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# Sugaring off: enduring insights from long-term research on environmental governance

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**Abstract**   This article presents the results of an effort to identify the most important contributions I have been able to make in the course of a lifetime of thinking about the roles that social institutions play in governing human–environment relations. Some of the resultant propositions are general in the sense that they apply to environmental governance at all levels of social organization. Others are specific to the international level or to what we generally think of as international environmental governance. The basic message is that institutions are important determinants of human–environment relations but that they typically operate in conjunction with a variety of other drivers in a pattern best described as complex causation. As we move deeper into the Anthropocene, an era characterized by human domination of biophysical systems, the need to improve our understanding of environmental governance has become increasingly urgent.

**Keywords**   Effectiveness · Governance · Human–environment relations · Institution · Regime

## 1 Introduction

Where I come from, people make maple syrup by collecting sap from maple trees in the late winter and early spring and boiling off the water to produce the syrup most of us know and love. In a good run, the syrup amounts to 2–5 % of the initial volume of the sap. We even assign grades to the syrup produced; only a fraction of the syrup receives the highest grade of "fancy." In this article, I take the view that we can hope for a similar ratio of enduring insights to the total volume of our research. Enduring insights amounting to 5 % of our work, with an even smaller harvest of really influential ideas, should suffice to give us a sense of efficacy in our scientific endeavors. I apply this standard to my own work on environmental governance, seeking to identify the most important results of the research I

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have been conducting since the early 1970s on the roles that institutions play in governing human–environment relations in a variety of settings. My goal is to distill the enduring insights in the form of a set of propositions that have influenced the field in the sense that both established scholars and graduate students have found them useful in framing and guiding their own research programs on human–environment relations.

My story proceeds in five steps. The initial section provides a collection of working definitions that inform my research on environmental governance. The first substantive section formulates and elaborates on a set of ten propositions about environmental governance applicable in all settings. The next section sets forth five propositions that focus more specifically on international environmental governance. The penultimate section turns to some observations about challenges that I believe we must tackle in order to add to our existing understanding of environmental governance. A brief concluding section directs attention to the link between analysis and praxis in this realm and explains why I have found it particularly rewarding to have a foot in both camps in my work on environmental governance.

I dispense with all but the most essential references, since I am drawing largely on my own work in this assessment. I have benefitted greatly from interactions with a sizable group of collaborators and other colleagues over the course of this multi-decade effort. I identify them wherever it is appropriate, and I am deeply grateful for the opportunity I have had to participate in a community of scholars interested in issues of environmental governance that has grown both larger and more vibrant with the passage of time. Still, my intention in what follows is to reflect on the evolution of my own thinking about such matters, rather than presenting a broader account of the current status and future prospects of this field of research.

## 2 Working definitions

I am a nominalist when it comes to definitions. I do not believe there are correct (or essential) definitions of key concepts waiting to be discovered, refined, and adopted by all members of the relevant research community. We are all free to attach whatever meanings we choose to key concepts. Nonetheless, it is essential to use concepts precisely and consistently.[1] A remarkable proportion of apparent disagreements among students of governance and, for that matter, those endeavoring to illuminate any important phenomenon turn out to be simple matters of definitional imprecision or inconsistency. Once we clarify our definitions, many of these apparent differences evaporate. So, here is a set of definitions covering the most important terms I use in formulating the propositions discussed in the next two sections.

*Governance is a social function centered on steering human groups toward desired outcomes and away from undesirable outcomes.* A critical feature of this way of thinking about governance is that it allows us to decouple the idea of governance from the more familiar concept of government. As a result, we can think about a variety of mechanisms through which societies fulfill the function of governance and consider the prospect of providing governance without government, an idea of special importance for those of us focusing on international/global society, a setting that lacks a government in the ordinary sense of the term. *A governance system is an ensemble of elements performing the function*

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[1] Consensus within the research community regarding such matters is also a worthy goal. But my main point here concerns the importance of precision and consistency.

*of governance in a given setting. Institutional arrangements form the core of such a system, but the ensemble normally includes cognitive, cultural, and technological elements as well.* Governance systems come in many forms; a key concern in specific settings involves matching governance systems with the issues they address rather than seeking to evaluate the relative merits of alternative governance systems in generic terms.[2]

*Institutions are collections of rights, rules, and decision-making procedures that give rise to social practices, assign roles to the participants in these practices, and guide interactions among the participants.* Institutions are prominent features of governance systems at all levels of social organization. *Regimes are institutions specialized to addressing functionally defined topics (*e.g., health care, pollution, and trade*) or spatially defined areas (*e.g., Antarctica, the North Pacific, and Western Europe*)* (Young 1982a). Regimes constitute a proper subset of institutions. All regimes are institutions, but not all institutions are regimes.

*Environmental and resource regimes are institutions that address matters of governance relating to human–environment relations.* They address questions of governance involving human uses of natural resources (e.g., stands of trees, stocks of fish, and deposits of minerals) and human actions affecting biophysical systems (e.g., air and water pollution).[3] Desired outcomes in such settings center on the achievement of sustainability and resilience but typically include matters of efficiency and equity as well. Individual environmental and resource regimes may exhibit both functional and spatial characteristics (e.g., the clean-air regime applicable to United States). When these regimes deal with matters that are transboundary in nature (e.g., the regime dealing with transboundary air pollution in Europe) or that lie beyond the jurisdiction of nation states (e.g., the regime for the deep seabed and the regime for the Earth's climate system), it is standard practice to refer to them as *international environmental regimes*.

