods with Information Asymmetry. *Policy Studies Journal* 39(1):99–113.
- Clement, F. 2010. Analysing Decentralised Natural Resource Governance: Proposition for a “Politicised” Institutional Analysis and Development Framework. *Policy Sciences* 43:129–156.
- Cox, M., G. Arnold, and S. Villamayor Tomás. 2010. A Review of Design Principles for Community-based Natural Resource Management. *Ecology and Society* 15(4):38. <http://www.ecologyandsociety.org/vol15/iss4/art38/>.
- Cox, M. 2014a. Understanding Large Social-Ecological Systems: Introducing the SESMAD Project. *International Journal of the Commons* 8(2):265–276.
- Cox, M. 2014b. Applying a Social-Ecological System Framework to the Study of the Taos Valley Irrigation System. *Human Ecology* 42(2):311–324.
- de Loë, R. C. and J. J. Patterson. 2018. Boundary Judgments in Water Governance: Diagnosing Internal and External Factors that Matter in a Complex World. *Water Resources Management* 32(2):565–581.
- Epstein, G., J. M. Vogt, S. K. Mincey, M. Cox, and B. Fischer. 2013. Missing Ecology: Integrating Ecological Perspectives with the Social-Ecological System Framework. *International Journal of the Commons* 7(2):432–453.
- Epstein, G., A. Bennett, R. Gruby, L. Acton, and M. Nenadovic. 2014. Studying Power with the Social-Ecological System Framework. In *Understanding Society and Natural Resources: Forging New Strands of Integration across the Social Sciences*, eds. M. J. Manfredo, J. J. Vaske, A. Rechkemmer, and E. A. Duke, 111–135. New York: Springer.
- Fleischman, F., K. Boenning, G. A. Garcia-Lopez, S. Mincey, M. Schmitt-Harsh, K. Daedlow, M. C. López, X. Basurto, B. C. Fischer, and E. Ostrom. 2010. Disturbance, Response, and Persistence in Self-Organized Forested Communities: Analysis of Robustness and Resilience in Five Communities in Southern Indiana. *Ecology and Society* 4:15.
- Fleischman, F. D., N. C. Ban, L. S. Evans, G. Epstein, G. Garcia-Lopez, and S. Villamayor-Tomas. 2014. Governing Large-Scale Social-Ecological Systems: Lessons from Five Cases. *International Journal of the Commons* 8(2):428–456.
- Frey, U. J. 2017. A Synthesis of Key Factors for Sustainability in Social-Ecological Systems. *Sustainability Science* 12:507–519. DOI 10.1007/s11625-016-0395-z.
- Gari, S. R., Al. Newton, J. D. Icely, and M. M. Delgado-Serrano. 2018. An Analysis of the Global Applicability of Ostrom’s Design Principles to Diagnose

- the Functionality of Common-Pool Resource Institutions, *Sustainability* 9:1287. <http://dx.doi.org/10.3390/su9071287>.
- Gibson, C. C., M. A. McKean and E. Ostrom, eds. 2000. *People and Forests: Communities, Institutions and Governance*. Cambridge, MA: The MIT Press.
- Grossman, P. Z. 2019. Utilizing Ostrom's Institutional Analysis and Development Framework Toward an Understanding of Crisis-Driven Policy. *Policy Sciences* 52(1):3–20.
- Gutierrez, N. L., R. Hilborn, and O. Defeo. 2011. Leadership, Social Capital and Incentives Promote Successful Fisheries. *Nature* 470(7334):386–389.
- Heikkila, T. and K. Andersson. 2018. Policy Design and the Added-Value of the Institutional Analysis Development Framework. *Policy & Politics* 46(2):309–324.
- Kashwan, P. 2016. Integrating Power in Institutional Analysis: A Micro-Foundation Perspective. *Journal of Theoretical Politics* 28(1):5–26.
- Kiser, L. L. and E. Ostrom. 1982. The Three Worlds of Action: A Metatheoretical Synthesis of Institutional Approaches. In *Strategies of Political Inquiry*, ed. E. Ostrom, 179–222. Beverly Hills, CA: Sage.
- Knight, J. 1992. *Institutions and Social Conflict*. Cambridge: Cambridge University Press.
- Lubell, M. 2013. Governing Institutional Complexity: The Ecology of Games Framework. *Policy Studies Journal* 41(3):537–559.
- Lubell, M., M. Schneider, J. T. Scholz, and M. Mete. 2002. Watershed Partnerships and the Emergence of Collective Action Institutions. *American Journal of Political Science* 46(1):148–163.
- Lubell, M., G. Robins, and P. Wang. 2014. Network Structure and Institutional Complexity in an Ecology of Water Management Games. *Ecology and Society* 19(4):23. doi:10.5751/ES-06880-190423.
- Lukes, S. 2005. *Power: A Radical View*, 2nd Edition. London: Palgrave Macmillan.
- McCord, P., J. Dell'Angelo, E. Baldwin, and T. Evans. 2017. Polycentric Transformation in Kenyan Water Governance: A Dynamic Analysis of Institutional and Social-Ecological Change. *Policy Studies Journal* 45(4):633–658.
- McGinnis, M. D. 2011. Networks of Adjacent Action Situations in Polycentric Governance. *Policy Studies Journal* 39(1):45–72.
- McGinnis, M. D. and E. Ostrom. 2014. Social-Ecological System Framework: Initial Changes and Continuing Challenges. *Ecology and Society* 19(2):30.
- Mincey, S. K., M. Hutten, B. C. Fischer, T. P. Evans, S. I. Stewart, and J. M. Vogt. 2013. Structuring Institutional Analysis for Urban Ecosystems: A Key to Sustainable Urban Forest Management. *Urban Ecosystems* 16(3):553–571.
- Oakerson, R. J. and R. B. Parks. 2011. The Study of Local Public Economies: Multiorganizational, Multi-level Institutional Analysis and Development. *Policy Studies Journal* 39(1):141–161.
- Ostrom, E. 1986. An Agenda for the Study of Institutions. *Public choice* 48(1): 3–25.

