Chapter Three

Fit:
Matching Ecosystem Properties and Regime Attributes

ALL ACCOUNTS OF THE PROBLEM OF FIT start from the same premise: the effectiveness of environmental and resource regimes or, in other words, the capacity of these arrangements to prevent undesirable environmental changes and to solve environmental problems once they arise is determined in considerable measure by the degree to which they are compatible with the biogeophysical systems with which they interact. We are increasingly aware, in this connection, that "… sustainability requires human systems that are concordant at appropriate scales with the ecosystems to which they are related" (Cleveland et al. 1996: 3). We are becoming accustomed as well to asking "to what extent are the … rhythms of natural and social systems compatible, and under what criteria can we make their purposes coincide?" (Holling and Sanderson 1996: 58).

It follows that we should resist any temptation to think that one size fits all when it comes to designing regimes to solve a variety of environmental problems. We should be leery of simple generalizations purporting to spell out conditions necessary to achieve sustainable human/environment relations – much less to produce efficient or equitable outcomes - across a wide range of biogeophysical settings. An arrangement that works well in dealing with resilient ecosystems capable of recovering quickly in the aftermath of severe disturbances may produce disastrous results when applied to systems in which even moderate disturbances can trigger cascading changes (NRC 1996). An arrangement well-suited to minimizing the probability of disruptive changes in ecosystems that are relatively self-contained may generate unsustainable results when applied to more open systems in which exogenous forces are major determinants of robustness or stability.

These examples are helpful in clarifying the meaning of the concept of fit in the context of human/environment relations. But they do not provide a basis for developing a systematic account of the problem of fit. How, then, can we devise a conceptually coherent and analytically tractable approach to understanding the problem of fit? One way to respond to this question is to look for parallel features or characteristics of ecosystems and human systems on the assumption that these systems are comparable in terms of their fundamental structures and processes (Costanza and Folke 1996). This approach, which leads to an analysis of ecological and social stocks, flows, and controls, has much to recommend it as a point of departure for the development of a general theory of interactions between ecosystems and social systems (see Figure 1). But it does not lend itself to a sustained examination of the implications of specific ecosystem properties for the nature of the management arrangements needed to ensure that human actions are compatible with the achievement of sustainability – much less efficiency or equity – in a variety of biogeophyiscal settings (Berkes and Folk 1998, Pritchard et al. 1998).

Figure 1 about here

In this chapter, I adopt an approach that is less ambitious yet more likely to yield results whose relevance to a study of the institutional dimensions of environmental change is easy to grasp. The chapter's first substantive section identifies a number of important ecosystem properties and discusses the implications of these properties for the design of environmental regimes created to deal with problems in which they figure prominently. This is followed by a section that explores the sources of misfits or mismatches between the properties of the ecosystems associated with various environmental problems and the attributes of the institutional arrangements or regimes created to deal with them. The final substantive section turns to a consideration of issues relating to efforts to eliminate or alleviate these mismatches.

The principal challenge confronting this analysis is to explain why mismatches between ecosystem properties and institutional attributes occur so frequently and why it often proves difficult to close these gaps. I argue that the answers to these questions lie in three clusters of variables: the state of knowledge, institutional constraints, and rent-seeking behavior. An important insight arising from the analysis is that revealing and even publicizing the existence of a mismatch in a specific case is not sufficient to eliminate its impact on the course of human/environment relations. The point of this argument is not to provide an excuse for fatalism or inaction with regard to the institutional dimensions of environmental change. Rather, the argument reminds us that problems of this sort are ordinarily difficult or impossible to solve through exercises in social engineering alone. They involve political processes, a fact that means efforts to address them will regularly give rise to processes of institutional bargaining (Young 1994a). In an effort to make these matters more concrete, I turn frequently to cases involving human interactions with large marine and terrestrial ecosystems as sources of examples. But the problem of fit is generic; it occurs whenever and wherever humans interact with biogeophysical systems.

1. Ecosystem Properties

It is easy enough to point to examples of situations in which mismatches between ecosystem properties and regime attributes have become serious obstacles to the achievement of sustainability. Particularly striking in this regard are cases involving jurisdictional constraints and the use of simple scientific models as management tools. Efforts to conserve highly migratory species (e.g. birds that migrate from one continent to another or fish and marine mammals that migrate from one ocean to another) cannot succeed in the absence of cooperation on the part of all those states whose jurisdictions they pass through as well as those states exercising jurisdiction over users whose harvesting activities take place in areas located outside the jurisdiction of any state. Similar comments are in order regarding large ecosystems – and even larger bioregions - that extend across jurisdictional boundaries either at the domestic level (e.g. forest ecosystems that lie within the jurisdiction of two or more states or provinces) or at the international level (e.g. semi-enclosed seas that are surrounded by two or more coastal states). Although the need to cooperate as a means of achieving sustainability in using the resources of these systems is obvious, the occurrence of conflicts of interest or the preoccupation of policymakers with other matters deemed to be of higher priority can and often does complicate or even preclude efforts to design and implement cooperative measures.

Although the mechanism involved is different, the use of simple models as management tools in the administration of regimes can result in equally serious problems. The familiar logistic models used to calculate sustainable yields from stocks of fish offer a clear example. Whatever their merits in analytic terms, the incorporation of these models into resource regimes regularly leads to unsustainable harvesting practices in ecosystems featuring assemblages of interactive species and complex dynamics involving physical conditions (e.g. water temperatures) as well as biological conditions (e.g. reproduction rates) (Larkin 1977). Today, we are aware that marine conservation normally requires a sustained effort to think in terms of large marine ecosystems (Sherman 1992) that can and sometimes do behave chaotically so that relatively small errors in calculations of allowable harvest levels for specific stocks can trigger transformative or cascading changes. The attractions of simple models from the perspective of policymakers and managers are obvious. It is relatively easy to follow standard operating procedures for making collective choices about matters like allowable catches so long as these models provide the basis for making the necessary calculations. But when regimes rely on such models in making decisions pertaining to human activities in highly interactive and chaotic systems, the predictable result is a problem of fit that leads to unintended consequences that threaten - or even preclude - the achievement of sustainability (Wilson et al. 1994).