An important distinction regarding environmental and resource regimes separates those that are *constitutive* in nature (e.g., the overarching framework for ocean governance set forth in the 1982 UN Convention on the Law of the Sea) from those that are *operational* in nature (e.g., the regulatory measures and decision-making procedures articulated in the 1987 Montreal Protocol on the control of ozone-depleting substances). Constitutive arrangements often provide a foundation for the development of a number of operational regimes; operational regimes typically are nested into the broader frameworks provided by constitutive arrangements. The law of the sea, for instance, underlies a variety of operational arrangements dealing with commercial shipping, industrial fishing, and marine pollution.

*Regimes treated as collections of rights, rules, and decision-making procedures differ from organizations treated as material entities that have offices, personnel, budgets, and legal personality* (Young 1989a). The point of this distinction is not to suggest that regimes (or institutions more generally) are more important than organizations or vice versa. Rather, the distinction allows us to think about relationships between regimes and organizations as a topic for systematic investigation. Do regimes always require organizations to administer or implement their provisions under real-world conditions? Can

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[2] Of course, there is typically a gap between the ideal and the actual with regard to the performance of governance systems. Governance failures, like market failures, are common occurrences.

[3] Some analysts use the term resource regime to refer to situations involving natural resources, reserving the term environmental regime to apply to situations featuring environmental protection. But there is no consensus regarding this usage. I use the phrase environmental and resource regimes to cover all arrangements relating to the governance of human–environment relations.

organizations operate independently of regimes or even take the initiative in creating new regimes to address a range of substantive concerns?

*The effectiveness of environmental and resource regimes is a function of the extent to which these arrangements contribute to solving or mitigating the problems that lead to their creation* (Young 2011). Analyses of the effectiveness of regimes often include distinctions among outputs, outcomes, and impacts. Outputs involve the promulgation of regulations and the establishment of infrastructure needed to move a regime from paper to practice. Outcomes refer to changes in the behavior of those subject to the rights, rules, and decision-making procedures of a regime. Impacts are a matter of problem-solving as such. There is no way for a regime to solve a problem without producing outputs and outcomes. But the production of outputs and outcomes provides no guarantee that a regime will prove successful in solving problems. I treat outputs and outcomes as important topics to consider but always in relation to problem-solving. Other criteria of evaluation are useful in assessing the performance of a regime, including sustainability, efficiency, equity, and various considerations of good governance. It is important to solve problems, but it is desirable to do so in a manner that is efficient, equitable, and democratic.[4]

## 3 Ten propositions about environmental governance

With these definitions in hand, we are ready to move on to an examination of enduring insights. Bear in mind that these propositions do not purport to provide an assessment of the state of regime analysis, much less a general account of what we currently know about environmental governance. I have provided a general assessment of the state of our understanding of regime effectiveness in a recent article in the *Proceedings of the National Academy of Sciences* (Young 2011). Here, my goal is to reflect on my own contributions to this research domain and to say some things about why I think these contributions are important.

I start with ten propositions that are general in nature in the sense that they apply to environmental governance in all settings. Since no one can keep ten propositions in mind at the same time, however, let me summarize the essential take-home message at the outset. Environmental and resource regimes play major roles in determining the extent to which societies are able to solve a wide range of problems arising in human–environment relations. But a cookie-cutter approach to the formation and implementation of regimes cannot succeed. Regimes interact with a variety of biophysical and socioeconomic factors that affect their performance in specific settings. Successful regimes are those that are well matched to the principal features of the biophysical and socioeconomic settings in which they operate (Table 1).

**Proposition 1.1** *Governance without government is a common phenomenon.*

The existence of a government in the ordinary sense of the term is neither sufficient nor necessary to assure success in fulfilling the function of governance. The significance of this proposition is that it allows us to break apart the study of governance treated as a social function from research focusing on the nature and performance of governments. There are

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[4] In cases where the parties do not share a common understanding of the problem(s) to be solved or regime formation is a political gesture that has little to do with problem-solving, this conception of effectiveness will not apply. Properly speaking, therefore, my focus on effectiveness applies to a subset of the overall category of environmental and resource regimes.

**Table 1** Ten propositions about environmental governance

**Proposition 1.1**: *Governance without government is a common phenomenon*

**Proposition 1.2**: *Three distinct processes dominate both the formation of environmental and resource regimes and their evolution over time*: *spontaneity/self-generation, negotiation/bargaining, and coercion/imposition*

**Proposition 1.3**: *Institutional bargaining focuses on the supply of public goods rather than on reaching agreement on a mutually acceptable outcome located at some point on a contract curve*

**Proposition 1.4**: *Although it is common to think of regimes as regulatory arrangements, they can and often do perform procedural, programmatic, and generative functions*

**Proposition 1.5**: *Individuals play important roles both in the formation of environmental and resource regimes and in efforts to maximize their effectiveness once they are in place*

**Proposition 1.6**: *Environmental and resource regimes can guide the behavior of actors either by alleviating collective-action problems or by encouraging the development of social practices*

**Proposition 1.7**: *Effective and resilient environmental and resource regimes generally rest—implicitly if not explicitly—on the cognitive foundation provided by a prevailing discourse or worldview*

**Proposition 1.8**: *High levels of uncertainty alter normal utilitarian calculations guiding the formation and operation of environmental and resource regimes*

**Proposition 1.9**: *The success of environmental and resource regimes is a function of the fit or match between the principal elements of these institutional arrangements and the major features of the biophysical and socioeconomic settings in which they operate*

**Proposition 1.10**: *Although some propositions about the effectiveness of environmental and resource regimes scale up/down in the dimension of social organization, others do not*

many cases in which governments perform poorly in fulfilling the function of governance. Where governments come under the sway of dictators or fall prey to corruption, they may do more to block or undermine efforts to perform the function of governance than to promote progressive results. There is nothing surprising about these observations. More interesting in terms of the production of new knowledge is the realization that there are situations in which it is possible to perform the function of governance in the absence of a government (Rosenau and Czempiel 1992). This realization has triggered a growing body of the literature on mechanisms that yield favorable results in situations in which there is no government in the ordinary sense of the term. Although this observation applies across a range of issue areas, it has proven particularly valuable for those of us concerned with human–environment relations. Small-scale stateless societies often succeed in avoiding or mitigating problems like the "tragedy of the commons" through the development of regimes that prove successful in the absence of anything recognizable as a government (Hardin 1968; Ostrom et al. 2002); especially important now, as we endeavor to solve large-scale problems like climate change and the loss of biological diversity that have emerged as great issues of our time, is the observation that the absence of anything resembling a supranational government does not condemn us to a future in which threats to individual well-being and social welfare become ever more severe (Young et al. 2008). This line of thinking has led also to a lively discussion about the extent to which propositions about the determinants of effectiveness in environmental and resource regimes scale up/down across levels of social organization (Young 2005a).

