Chapter One

Environmental Change: Institutional Drivers/Institutional Responses

INSTITUTIONS FIGURE PROMINENTLY in most accounts of the causes of major changes in biogeophysical systems as well as in many prescriptions for solving problems arising from these changes or, more modestly, ameliorating their impacts on human welfare. Many observers regard unsustainable uses of renewable resources, such as stocks of fish and wildlife, grazing lands, forests, soils, and groundwater, as consequences of the operation of systems of property or use rights that fail to give human users adequate incentives to devote energy and resources to conserving these resources. These observers also explain emissions of harmful pollutants, including sulfur dioxide and nitrogen oxides, ozone-depleting substances, greenhouse gases, and persistent organic pollutants, in terms of the absence of regulatory rules needed to provide owners or users of various factors of production with effective incentives to avoid or minimize social costs arising as unintended byproducts of their actions.

Conversely, strategies aimed at coming to terms with environmental problems frequently call for changes in prevailing structures of property rights, the introduction of new regulatory regimes, or the development of appropriate incentive mechanisms (e.g. charges or tradable permits) as procedures for redirecting or guiding the behavior of those whose actions lead to anthropogenic disturbances of ecosystems. Suitably adapted to the circumstances of specific problems, the resultant recommendations may be directed toward actors ranging from local appropriators of fish or groundwater to the operators of large power plants that are major emitters of greenhouse gases.

The emergence of a sustained interest in what may be called the institutional dimensions of environmental change is therefore easy to understand. Yet it is worth noting at the outset that this theme differs – in at least two fundamental ways – from most other topics that have emerged as major research foci among those interested in environmental change. The emphasis on institutions directs attention to a particular suite of independent variables or, in the terminology that has become familiar in this field, driving forces in contrast to a specific type of environmental change, such as the depletion of fish stocks, the loss of biological diversity, or the thinning of the stratospheric ozone layer. Whereas those concerned with phenomena like changes in patterns of land use needed to protect biological diversity or the transformation of industrial systems required to reduce emissions of greenhouse gases concentrate on key dependent variables and consider the role of a variety of driving forces, analysts interested in the contributions of institutions seek to understand the roles that institutional drivers play in the occurrence of a range of environmental changes. Thus, the study of institutions constitutes a crosscutting theme for those interested in what has become known as global environmental change.

Institutions play more or less significant causal roles with regard to most environmental changes involving human action. Yet – and this is the second distinctive feature of this research agenda - institutions seldom account for all of the variance in these situations. In the typical case, they are one among a number of driving forces whose operation, both individually and in combination, generates the relevant environmental changes. And it is reasonable to expect that there will be substantial variations in the significance of the roles that institutions play from one situation involving environmental change to another. A prominent feature of research on the institutional dimensions of environmental change, therefore, is a sustained effort to separate the signals associated with

institutional drivers from those associated with other drivers and to understand how different driving forces interact with one another to account for observed outcomes.

1. The Focus on Institutions

Over the last two decades, a movement known to many as the "new institutionalism" has gathered force throughout the social sciences. Several common concerns animate this movement in all its manifestations. The new institutionalism is pragmatic, empirical, and marked by an emphasis on rules in use in contrast to the formal provisions of contracts, constitutions, treaties, or other constitutive documents (Ostrom 1990). What holds this movement together and differentiates it from older forms of institutionalism (Powell and DiMaggio eds. 1991, Rutherford 1994) is a desire to understand the actual roles that institutions play as determinants of the outcomes of interactive human behavior or, as Thomas Schelling has put it, the links between micromotives and macrobehavior in various social settings (Schelling 1978). This does not imply any lack of interest in institutional design. But from this perspective, design makes sense only to the extent that it involves an understanding of the ways institutions are likely to work in practice in contrast to a study of outcomes that would occur in an idealized world in which those subject to the rules and procedures of institutions internalize them and comply fully with their requirements under all circumstances.

The new institutionalism offers a broad umbrella that shelters a range of distinct perspectives on human affairs. Most contributors to this movement are comfortable with a point of departure that treats institutions as sets of rules, decisionmaking procedures, and programs that define social practices, assign roles to the participants in these practices, and guide interactions among the occupants of individual roles. Structures of property rights,

electoral systems, and practices relating to marriage and the family are all examples of institutions in this sense. Institutions, on this account, must not be confused with organizations construed as materials entities possessing staffs, officers, equipment, budgets, and (often) legal personality. In rough and ready terms, organizations (e.g. the Exxon Corporation, the Republican Party in the United States, the World Bank) can be thought of as actors that typically emerge as players whose activities are guided by the rules of the game of the institutions in which they participate. Conceptualized in this way, institutions can and do vary widely in terms of a range of dimensions, including functional scope, spatial domain, degree of formalization, stage of development, and interactions with other institutions. Institutions that deal explicitly with environmental or resource issues are commonly known as environmental or resource regimes (Young 1982).

Beyond this, the perspectives of those whose thinking about institutions is rooted in disciplines as diverse as economics and anthropology diverge substantially. There is, to begin with, an important distinction between thin perspectives and thick perspectives on institutions. Institutions in the thin sense are systems of rules, decisionmaking procedures, and programs as articulated in constitutive documents (e.g. contracts, constitutions, treaties). This is the normal point of departure for those who speak of the rules of the game as the defining features of institutions and leave open as suitable topics for analysis all questions regarding the behavioral consequences of these arrangements (North 1990). Institutions in the thick sense, by contrast, are social practices that are based on the rules of the game but that also include common discourses in terms of which to address the issues at stake, informal understandings regarding appropriate behavior on the part of participants, and routinized activities that grow up in conjunction with efforts to implement the rules of the game (Scott 1995). Although they are typically based on the rules, procedures, and programs articulated

in constitutive agreements, social practices can and ordinarily do evolve over time in ways that are not easy to trace to their constitutive foundations, even though they are apt to be well-understood by participants. This is part of the message associated with the familiar contrast between rules in use and rules on paper. Among other things, this distinction provides the point of departure for debates occurring in many settings between strict constructionists who take the formulations set forth in constitutive documents as their guide and endeavor to bring behavior into conformity with them and liberals who are content to adjust or even reinterpret these formal characterizations of constitutive provisions to bring them into line with changing circumstances.