It follows that those endeavoring to create environmental or resource regimes should begin with an assessment of the principal properties of the relevant ecosystem(s) and proceed to design and build institutional arrangements that fit the biogeophysical contours of the problem to be solved. Yet it turns out that this is easier said than done. Even if we set aside the more extreme variants of constructivism, there is something to be said for the views of those who argue that important properties of ecosystems are socially constructed (Jasanoff and Wynne 1998). The idea of an ecosystem is itself an analytic construct useful for many purposes but often difficult to map onto the observable world. A central tenet of modern ecology is the proposition that everything is related to everything else (Commoner 1972). Under the circumstances, the specification of boundaries separating distinct ecosystems is ultimately somewhat arbitrary and may emerge as a barrier to addressing important issues. The conventional separation among atmospheric, marine, and terrestrial ecosystems, for instance, can actually impede efforts to understand the dynamics of land/ocean and ocean/atmosphere interactions. Similar observations are in order about the idea that most ecosystems possess stabilizing mechanisms that produce a more or less pronounced tendency to restore the system to some well-defined equilibrium state following various types of disturbances (e.g. changes in the abundance of individual species due to human harvesting). Although this idea is attractive in some respects, it masks a striking tendency in some ecosystems to shift from one state to another and makes it difficult to focus on the chaotic or nonlinear behavior that characterizes many ecosystems, even in the absence of largescale human interventions.

This discussion should suffice to make us wary of any argument that treats the properties of ecosystems as objective realities or facts of life that are immune from the effects of social construction. Even so, it is hard to deny that ecosystems do exhibit a variety of properties that are more than mere artifacts of human cognition or social discourses and that have considerable relevance for the achievement of sustainability in human/environment relations. Consider variations in levels of net primary productivity or rates of regeneration following removals of biomass as cases in point. It seems clear that regimes governing human harvesting of renewable resources that do not take into account variations among ecosystems in these terms are asking for trouble by ignoring the problem of fit or, in other words, failing to devise institutional arrangements that are constructed in such a way that they are compatible with key properties of the relevant ecosystems.

The difficulty afflicting efforts to cope with the problem of fit that arises in this connection is quite different from the effects of social construction. There is no well-specified and widely accepted typology of ecosystem properties that can serve to anchor a discussion of the fit between ecosystem properties and regime attributes. I am in no position to propose a typology that would win favor among students of biogeophysical systems. Fortunately, however, there is no

TABLE 1

ECOSYSTEM PROPERTIES RELEVANT TO THE PROBLEM OF FIT

Structures
Complexity
Homogeneity
Interdependence
Processes
Productivity
Growth
Stabilization
Change
Linkages
Boundary Conditions
Transboundary Interactions

need to solve this problem in order to proceed with the central argument of this chapter; a set of illustrative distinctions among familiar categories of ecosystem properties will suffice for my purposes. In the following paragraphs, then, I identify a range of ecosystem properties grouped under three broad headings - structures, processes, and linkages (see Table 1) - and comment briefly on their relevance to the problem of fit.

The category of structures encompasses properties pertaining to the elements or parts of ecosystems and the relationships among them. Familiar members of this cluster include complexity, homogeneity, and interdependence. Complexity is a measure of the number of distinct parts or components of an ecosystem and the extent to which the functions of individual components are distinct. Complex systems have large numbers of elements playing functionally distinct roles that are essential to the maintenance of the systems. The level of complexity is particularly high in cases where these elements are layered vertically or relate to one another in a hierarchical fashion. There is a longstanding debate among ecologists about the extent to which complexity contributes to the resilience of systems by providing alternative mechanisms for the performance of important functions in cases where individual elements are impaired. With regard to the problem of fit, however, the principal implication of complexity involves the increasing problems arising from efforts to compartmentalize occurrences affecting individual elements of ecosystems as the level of complexity rises. Disturbances affecting individual elements of a complex system are apt to ripple through the entire system and may gain force as they move from one element to another producing what have become known as ecological cascades (NRC 1996). It follows that regimes created to deal with complex systems must take into account the indirect effects of human actions as well as more direct or first-order effects. In situations involving the harvesting of renewable resources, for instance, this means considering the impacts of harvesting practices on non-targeted species as well as on those species targeted for consumptive use.

Similar observations are in order regarding the properties of homogeneity and interdependence. Homogeneity refers to the degree of similarity among the individual elements or parts of ecosystems. Homogeneous systems include assemblages of living organisms that resemble one another in biological terms coupled with physical conditions (e.g. ambient air temperatures, precipitation patterns) that are uniform in nature. Homogeneity may vary greatly from one system to another or even within a single system over time. But in general, the lower the level of homogeneity (or equivalently, the higher the level of heterogeneity) in ecosystems, the more important it is to devise resource regimes capable of tracking the behavior of the various elements of systems individually and making appropriately differentiated responses to developments affecting individual elements. In developing management practices to cope with the impacts of acid precipitation on lakes, for example, it is important to consider natural variations in the capacity of individual lakes to neutralize acids. In contrast to homogeneity, interdependence refers to the tightness of the links or couplings among the elements or subsystems of an ecosystem. The elements of an ecosystem may be homogeneous but exhibit a high degree of independence from one another. Conversely, the individual subsystems of heterogeneous systems may be tightly coupled. Broadly speaking, the higher the level of interdependence, the more important it is to adopt a holistic perspective or what has become known as a whole ecosystem approach in managing human actions affecting these systems. In systems where marine mammals depend on the same stocks of fish that are targets of human harvesting, for instance, it is essential to consider these predator/prey relationships in efforts to calculate allowable catches for human harvesters.

The category of processes, by contrast, refers to ecosystem dynamics that operate to develop, maintain, or transform individual systems through time. Among the familiar properties belonging to this cluster are productivity, growth, stabilization, and change. Ecosystems vary greatly with regard to what is sometimes called their metabolism and measured in terms of criteria like net primary productivity, the production of harvestable surpluses, and rates of regeneration following more or less severe depletions of their individual elements. These metabolic processes often involve natural cycles whose length, magnitude, and regularity varies from one system to another. The implications of this set of properties for the creation and operation of resource regimes are profound. Management practices that assume the existence of high rates of productivity on the part of targeted species but that operate in settings where productivity is unusually low, for example, can lead to depletions that are so severe that the systems are unable to recover. Much the same is true of assumptions about regenerative processes. As those dealing with marine fisheries have discovered again and again, for instance, depletions of targeted species may lead to unintended and undesirable changes in an ecosystem's species composition, even when there is no net loss of biomass.

