

Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism

by Bradley C. Karkkainen

I. Introduction

Much of the discussion at academic conferences on this subject focuses on the relative merits of some familiar sorts of land tenure and regulatory arrangements—public ownership, private stewardship, government-regulated private ownership, and government-created systems of market incentives that aim to influence rather than compel changes in the behavior of private landowners. The presenters often offer new and interesting wrinkles, to be sure, but the general terrain is pretty familiar territory—it’s where most of the mainstream academic debate has been centered for some time now.

I will argue that we are now witnessing the emergence of a distinctive new alternative to these: a new model of *collaborative ecosystem governance*. This model, in my view, represents a major departure from, and challenge to, the conventional legal and institutional arrangements that continue to receive most of the attention of legal academics. The model can be discerned in areas ranging from

- *Habitat Conservation Plans* under the Endangered Species Act, and particularly those HCPs and HCP-like agreements negotiated under California’s Natural Communities Conservation Planning (NCCP) process;
- *public lands management*, arising out of efforts to protect critical, and critically challenged, ecosystems, such as Florida’s Everglades where conventional “inside the fenceposts” management is now recognized as inadequate;

- *the “watershed approach” to clean water protection*, as exemplified by the Chesapeake Bay Program and the Great Lakes Program, which EPA now seeks to replicate on a nationwide basis through such varied mechanisms as the Clean Water Action Plan, the new TMDL rules, and the National Estuary Program;
- in the Western U.S. in particular, where water is a scarce and precious commodity, a new and multi-faceted approach to *water resources management* that simultaneously seeks to conserve, allocate, and protect the quality of water resources, taking into account the needs of a variety of human and non-human users;
- at the international level, collaborative regional efforts to protect *regional seas, estuaries, and other critical marine ecosystems*, such as the Baltic, the North Sea, the Southern Ocean, and the Caribbean.

This is only a partial list. I could go on at length, reciting additional examples.

Now you may fairly question whether these varied programs, each designed to address a distinctive problem (or set of problems) and arising in a unique legal and institutional context, have much to do with one another. It’s not obvious on its face that an HCP—essentially, a conditional waiver from a narrowly prohibitory regulatory provision of the Endangered Species Act—is by any stretch akin to the Great Lakes Program, a “voluntary” intergovernmental arrangement through which the Great Lakes states, the Province of Ontario, and the U.S. and Canadian federal governments attempt to jointly manage water quality problems (such as toxic pollution) and protect aquatic species in the world’s largest system of freshwater lakes. The nature of the environmental threat, the scale of the effort, the identities and characteristics of the parties involved, the varied legal and institutional settings, the nature and form of the commitments

undertaken—all differ. Upon closer examination, however, I believe the family resemblance is a strong one. Despite their apparent differences, these and the other programs I’ve mentioned share a set of characteristics that place them together as a group, and set them apart from the conventional legal and institutional arrangements out of which, in many cases, they grow.

What, then, are the characteristics that define this family of “collaborative ecosystem governance” arrangements?

The new model explicitly grapples with questions of *scale and complexity* in ecosystem management, emphasizing *locally (or regionally) tailored* solutions within broader structures of public accountability, and recognizing the need for *experimentation* and *dynamic adjustment* in response to new learning. These challenges are typically addressed through *hybrid public-private governance* structures, emphasizing broad *information-sharing* and *collaborative problem-solving* among parties representing interests at multiple, *nested spatial scales*, from the immediately local (the landowner) to the national, international, or even global. This paper explores the unique strengths and some potential weaknesses of the new model.

II. Two Propositions about Ecosystems as Complex Dynamic Systems

Let me begin with a couple of propositions about ecosystems that I hope are uncontroversial. But as I move along through the talk, I hope to spin out some implications that I hope will be somewhat more provocative. This is, after all, an academic conference and our goal here is not simply to restate what we all agree to be the case, but to confront clashing sets of ideas and to tease out their implications in a way that may help to clarify the terms of debate and advance our collective understanding.