What is the significance of this distinction between thin and thick definitions of institutions? The two conceptions ordinarily identify universes of cases that are overlapping, though by no means identical. The thin definition counts all sets of rules and procedures articulated in constitutive agreements as institutions, regardless of their behavioral significance. The thick definition, by contrast, treats behavioral consequences as a defining characteristic of institutions. It omits dead letters from the universe of cases (Rittberger 1993). At the same time, it includes de facto practices that do not rest on formal constitutive agreements. The two conceptions are also likely to produce descriptions of specific institutions that are not fully congruent, even when they agree regarding the inclusion of these arrangements in the same universe of cases. This is a consequence of the gap between rules on paper, highlighted by the thin definition, and rules in use, emphasized by the thick definition. It follows that there will be differences as well regarding the perspectives on effectiveness embedded in the two types of definitions and, as a result, in the views of those making use of these definitions to examine the determinants of effectiveness. Simply put, the thin definition directs attention to matters of compliance or conformance, while the thick

definition focuses on a broader range of behavioral patterns arising in conjunction with the operation of social practices.

Whether we adopt a thin perspective or a thick one as a point of departure, it is helpful to draw a distinction between the strength or depth of institutions on the one hand and their robustness or durability on the other. Strength is a measure of the extent and stringency of an institution's rules and procedures or, in other words, the extent to which the institution requires subjects to alter or adapt their behavior to conform to its requirements. Those who think in these terms often posit links between strength and compliance. George Downs and his colleagues, for instance, argue that the deeper cooperation becomes (that is, the stronger the institution), the harder it will be to achieve high levels of compliance on the part of individual members (Downs, Rocke, and Barsoom 1996). But note that a strong institution whose members have only mediocre records of compliance may actually prove more significant in functional terms than a weak institution whose members always comply with the undemanding requirements it imposes on them.

Robustness, by contrast, is a measure of the capacity of an institution to survive various pressures intact in the sense of withstanding the impact of destabilizing forces without suffering collapse or experiencing transformative change (Hasenclever, Mayer, and Rittberger 1999). Empirical studies of robustness are hampered by difficulties encountered in devising operational measures of collapse or transformation. But several significant conceptual distinctions regarding robustness are worthy of note. Destabilizing forces may be either endogenous (e.g. democratic electoral systems that select anti-democratic leaders) or exogenous (e.g. non-anthropogenic changes in ecosystems that overwhelm arrangements governing human uses of renewable resources) in nature. Similarly, such forces may take the

form of sharp shocks or crises (e.g. sudden collapses in fish stocks) or pressures whose intensity increases or builds more gradually (e.g. rising sea levels). Institutions that have considerable capacity to adjust to pressures that increase gradually may succumb to severe shocks (e.g. monetary crises) almost overnight. There are cases as well in which institutions whose members are able to mobilize effective responses to sudden crises have little capacity to adjust to pressures that rise slowly – sometimes even imperceptibly - but are more systemic in nature. Robustness, then, is a multi-dimensional variable, a fact that is likely to lead to the formulation of a number of distinct hypotheses intended to explain why some institutions are more durable than others.

Another conceptual matter of obvious relevance to a study of the institutional dimensions of environmental change concerns the density of institutions operating at the same time within a given social space (e.g. a local society, a national society, international society). Identifying clear boundaries between institutions may not be straightforward in specific cases. Like ecosystems, individual institutions are often linked together through various types of interdependencies (Commoner 1972). Even so, every society encompasses a number of distinct institutions separated in terms of functional scope, spatial domain, or membership. The density of institutions operative in specific social settings is a variable. Most national societies feature a high density of institutions. International society, by contrast, has long been treated as a low density setting. But there are clear indications that the density of distinct institutional arrangements operating at the international level has been on the rise for some time, especially with regard to functional concerns like economic relations and the environment.

Density is a matter of interest both as a dependent variable and as an independent variable. There is considerable interest at present, for example, in finding ways to measure trends in the density of international institutions and to identify the conditions that account for increased density in this social space (Meyer et al. 1997). Although this development is a matter of interest in its own right, the effort to explain trends in density is driven in considerable part by an interest in the likely consequences flowing from increases in the density of international institutions. Some observers have suggested that increasing density will lower the probability of severe (even violent) conflict at the international level on the grounds that the cost of conflict rises as a function of the number and variety of institutional arrangements it is likely to disrupt (Conca 1998). In addition, rising density leads to an increase in institutional interplay in the sense of interactions between or among distinct institutions. Institutional interplay is a familiar phenomenon at the domestic level where institutional density has been high for some time; numerous procedures have evolved over time to deal with such interactions in ways that protect or enhance social welfare. But rising levels of institutional interplay constitute a more novel concern at the international level. Finding ways to handle the resultant interactions is especially challenging in a social setting that lacks a central public authority - or what we normally think of as a government - authorized to deal with such matters.

These comments lead to the additional observation that institutions created to deal with specific environmental problems or issues frequently become embedded in larger hierarchical structures (von Moltke 1998). Take the arrangements known as exclusive economic zones (EEZs) as a case in point. Created during the 1970s and 1980s and formalized in the 1982 UN Convention on the Law of the Sea (UNCLOS), EEZs now cover over a third of the world ocean and accord jurisdiction over the lion’s share of living marine

resources to coastal states. As a result, this shift in the rules of the game constitutes one of the most important changes of modern times in the institutional arrangements prevailing in international society. But exclusive economic zones do not operate as isolated or stand-alone arrangements. The EEZs provide a framework within which individual countries have devised national regimes dealing with fish and other resources located within the zones. In some cases, there are also subnational and even local arrangements dealing with the resources in question. This has led some commentators to use the term meta-regime in seeking to understand the significance of the EEZs as a major institutional innovation in international society. At the same time, the EEZs themselves form a part of the overarching arrangements for the world ocean codified in the law of the sea convention, and they are embedded in the broader institutional arrangements that make up the deep structure of international society.