Processes of growth, stabilization, and change have related management implications. Whereas growth is a developmental process, the idea of stabilization refers to the capacity of an ecosystem to recover from disturbances or, in other words, to return to some prior state in the wake of disruptions. Although growth is a natural process, it is important to manage human actions in such a way that they do not interfere with normal growth cycles. Rules designed to allow escapement of a sufficient number of fish to ensure adequate reproduction constitute a typical example. With regard to stabilization and change, a major concern arises from the distinction between brittleness construed as the vulnerability of an ecosystem to sudden shocks and the vulnerability of the system to pressures – often referred to as critical loads - that mount slowly over time. Ecosystems that are remarkably resilient under the impact of cumulative pressures may collapse suddenly when hit by sharp shocks and vise versa. A particularly important consequence of this observation is that resource regimes associated with brittle systems must be sensitive to the prevention of sudden shocks if they are to produce sustainable outcomes. For their part, processes of change may be cyclical, episodic, or chaotic. Ecosystems vary greatly in terms of both the nature of the triggers that set processes of change in motion and in the extent to which the resultant processes are path dependent or, in other words, constrained by events occurring within a system during previous time periods. Relatively crude management systems may suffice to produce sustainable results with regard to human activities affecting resilient systems in which change is cyclical and path dependent. But the same arrangements may prove disastrous when applied to ecosystems in which modest triggers can touch off non-linear changes that radically alter the capacity of the systems to sustain human harvesting on an ongoing basis.

The category of linkages refers to connections between individual ecosystems and their environments (including other ecosystems). What is sometimes called the first law of ecology – the proposition that everything is related to everything else - suggests that there are no completely closed systems or, in other words, that exogenous forces will play a role no matter how or where the boundaries of individual systems are drawn (Commoner 1972). Nonetheless, both the strength and the significance of the linkages between ecosystems and their environments vary greatly. In some cases (e.g. the marine systems of the central Arctic Basin), it seems intuitively plausible to assume that biogeophysical systems are relatively self-contained. This initial impression is accurate up to a point. But now let certain long-range transport mechanisms (e.g. airborne or waterborne transport of persistent organic pollutants) or even global processes (e.g. changes in the Earth's climate system) come into play. Under these conditions, it quickly becomes apparent that what were relatively self-contained systems prior to the onset of these larger developments are now affected – in some cases dramatically – by exogenous events. Major changes in the extent and thickness of sea ice in the Arctic Basin, for example, are currently underway. This suggests both that it is dangerous to ignore potential linkages even in seemingly self-contained systems and that significant linkages may arise over time even where none existed at some initial point.

The implications of these linkage properties for the problem of fit are twofold. It is important to exercise care in establishing the boundaries of the domains of resource regimes in the first place; a regime that ignores what turn out to be significant elements of an ecosystem cannot produce sustainable results. In addition, there is a need to review the relationship between ecosystem boundaries and regime boundaries from time to time. A regime whose coverage is perfectly appropriate at the time of its creation may prove inadequate at a later stage in the wake of exogenous developments (e.g. the introduction of airborne or waterborne pollutants) occurring after the regime's establishment. What is needed, in this connection, is a practice that involves managing boundaries rather than setting them once-and-for-all at the outset.

2. Sources of Mismatches

Dramatic mismatches between ecosystem properties and regime attributes are all too common. In the American West, to take a striking example, the federal government imposed a system of land tenure intended to guide the settlement of the Great Plains on the arid lands of the Four Corners region where Colorado, Utah, New Mexico, and Arizona come together (Stegner 1954).[1] As Donald Worster has shown in his study of the dust bow of the 1930s, there are reasons to doubt the appropriateness of this regime, which assumes that a family can sustain itself by working 160 acres of land, even as applied to some parts of the Great Plains (Worster 1979). But the consequence of applying this system to the arid lands of the Southwest was an unmitigated disaster. A regime designed for areas receiving an average annual rainfall of twenty inches or more could hardly be expected to produce sustainable livelihoods for residents of arid areas where the average annual rainfall is more like three or four inches. Where the universe of cases is heterogeneous, in other words, once size does not fit all with regard to the performance of institutions.

The history of the regime for whales and whaling offers an equally dramatic example of a mismatch occurring at the international level. Those who established the whaling regime in the 1940s drew on the intellectual capital accumulated in efforts to manage fisheries and assumed that models used to calculate maximum sustainable yields from fish stocks would work reasonably well when applied to the harvesting of whales (Gulland 1964, Small 1971). But whatever the virtues of these models in providing a basis for the management of fisheries - and

[1] . Set forth in the Homestead Act of 1862, this system allowed settlers to gain title to land included in the public domain largely on the basis of their own labor.

this is a matter of considerable debate - they proved severely deficient in the context of the whaling regime. Whale stocks are not only difficult to monitor precisely, but also most are characterized by low rates of regeneration.[2] Under the circumstances, managers can and often do fail to detect depletions in a timely manner or to take action to deal with them until the depletions have reached a level where stocks are unable to recover or recover so slowly that an indefinite moratorium on harvesting is needed to guarantee their survival. In many large marine ecosystems, in fact, the removal of whales from the biomass allows other species to expand to fill the (temporarily) vacant niche, a development that sharply curtails the regeneration of whale stocks. The evidence suggests that this is exactly what happened in the Bering Sea Region during the first half of the twentieth century (NRC 1996). In effect, high levels of interdependence among the individual elements of this ecosystem ensured that major changes in one important element would ripple through the entire system.

What are the sources of such mismatches, and why do they occur so frequently? Such problems are not attributable solely to human stupidity or avarice, although history does record its fair share of these phenomena. An initial examination of the evidence suggests that there are a number of distinct mechanisms that produce institutional misfits. These sources are not mutually exclusive; two or more of them may operate at the same time. It is perfectly possible, therefore, for specific mismatches to be over-determined. Nonetheless, we can gain insight into the sources or causes of misfits by grouping them into three main categories: imperfect knowledge, institutional constraints, and rent-seeking behavior.