Proposition 1. *Ecosystems are complex dynamic systems.* Now this may seem too obvious to mention, but I mean it here in a fairly specific, somewhat technical sense, the sense used by the emerging cross-disciplinary science of complexity. That is to say:

A. As **complex dynamic systems**, ecosystems are composed of **many mutually interdependent parts** operating in **dynamic, co-evolutionary trajectories**. They are not static, and do not necessarily tend toward equilibrium. Parts interact with other parts in rich, multiple (and often poorly understood) ways, so that the arrows of causation—what action causes what effect—often point in many directions simultaneously, some in self-reinforcing chains, some held in check by others tending in the opposite direction (positive and negative feedback loops).

B. Like other complex dynamic systems, ecosystems exhibit **nonlinearity** in many dimensions. That is to say, the effects of many actions are discontinuous. For example, there are numerous natural threshold effects, as well as complications caused by co-causation and synergistic interactions among multiple factors operating along multiple complex chains of causation, often incorporating both positive and negative feedback loops simultaneously. As a result, small inputs can sometimes result in large, and often partially or even wholly unpredictable consequences for other parts of the system, and for the system as a whole. As with other complex systems (e.g., the weather), even if our understanding of the individual components and their operational principles is relatively complete, our understanding of the trajectory of the entire system qua system, and the ultimate effect that certain inputs will have on the system as a whole and its individual component parts, may be quite limited. And as with the weather, although we can do our best to plumb the deep scientific principles and to monitor conditions carefully to give us as complete a picture as possible, we need to expect and prepare for surprises.

This is the sense in which an ecosystem is a complex, nonlinear dynamic system. It is more than that it is complicated (although it is also that). It is that even with relatively sophisticated scientific understanding of each of the components (and often, perhaps in most cases, we lack even that much), there is likely to remain a **residuum of inherent uncertainty and unpredictability** with respect to the consequences of any particular input—including any adjustments we might make through management measures. This, I think, is an important and non-trivial insight from complexity theory, applicable across complex non-linear dynamic systems in general. I shall argue that it has large implications for environmental law and natural resources management. Precisely because the first 30 years or so of sustained regulatory effort to protect the environment and critical environmental resources have *not* been based on this insight, we have constructed an architecture of laws and management systems that are poorly matched to the challenge of managing ecosystems as complex systems. It is this shortcoming, I shall argue, that the new architecture is attempting to address, often in quite innovative and sometimes surprisingly successful ways.

Proposition 2. *Most ecosystems are human-influenced or human-dominated complex dynamic systems.* As human beings, we interact with the ecosystems that surround us (and upon which we depend) in numerous and complex ways. There are multiple anthropogenic inputs into the ecosystem, some benign, others more pernicious to other species and the physical environment that sustains them. For example, we are responsible for:

- multiple kinds and varying levels of air, water, groundwater pollution
- habitat destruction, fragmentation, or degradation through, e.g., displacement of native vegetation by controlled, domesticated replacements, many of them exotics
- resource exploitation, placing immediate pressures on populations of certain members of

biotic communities, or withdrawal of critical physical components (e.g., water from the Everglades)