Any effort to determine the impact of EEZs will therefore require an assessment of the larger institutional structures of which they form integral elements. In all likelihood, this will lead to mixed conclusions. The results flowing from the introduction of EEZs are likely to vary considerably as a function of the character of the national and subnational arrangements established to bring this meta-regime to bear in different geopolitical settings. What is more, the consequences of the EEZs themselves, which encompass the same elements throughout international society, will be sensitive to regional variations in the character of key ecosystems. It is not surprising, for instance, that problems have arisen in cases where individual fish stocks straddle boundaries separating the EEZs of two or more coastal states or EEZs from the high seas in contrast to cases where stocks are wholly encompassed within individual EEZs. The significance attached to the negotiations leading to the 1995 Straddling Stocks Convention is indicative of the importance of these problems (Stokke forthcoming).

Finally, it is worth highlighting at the outset one important consequence of the fact that institutions – even in the thick sense – constitute crosscutting forces. In virtually every setting involving environmental change, institutions make up only one of a set of drivers which may include non-anthropogenic forces (e.g. changes in the Earth's climate system unrelated to human interventions) as well as other anthropogenic forces (e.g. population growth, technological innovation, business cycles). This has a number of implications to which I will return in the next section of this chapter. But the point to ponder at this stage is that an institutional arrangement which produces good results in one setting may prove to be an outright failure in other settings. Just as there may be a number of different institutional arrangements that are sufficient to solve a particular problem, therefore, it is risky to assume that because a particular institution yields good results in one setting, it can be expected to perform equally well in other settings. To be specific, a management system governing the harvesting of fish that works well so long as the behavior of appropriators is guided by the logic of appropriateness may fail dismally in a setting where behavior is based largely on the logic of consequences (March and Olsen 1998). Similarly, a system that does fine in the absence of sharp biogeophysical fluctuations that produce sudden crises may collapse quickly in a setting where the occurrence of such crises requires rapid responses on the part of those responsible for monitoring the status of fish stocks and adjusting quotas to reflect biogeophysical changes.

2. The Principal Science Questions

All those seeking to understand the connections between institutions and environmental change share a general interest in the roles that institutions play both in causing and in confronting disruptions in large and important ecosystems. Yet it is possible to

draw distinctions among several specific science questions that animate the efforts of members of this community (Young et al. 1999). At the most basic level lies the question of causality: How much of the variance in the condition of ecosystems is attributable to institutions? Next is the question of performance: Why do some institutional responses to environmental problems prove more successful than others in terms of criteria like sustainability, efficiency, and equity? At the most applied level is the question of design: How can we structure institutions to maximize their performance? Obviously, these questions are linked to one another. Basic research on the question of causality is motivated, at least in part, by a desire to improve our ability to design regimes that will prove effective in solving – or at least managing - specific environmental problems and, for that matter, in meeting various standards of efficiency and equity. It is impossible to succeed in designing effective institutions without some understanding of the roles that these arrangements play as driving forces in the realm of human affairs. Nonetheless, individual researchers are attracted more or less powerfully to one or another of these questions, and the paradigmatic research puzzles that come into focus in connection with each of the questions are distinct.

2.1 The Question of Causality

In the final analysis, interest in the institutional dimensions of environmental change rests on claims about the roles that institutions play in causal terms. Yet claims regarding causation involve several analytic complications or puzzles that run through all efforts to add to our understanding of the significance of institutions in human affairs. Because institutions are not actors in their own right, they can only affect the outcomes of interactive decisionmaking by influencing the behavior of those who are actors. But the pathways through which this influence occurs include a number of behavioral mechanisms that are distinct but often operate simultaneously or even interact with one another under conditions

that are poorly understood (Young 1999a). What is more, spatial and temporal associations between institutions and environmental changes do not provide unambiguous evidence of significant causal connections. The apparent role of institutions both in causing environmental problems (e.g. the collapse of a fish stock following increases in levels of human harvesting) and in solving such problems (e.g. the loss of biological diversity arising from clearcutting in forests) may well turn out to be spurious. It is perfectly possible that biogeophysical forces (e.g. changes in seawater temperatures) constitute the real cause of the collapse of a given fish stock; the ability of key species to adapt to changing ecological conditions may account for improvements in biodiversity. Under the circumstances, it will come as no surprise that the effort to pinpoint the mechanisms through which institutions become causal forces and to demonstrate causal connections between institutions and specific ecological conditions constitutes the most fundamental challenge in this field of study. To put it bluntly, in the absence of demonstrated causal links, interest in the institutional dimensions of environmental change will fade away and eventually disappear.

In thinking about this challenge, it makes sense to start with the simplest case and work toward more complex cases. To begin with, then, consider a relatively well-defined ecosystem (e.g. a large marine ecosystem like the Bering Sea) and a single regime focused on that system and composed of a set of harvesting rules dealing with seasons, gear restrictions, and catch limits (Iudicello et al. 1999). The issue here can be framed as follows: How much of the variance in the status or condition of the living resources of the ecosystem can be attributed - ceteris paribus - to the operation of these rules? Or to put it more concretely, to what extent does the operation of the regime determine the condition of these resources? Most efforts to answer these questions fall into two categories (Young 2001). One strategy is to begin by asking what would have happened in the absence of the regime and then to treat

the effects or consequences of the regime as the difference between the no regime outcome and the actual outcome (Helm and Sprinz 1999). The other strategy seeks to track changes in key variables (e.g. increases or decreases in various fish stocks) occurring during the period beginning with the creation of the regime and then to determine what proportion of these changes can be attributed convincingly to the operation of the regime (Mitchell forthcoming). Each strategy has merit; neither strategy alone offers a simple procedure for circumventing or addressing the question of causality.