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[2] . Advances in technology occurring in recent decades have led to significant improvements in the monitoring of whale stocks. But even now, there are significant uncertainties regarding the status of

2.1 Imperfect Knowledge

Efforts to match institutional arrangements governing human actions to the properties of biogeophysical systems cannot succeed in the absence of usable knowledge regarding the ecosystems in questions. Of course, this knowledge need not be rooted in the western scientific tradition that dominates most thinking about ecosystems in today's world. Informal knowledge of the sort accumulated by indigenous peoples living in close contact with the same ecosystems over long periods of time can play an important role in efforts to adapt institutions - including arrangements rooted in informal social practices in contrast to formal agreements – to the properties of relevant ecosystems (Berkes 1989, Berkes 1999). In some situations, there is even a role for implicit knowledge, in the sense of de facto norms or rules that arise through a process of trial and error rather than a conscious effort to devise management systems to govern human actions involving the use of natural resources (Fienup-Riordan 1990). Much of the burgeoning literature on the development of common property regimes in smallscale systems deals with arrangements that rest on informal or implicit knowledge (McCay and Acheson 1988). But none of this alters the fact that the avoidance of mismatches requires the development of usable knowledge in one form or another.

We should never underestimate the influence of simple ignorance about the behavior of biotic and abiotic systems as a source of misfits, especially when it is combined with an attitude of dominance that licenses or even encourages human exploitation of natural resources unless and until the consequences become demonstrably destructive. In some cases, ignorance takes the form of a lack of awareness or understanding regarding straightforward factual matters. Harvesting often leads to depletions of stocks of renewable resources that are not detected or

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many stocks.

documented until the problem becomes unusually severe or even unsolvable (Harris 1998). Emissions of pollutants (e.g. ozone-depleting substances) frequently go on for some time before their impacts on biogeophysical systems are detected, much less documented in an irrefutable manner (Roan 1989). In other cases, ignorance involves a lack of understanding of the causal mechanisms at work in large, dynamic systems. Even in severely depleted fisheries, for instance, we still have trouble sorting out the relative weight of anthropogenic forces (e.g. overharvesting) and nonanthropogenic drivers (e.g. changes in water temperatures) as causes of the problems. And the primitive nature of our grasp of the dynamics of the Earth’s climate system is clearly one major source of disagreements about how to deal with emissions of greenhouse gases in the context of efforts to create a global regime designed to protect the Earth's climate system.

Ignorance can lead to institutional mismatches in at least two distinct ways. Human users may simply fail to consider key facts or causal mechanisms, concluding that regimes are unnecessary or building regimes that overlook important properties of the relevant ecosystems. Arrangements designed to determine allowable harvest levels in specific fisheries without any consideration of the dynamics of the larger ecosystems in which individual stocks of targeted species are embedded exemplify this case (Sherman 1992). Alternatively, users may resort to familiar but ultimately false analogies in an effort to come to terms with facts or causal mechanisms that are acknowledged to be important but poorly understood. Assuming that the population dynamics of whale stocks will resemble the population dynamics of fish stocks constitutes a case in point. Either way, it is easy to see how ignorance can give rise to institutions that are incompatible with important properties of the biogeophysical systems affected by human actions.

Important as it is, simple ignorance is not the only link between imperfect knowledge and institutional misfits. In order to regulate or control the course of human/environment relations, analysts and practitioners regularly construct and apply models designed to explain or predict the dynamics of important ecosystems. The familiar logistics models developed to calculate sustainable yields from individual stocks of living resources constitute a particularly prominent example. More broadly, human actors typically develop discourses or ways of framing problems and structuring thinking about them (in contrast to models in the more rigorous sense) which shape efforts to come to terms with problems arising in human/environment relations (Litfin 1994). The tendency to think in terms of equilibrating mechanisms in contrast to nonlinear or chaotic processes in assessing the impacts of human actions on ecosystems is a prominent case in point. So long as we assume that a biogeophysical system will exhibit a pronounced tendency to return to some prior state in the wake of - more or less severe - disturbances, there is no compelling reason to adopt a precautionary attitude in regulating human actions affecting the system. The point to ponder here is not that models or, more generally, discourses are bad. In fact, building models can become a powerful tool in the hands of those seeking to understand the dynamics of complex systems. In any case, there is no way to escape the influence of models and discourses in thinking about the behavior of ecosystems. Rather, the problem is that faulty models or misleading discourses can go far toward producing mismatches between ecosystems and the attributes of regimes humans create to govern their interactions with these systems. The fact that specific models or discourses can become entrenched through processes of socialization or the development of standard operating procedures on the part of management agencies only intensifies the problem. Once again, the familiar logistics models used to support calculations of sustainable yields in various fisheries provide an illustration. We know that these models are inadequate and that the results they produce fail to take critical features of the relevant ecosystems into account in many marine settings (Larkin 1977). Yet even today, it is difficult to break the grip of these models on the thinking of those responsible for setting allowable harvest levels for specific fisheries on an annual basis.

Imperfect knowledge as a source of institutional misfits takes on added significance when it comes to dealing with what have become known as human-dominated ecosystems (Vitousek et al. 1997). We are used to drawing a clear distinction between biogeophysical systems on the one hand and social systems on the other. In the typical case, we assume that it is feasible to understand the dynamics of biogeophysical systems without reference to human actions and that it makes sense to employ the resultant knowledge as a basis for making decisions about permissible human uses of natural resources or environmental services (e.g. the establishment of air quality standards to regulate emissions of various airborne pollutants). Increasingly, however, we are coming to the realization that humans are major (sometimes dominant) players in ecosystem dynamics. Although the extent of human dominance has increased dramatically in the recent past, evidence has surfaced that points to the important roles humans have played in ecosystem dynamics over at least the last ten millennia (Turner et al. 1990, Ponting 1992). The significance of this observation for the problem of institutional misfits is straightforward but important. We need to endogenize the role of human actors in order to develop models of ecosystems to be used in efforts to create appropriate regimes. A regime designed to protect biological diversity that does not take into account the role of humans as agents of land-cover change, for instance, cannot be well-matched to the problem it is intended to address. Yet endogenizing human actions is easier said than done. As the example of land-cover change makes clear, efforts to incorporate human actions into models of terrestrial ecosystems are still at an early stage. It will come as no surprise, then, that mismatches between ecosystems and institutions attributable to imperfect knowledge are apt to be particularly severe in cases featuring human-dominated systems.