These various human-induced stressors can themselves interact in complex ways. For example, it now appears that when nutrient pollution is combined with the systematic, large-scale removal of filter-feeding shellfish (e.g., oysters), each makes a larger contribution to algae blooms and eutrophication in the Chesapeake Bay and other estuaries than either factor would without the co-presence of the other. Indeed, at a certain point their interaction may develop into a self-reinforcing feedback loop; high nutrient concentrations lead to algae blooms and eutrophication which block sunlight and oxygen from reaching filter-feeding shellfish, reducing their populations and thereby preventing them from filtering the water in the estuary, thus reducing its buffering capacity and worsening the impact of a given level of nutrient inputs. At the same time, of course, a reduction in shellfish populations means that a given level of fishing effort puts even more pressure on the remaining population, potentially disrupting its ability to regenerate and thus indirectly reducing the estuary's buffering capacity for nutrient inputs, and so on. In this self-reinforcing cycle, everything depends on everything else, in complex and often difficult-to-specify and even more difficult-to-predict ways. We know that other things equal, nutrient pollution is likely to have adverse effects; but the precise nature and extent of the adverse effects depend on a highly localized context which includes the co-presence of numerous other factors, and a complex web of causation among multiple factors. The upshot is that we may not understand very well how the ecosystem will respond to a management choice—e.g., to reduce nutrient inputs (or concentrations) to level X, or to reduce fishing effort to level Y—even if we do understand a great deal about shellfish propagation and the role of nutrients in promoting algae blooms. Because the nature and magnitude of the effect will depend in part on local context, we may not be able to say,

in general and across a range of ecosystems, what is an “acceptable” level of nutrient pollution, whether measured in terms of releases or ambient concentrations (and even if we start with some agreed-upon set of criteria for deciding whether the consequences are “acceptable”, which of course we also do not have). Reducing nutrient inputs or concentrations to level X may have a very different effect in the Chesapeake than in San Francisco Bay, due to e.g., different flushing rates, temperatures, and salinity gradients that may affect algae growth; the presence of different algae and shellfish populations; the co-presence of other pollutants; or other pressures on shellfish reproduction rates such as fishing effort, fishing methods, physical alteration of shellfish habitat, competition from invasive species, and so on. Consequently, if our goal is to reduce nutrient pollution so as to protect ecosystems, the target level will need to be set by reference to a specific local context, in light of our best current understanding of the likely effects on the individual ecosystem. Cookie-cutter answers—uniform standards, whether set at the federal or state level—just won’t suffice.

But there are also other implications, beyond the need for local tailoring and thick, locally contextualized knowledge. For any given ecosystem at any moment in history, we are likely at all times to have at best incomplete knowledge about the complex synergies and multiple interactions among its many components, even if as individual components they are relatively well understood. There will be residual uncertainty and unpredictability, even with the best investments in science that money can buy. But if we are attentive, and make the necessary investments in science and, just as critically, in monitoring capacity, we can put ourselves on a trajectory to see continuous improvements and refinements in our understanding of the complex dynamics of the ecosystem. So implication number two is this: whatever rule we choose must be not only locally tailored but also flexible, adjustable in response to new learning, and we need to put in place the resources and

institutional mechanisms to ensure that new learning occurs, and that subsequent rounds of policy adjustment are informed by it.

II. Some Further Implications: Scale, Dynamism, Holistic Management

Now I hope that most of what I've said so far is neither particularly new nor surprising. As I said, this is the part that I hope is uncontroversial.¹ But what is new, I think, and still substantially uncharted territory in the legal academic literature, is our growing recognition of the implications of this conception of ecosystems as complex, dynamic, non-linear, human-influenced systems for environmental law and policy. And this is where I intend to be provocative.

I'd like to draw out three implications that, in my view, call into question many of the foundational assumptions behind most of the elaborate architecture of environmental and natural resources management law that has been built up over the past 30 years. I'll mention them here, then say more about each in turn. They are:

A. SCALE: Management efforts must be **local and/or regional** in character. Because problems and solutions are not uniform across all ecosystems, management systems must be capable of generating locally and regionally tailored responses. As a corollary, because the ecosystems we endeavor to manage are themselves not uniform across the larger landscape but instead are complex mosaics, there may need to be even more localized tailoring of some

¹Indeed, although the "New Ecology" has arguably brought about a sea change in ecology, a shift from thinking of ecosystems as tending toward equilibrium toward a non-equilibrium, dynamic view, my suspicion is that some of this is a matter of emphasis. Even Aldo Leopold would probably not be terribly surprised by what I've just said, and the Odum-inspired equilibrium ecologists would subscribe to much of it.

management efforts to subsystems within the larger complex, e.g., to various tributaries of a troubled estuary like the Chesapeake Bay, since nutrient inputs into and from the Susquehanna River will have very different effects than a similar level of inputs to and from the James. The “natural” locus for management efforts, then, will be at a regional level that does not correspond to familiar political, territorial, and jurisdictional boundaries.