A somewhat more complex issue arises in efforts to assess the relative contributions of two or more distinct drivers as determinants of the status or condition of an ecosystem. Turning again to the case of a marine ecosystem, we can ask how much of the variance in the condition of fish stocks of interest over time is caused by institutional drivers (e.g. rules governing human harvesting) in contrast to biogeophysical drivers (e.g. changes in seawater temperatures or increases/decreases in populations of other organisms). The challenge here is not to identify a master variable in the sense of a single driver that can account by itself for the condition of the relevant ecosystem. Rather, the objective is to separate out the signals of several distinct types of drivers and to assess the causal role that each plays in determining the status or condition of the ecosystem. Nothing in this way of framing the problem yields convincing procedures for demonstrating the causal significance of individual drivers. But this approach is both compatible with the view of institutions as crosscutting factors and conducive to thinking about the dynamics of environmental problems in terms that are relevant to policymaking.

An even more complex issue arises in cases where institutional drivers interact with other driving forces. Consider the marine ecosystem once again as a case in point. A

successful regime would track fluctuations in the abundance of specific stocks of fish, raising quotas when the stocks are increasing in size and lowering them when the stocks are decreasing. But suppose, now, that those responsible for operating the regime fail to lower quotas or even raise them in response to economic or political pressures at a time when the size of a stock is declining. Here is a case in which a stock that is perfectly capable of recovering in the absence of anthropogenic interventions may be pushed beyond the margin of recoverability by the interaction of anthropogenic and biogeophysical drivers. Recent years have brought an awareness of the fact that many ecosystems do not have powerful stabilizing mechanisms which can be counted on to move them back toward some preexisting equilibrium following major disturbances (Wilson et al. 1994). Even in the absence of human interventions, ecosystems frequently undergo dramatic shifts from one state to another. Interactions between institutional and biogeophysical drivers can be expected to accentuate the impacts of non-linear dynamics in a wide range of systems (NRC 1996).

The preceding paragraphs serve to clarify and highlight the question of causality rather than to answer it. What can be done to generate convincing answers to this question? At this stage, it seems clear that we are unlikely to find any silver bullet in this realm in the sense of a straightforward procedure that can be counted on to sort out the causal connections between ecosystems on the one hand and a variety of driving forces on the other. Controlled experiments are seldom feasible in dealing with large ecosystems and complex institutions. Although procedures featuring statistical inference are useful in some settings, small and heterogeneous universes of cases often impose severe constraints on this approach to the question of causality. Under the circumstances, it is easy to understand why those seeking answers to the question of causality, regularly resort to a combination of procedures featuring the conduct of in-depth case studies, the analysis of behavioral pathways, the procedure based

on Boolean algebra and known as qualitative comparative analysis, and even computerized simulations (Underdal and Young forthcoming). None of these procedures, by itself, is likely to yield convincing conclusions about the roles that institutions play in the dynamics of large ecosystems. But taken together, this collection of procedures is capable of adding incrementally – albeit sometimes slowly - to our understanding of the institutional dimensions of environmental change.

2.2 The Question of Performance

Assuming that institutions make a difference in the sense that they emerge as significant driving forces in a variety of settings, it is logical to move on to ask a range of questions pertaining to their performance. Whereas the question of causality centers on establishing the significance of institutions as driving forces, the question of performance requires the specification of criteria of evaluation followed by an assessment of the extent to which actual outcomes measure up in terms of the criteria selected. Under the circumstances, it is easy to see that an institution may be accepted as a powerful causal force but nevertheless be regarded as a failure or an underachiever in terms of standards based on criteria such as sustainability, efficiency, or equity. The question of performance makes sense only in settings where there is general agreement on the proposition that institutions are significant causal forces. But once that threshold is crossed, a range of additional issues relating to performance come into focus.

Several distinctions of a conceptual nature will help to organize thinking about the question of performance. The concept of simple performance directs attention to results flowing from the operation of an institution that are (1) internal in the sense that they are confined to the relevant behavioral complex, (2) direct in the sense that they involve short

causal chains, and (3) positive in the sense that they contribute to solving identifiable problems (Young ed. 1999a). Complex performance, by contrast, subsumes simple performance and adds to it a range of broader or more extended outcomes that occur outside the initial behavioral complex, involve longer causal chains, and encompass negative as well as positive impacts (Levy, Young, and Zürn 1995). Most thinking about the question of performance has focused on efforts to assess simple performance. But it is easy to see that a regime created to solve an environmental problem can achieve high marks with regard to simple performance while, at the same time, generating broader outcomes that offset its contribution to problem solving and that may even produce a situation in which the net effects of the arrangement are judged to be negative from the perspective of social welfare more generally.

The most common criteria of evaluation employed by those concerned with simple performance regarding environmental problems center on the idea of sustainability in one or another of its forms. Is the fish stock robust in the sense that it produces sustainable yields over time? Is the level of biological diversity stable or even increasing? Are emissions of greenhouse gases being kept at levels that are low enough to avoid serious anthropogenic interference in the Earth's climate system? Important as this biogeophysical perspective is, however, it is not the only criterion relevant to assessing simple performance. At a minimum, most observers would add to these sustainability considerations a concern for efficiency (e.g. is sustainability being achieved in a way that minimizes costs?) and for equity (who gains and who loses and are outcomes achieved through the use of legitimate procedures?). Although they are distinct in analytic terms, these considerations often interact with one another in fact. A demonstrable commitment to the pursuit of efficiency is likely to be necessary to convince actors to agree to the terms of institutional arrangements in the first place. A willingness to

address matters of equity will often prove critical in persuading actors to comply with the requirements of institutional arrangements once they are in place.