2.2 Institutional Constraints

Regimes created to govern human actions affecting various ecosystems are typically embedded in larger or overarching social institutions. Of course, this is obvious at the national level where management arrangements pertaining to fish, forests, and various types of pollution are created through legislative processes and entrusted to government agencies to implement (Klyza 1996). But similar links exist at other levels of social organization. Individual international regimes dealing with renewable resources (e.g. whales), geographically defined areas (e.g. Antarctica), or pollution (e.g. intentional oil pollution at sea) are embedded in a society of territorially-organized states which has no centralized public authority but which features a rising level of interdependence among its members (Bull 1977). Similar remarks are in order about institutional arrangements operating in smallscale systems (Jodha 1996). In some cases, resource regimes are integral to the larger social system. It would be incongruous, for example, to attempt to describe reindeer herding societies or whale hunting societies without reference to social practices governing the herding of reindeer and the hunting of whales (Krupnik 1993). But even in such cases, specific resource regimes constitute elements in larger sets of social institutions that can be expected to affect the operation of these regimes.

The existence of these institutional linkages is a fact of life, which is neither good nor bad in itself. Yet it is easy to see that these relationships give rise to institutional constraints that can and sometimes do lead to mismatches between ecosystem properties and institutional attributes. An obvious case in point, referred to already in several illustrations, arises from the existence of jurisdictional boundaries. In today's world, most politically organized units – ranging from local communities through nation states to supranational organizations (e.g. the European Union) – are territorially based. The scope of their jurisdiction, including jurisdiction over adjacent marine areas, is the product of a range of political, economic, and cultural forces. It is a rare instance in which ecological considerations have played any significant role in the determination of jurisdictional boundaries. Under the circumstances, it will come as no surprise that the coverage of regimes frequently fails to match the spatial boundaries of ecosystems. Arrangements dealing with renewable resources that migrate over long distances (e.g. birds) and flow resources that cross the domains of several countries (e.g. international rivers) are obvious examples of such mismatches. But similar problems occur frequently in instances where stocks of nonrenewable resources (e.g. pools of oil) straddle the jurisdictional boundaries of two or more political units. It is possible, of course, to address problems of this kind by shifting management authority to a higher level of social organization, as in cases where national governments assume authority to manage resources not confined to individual communities, or by negotiating cooperative arrangements among territorially-based units, as in cases where two or more states create international resource regimes. But the transaction costs involved in resorting to these strategies are apt to be high. In many cases, unrelated obstacles (e.g. disputes about the locus of jurisdictional boundaries or cultural antagonisms) effectively rule out solutions of these types (Lowi 1995). Even though the ecological consequences may be well understood, therefore, there is no reason to be surprised by cases in which the locus of jurisdictional boundaries causes mismatches between ecosystems and institutions.

Nor are jurisdictional problems the only type of institutional constraints of interest in this connection. Even in cases where the attributes of environmental or resource regimes seem well-suited to the properties of the relevant ecosystems in principle, mismatches may emerge during the course of implementation or the effort to move institutional arrangements from paper to practice (Mitchell 1994). Partly, this is a matter of bureaucratic politics (Allison 1970). A number of units may compete for the status of lead agency for purposes of administering a regime, and the winner in bureaucratic terms may have a corporate or collective ideology or a management style that is not conducive to the pursuit of sustainability in managing human uses of the relevant ecosystems (Clarke and McCool 1996). Battles between the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers over the management of lands in Alaska come to mind in this connection. In other cases, numerous agencies may want a voice in any decisions made about certain ecosystems, but none may be able or willing to take on the role of lead agency. In such cases, rules in use are apt to become haphazard and to bear little resemblance to the features of key ecosystems, even when a regime exists on paper that seems reasonably well-matched with the relevant ecosystem properties.

Somewhat similar observations are in order regarding the impact of interest group politics, especially in relatively open settings like the American political system. It is particularly important to note in this connection that most interest groups (e.g. fishers, loggers, oil producers) do not refrain from efforts to influence the character of institutional arrangements once they have been established through legislative action or institutional bargaining. As a result, arrangements that seem reasonably well-matched to ecosystem properties on paper may turn out to be poorly matched to these properties in practice. A sizable fraction of the debate about emissions trading in the case of climate change, for instance, turns on disagreements about how carbon markets would work in practice rather than on arguments about the results that would arise from the operation of ideal carbon markets.

Beyond this lies the institutional problem often described in terms of the idea of path dependence or, in other words, the pronounced tendency of human systems to follow well-defined courses once they are launched on particular paths. A number of analysts have pointed to a distinction between fast variables and slow variables in thinking about human/environment interactions (Holling and Sanderson 1996). Fast variables, including technological changes as well as many biogeophysical processes, involve features of systems that can experience dramatic - even transformative - changes over short periods of time. Slow variables, including intentional changes in social institutions, are elements of systems that generally unfold slowly. The problem in this connection is easy to identify, even though it is difficult to solve. Many ecosystems undergo rapid changes; cascades leading to shifts in assemblages of species can occur over periods of months to years. Much the same is true of technologies used to harvest renewable resources or implicated in emissions of pollutants. Institutional arrangements, by contrast, often change or evolve at a much slower pace; major adjustments in many – though by no means all - resource regimes can take years to decades. It follows that path dependence with regard to the behavior of environmental and resource regimes can become a source of more or less serious mismatches between ecosystems and institutions. Sudden changes in fish stocks due to abiotic forces like shifts in water temperature, for example, may not trigger changes in procedures for calculating allowable harvest levels until serious damage is done (Dobbs 2000). Rapid developments in harvesting technologies like the introduction of high-endurance stern trawlers may not be followed by appropriate adjustments in procedures for regulating the actions of harvesters until a severe crisis occurs (Warner 1983). Such mismatches need not be accepted as unalterable facts of life. There is much interest today in devising more flexible institutions, capable of monitoring and adjusting quickly to changing ecological conditions. Even so, path dependence on the part of institutions created to deal with ecosystems or socioeconomic systems that are highly dynamic looms as an important source of institutional misfits in many settings.