**Proposition 1.2** *Three distinct processes dominate both the formation of environmental and resource regimes and their evolution over time: spontaneity/self-generation, negotiation/bargaining, and coercion/imposition.*

Like all social institutions, regimes may simply develop as a matter of practice in the absence of intentional initiatives on the part of anyone, much less the development of a rule

book to guide the actions of those who participate in these arrangements. Such arrangements are known as spontaneous or self-generating regimes (Hayek 1973). On the other hand, bargaining about the attributes of institutions is a common occurrence at all levels of social organization, and it is clearly the case that powerful actors often call the shots when it comes to working out the defining features of environmental and resource regimes. This is particularly apparent at the international level, where efforts to negotiate the terms of multilateral environmental agreements are a prominent feature of the political landscape, and dominant actors—often referred to as hegemons—can play exceptionally influential roles in the creation of regimes treated as public goods. Needless to say, these distinctions are analytic in nature (Young 1982a, b). Actual cases typically involve elements of two or even all three of these processes. One or a few powerful actors regularly wield exceptional influence, for example, when it comes to hammering out key provisions of the conventions or treaties setting forth the terms of international regimes. Under the circumstances, the interesting challenges involve identifying scope conditions that govern the roles that each of the three processes play in real-world situations and understanding interactions among the three processes as determinants of the principal attributes of the regimes that emerge to address specific problems arising in human–environment relations.

**Proposition 1.3** *Institutional bargaining focuses on the supply of public goods rather than on reaching agreement on a mutually acceptable outcome located at some point on a contract curve.*

Institutions are public goods in the sense that once supplied to a group, they are largely non-excludable and non-rival for the individual members of the relevant group (Young 1989b). Individual members may have strong preferences among available institutional options; they may even regard some options as public "bads." They will naturally campaign vigorously for their preferred options. But this does not alter the fact that institutions are non-excludable and non-rival.[5] This feature of environmental and resource regimes (or any other institutions) has profound implications for the character of the negotiations or bargaining processes that often play a central role in regime formation. In conventional bargaining, the participants have incentives to form minimum winning coalitions to arrive at agreements that reduce the number of actors expecting to share in the proceeds (Riker 1962). But when the proceeds take the form of public goods, there are no such incentives. Non-rivalness ensures that enlarging the size of the group does not diminish the benefits accruing to individual members. In institutional bargaining, the focus is apt to shift to the issue of ensuring that participants implement and live up to the obligations they assume, and it is widely expected that those who have a voice in crafting the terms of regimes will be more likely to regard them as legitimate and, as a result, to live up to the obligations they assume on a voluntary basis. To the extent that this is the case, those engaged in institutional bargaining are apt to aim to create maximum winning coalitions in contrast to minimum winning coalitions. The attractions of this strategy will be particularly strong in settings like international society where the fulfillment of obligations on an ongoing basis is to a large degree voluntary (Young 1994a, b).

**Proposition 1.4** *Although it is common to think of regimes as regulatory arrangements, they can and often do perform procedural, programmatic, and generative functions.*

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[5] There are cases in which an actor may choose to opt out of the social group to which an institution applies. This is one reason why some individuals choose to emigrate from their countries of origin and some states refuse to sign or ratify international agreements.

There is a natural tendency to equate institutions in general with the rules of the game in the domains in which they operate. Certainly, this is a key feature of many environmental and resource regimes. Think of the rule requiring emitters of sulfur dioxide to have permits in the US clean-air regime or the rule prohibiting mining activities in the Antarctic Treaty System. But regulation is not the only function that regimes perform (Young 1999). They often handle procedural tasks, like setting annual quotas in commercial fisheries or making decisions about phaseout schedules for ozone-depleting substances. Some regimes focus on programmatic activities, such as the actions needed to clean up the Rhine River or the remedial action plans developed to improve water quality in the Great Lakes of North America. Still others play generative roles in enhancing knowledge about the relevant problems (e.g., the operation of the assessment program in the European long-range transboundary air pollution regime), making judgments about the extent and severity of the problems, and framing them for inclusion on policy agendas. These functions are not mutually exclusive; the same regime may be structured to address two or more of them. One or another of these functions may take on particular importance at various stages in the life of a single regime.