To this set of concerns the idea of complex performance adds a range of issues that are broader and more difficult to deal with in terms of empirical analysis. An institution created to solve a well-defined problem (e.g. ensuring sustainable uses of fish stocks) may produce consequences affecting the domestic politics of individual member states (e.g. the influence of the fishing industry as an interest group), other regimes dealing with issues that intersect with the arrangement at hand (e.g. rules governing international trade or investment), or social practices operating at the level of the social system as a whole (e.g. practices relating to the divisibility of sovereignty at the international level). Similarly, the broader outcomes that institutions produce may vary greatly in terms of directness or the length of the causal chain linking the institution and the outcome. It is relatively easy, for instance, to demonstrate convincing connections with regard to immediate outcomes, such as the promulgation of regulations devised for the express purpose of operationalizing the rules articulated in a law or a treaty creating a specific regime. But the trail grows cold quickly as the length of the causal chain increases. This does not mean that the more indirect outcomes generally considered under the heading of complex performance are insignificant or that they can be ignored safely. But it does help to account for the fact that efforts to assess complex performance are considerably less advanced than studies of simple performance.

Hovering over this discussion of the question of performance is the overarching concept of social welfare (Underdal 1999). Even at the local level, social welfare is a concept that is difficult to operationalize; the complications associated with the concept increase proportionately as we move toward the national and international levels. Nonetheless, it is

pertinent to ask whether efforts to solve environmental problems by creating institutions to regulate or govern human interventions in large ecosystems yield net improvements in social welfare. What makes this issue both interesting in substantive terms and challenging in analytic terms is the fact that social welfare in this context must take into account both the costs to individual actors arising from restrictions on their freedom to act independently and the opportunity costs arising from the fact that societies cannot use resources invested in solving one problem to deal with other problems. Even when a regime does a good job of solving a well-defined environmental problem (e.g. sustaining a fish stock, controlling intentional oil pollution at sea), therefore, critics may contend that society would be better off if the resources devoted to creating and operating the governance system for that problem had been used instead to address some other problem (e.g. protecting habitat critical to endangered species). Because social agendas are typically compartmentalized and addressed in different arenas, policymakers seldom consider questions of this sort in a systematic manner. Yet any comprehensive account of the question of performance cannot afford to ignore them completely.

2.3 The Question of Design

In practice, much of the interest in the institutional dimensions of environmental change is driven by a desire to (re)design arrangements to solve more or less well-defined problems (the depletion of fish stocks, the thinning of the ozone layer, the loss of biological diversity). In cases where existing institutions are treated as sources of the problem, this means modifying or replacing these arrangements to redirect the behavior of the relevant human actors. Where problems are attributable to biogeophysical drivers, on the other hand, the goal is to create institutions that will give human actors proper incentives to regulate these drivers. Efforts to design specific institutions are constrained both by limitations on our

ability to foresee how institutions treated as complex systems will perform in practice and by the fact that the character of institutional arrangements is more often a product of bargaining among actors pursuing their individual interests than a result of some systematic exercise in social engineering (Young 1982). Nonetheless, interest in (re)designing institutions as a means of coming to terms with environmental problems is strong and likely to become even stronger during the foreseeable future.

Because institutions are not actors in their own right, those engaged in institutional design must think at all times about the probable impacts of the arrangements they create on the behavior of various groups of actors. Broadly speaking, two ways of thinking dominate this endeavor: the logic of consequences and the logic of appropriateness (March and Olsen 1998). Those who think in terms of the logic of consequences assume that actors are utilitarians responding to changes that affect the benefits and costs associated with the options available to them. They will seek to design arrangements that alter incentives by driving up the costs of undesirable actions (e.g. increased harvests of fish) and increasing the benefits of desirable actions (e.g. investing in future returns from renewable resources). Those who think in terms of the logic of appropriateness, by contrast, assume that actors behave in ways that they regard as right or proper and that they will normally accept restrictions that they conceive of as legitimate. They will seek to design arrangements (e.g. procedures for setting allowable catches in various fisheries) that actors treat as authoritative because their voices have been heard in the design process or because they are based on underlying principles that actors regard as fair or just (Risse 2000). The logic of consequences and the logic of appropriateness are not mutually exclusive; designers seeking to create institutions that will perform well are likely to pay attention to both perspectives on

behavior. Still, the two approaches do yield strikingly different outlooks on the question of design.

Beyond this lies the challenge of bringing general knowledge about causality and institutional performance to bear on processes of design involving specific environmental problems (e.g. managing fish stocks, stabilizing the Earth's climate system). One approach features the development of design principles. A design principle, as Elinor Ostrom puts it in her well-known analysis of common-pool resources or CPRs is "an essential element or condition that helps to account for the success of … institutions in sustaining the CPRs and gaining the compliance of generation after generation of appropriators to the rules in use" (Ostrom, 1990: 90). This approach yields tentative generalizations spelling out necessary conditions for success of the following sort: (1) "[m]ost individuals affected by the operational rules can participate in modifying the operational rules" and (2) "[m]onitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators" (Ostrom 1990: 90). The obvious implication of this exercise is that once design principles have been identified and tested through systematic empirical analysis, it should be possible to apply them in connection with efforts to (re)design institutions addressing any member of the relevant universe of cases (smallscale CPRs in Ostrom's analysis).

Needless to say, this is an appealing prospect. Yet, as Ostrom herself would be the first to acknowledge, it assumes a universe of cases that is both well-defined and relatively homogeneous. As we move toward many of the familiar problems on today's environmental agenda, the applicability of these principles becomes less and less clear. In cases where incentives to cheat are not strong or behavior is highly transparent, for instance, monitoring

may be far less important than arrangements designed to enhance the capacity of actors to fulfill the commitments they have made under the terms of constitutive agreements. In cases where the ultimate problem centers on the consumption of environmentally unfriendly goods (e.g. ozone-depleting substances), it may make sense to focus attention on the actions of the relatively small number of producers of these goods rather than directing attention to the actions of the multitude of consumers. The point is not that we should eschew any efforts to develop design principles. Rather, it is important to exercise great care in thinking about the application of seemingly simple principles to the complexities of specific situations.