- Ostrom, E. 1989. Microconstitutional Change in Multiconstitutional Political Systems. *Rationality and Society* 1:11–50.
- Ostrom, E. 1990. *Governing the Commons*. Cambridge, UK: Cambridge University Press.
- Ostrom, E. 2005. *Understanding Institutional Diversity*. Princeton, USA: Princeton University Press.
- Ostrom, E. 2007a. Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework. In *Theories of the Policy Process*, 2nd ed., ed. P. A. Sabatier, 21–64. Boulder, CO: Westview Press.
- Ostrom, E. 2007b. A Diagnostic Approach for Going Beyond Panaceas. *Proceedings of the National Academy of Sciences* 104(39):15181–15187.
- Ostrom, E. 2009. A General Framework for Analyzing Sustainability of Social-Ecological Systems. *Science* 325:419–422.
- Ostrom, E. 2010. Beyond Markets and States: Polycentric Governance of Complex Economic Systems. *American Economic Review* 100:641–672.
- Ostrom, E. 2011. Background on the Institutional Analysis and Development Framework. *Policy Studies Journal* 39:7–27.
- Ostrom, E. and M. Cox. 2010. Moving Beyond Panaceas: A Multi-Tiered Diagnostic Approach for Social-Ecological Analysis. *Environmental Conservation* 37:451–463.
- Ostrom, E., M. Janssen, and J. M. Anderies. 2007. Going Beyond Panaceas. *Proceedings of the National Academy of Sciences* 104(39):15176–15178.
- Partelow, S. 2018. A Review of the Social-Ecological Systems Framework: Applications, Methods, Modifications, and Challenges. *Ecology and Society* 23(4):36.
- Rudd, M. A. 2004. An Institutional Framework for Designing and Monitoring Ecosystem-Based Fisheries Management Policy Experiments. *Ecological Economics* 48:109–124.
- Schlager, E. and M. Cox. 2018. IAD Framework and the SES Framework: An Introduction and Assessment of the Ostrom Workshop Frameworks. In *Theories of the Policy Process*, 225–262. New York: Routledge.
- Scopel, D. A., W. J. Golet, and W. H. Watson, III. 2009. Home Range Dynamics of the American Lobster, *Homarus Americanus*. *Marine and Freshwater Behaviour and Physiology* 42(1):63–80.
- Tang, S. Y. 1992. *Institutions and Collective Action: Self-Governance in Irrigation*. San Francisco, CA: ICS Press.
- Thiel, A., M. E. Adamseged, and C. Bakke. 2015. Evaluating an Instrument for Institutional Crafting: How Ostrom’s Social-Ecological System is Applied. *Environmental Science & Policy* 53(Part B):152–164.
- Villamayor-Tomas, S., P. Grundmann, G. Epstein, T. Evans, and C. Kimmich. 2015. The Water-Energy-Food Security Nexus through the Lenses of the Value Chain and the Institutional Analysis and Development Frameworks. *Water Alternatives* 8(1):735–755.

-
- Vogt, J. M., G. B. Epstein, S. K. Mincey, B. C. Fischer, and P. McCord. 2015. Putting the “E” in SES: Unpacking the Ecology in the Ostrom Sociale-Cological System Framework. *Ecology and Society* 20(1):55.
- Webster, D. G. 2015. The Action Cycle/Structural Context Framework: A Fisheries Application. *Ecology and Society* 20(1):33.
- Weible, C. M. and P. A. Sabatier, eds. 2018. *Theories of the Policy Process*, 4th ed, New York: Routledge.
- Wilson, J. A., J. M. Acheson, and T. R. Johnson. 2013. The Cost of Useful Knowledge and Collective Action in Three Fisheries. *Ecological Economics* 96:165–172.
- Young, O. 2002. *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. Cambridge, MA: MIT Press.