**Proposition 1.5** *Individuals play important roles both in the formation of environmental and resource regimes and in efforts to maximize their effectiveness once they are in place.*

There is a tendency among some observers, particularly those who think about international politics and focus on the roles that nation states play, to downplay the influence of the actions of individuals in creating and implementing regimes. But this turns out to be a mistake. Of course, it is essential in thinking about leadership on the part of individuals to avoid the endogeneity trap: if we use some measure of their contributions to identify those who are leaders, we can no longer ask questions about the extent to which the activities of leaders make a difference. But it is fairly easy to avoid this trap by identifying a universe of cases populated by those who have occupied particular roles (e.g., chief negotiators and chairs of negotiating committees) and then asking questions about their influence with respect to the creation and operation of regimes. Not all members of this universe prove to be influential. But it is striking how often such individuals do make a difference in cases characterized by success in forming regimes and effectiveness in the operation of regimes (Young 1991, 1998; Young and Osherenko 1993). It turns out that there are several distinct types of leadership that are worthy of separate treatment: (1) cognitive leadership or the ability to come up with new ways of thinking about key issues, (2) entrepreneurial leadership or the ability to exercise skill in making deals or devising the terms of mutually acceptable agreements, and (3) structural leadership or the ability to bring the influence of powerful actors to bear in a constructive manner. These types of leadership are not mutually exclusive; the same individual may excel in more than one domain of leadership. Nevertheless, the activities involved are so different that the ability to operate successfully in more than one mode is exceptional.[6]

**Proposition 1.6** *Environmental and resource regimes can guide the behavior of actors either by alleviating collective-action problems or by encouraging the development of social practices.*

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[6] An important theme in regime analysis concerns the roles that collective entities (e.g., states) play as leaders and laggards in the formation and implementation of regimes. This has not been a focus of my work in this field.

Two distinct perspectives dominate thinking about the mechanisms through which regimes operate to steer the behavior of the actors engaged in human–environment relations (Young 2001).[7] Those who think about such matters in broadly utilitarian terms and focus on the behavior of self-interested actors look to regimes to solve or alleviate collective-action problems by reassuring individual actors regarding the cooperative behavior of others, linking the reputations of actors to compliant behavior, and lengthening the shadow of the future. Those who adopt a social-practice perspective, by contrast, are more likely to link the influence of regimes to mechanisms like encouraging socialization, shaping the content of social conventions, and embedding compliance in standard operating procedures. The two sets of mechanisms are not mutually exclusive. The same regime may contribute to the effectiveness of a governance system by influencing calculations of the costs and benefits of (non)compliance and by inculcating a willingness on the part of actors to comply with prescriptions as a matter of habit or without engaging in an effort to make calculations regarding costs and benefits. A general theory of environmental governance ought to integrate these perspectives into a comprehensive account of the influence of institutions on the course of human–environment relations.

**Proposition 1.7** *Effective and resilient environmental and resource regimes generally rest—implicitly if not explicitly—on the cognitive foundation provided by a prevailing discourse or worldview.*

Most environmental and resource regimes are focused arrangements consisting of collections of rights, rules, and decision-making procedures applicable to specific situations. Fisheries regimes operating in domestic settings feature procedures for setting allowable harvest levels on an annual basis, allocating quotas among fishers, devising gear restrictions, and so forth. At the international level, the ozone regime covers several families of chemicals and specifies phaseout schedules for each of the regulated chemicals. Yet, these specific arrangements reflect, implicitly if not explicitly, broader and deeper presumptions about proper ways of organizing human activities in the relevant domains. A familiar example of this phenomenon is associated with the idea of "embedded liberalism" in the realm of economic affairs (Ruggie 1982). The concrete elements of the international monetary and trade regimes are based on a set of propositions calling for a clear separation between the public sector and the private sector coupled with an understanding that it is appropriate for governments to intervene from time to time by deploying monetary and fiscal policies or supporting infant industries or industries deemed essential to national security. Parallel, though perhaps less familiar, ideas dealing with human–environment relations feature propositions about the role of free enterprise coupled with regulatory measures needed to avoid the tragedy of the commons and to deal with environmental side effects or externalities, while pursuing maximum sustainable yields. The point of this proposition is not to extol the virtues of any particular discourse or worldview. It merely asserts that a link to some coherent cognitive underpinnings is an important condition for the achievement of effectiveness in the operation of regimes dealing with specific issues.

**Proposition 1.8** *High levels of uncertainty alter normal utilitarian calculations guiding the formation and operation of environmental and resource regimes.*

Real-world conditions often feature high levels of uncertainty both about the costs of failing to take action by (re)forming suitable regimes and about the costs and benefits of

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[7] This distinction bears a resemblance to what March and Olsen describe as the logic of consequences and the logic of appropriateness (March and Olsen 1998).

creating such regimes and operating them effectively. The case of climate change provides a prominent example. Opinions vary dramatically about the likely consequences for social welfare of a failure to control climate change, even over the short run. There are profound differences in the estimates of the probable costs of taking effective steps to address the problem of climate change in a timely manner. Such situations give rise to a "veil of uncertainty," ensuring that straightforward calculations of benefits and costs will not suffice as a basis for making sensible decisions about the (re)formation of environmental regimes (Brennan and Buchanan 1984; Young 1994a, b). The thicker the veil, the more likely are actors to respond by imposing conditions on the applicability of their commitments, entering into agreements that are easy to opt out of or rescind, or establishing sunset provisions that limit the length of any commitments they make. High levels of uncertainty also may increase the receptivity of those engaged in regime formation to considerations of fairness or justice. To the extent that it is difficult to forecast the incidence of the costs of inaction as well as the costs of taking concrete steps to solve specific problems, the parties to regimes will have incentives to favor arrangements that produce results regarded as equitable for all those concerned.