An alternative approach centers on what may be called institutional diagnostics (see Ch. 7). This approach starts from the premise that one size does not fit all when it comes to designing institutions to solve environmental problems. It therefore calls for an effort to identify the critical features of specific problems followed by an effort to specify institutional arrangements that are best suited to deal with the most prominent of these features in the case(s) at hand. Consider climate change as a case in point. Because there is a significant chance that the Earth's climate system will behave chaotically and generate costly surprises, the climate regime needs to grant priority to the creation of early warning systems and procedures that allow rapid adjustments in the regime's rules. Similarly, the fact that there is a relatively high level of uncertainty about the nature – and even the reality - of climate change as an environmental problem makes it important to devote resources to improving knowledge about this problem and to provide mechanisms through which social learning can lead to suitable modifications in the character of the climate regime (Clark et al. 2001). There is no reason to set the search for design principles and the practice of institutional diagnostics in opposition to one another. Both may yield results that help us to cope with important environmental problems. But it is worth noting that the diagnostic approach can only succeed

when there is a close working relationship between those who possess high quality knowledge of the biogeophysical attributes of a particular problem and those who are seeking to devise an institutional arrangement that is best suited to the character of that problem.

3. Analytic Frontiers: Fit, Interplay, and Scale

The questions of causality, performance, and design define the research agenda for those interested in the institutional dimensions of environmental change. They also provide appropriate criteria of evaluation to be used in assessing the performance of the members of the research community engaged in studies of this subject. That much is clear. But the issue of where to cut into this subject in the interests of maximizing contributions to knowledge and helping to solve problems is more difficult to resolve. There is room for numerous strategies, and individual researchers must be allowed to make their own investment decisions in allocating their time and energy among alternative approaches to the central questions. Recently, however, the community of researchers working on the institutional dimensions of environmental change has engaged in a coordinated effort to identify particularly promising lines of enquiry in this field. This has led to the identification of three cutting-edge themes that have become known in the field as the problems of fit, interplay, and scale. I introduce these themes here and subsequently use them as points of departure for the substantive chapters of this book.

3.1 The Problem of Fit

The problem of fit centers on one fundamental proposition. An institutional arrangement that performs perfectly well in dealing with one environmental problem may prove to be a dismal failure when used in an effort to solve other problems. A regime based on the assumption that stocks of renewable resources are highly resilient and able to rebound

quickly following a temporary ban or moratorium on harvesting will run into problems when the resources in question are easily driven to a point where recovery is slow or even past the point of no return. Similarly, an arrangement that performs creditably in managing human activities affecting biogeophysical systems that are surprise free in the sense that they are not subject to sudden and unexpected shifts from one state to another will produce unsatisfactory results in settings where non-linear changes or cascades can trigger severe crises. In essence, then, the problem of fit deals with the congruence or compatibility between ecosystems and the institutional arrangements created to manage human activities affecting these systems (Berkes and Folke 1997, Cleveland et al. 1996). Overall, the presumption is that the closer the fit between ecosystems and institutional systems, the better the relevant institutions will perform, at least in terms of sustainability.

The problem of fit is comparatively easy to deal with in situations where universes of case are homogeneous. To the extent that all members of a class of environmental problems involve biogeophysical systems that are roughly comparable in terms of structures and processes, those responsible for creating regimes to manage the relevant human activities can be expected – perhaps gradually – to develop a repertoire of best practices that can be applied to one case after another with reasonable expectations of success. This is not to say that knowledge regarding best practices will accumulate easily or quickly. In fact, a good deal of trial and error may be required to devise effective procedures for managing human activities even in cases where the essential nature of environmental problems is strikingly uniform. Moreover, superficial differences may obscure the underlying similarities among different situations. Not all CPRs, for instance, look the same to a casual observer who may be struck by the fact that the resources in question differ greatly in biogeophysical terms. The transfer of knowledge about best practices may also prove difficult in social settings where individual

actors are reluctant to draw lessons from or rely on each other's experiences. Even in cases where the environmental problems are more or less the same, therefore, individual human groups may have to learn about best practices the hard way or, in other words, by accumulating experience of their own rather than benefiting from the relevant experiences of others.

The problem of fit becomes more complex – and this is the important point – in situations where the universe of cases is heterogeneous in biogeophysical or socioeconomic terms and where it may not be easy to pinpoint the essential differences among the individual members of the universe. Consider the problems of ozone depletion, climate change, and the loss of biological diversity in these terms. All three problems are generally treated as prominent cases of global environmental change. But beyond this, the similarities and differences among them are anything but clear. It is easy to see that ozone depletion and climate change are closely tied to industrial production, whereas the loss of biodiversity is largely a matter of habitat destruction, and that ozone depletion involves a relatively small economic sector, whereas climate change and the loss of biodiversity involve more fundamental economic and political arrangements. But at this stage, we lack any systematic procedure for identifying those attributes of environmental problems that are most critical from a managerial perspective and analyzing the implications of these attributes for the development of effective institutional arrangements. While there are good reasons to believe that the universe of cases is relatively heterogeneous, then, the tools available for ensuring that regimes are well-suited to the problems they address are limited.

Under the circumstances, it is not surprising that more or less serious misfits or mismatches between environmental problems and regimes are common. In the absence of a

systematic understanding of the problem of fit, it is tempting to proceed by analogy and especially to assume that regimes that are successful in one context will work well in other settings as well. Thus, many commentators are drawn to the view that we can derive "lessons" from the experience with confronting ozone depletion that will help to solve the problem of climate change, despite the obvious differences between the two problems (Susskind 1994). It is also natural in such situations for individual actors to push hard for the creation of arrangements that are compatible with their own interests in the process of establishing regimes to deal with salient environmental problems. The differences between the members of the European Union and those that form the so-called Umbrella Group regarding matters like carbon sequestration and emissions trading in the case of climate change, for example, are easy to understand as reflections of the particular interests of the two groups. But so also are numerous other situations involving institutional preferences, such as disagreements about regulations affecting land use and about standards applying to air pollution in domestic settings.