2.3 Rent-Seeking Behavior

The concept of rent-seeking has emerged over the last several decades as a way of organizing thinking about tensions or even conflicts between the pursuit of individual gains and the promotion of social welfare (Buchanan, Tollison, and Tullock 1980, Tullock 1989). In principle, everyone should have an interest in enhancing social welfare, at least in the sense of expanding the size of the common pie in contrast to distributing a fixed pie among individual recipients. So long as each expansion meets the test of Pareto optimality, everyone's lot should improve (or at least remain unchanged) as the social welfare frontier moves in a northeasterly direction.[3] But, as most observers now acknowledge, this perspective fails to explain a sizable fraction of situations in which actors seek to improve their individual payoffs at the expense of social welfare. Partly, this is attributable to the contrast between what have become known as relative gains in contrast to absolute gains (Baldwin 1993). An actor whose absolute gains

[3] . Pareto optimality occurs when there is no feasible change from the status quo that will enhance the welfare of some or all members of a group without leaving any member worse off than before.

increase as a consequence of group action may nevertheless conclude that his or her situation has in fact deteriorated if others experience greater gains in relative terms. In part, however, the emphasis on social welfare overlooks the central role of classic distributive concerns in contrast to integrative efforts. In effect, actors frequently devote themselves to improving their individual lot without regard to the consequences for others (including members of future generations). In some cases, the social consequences of their actions may go unnoticed or be hard to compute in any rigorous way. In other cases, actors may simply be indifferent to the impact of their actions on the welfare of others. But in any case, the emphasis on the pursuit of individual gains without reference to the implications of such actions for social welfare is increasingly discussed in terms of the idea of rent-seeking behavior.

Rent-seeking behavior can lead to mismatches between ecosystems and institutional in at least two major ways. One centers on economic practices often characterized by environmentalists as “rape, ruin, and run.” In the absence of rules designed to protect the public interest, private actors can and often do exploit natural resources ruthlessly for their own benefit (Hays 1959). They destroy forests, simply shifting their operations to new lands when areas subjected to heavy logging are exhausted. They move their places of residence to distant locations, so that they are insulated from the impacts of pollution in areas affected by the activities of industries they work for or own. They transform natural capital into industrial capital with the result that the condition in which ecosystems are left has no direct bearing on their individual wealth or well-being. The mechanisms involved differ from one case to another. But the underlying problem in such situations is invariably the same. In the absence of rules that compel private actors to pay attention to the welfare of others, there is every reason to expect that rent-seeking behavior will lead to situations in which renewable resources are over-exploited for consumptive purposes, the use of resources to produce non-excludable goods is marginalized, and little attention is paid to the impacts of (especially long-range) pollution. In every case, these occurrences reflect situations in which institutional arrangements are poorly matched with the properties of the ecosystems they address.

Beyond this, rent-seeking behavior is not limited to situations involving straightforward or conventional economic practices. In most social settings, issues relating to natural resources and the environment are matters of public policy and therefore subject to manipulation on the part of actors seeking to promote their own interests through political processes. The case of land tenure in the Four Corners region of the American Southwest offers a striking illustration. In the period following the Civil War, territories seeking to qualify for statehood were obliged to acquire a minimum population and to demonstrate a capacity to attract additional settlers. Under the circumstances, political leaders hoping to become governors of new states had good reasons to attract new settlers, regardless of the long-term ecological consequences of doing so. One approach to this goal was to extend the regime of the Homestead Act to these lands, thereby attracting settlers with the promise of land despite the mismatch between the ecological conditions envisioned in the act itself and those actually obtaining in the Four Corners region. To cover up this environmentally inappropriate strategy, supporters of the move invented the ingenious but disingenuous and ultimately destructive thesis that rain follows the plow (Stegner 1954). But this could hardly mask, much less alter, the underlying mechanism at work. A relatively severe mismatch between ecosystem properties and institutional attributes arose in this case as a consequence of political rent-seeking on the part of leaders able and willing to pursue their own objectives regardless of the longer-term consequences for the sustainability of human/environment relations.

2.4 Interaction Effects

So far, I have been describing the sources or causes of institutional mismatches on the assumption that the forces at work are independent of one another. This makes sense from an analytic point of view. Because the individual sources are relatively complex and poorly understood, the advantages of treating them on their own merits are obvious. Nonetheless, it would be inappropriate to conclude this account of the sources of misfits without noting that individual causes of mismatches can and frequently do interact with one another. Any number of interactions are possible; it is not feasible to provide a systematic treatment of this topic in this brief account. But a few representative examples should suffice to convey a sense of the significance of these interactions.

One common variety of interaction involves linkages between rent-seeking behavior and imperfect knowledge. With regard to most major environmental problems, there are significant uncertainties both about the behavior of the relevant biogeophysical systems and about the capacity of humans to cope with the impact of environmental problems in such a way as to avoid serious losses of social welfare. In particularly complex situations, these uncertainties are likely to be profound. In the case of climate change, for instance, there is room for serious debate not only about whether we are currently witnessing the onset of global warming attributable to anthropogenic forces but also about the underlying dynamics of the Earth's climate system. What is more, scientists are not immune from the influence of a variety of pressures (e.g. promises of enhanced funding for their research) that go well beyond the bounds of scientific reasoning as such (Jasonoff and Wynne 1998). Despite the best efforts of the Intergovernmental Panel on Climate Change (IPCC) to arrive at carefully crafted and rigorously reviewed conclusions about a number of matters pertaining to climate change, the scope of uncertainty regarding this problem remains wide. The result is an obvious opportunity for those benefiting from the current state of affairs to exploit uncertainty to their own advantage. It is no cause for surprise that the energy industry employs and deploys its own experts who assert that the problem of climate change is not something to become exercised about or that groups of consumers who prefer energy-intensive lifestyles find it easy to discount reports about climate change that make it hard to justify activities like unnecessary uses of sport utility vehicles. Of course, these skeptics may prove to be right in the long run. But a far more likely outcome will be an increasingly serious mismatch between the properties of the Earth's climate system and the attributes of institutional arrangements governing emissions of various greenhouse gases.

A second common type of interaction involving distinct sources of mismatches features links between the influence of dominant discourses or paradigms and bureaucratic politics. Public agencies – especially the more successful ones – generally develop more-or-less well-defined points of view or ideologies that give them a kind of collective or corporate personality (Kaufman 1960). In the case of agencies dealing with natural resources and the environment, these ideologies are typically rooted in discourses or perspectives on human/environment relations that guide human actions, even in situations characterized by imperfect knowledge (Klyza 1996). In the United States, for example, the Bureau of Reclamation espouses a worldview that extols the virtues of producing cheap energy through the construction of high dams; the Forest Service subscribes to the doctrine of multiple use which it interprets as requiring the opening of public lands for timber harvesting under the terms of long-term contracts, and the Minerals Management Service sees itself as an agency dedicated to opening oil-bearing lands to exploration and potential development on the part of private industry (McPhee 1971). Of course, these agency outlooks are not cast in concrete; they can and do adjust to outside pressures on a timescale measured in decades. Yet it is remarkable how resistant these outlooks often prove, even in the face of mounting evidence regarding the social costs of clinging to the status quo. There are a number of explanations for this rigidity, including the effects of socialization on agency personnel and the closeness of the relations agencies frequently develop with interest groups – especially powerful corporate actors – whose actions they are nominally required to regulate (Stigler 1975). But the main point to notice in this discussion is the tendency of dominant discourses to reinforce the effects of bureaucratic politics, even in situations where mismatches between ecosystems and institutions have reached proportions where they are visible to the general public.