**Proposition 1.9** *The success of environmental and resource regimes is a function of the fit or match between the principal elements of these institutional arrangements and the major features of the biophysical and socioeconomic settings in which they operate.*

Some scholars have argued that it is possible and helpful to rank environmental problems on a scale ranging from easy or benign problems at one end to difficult or malign problems on the other end (Miles et al. 2002). On this account, problems like climate change are extremely malign—some even call them wicked or diabolical—and we should not expect to be able to solve them during the foreseeable future (Steffen 2011). My view, by contrast, is that the critical challenge is to pinpoint the essential features of problems and then to construct regimes that are well matched to the problems at hand in the sense that they are crafted in such a way as to be responsive to these essential features (Young 2002a). There are cases in which this approach has yielded successful solutions to seemingly malign problems. The Antarctic Treaty of 1959, for instance, emerged in the midst of the cold war, involved active cooperation on the part of the superpowers, and included arrangements dealing with notoriously challenging problems like demilitarization and disputes over jurisdictional claims. Conversely, efforts to address seemingly benign problems can fail when those who design regimes come up with arrangements that are poorly matched to the problems at hand. Many regional fisheries regimes, for example, fail or perform poorly because they do not include effective procedures for setting allowable harvest levels and eliciting compliance, even when their members are generally friendly and have cooperated successfully on other issues. The principal insight to be drawn from these observations is that we need to strengthen our skills in the realm of what I (and others) call institutional diagnostics (Young 2002a, 2008; Ostrom 2007). The road to success in devising effective environmental and resource regimes lies in diagnosing the essential features of specific problems and then devising institutional arrangements that are crafted carefully to address the key issues.

**Proposition 1.10** *Although some propositions about the effectiveness of environmental and resource regimes scale up/down in the dimension of level of social organization, others do not.*

The issue of scale is a prominent concern among ecologists who think regularly about the generalizability of their findings across levels ranging from leaf to landscape. This

concern is less familiar to social scientists thinking about generalizability across levels of social organization from the microlevel of local systems to the macrolevel of global systems. Yet, it is natural to pose such questions with regard to the effectiveness of governance systems (Young 1994a, b, 2002a; Dietz et al. 2003). Do findings about the conditions under which small-scale societies succeed in avoiding or mitigating the tragedy of the commons apply to thinking about ways to protect global commons like the Earth's climate system? Do ideas emanating from the analyses of international environmental governance (e.g., the concept of regime complexes) have counterparts in thinking about the governance of local commons? There are particularly interesting parallels in this regard between the microlevel and the macrolevel, since many small-scale societies are stateless in a manner that resembles the statelessness of international society. In both cases, the issue of providing governance without government becomes a central concern (Young 2005a). But a more systematic assessment regarding prospects for scaling up/down must delve into similarities and differences relating to the behavior of the actors involved, the characteristics of the issues they seek to address, the nature of the institutional context, and key features of the broader setting (e.g., the nature of prevailing technologies). It is easy to see that facile efforts to scale up/down across levels of social organization will almost always fail. Nevertheless, there is much to be learned about the factors that determine the effectiveness of environmental and resource regimes by comparing and contrasting the insights about such matters produced by analysts who are steeped in the forces at work in different social settings.

## 4 Five propositions about international environmental governance

I was trained originally in the field of international relations. I began to take a professional interest in environmental issues during the run-up to the 1972 United Nations Conference on the Human Environment, and I developed an interest in international environmental governance at an early stage. The bulk of my applied work through the years has dealt with efforts to solve large-scale problems relating to the polar regions, the oceans, and the Earth's climate system. Naturally, some of my enduring insights focus on international environmental governance treated as a proper subset of the overarching category of environmental governance. In this section, I present five propositions emerging from my work on environmental governance at the international level (Table 2).

**Proposition 2.1** *The anarchic character of international society complicates but does not rule out efforts to create effective environmental and resource regimes.*

Perhaps, the first issue to tackle in this realm arises from the fact that international society lacks a government in the ordinary sense and that this condition is widely regarded as a serious limitation when it comes to meeting needs for governance at the international level. There is even a strand of thinking leading to the conclusion that the absence of enforcement mechanisms in international society makes the idea of international law an oxymoron. But these views are exaggerated. If we start by separating compliance, which is a matter of behavior that conforms to the requirements of prescriptions, from enforcement, which is a matter of applying sanctions to elicit compliance, it becomes clear that the absence of effective enforcement mechanisms is not a fatal flaw (Young 1979). A number of factors are relevant in this connection (Young 1999). Some regime functions (e.g., capacity building and the production of scientific assessments) are not regulatory in nature and do not give rise to issues of compliance. Some regulations (e.g., those adopted to

**Table 2** Five propositions about international environmental governance

**Proposition 2.1**: *The anarchic character of international society complicates but does not rule out efforts to create effective environmental and resource regimes*

**Proposition 2.2**: *International regimes interact with one another in a variety of ways that have significant consequences for their effectiveness*

**Proposition 2.3**: *While the subjects of international regimes are normally states, the success of these arrangements depends on both the capacity and the willingness of members states to implement their requirements in domestic political arenas*

**Proposition 2.4**: *Institutional dynamics affecting international regimes produce a diverse but limited set of outcomes best understood as emergent properties of complex systems*

**Proposition 2.5**: *The onset of the Anthropocene puts a premium on the creation and operation of international environmental and resource regimes that are effective in turbulent times and capable of adapting nimbly to rapidly changing conditions*

address what are known as coordination problems) do not generate incentives to cheat. Some regulatory systems can tolerate a considerable amount of non-compliance without collapsing or becoming ineffectual. Some non-compliance procedures (e.g., those developed under the terms of the Montreal Protocol on stratospheric ozone depletion) address issues of non-compliance without resorting to the use of sanctions in the ordinary sense. Some regimes acquire domestic constituencies either in the form of lead agencies responsible for their implementation or in the form of sizable groups of supporters in the general public (Dai 2005). The core elements of powerful discourses can become normative precepts that influence the behavior of decision makers, whether or not they are backed by sanctions. None of this leads to the conclusion that there is no need to worry about compliance with the terms of international regimes. But it would be a serious mistake to assume that these arrangements are bound to fail simply because there is no government in the ordinary sense to enforce the rules of international governance systems.