B. DYNAMIC MANAGEMENT: LEARNING, ADJUSTMENT AND THE

“ROLLING RULE”: We’re accustomed to thinking of environmental protection in terms of fixed, uniform rules. But given what we’ve just said about complexity, the search for “optimal” fixed rules, or even minimally effective ones, may be chimerical. Other things being equal, nutrient run-off is likely to be a bad thing, or at least not a good thing. But just how serious a problem it is, indeed whether it’s really a problem at all from the standpoint of protecting environmental resources that we care about, will depend not only on local context but on features of the local context that at any given moment we will only partially understand. With sufficient effort—scientific effort, coupled with systematic monitoring and thoughtful experimentation—our understanding may improve over time. But at any given moment, it is likely to remain incomplete. We will therefore inescapably operate under a chronic information deficit, or partial knowledge vacuum, with respect to what could be known that is relevant to our efforts to protect environmental resources. Yet if we make a good faith effort, we can put ourselves in a position always to know more tomorrow than we do today. Under the circumstances, a strategy of acting only at the point where we think we know with reasonable certainty what the effects of a particular rule will be—the approach that has characterized most regulatory law, including environmental law—is a prescription for inaction and ineffectiveness.

An alternative strategy therefore commends itself. Under the alternative approach, we would act on the basis of the best currently available information and understanding, but explicitly recognize that the action undertaken now is provisional, subject to revision in light of subsequent learning and observed results. As a corollary, emphasis should be placed on contextualized science and systematic monitoring of ecosystem conditions, to ensure that future decisions are as well-informed as possible. This pragmatic “rolling rule/institutional learning” approach is being increasingly adopted in practice.

The rationale is straightforwardly stated. Precisely because the system we seek to manage is itself dynamic and unpredictable, the search for any kind of optimal rule or fixed target may prove illusory. There may be no stable optimal rule to be found. To put it more precisely, ecosystem dynamics are not wholly random and unpredictable, but at any given stage there will still be much more that we can learn. Even what appears relatively certain may in fact be predictable only within relatively large ranges of uncertainty, even if our scientific understanding is highly advanced. But because in most cases our scientific understanding will be riddled with gaps and incompleteness, additional deep layers of uncertainty are added to our management efforts. The upshot, then, is that rather than seeking optimal fixed rules, we need to build flexibility and dynamism into our management efforts. We need to expect surprises, for we will discover on occasion that we had it all wrong, perhaps because we simply overlooked a critical factor or two in the causal equation, and now need to change course completely. Or, less drastically, we may discover as we go along that although we were generally on the right track we nonetheless need to make mid-course corrections, informed by subsequent scientific advances, new learning, and the observed effects of past management efforts. In short, what is required is a “rolling rule” regime capable of relatively rapid adjustment to new learning and environmental

change.

C. “HOLISTIC” MANAGEMENT: I use the term “holistic” cautiously for fear of invoking New Age mysticism, which I want to avoid here. But the conception of ecosystems as complex systems demands that we endeavor to understand and try to manage the whole system *qua system*. The whole is greater than the sum of its parts. It operates as a system, and has its own dynamics and characteristics as a system, and not merely as a collection of individual components. The interdependencies among its numerous interacting and mutually interdependent parts are so many, so thick, and form so elaborate and intricate a web (or nested series of webs) that we can’t reasonably expect to manage individual components in isolation from one another. The first lesson of ecology, “everything affects everything else,” is still the truest, and it ought to serve as a guiding beacon in our management efforts. So, for example, shellfish populations in the Chesapeake Bay can’t be managed solely by the traditional mechanisms of fisheries management, i.e., by limiting fishing effort and fishing technologies. Instead, shellfish management must be integrated with non-point pollution control, and both with habitat conservation. There’s another mismatch here with existing governmental structures, but in this case the problem is not so much territorial one of territorial scale as it is of functional divisions of responsibilities functional. Government agencies often have relatively narrow missions. We are accustomed to managing environmental and natural resource problems one-at-a-time and in isolation from each other, as if pollution control and water supply and fisheries management and habitat conservation had nothing to do with each other. The lesson of ecosystems as complex dynamic systems is that we need to manage each in the context of the others, and all in the context of the whole, each in its own unique locally/regionally situated ecosystem context, and always, as we just said, recognizing that we operate under the constraints of a chronic information deficit. The challenge, then, is to try to consider as many of the