It is worth noting as well that mismatches between regimes and ecosystems are frequently difficult to eliminate. Simply pointing to poor results measured in terms of indicators of sustainability and appealing to the members of the relevant group to take the steps needed to enhance social welfare is seldom sufficient to ensure positive results. Partly, this is a matter of difficulties associated with efforts to document unsustainable activities and to demonstrate conclusively the role of prevailing institutions as causes of these activities. To revert to the example of marine ecosystems, it is remarkable how hard it is to gain consensus regarding the biogeophysical status of overexploited fish stocks, much less on the role of human harvesting as a driving force in the decline or even collapse of specific stocks (Dobbs 2000). In part, the problem lies in the interests of those whose livelihoods are affected. Many

fishers resist changes in regulatory arrangements even when they know perfectly well that key stocks are overexploited because they have large debts to service on a regular basis and because they have little ability to switch from fishing to alternative ways of making a living. It follows that mismatches can be highly resistant to change, even in cases where all parties concerned are aware that existing practices are unsustainable and generally inefficient as well.

3.2 The Problem of Interplay

Although it is tempting to treat institutions as self-contained arrangements, most institutions interact with other similar arrangements both horizontally and vertically. Horizontal interplay involves interactions occurring at the same level of social organization; vertical interplay is a result of cross-scale interactions or links involving institutions located at different levels of social organization. The resultant interplay between or among institutions may take the form of functional interdependencies or arise as a consequence of the politics of institutional design and management. Functional interdependence is a fact of life. It occurs - whether we like it or not - when the substantive problems that two or more institutions address are linked in biogeophysical or socioeconomic terms. The politics of institutional design and management, by contrast, comes into play when actors forge links between issues and institutions intentionally in the interests of pursuing individual or collective goals (Young et al. 1999). Combining the two dichotomies gives us a 2x2 matrix that provides a conceptual map of the domain of institutional interplay (see Matrix 1).[1]

[1] . The terminology employed in this matrix differs somewhat from the parallel terminology in the IDGEC Science Plan. Specifically, I have embellished the original functional/political distinction to emphasize that functional linkages arise from biogeophysical and socioeconomic interdependencies

Identifying cases of vertical interplay requires an explicit demarcation of the boundaries separating different levels of social organization. It is common, in this connection, to start by distinguishing among micro, meso, and macro-scale systems or, in other words, local, national, and international levels of social organization. But this classification is far from precise, much less objectively correct. National systems range from micro-states (e.g. Luxembourg or Nauru) to continental states (e.g. the Russian Federation or the United States), and some local jurisdictions (e.g. the North Slope Borough in Alaska) cover larger areas than many nation states. Nor is there anything sacred about the tripartite division of levels of social organization into local, national, and international systems. Although social scientists have used this simple scheme for many purposes, there is growing interest in regional arrangements operating above the local level but below the national level as well as in regional arrangements operating above the national level but below the global level. Analyses of vertical interplay do not presuppose anything about appropriate or preferred ways to differentiate among levels of social organization. They simply direct attention to cross-scale interactions, however the relevant levels of social organization are defined.

MATRIX 1

TYPES OF INSTITUTIONAL INTERPLAY

	Functional Interdependencies	Politics of Design and Management
Horizontal	FCCC/ozone regimes	Joint funding mechanisms (e.g. GEF)
Vertical	CBD/national forest regimes	CLRTAP/national air pollution regimes

Whereas vertical interplay turns on distinctions among levels of social organization, horizontal interplay emphasizes the importance of differentiating between or among institutions operating at the same level of social organization. Because institutional arrangements often run into one another at the margins, it is not always easy to determine where one institution ends and another begins, and this problem can become increasingly complex as rules in use evolve with the passage of time. As the global trade regime has taken on environmental provisions and a variety of environmental regimes (e.g. the arrangements dealing with ozone depletion, trade in hazardous wastes, and trade in endangered species) have taken on provisions dealing with trade, for instance, the boundaries between and among these arrangements have begun to blur. It follows that separating distinct regimes operating at the same level of social organization can be a tricky business. Yet no one doubts that there are useful distinctions to be drawn in this realm, and it is the separation between functionally or spatially distinct arrangements that opens up the prospect of horizontal interplay.

Long familiar in domestic settings, functional interdependencies are rapidly becoming an important concern at the international level as well. The international regimes dealing with ozone depletion and climate change, for instance, are linked functionally because chlorofluorocarbons (CFCs), which are the central concern of the ozone regime, are also potent greenhouse gases and because a number of the chemicals that seem attractive as substitutes for CFCs are at the same time greenhouse gases (Oberthür 1999). Regimes dealing with the regulation of marine pollution and with the protection of stocks of fish and marine mammals are functionally linked because the success or failure of efforts to control pollution can be expected to have significant consequences for the well-being of marine ecosystems and the stocks of fish and other organisms they support. For that matter, regimes that regulate fishing and regimes designed to protect marine mammals are functionally linked

as a consequence of the fact that whales, seals, and other marine mammals are dependent on fish as a food source and often suffocate when they become entangled in fishing gear.

A number of distinct motives can lead actors to engage in deliberate attempts to link institutions at the stages of design and management. Such initiatives sometimes arise from a desire to improve the performance of individual regimes. Efforts to nest local or regional arrangements (e.g. the various regional seas regimes) into larger or more comprehensive arrangements (e.g. the overall law of the sea), for instance, typically rest on a belief that the effectiveness of the smaller scale arrangements will be enhanced by integrating them into larger systems. In other cases, political linkages arise from efforts to improve efficiency by integrating the supply of services needed to operate two or more institutional arrangements. Funding mechanisms and dispute settlement procedures are familiar cases in point. The Global Environment Facility (GEF), for instance, provides funding both for the climate regime and for the regime dealing with the protection of biological diversity (Sand 1999). At the same time, political linkages are common in situations where actors seek to use a second arena to gain advantages with regard to the pursuit of interests that are blocked in a primary arena. Recent efforts on the part of those favoring a resumption of (limited) commercial whaling to promote their goal through the regime for trade in endangered species constitutes a case in point.