**Proposition 2.2** *International regimes interact with one another in a variety of ways that have significant consequences for their effectiveness.*

Distinct regimes operating in the same broad issue domain often interact with one another. The interplay between the ozone regime and the climate regime constitutes a prominent example. Environmental regimes also interact with regimes operating in other issue areas. The interplay between the ozone regime and the trade regime exemplifies this type of interaction. In my early work on this phenomenon, I distinguished among (1) embedded regimes or arrangements rooted in some deeper social order or common worldview, (2) nested regimes or arrangements dealing with distinct issues but based on a common constitutive framework, (3) clustered regimes or non-hierarchical arrangements linked to one another in spatial or functional terms, and (4) overlapping regimes or separate arrangements that interact in unintended and often unforeseen ways (Young 1996). Others have picked up on this general theme and introduced a variety of important distinctions going beyond my early formulation. They have been particularly successful in shedding light on the consequences arising in situations featuring overlapping regimes (Oberthür and Gehring 2006; Oberthür and Stokke 2011). In my judgment, there is much to be learned about the roles that nested and clustered regimes play in efforts to solve complex environmental problems. The analysis of nested regimes directs attention to the links between constitutive arrangements (e.g., the UN Convention on the Law of the Sea) and a variety of more operational arrangements built on a common constitutive base (e.g., regimes dealing with commercial shipping, industrial fisheries, and marine pollution). The idea of clustered

regimes now appears as a precursor to the productive analyses of regime complexes that have flourished in recent years (Raustiala and Victor 2004; Keohane and Victor 2011; Orsini et al., forthcoming). Such complexes, dealing with multidimensional issues, like Antarctica, plant genetic resources, or climate, offer promising ways forward in situations where it is politically infeasible to devise fully integrated governance systems covering all aspects of a spatially or functionally delimited topic or theme.

**Proposition 2.3** *While the subjects of international regimes are normally states, the success of these arrangements depends on both the capacity and the willingness of member states to implement their requirements in domestic political arenas.*

International regimes differ from governance systems operating in other settings both because there is no government in the ordinary sense to induce or compel states to comply with their commitments and because states may find it difficult to ensure compliance with such commitments on the part of domestic actors even when their intentions are honorable. The issues arising from the anarchic character of international society are familiar to all those who work in this field. But there is much more to be said about the treatment of international commitments in domestic settings (Putnam 1988; Dai 2005). Ratification typically makes international commitments legally binding on actors operating in domestic settings. But other mechanisms may play equally important roles in turning international commitments into legally and politically potent forces affecting the behavior of member states and their domestic constituents. These include: (1) designating a lead agency for the purposes of implementation that subsequently becomes a staunch advocate for the regime in domestic politics (e.g., the US Department of the Interior in the case of wildlife regimes), (2) embedding the provisions of a regime in thick social practices even in the absence of ratification (e.g., the American practice of adhering to most of the provisions of UNCLOS), and (3) using the existence of the regime as an important argument in domestic legal proceedings (e.g., reliance on the terms of international agreements relating to migratory birds in domestic litigation addressing the scope of the authority of the federal government in the United States). None of this alters the challenge of making international regimes effective in a world in which states are sovereign with regard to their role in international society but frequently weak with regard to their ability to make domestic constituents comply with their international commitments. But these factors do go some way toward explaining why the anarchical character of international society is not a fatal flaw when it comes to the creation of successful environmental regimes.

**Proposition 2.4** *Institutional dynamics affecting international regimes produce a diverse but limited set of outcomes best understood as emergent properties of complex systems.*

Environmental and resource regimes are highly dynamic. Once formed and put into practice initially, they experience continual change. Both internal or endogenous forces and external or exogenous forces play major roles in influencing the trajectories of institutional change over time (Young 2010). We can identify a number of distinct patterns in the emergent properties arising from such processes. International regimes may experience: (1) progressive development in the sense of moving from strength to strength toward success in problem-solving, (2) punctuated equilibrium in the sense of experiencing relatively long periods of stasis separated by shorter bursts of change, (3) arrested development in the sense of running into severe obstacles or road blocks that become lasting barriers to success, (4) diversion in the sense of a more or less sharp departure from the goals or purposes established at the outset, and (5) collapse in the sense of disintegration and disappearance in the wake of changed circumstances. Which of these patterns occurs in

specific cases is determined by the alignment and interaction of internal features and external forces. A regime that is relatively simple and lacking in capacity to adapt to changing circumstances, for example, may perform perfectly well in a stable setting in which the identity of the actors and the character of the problem remain unchanged. But such a regime may simply collapse and be swept away in the face of changes in the biophysical or socioeconomic setting that it has no capacity to address. A case in point is the North Pacific fur seal regime. Students of wildlife management long regarded this regime, created in 1911 to cope with severe depletions of fur seals stocks resulting from commercial harvesting, as a striking case of success. But the regime collapsed almost overnight in 1984–1985, following dramatic changes in the jurisdiction of coastal states over marine systems and sharp shifts in the condition of the Bering Sea ecosystem (Young 2005b). As this discussion suggests, the analysis of institutional dynamics constitutes a cutting-edge concern regarding our understanding of international regimes.

**Proposition 2.5** *The onset of the Anthropocene puts a premium on the creation and operation of international environmental and resource regimes that are effective in turbulent times and capable of adapting nimbly to rapidly changing conditions.*

The Earth is moving out of the Holocene, a period of roughly 10,000 years marked by relatively stable and benign conditions from the perspective of humans, and into the Anthropocene, a period of human-dominated systems prone to changes that are far-reaching and sometimes abrupt but difficult to anticipate (Steffen et al. 2011). The requirements for success in an era marked by changes that are nonlinear, sometimes abrupt, typically irreversible, and often nasty from the perspective of human welfare differ significantly from those characteristic of more settled times (Young 2012). From the point of view of effectiveness, these conditions place a premium on the ability to anticipate state changes, to take steps to stop short of tipping points, and to adapt quickly to changing circumstances on an ongoing basis. The point of this observation is not to cast doubt on our ability to solve the large-scale governance problems coming into focus as we move deeper into the Anthropocene. Rather, the take-home message is that standard operating procedures will need to be reexamined and in some cases reformed if we are to achieve success in solving problems under these new conditions. We will need to devote more resources to the operation of effective early warning systems, develop procedures that enhance decision making under uncertainty, and move away from the sort of paralysis that often accompanies reliance on consensus procedures. There is no reason to conclude that we will be unable to create international regimes that produce successful outcomes under the conditions characteristic of the Anthropocene. But the social capital needed for success in this new era is likely to differ substantially from the social capital we have relied on in the past.