implications of any particular management decision as we can given our current level of knowledge, even while recognizing that our judgment will be based, inevitably, on partial information and incomplete (though, we hope, continuously improving) knowledge, and therefore must always be revisable in light of subsequent learning.

More on each of these three main themes:

IV. SCALE: REGIONAL POOLING

It is sometimes argued that there are no well-defined “natural” units for ecosystem management. An “ecosystem” can be defined as a community of mutually interdependent species and the physical environment with which they interact, which could mean anything from the microbes in a single drop of water to the entire solar system. Yet “ecosystem” is not an utterly vacuous term. Without wandering too far off into the philosophical implications of the term, I think most ecologists and most enlightened natural resource managers would say that there are recognizable “natural kinds” of ecosystems. It makes sense, for example, to talk about estuaries or watersheds as natural kinds of ecosystems. They have objectively discernible physical boundaries (though we may disagree about the definitional details), and are composed of thick and localized concentrations of interacting and mutually interdependent plant and animal species co-habiting in a distinctive set of physical habitats. It is this thickness and local concentration of interactions that leads us to believe it may make some sense to focus our management efforts at that level. Of course, the estuary itself comprises numerous smaller, and often overlapping, habitat mosaics; it also interacts substantially with both adjacent coastal waters, “the ocean” considered as a unified whole, and its upstream freshwater tributaries, as well as adjacent shore lands. But to talk about

the Chesapeake Bay estuary as an ecosystem is hardly nonsense; and if we know anything about estuaries, it may immediately point us in the direction of some of the critical factors we will need to consider in managing it. For example, it will share certain distinctive features with other estuaries that it does not share with the Sonoran Desert or the Sierra Nevada, which both belong to distinctive types or “natural kinds” of ecosystems.

Again, perhaps all this is obvious. (At least I hope it’s not obviously wrong, but if it is I welcome your intervention). What is not obvious, however, given that we appear to have some choice in the matter, is what are the best (or “optimal”) ecosystems to manage. That is a question we may never be able to answer definitively. We may never be able to conclude with any degree of confidence, for example, that watersheds are invariably the “best” management units. We may think that the answer will vary by local circumstance, so that the appropriate management units should be determined on a more or less ad hoc, case-by-case basis for each region. Or perhaps we will decide that there are more-or-less consistent patterns across larger “sectional” scales (e.g., Northeastern U.S. v. Southeast v. Midwest v. Southwest v. Northwest), so that management at the watershed scale may make sense in the Chesapeake or the Everglades, for example, and perhaps in other areas of the Eastern United States where flowing water tends to be ubiquitous and a dominant and defining factor for both aquatic and terrestrial species. But it may not make as much sense to focus on watersheds in the relatively drier portions of the American West, such as the Sonoran Desert which is crossed by several streams but dominated by none of them; or the Sierra Nevada, which provides the headwaters for a number of important rivers but also has its own ecological integrity and connectedness, and unique problems characteristic to it as a unit. Or we may decide that several kinds of ecosystems are critical—aquatic ecosystems as defined by estuaries and watersheds, for example, and land masses as defined by vegetative cover (forests,

prairies, steppes, deserts). We thus might end up with overlapping management schemes, e.g., for management of aquatic and terrestrial units (recognizing, of course, that each profoundly affects the other and so some significant degree of coordination and co-management may be necessary). Or we may opt for management on “nested scales” as in the Chesapeake, where the basinwide strategy provides an overarching framework within which individual tributary strategies can be worked out, tailored to the unique characteristics of each stream but cognizant of and accountable for the consequences for the larger system.