Similar comments are in order about interactions between the effects of cognitive rigidities on the part of individuals and the impact of path dependence as an organizational phenomenon. Although rent-seeking behavior sometimes involves deliberate manipulation, most individuals are socialized to accept certain propositions as articles of faith or convince themselves that the actions they engage in on a day-to-day basis will help to advance the common good. There is no reason to question the sincerity of the average oil company executive who dismisses the significance of climate change, the typical bureaucrat who sees no reason to question the standard operating procedures of his agency, or the ordinary citizen who is loath to accept any personal responsibility for the occurrence of a problem like climate change. Most individuals have a limited tolerance for cognitive dissonance; they will seek to adjust conflicting statements of fact, causal inferences, or norms in such a way as to restore harmony in their thought processes. More often than not, this means finding some means to minimize the significance of environmental problems that credible observers regard as threats to the maintenance of sustainable human/environment relations. The consequence is a conservative bias in most institutional arrangements governing human activities affecting natural resources and the environment. As a result, mismatches have to become severe and the evidence pertaining to them has to be undeniable before action is taken to address incompatibilities between ecosystem properties and institutional attributes. Ironically, these same forces sometimes contribute to the sudden collapses of important institutions. Once the faith of supporters is undermined, the credibility of systems of roles, rules, and relationships can evaporate almost overnight. But until that point is reached, cognitive rigidities will generally serve to deflect the forces for change in institutional arrangements and, in the process, to enhance the effects of path dependence.

3. The Persistence of Mismatches

Why do mismatches between ecosystem properties and institutional attributes often persist over long periods of time and prove resistant even to well-informed and well-organized efforts to close the gap? Part of the answer to this question lies in well-known complications associated with collective action (Young 1989). Revised or restructured institutions are apt to treated as exhibiting the characteristics of public goods (i.e. non-excludability and non-rivalness), a fact that generates incentives for individual members of relevant social groups to behave as free riders when it comes to the pursuit of institutional reform (Olson 1965). Even when actors do become engaged in efforts to restructure institutional arrangements, moreover, they are apt to bring conflicting preferences regarding options for improvement to the process, so that the pursuit of institutional reform regularly gives rise to protracted and costly bargaining over the relative merits of various institutional attributes (Young 1994). Important as they are, however, these generic or universal factors cannot account for all of the persistence of institutional mismatches. In specific cases, they are apt to be reinforced by forces associated with one or another of the sources of mismatches discussed in the preceding section. A few illustrations will serve to lend substance to this proposition.

Ideas are sticky, especially when they give rise to coherent and tractable models and when there is no obvious alternatives to adopt once the limitations of old models become apparent. Consider, again, the case of the logistics models that provide the analytic basis for standard calculations of maximum sustainable yields (MSY) in the realm of fisheries management. The limitations of these models, at least as management tools in most marine settings, have been apparent for some time. Today, we are regularly reminded of the importance of thinking about large marine ecosystems, the dynamics of nonlinear changes or cascades, and the role of humans as major players in these ecosystems in making decisions about allowable harvest levels for individual fisheries (Wilson et al. 1994). Already in the 1970s, prominent specialists were writing epitaphs for the idea of maximum sustainable yield as a management tool (Larkin 1977). Yet it is hard to eliminate the influence of the logistics models in day-to-day decisionmaking on the part of those responsible for administering management regimes in this realm. The models are intuitively appealing and easy to use. There is no straightforward substitute available to replace the intellectual capital embedded in these models. In any case, it takes time to train a new generation of managers who have internalized current thinking about the properties of the larger ecosystems to which fish stocks belong. Without doubt, the stickiness of this way of thinking is one - albeit only one - of the elements of the story of the dramatic collapse of the cod stocks of the Northwest Atlantic during the 1980s and 1990s (Harris 1998, Dobbs 2000). The absence or underdeveloped character of analytic alternatives is surely a factor to be reckoned with in coming to grips with the crisis in the world's fisheries that has been amply documented during the last two decades (McGoodwin 1990). Nor is there anything unusual about the case of fisheries in this respect. Apart from occasional episodes of cognitive revolution, the expansion or redirection of intellectual capital is a slow variable in the context of human/environment relations (White 1967).

Similar comments are in order about the influence of institutional constraints. We are all aware, of course, that seemingly entrenched political systems sometimes collapse, leading to dramatic institutional changes over short periods of time. But such events are rare. For the most part, legislative processes and agency practices are highly resistant to change, even in the presence of mounting evidence that existing arrangements are not well-suited to dealing with current problems and that serious threats to sustainability – much less the achievement of efficiency or equity – have arisen. The struggles of those seeking to reform the U.S. Forest Service with its bias toward consumptive uses of wood even when this policy leads to net operating losses or the National Marine Fisheries Service with its bias toward the short-run needs of commercial fishers provide rich case studies of the significance of path dependence as a determinant of the performance of managers and management systems. Of course, part of the problem in this realm arises from the power of interest groups that are more concerned with promoting their special interests than with the pursuit of the common good defined in terms of sustainability, efficiency, or equity. There is no need to rehearse the evidence regarding what is known as the capture of regulatory agencies by those groups whose actions they are intended to guide to understand the relevance of this phenomenon to the problem of fit. But it is important to emphasize the impact of path dependence, quite apart from the influence of special interests. Where ecosystems are highly dynamic and subject to periodic changes of a transformative nature, the conservative bias built into most institutions can easily produce mismatches that become more severe with the passage of time.

For its part, rent-seeking behavior is a constant feature of the landscape of human/environment relations. Rent seekers have no genuine interest in the pursuit of sustainability. If they are able to maximize their private welfare by clearcutting a forest and investing the proceeds in the stock market or decimating a fish stock and moving on to exploit some other resource, they can be expected to do so. Rent seeking is a universal phenomenon by no means limited to human uses of natural resources or environmental services. But what makes it a particularly severe obstacle to avoiding or alleviating mismatches in human/environment relations is the fact that the gap between private welfare and social welfare, arising from the depletion of common-pool resources, the production of externalities, and the under-supply of public goods, is unusually large. As many observers have noted, this is exactly why there is a need to construct effective resource regimes at all levels of social organization. A number of initiatives of this sort have proven quite successful, even at the level of international society where the capacity of regimes to enforce their regulatory provisions is severely limited.