The occurrence of functional interdependencies will often suffice to trigger the emergence of political interplay. Faced with severe side effects or mutual interference, actors may find there are compelling reasons to address these issues in the context of institutional design. Similar remarks are in order regarding efforts to create vertical hierarchies of institutions operating in a single issue area. But the existence of such linkages is not a

necessary condition for the emergence of linkage politics. A particularly interesting illustration of this proposition arises in cases where actors devise packages or clusters of institutional arrangements largely for strategic purposes rather than as instruments for coming to terms with functional interdependencies. Matters pertaining to navigation, fisheries, offshore oil and gas development, deep seabed mining, pollution control, and scientific research are often dealt with by distinct systems of rules that work perfectly well in their own domains. But in specific cases, actors may find it expedient to combine these distinct concerns into comprehensive sea-use regimes in order to negotiate package deals that are acceptable to all stakeholders possessing legitimate claims to use the relevant resources (Sebenius 1983). As the example of the comprehensive law of the sea set forth in the 1982 convention makes clear, complex packages are often difficult to negotiate, much less to implement once their provisions have been ratified (Friedheim 1993). Over time, however, they may prove helpful in coming to terms with common problems of institutional interplay that arise in areas in which a variety of individual arrangements have been created with little concern about their implications for related arrangements.

3.3 The Problem of Scale

The concept of scale has to do with the levels at which phenomena occur in the dimensions of space and time. Much of the work on regimes dealing with CPRs, for instance, is based on the study of smallscale, typically local arrangements devised to deal with human uses of natural resources like stocks of fish, water, trees, or grazing lands. At the same time, many observers have noted the fact that some global systems, such as the electromagnetic spectrum or the Earth's climate system, also exhibit the defining features of common-pool resources (Sandler 1997). It is natural, under the circumstances, to ask whether propositions derived from the study of smallscale systems apply to global CPRs as well and vice versa

(Young 1994a). Note that the issue at stake here differs from the central concern of the problem of interplay. Institutional arrangements can and often do interact with one another across levels of social organization, giving rise to more or less complex forms of vertical interplay. But the problem of scale is not a matter of interactions or linkages among distinct institutions. Rather, it centers on the extent to which the dynamics of systems that differ from one another in terms of spatial or temporal scales are nonetheless sufficiently similar so that we can scale up and scale down in seeking to understand how they work.

In the analysis of human systems, spatial scale is a familiar concept. In fact, disciplines like political science employ clear distinctions based on the idea of scale (e.g. local politics, national politics, international politics) as a means of differentiating important subfields. The assumption implicit in this procedure is that scale matters in the sense that there are important differences between local polities and national polities or between national polities and politics at the international level. In the case of political science, this distinction turns, for the most part, on the character of the political institutions prevailing at different levels of social organization. Thus, the presence or absence of a state is treated as a matter of such fundamental importance that it is unlikely that cross-scale comparisons between local and national or between national and international systems will prove insightful. Yet the study of governance systems created to deal with environmental problems has raised interesting questions about this presumption (Young 1999b). To the extent that design principles derived from a study of smallscale CPRs are also helpful in thinking about avoiding tragedies of the commons at the global level (Ostrom et al. 1999), for instance, the problem of spatial scale will emerge as an interesting focus of analysis for those concerned with the institutional dimensions of environmental change.

Temporal scale is a different matter. One of the central puzzles for those seeking to understand the behavior of the Earth's climate system, for instance, involves the relative importance of inter-annual cycles (e.g. El Niño events), decadal cycles (e.g. variations in solar radiation), and millennial cycles (e.g. advances and retreats of glaciers and ice sheets) which operate simultaneously - albeit at different temporal scales – but which appear to involve mechanisms that are quite distinct. With regard to human systems, a number of observers have attempted to document business cycles; some have sought to identify electoral cycles or issue-attention cycles, and a few have suggested that it is possible to discern "long cycles" relating to the rise and fall of great powers at the international level or even the rise and fall of human civilizations as portrayed by writers like Spengler and Toynbee (Downs 1972, Goldstein 1986, Kennedy 1987). Such efforts constitute a minor stream of analysis, and the obvious differences among the cycles in question are so great that few have thought to pose specific questions relating to cross-scale comparisons. Nonetheless, temporal scale constitutes an interesting topic for those concerned with the institutional dimensions of environmental change. To the extent that considerations of temporal scale are relevant to the biogeophysical systems in question, institutional arrangements will need to include procedures for tracking processes occurring at different scales (e.g. inter-annual fluctuations in temperatures due to natural variability versus decadal changes in temperatures associated with the greenhouse effect). And should it turn out that temporal scale is relevant to human systems as well, this may have additional implications for the creation and implementation of institutions. It is perfectly possible, for example, that the formation of institutions occurs in waves, with periods of innovation (e.g. the 1970s, the 1990s) alternating with periods of consolidation (e.g. the 1980s, the 2000s?).

4. The Road Ahead

Many individual studies have shed light on the roles that institutions play both as drivers of environmental change and in the responses that humans make to environmental problems. Clearly, there is ample scope for the flow of these individual studies to continue. At the same time, this subject lends itself to a largescale, programmatic effort on the part of researchers trained in a variety of fields of study but willing to engage in a concerted effort to make progress toward answering the questions of causality, performance, and design outlined in this chapter. The key to success here is to strike a proper balance between coordinating the activities of numerous researchers on the one hand and leaving individual researchers ample scope for imagination and creativity on the other. Individual projects that are not based on compatible definitions of key concepts and common formulations of central questions run the risk of yielding results that are not comparable, even when they seem on the surface to be addressing the same topic (e.g. the role of institutions as causal forces). Yet any attempt to impose too much order on the scientific endeavors of individuals not only suppresses innovation; it is virtually certain to break down in dissension as well. Familiar to those working in many of the natural sciences, this challenge is a relatively new one in most of the social sciences. But success in meeting this challenge is likely to make all the difference in determining our ability to produce both basic knowledge and policy-relevant insights pertaining to the institutional dimensions of environmental change.