The answer, I take it, will depend in part on the natural features of ecosystems that we deem most significant, and the particular anthropogenic stressors that we deem most critical—and these may vary considerably by region or by locality. But it may also depend crucially on the scale at which management efforts can be most effective, all things considered. Yet like our understanding of the underlying natural systems themselves, our understanding as to where management can be most effective is severely limited at this point. We can speculate and theorize (and we ought to do so), but until we make a serious attempt at actually managing ecosystems *qua* ecosystems,² we are unlikely to be able to say much with confidence about which kinds and scales of ecosystems are best suited to such management efforts. For the most part, we have not yet made that attempt. And even for the few ecosystems we have seriously attempted to manage *qua*

²That is, to try to “manage” our own affairs so as to mitigate and minimize what we believe to be the worst anthropogenic insults to ecosystem function, and to the limited extent possible within the bounds of our best current knowledge, to try to repair damage already done. Much of how the ecosystem functions, I take it, will be beyond our ability to control; and in other areas, although they might be within our power to manipulate and alter, we are probably better off leaving well enough alone, because we simply will not know enough to manage wisely without introducing substantial additional risks of further harm. I take it something like this is what most ecologists and natural resource professionals mean by “ecosystem management”: we manage human inputs into ecosystems, not ecosystems themselves.

ecosystems, we have not yet put in the serious work of critical analysis of particular management experiments, and synthesis across experiments, that would allow us to reach many definite conclusions at this stage.

The good news is that we are presently in a period of diverse and relatively robust experimentation in ecosystem management as evidenced by, for example, the Chesapeake Bay Program, the South Florida Ecosystem Restoration project, and regional NCCP/HCP multi-species habitat conservation planning in California. All are examples of large regional- (or “landscape-”) scale ecosystem management efforts. Each arises in response to a quite distinctive statutory and regulatory background, a unique set of perceived problems, and even differing initial conceptions as to what is the critical resource to be protected. It is tempting, therefore, for the relatively few legal commentators who have even taken notice of these efforts to dismiss each as *sui generis*—an interesting localized response to a highly localized problem, arising under such unique and difficult-to-replicate circumstances that any lessons that we may attempt to draw from the experience can be expected to have limited applicability outside that unique local context. That, I think, would be a serious error.

I am inclined to think that, given the infancy of ecosystem management, and the consequent magnitude of our present knowledge deficit, diverse experimentation is precisely the right strategy for the moment. But we also need to begin to think of it explicitly as a conscious strategy of experimentation aimed at informing subsequent rounds of decision-making. And that, in turn, requires that we begin to take a serious and sustained critical look at these projects explicitly as (potentially generalizable) policy experiments, rather than simply as *sui generis* responses to unique local problems. Individually and collectively, they suggest larger possibilities. Potentially, at least, they begin to point the way toward a new, replicable, and fully scalable

ecosystem-oriented approach to environmental management that could be bootstrapped out of the lessons learned from their experience. But if they are to serve that purpose, it will be necessary to probe the unique strengths and weaknesses of each, to compare them carefully, to isolate the factors that appear to lead toward success and those that stand as obstacles to further progress, and to draw whatever generalizable lessons there are to be learned from each of them, and from the lot of them. That is a task that, I am sorry to say, very few people appear to have yet undertaken in a serious way.