## 5 Challenges going forward

The propositions I have discussed in the preceding sections constitute a good beginning. But they do not add up to a comprehensive theory of environmental governance. So, where can/should we go from here? What challenges confront those seeking to broaden and deepen our knowledge of environmental governance? And what responses to these challenges does my research suggest? In this section, I discuss four challenges that have come into focus in the course of my work and that strike me as particularly important as we plan the next stage of research on environmental governance (Table 3).

**Table 3** Four challenges for environmental regime analysis

**Challenge 3.1**: *How can we deepen our understanding of the complex causality involved in the operation of environmental governance systems*?

**Challenge 3.2**: *How can we integrate the collective-action and the social-practice models of environmental governance*?

**Challenge 3.3**: *How can we address needs for governance arising in the Anthropocene*?

**Challenge 3.4**: *How can we improve our ability to design effective environmental and resource regimes*?

**Challenge 3.1** *How can we deepen our understanding of the complex causality involved in the operation of environmental governance systems*?

We can say with some assurance that environmental and resource regimes are not mere epiphenomena in the sense of being surface manifestations of deeper forces that explain the outcomes arising from human–environment interactions.[8] Nonetheless, there are fundamental challenges confronting those seeking to pin down the causal roles of regimes, separate out the signal of regime effects from the noise of other forces, and understand the interactions between institutional arrangements and other drivers that influence the success of efforts to avoid or solve problems like the tragedy of the commons or the consequences of large-scale environmental externalities. There is no doubt, for example, that shifts in the demand for protein, the introduction of new harvesting technologies, and changes in water temperatures all affect the state of fish stocks over and above the effects of regulatory regimes designed to head off the problem of overharvesting. What is more, these driving forces are often interactive (Young 2002b). A concern about overharvesting may stimulate efforts to develop new sources of protein or to devise new technologies for monitoring compliance; shifts in harvesting techniques and increases in the size of user groups may provide the stimulus leading to the establishment of new resource regimes. How can we find ways to sort out the complex causality characteristic of such situations in order not only to understand the roles resource and environmental regimes play in a variety of settings but also to provide a basis for determining the sorts of regimes that will be needed to solve specific problems arising in human–environment interactions? Given the difficulties in using the familiar reductionist techniques of science in this realm, what is the way forward for those seeking to make progress in building knowledge about environmental governance? My work has led to the development of a portfolio approach to this challenge (Young et al. 2006). There is much to be said for coupling qualitative and quantitative studies of environmental governance systems and for matching familiar reductionist methods with methods aimed at revealing the dynamics of causal interactions, such as qualitative comparative analysis (QCA) and meta-analysis (Underdal and Young 2004).[9] A particularly attractive line of attack relies on sophisticated reductionist methods (e.g., new forms of multiple regression) to identify associations among key variables coupled with theoretical case studies designed to probe the causal forces at work and methods like QCA that direct attention to the interactions among these causal forces.

**Challenge 3.2** *How can we integrate the collective-action and the social-practice models of environmental governance*?

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[8] For skeptical views regarding the significance of institutions, see Strange (1983) and Mearsheimer (1994/1995).

[9] A notable trend in a field long dominated by qualitative analysis is the emergence of a stream of quantitative studies of environmental regimes (Miles et al. 2002; Breitmeier et al. 2006, 2011).

At first glance, these models appear to be antithetical to one another (Young 2002a). The collective-action model assumes that actors are self-contained entities that have their own utility functions, assess options in utilitarian terms, and evaluate the consequences associated with specific options largely on the basis of self-interest. It is this ensemble of attributes that leads to a focus on collective-action problems like the tragedy of the commons and the phenomenon of free ridership. The social-practice model, by contrast, looks upon actors as products of the social settings in which they operate that have a limited capacity to identify and assess options, are subject to the influence of socialization, and are responsive to normative concerns like the importance of considerations of fairness or justice. Framed in this way, these models appear to represent alternative perspectives on the nature of environmental governance and on the factors that determine the effectiveness of environmental and resource regimes. The adoption of one model may seem to exclude the use of the other. But is this actually the case? Under the influence of the work of psychologists like Daniel Kahneman as well as economists who engage in what has become known as behavioral economics, we are developing a more nuanced understanding of the behavior of individuals and, by extension, more complex actors that demonstrate that neither the collective-action model nor the social-practice model by itself provides an adequate basis for analyzing the nature of environmental governance or for identifying the determinants of the effectiveness of environmental and resource regimes (Kahneman 2011; Akerlof and Shiller 2009). What may well prove useful in this connection is an interactive strategy in which those interested in environmental governance become consumers of the new insights flowing from psychology and behavioral economics, while at the same time identifying phenomena that become matters for analysis on the part of those working in these fields. This will not lead quickly to a new, much less an integrated, model that those working on environmental governance can use as a straightforward point of departure. But it does suggest that the way forward is to set aside the apparent opposition between the collective-action and social-practice models and to build on the new insights regarding behavior coming into focus in other fields. The result may seem untidy, especially in comparison with the apparent tractability of the collective-action model. But it is likely to produce results that are considerably more useful to those responsible for addressing the problems of environmental governance that we confront today.