Nonetheless, we can expect dedicated rent seekers to make an effort to block the creation of effective regulatory arrangements and to hamper their implementation once the relevant parties have agreed to their provisions. Coping with these obstacles is hard enough in the case of simple problems. But as our experience with the problem of climate change over the last ten to fifteen years makes clear, the ability of rent seekers to slow or even block progress is greatly enhanced when it comes to solving largescale and unusually complex environmental problems.

What is to be done? There are no simple antidotes to these forces leading to the persistence of mismatches between ecosystem properties and institutional attributes. Even so, the situation is far from hopeless. A few examples will serve to indicate the kinds of strategies available to those seeking to avoid or alleviate mismatches. One approach that is practical in a variety of settings centers on the establishment and operation of systems of implementation review. The purpose of such systems – SIRs as they have come to be known (Victor, Raustiala, and Skolnikoff 1998) – is to monitor both the status of key ecosystems and the performance of major environmental or resource regimes. The idea is that continuous, detailed, and credible feedback regarding the course of the relevant human/environment relations can serve to reveal mismatches and to provide evidence needed by those desiring to eliminate or alleviate the incompatibilities in question. Needless to say, evidence regarding the existence of mismatches is not sufficient by itself to ensure success in this realm. Beneficiaries of the status quo sometimes have a considerable capacity to discredit or reinterpret the evidence generated by SIRs, and reformers may lack the political influence needed to promote their objectives in various policy arenas, even in cases where the evidence of mismatches is clear and indisputable. But in many cases, a stream of evidence produced by mechanisms accepted by most members of the relevant community as legitimate or unbiased is likely to emerge, at a minimum, as a necessary condition for the success of reform movements.

Another response to the problem of mismatches is to build substantial flexibility into the provisions of environmental and resource regimes. Flexibility can become a double-edged sword in a variety of settings. Rent seekers and powerful interest groups may exploit institutional flexibility to force through changes that promote their own agendas, regardless of the consequences for sustainability, efficiency, or equity. Consider the recent efforts of anti-fur campaigners as a case in point (Lynge 1992). Yet it is apparent that flexibility is often critical to the success of efforts to alleviate or eliminate mismatches. This is particularly true in cases where knowledge regarding the dynamics of key ecosystems is limited at the time of regime creation and where the ecosystems in question are prone to nonlinear and even transformative changes. It is encouraging to note, in this connection, that flexibility of this sort can be built into regimes, even at the international level where sovereignty sensitivity often dictates the adoption of rigid procedures. The rules of the ozone regime governing changes in the phase-out schedules for certain families of chemicals without ratification on the part of individual member states constitute a particularly noteworthy example of flexibility at the international level (Gehring 1994). But it is not difficult to find other examples, particularly in cases where regimes rest on informal or soft-law agreements, that offer hope for the role of flexibility as a means of reducing incompatibilities between ecosystem properties and institutional attributes in a variety of fields.

Another approach, which may serve as a substitute for the creation of SIRs and the introduction of flexibility in some situations, features the role of what has become known as the precautionary principle. The basic idea is to respond to problems arising from imperfect information and institutional constraints by erring on the side of safety or, in other words, by building in margins of safety to ensure that exploited components of ecosystems are not pushed beyond the limits of sustainability. Like other responses to mismatches, this one is vulnerable to exploitation on the part of special interests. An interesting case in point involves the regime for whales and whaling in which supporters of the continuation of a blanket moratorium on harvesting have sought to make use of the precautionary principle to block efforts to put the Revised Management Procedure (RMP) into practice or, failing that, to impose such strict requirements under the terms of this procedure that the result is little short of a de facto moratorium (Friedheim 2000)[4]. A striking feature of this case arises from the fact that environmental groups as opposed to industry are leading the charge in this manipulative effort. But even so, the idea underlying the use of the precautionary principle as a response to the problem of fit is worthy of serious consideration. Given current limitations on our ability to predict the behavior of complex and often chaotic systems, there is much to be said for adopting strategies that feature generous safety margins in such forms as restrictive air quality standards or allowable harvest levels. In the end, this strategy for responding to the problem of fit offers what is almost certainly a second best solution. Still, it may be the best we can do in cases where knowledge is limited and pressures for exploitation are strong.

4. Conclusion

In one sense, the argument of this chapter rests on a limited and somewhat conservative base. In the long-run, we need a more general theory of human/environment interactions that is

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[4] . The RMP itself calls for a high degree of caution. But this has not stopped those opposed to any harvesting of whales from opposing it on precautionary grounds.

capable of endogenizing human actions rather than treating humans as actors located outside the bounds of various ecosystems. But it is likely to be some time before a general theory of this sort arises and becomes sufficiently well-developed to help in addressing the problem of fit. We must also reckon with the fact that there is an element of social construction in the concepts and models we have developed for the examination of ecosystems. To take a prominent example, we are accustomed to drawing relatively sharp distinctions among terrestrial ecosystems, marine ecosystems, and atmospheric ecosystems. Yet it is apparent that these distinctions are, in the final analysis, arbitrary and that there is a need to drop them or at least to modify them substantially in coming to terms with many current environmental problems. The growing emphasis on the need to develop models of coupled systems in seeking to understand the global carbon cycle provides one dramatic example of this line of thinking.

Still, there is much to be said at this stage for a relatively modest effort to identify a range of important ecosystem properties and then to focus on the fit or match between these properties and various attributes of the institutional arrangements created to govern human interactions with these systems. Glaring examples of misfits, such as the creation of regimes that do not cover the full migratory range of wild animals or birds and the use of equilibrium models in efforts to manage nonlinear or chaotic systems, quickly come into focus in this connection. A little probing is sufficient to identify a substantial range of mismatches between ecosystem properties and institutional attributes. Given the difficulties confronting efforts to eliminate or alleviate these mismatches, the problem of fit will surely occupy our attention for a long time to come. Naturally, the search for a more general theory of human/environment relations must go forward.

But for those concerned primarily with the institutional dimensions of environmental change, the research agenda for the foreseeable future with regard to the problem of fit is clear.