**Challenge 3.3** *How can we address needs for environmental governance arising in the Anthropocene*?

There is growing evidence to suggest that the problems of environmental governance arising in the Anthropocene differ in important ways from the more familiar problems of the past (Young 2013). Teleconnections are making it increasingly difficult to isolate problems spatially and in terms of levels of social organization. The occurrence of tipping points leading to cascades of nonlinear changes that are often abrupt and typically irreversible makes it unsatisfactory to adopt a wait-and-see attitude on the assumption that there is no hurry to devise appropriate responses (Lenton et al. 2008). The sense that we are operating in a finite world in which we may be approaching various planetary boundaries suggests that the margin for error is declining in a way that calls into question the efficacy of relying on strategies featuring what amounts to trial and error (Rockström et al. 2009). Of course, this does not mean that all problems of environmental governance have been affected by such radical changes and that we must wipe the slate clean and start over in the effort to build the social capital needed to produce effective environmental and resource regimes. Familiar problems involving the sustainable use of living resources and the regulation of externalities causing pollution will continue to occupy our attention. But it

seems clear that we are encountering a class of environmental problems for which our existing social capital in the realm of environmental governance is poorly adapted. These are large scale and rapidly changing problems (e.g., climate change) that cannot be solved through tortuous processes of negotiating and adjusting multilateral environmental agreements in a world of sovereign states. Efforts to address these problems will generate increasing pressures to consider significant changes in the character of international society as we have known it for several centuries (Kanie et al. 2012).

**Challenge 3.4** *How can we improve our ability to design effective environmental and resource regimes*?

Building knowledge about environmental governance is a legitimate pursuit in its own right. But increasingly, we are operating in a world in which there is a need to engage in applied institutional analysis or, in other words, to produce results that can help us to come to terms with the problems of environmental governance now becoming prominent as matters of public policy. My work suggests that the way forward in this realm must center on enhancing our skill in the use of institutional diagnostics (Young 2008). As Elinor Ostrom and others have observed, we must move beyond panaceas or, in other words, the hope that we can find simple solutions usable to solve problems like avoiding the tragedy of the commons in a wide range of settings (Ostrom 2007). We need a diagnostic approach, allowing us to assess the characteristics of specific problems in a rigorous manner and to design environmental and resource regimes crafted to produce the desired results under the circumstances prevailing in specific situations. Like the engineer asked to design a bridge or the architect charged with designing a public building, we must ask a range of questions both about the relevant biophysical and socioeconomic settings and about the nature and activities of the prospective users in order to come up with an institutional design likely to work well or prove effective in the situation at hand. None of this offers a way around the fact that the establishment of any environmental governance system is an intensely political process in which interested parties struggle to promote their own preferences, often at the expense of the selection of options that would produce results that are more desirable in societal terms. But it does suggest that what we now think of as the co-production of knowledge will be essential in this realm (Jasanoff 2004). To succeed in applied institutional analysis, we must work closely with members of the policy community in thinking about the best way to characterize the problem to be solved as well as in assessing the relative merits of alternative institutional arrangements that may be chosen to solve the problem.

What is the way forward in addressing these challenges? There will always be room in this field for individual analysts engaging in curiosity-driven research and pursing research agendas of their own devising. But we have moved into an era in which coordinated efforts to tackle common themes are taking center stage in this field of research. Prominent cases in which I have been active include the long-term projects on the Institutional Dimensions of Global Environmental Change (1998–2007) (Young et al. 1999, 2008) and on Earth System Governance (2009 to present) (Biermann et al. 2009) operating under the auspices of the International Human Dimensions Programme on Global Environmental Change and reflecting the overarching concerns of the global change research community with the need to address increasingly urgent societal problems.[10] A particular virtue of these projects is

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[10] I chaired the Scientific Steering Committee of the project on the Institutional Dimensions of Global Environmental Change, and I chaired the Scientific Committee of the International Human Dimensions Programme during the development of the Earth System Governance Project.

that they allow researchers to employ a range of methods to craft answers to common questions and to compare and contrast the answers they produce in the interests of developing robust propositions about environmental governance and articulating new questions to be examined in subsequent rounds of research.

## 6 Joining analysis and praxis

There are no panaceas in the realm of environmental governance in the sense of simple or straightforward prescriptions that can be counted on to produce effective solutions to environmental problems in a wide range of settings (Ostrom 2007). We must treat any sweeping prescriptions relating to environmental governance with a healthy dose of skepticism. The way forward is to foster productive interactions between practitioners who have both an intimate knowledge of the details of specific situations and an understanding of what is likely to be politically feasible and analysts who are able to look at the broader picture of governance systems that have proven successful in a range of cases and to think about innovative options to be considered in specific situations. This calls for a creative effort to engage in what is aptly characterized as a process of co-producing knowledge in which both practitioners and analysts have essential roles to play. Success in this realm does not come easily. Practitioners and analysts are apt to have different temperaments; they normally operate within cultures that privilege distinct modes of behavior and different criteria for measuring success. But applied institutional analysis thrives in settings in which practitioners and analysts are able to develop a sense of mutual respect allowing them to work together in the effort to devise governance systems that are well matched to the problems they are intended to solve.

My own experience suggests that it is highly beneficial to have a foot in both the world of practice and the world of analysis in order to engage effectively in applied institutional analysis. I come from the analytic side of things; I make no claims to have achieved great success as a practitioner. Nonetheless, I have had the privilege of participating in one way or another in a number of settings devoted to the creation and operation of environmental and resource regimes. There is no question that the opportunity to move back and forth between analysis and praxis has played an important role in the development of my thinking in this field. I am convinced that this is the road to success for those of us aspiring to populate Pasteur's Quadrant when it comes to solving major environmental problems (Stokes 1997).

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