I myself do not pretend to have yet made a thorough examination of any of these experiments (though it is certainly on my agenda to do so in the near future). But based on what a few colleagues and I have seen,³ there appears to be a broad kind of convergence among these projects. To begin with, all are distinctly *regional* in scale. Whether the particular regional scale, and the particular ecosystem targeted for protection, is too large or too small, too narrowly or too imprecisely defined, I'll leave to your judgment (and perhaps the commentators will have more to say about this). My own sense is that in each case they've probably gotten the scale more or less right, given the set of problems they've initially set out to address.⁴ Certainly smaller units

³See Charles F. Sabel, Archon Fung & Bradley C. Karkkainen, *Beyond Backyard Environmentalism*, in *BEYOND BACKYARD ENVIRONMENTALISM* (Joshua Cohen & Joel Rogers eds., 2000).

⁴This is an important qualification. The Chesapeake Bay Program at its most ambitious appears poised to provide a multi-dimensional framework within which more or less all environmental protection efforts in the region could potentially be lodged. Even the most ambitious of the NCCP/HCP projects appear to aim more narrowly at protecting wildlife habitat, most critically for rare, threatened and endangered species but also proactively for the benefit of other species not yet so challenged—that is, conserving “natural communities” (in the language of the California statute) but doing so primarily through habitat protection measures, and consequently less grand in scope and ambition.. On the other hand, we might describe the Chesapeake Bay Program as seeking much the same end: protecting the natural communities that comprise the Chesapeake Bay and its watershed.. But because the context is a critically challenged estuarine

than they've chosen would not have been appropriate, though at least in the case of the Chesapeake it's been found necessary over time to add an additional tier of smaller and more localized management units at the tributary scale—not as a substitute for, but as an additional level subordinated to and integrated into the regional framework. This is the feature of “nested scales” that I just mentioned.

What does seem readily apparent, however, is that whatever the precise geography of the ecosystems we ultimately decide to manage, conventional legal, political, institutional, and jurisdictional divisions of authority in most cases (perhaps all cases) won't map well onto ecosystems as natural systems. To begin with, conventional territorially delimited lines of authority are, almost without exception, either too large, too small, or both simultaneously.⁵

i. Proprietary rights-holders (landowners). The individual parcel of land almost invariably proves too small to serve as the basic unit for ecosystem management. This holds true even for the very largest parcels, most of them held by the federal government. Examples include the Everglades and Yellowstone, both of which are seriously threatened by the externalized consequences of activities occurring on other parcels, some of them held by other single-mission

system, the Chesapeake Bay effort necessarily implicates all manner of air and waterborne pollution along with what we might traditionally regard as “habitat” concerns. It is something like this more ambitious model of regional ecosystem management as the organizing framework for environmental protection in general that I am urging with this paper.

⁵Perhaps that's true almost as a matter of logical necessity. In general, we use two sets of principles to delimit territorial boundaries. Sometimes, we use some distinctive, visible natural feature—a river, let's say, or the crest of a mountain ridge. In doing so, we tend to divide the riparian habitats and montagne forests that straddle the border. Alternatively, we often use straight lines drawn from an ultimately arbitrary set of coordinates. But since natural boundaries rarely are fixed in such straight lines (and even if they did, would not necessarily use the same straight lines that we choose for our coordinates), it's all but guaranteed that whatever lines we draw will be either underinclusive, overinclusive, or both.

federal agencies working at cross-purposes with the managers of the parks, others by states or private landowners, most often by all of these simultaneously. And what is true of the federal government—by far the largest landowner in the aggregate, and the owner of most of the largest relatively undeveloped parcels—is all that much more true for privately held parcels, which are generally much smaller. Consequently, even the most ecologically enlightened landowners will find it difficult to undertake anything remotely resembling “ecosystem management” on their lands in isolation. The Nature Conservancy, which has long managed a large number of small-to-medium-sized nature preserves (indeed, very large by private landowner standards, though generally small in comparison to the federal holdings), recognizes that it can no longer rely solely on its capacity manage nature preserves in isolation. Its management strategy now explicitly includes working within, and where necessary working to help create, larger regional ecosystem-oriented coordinating bodies. As an official of the Washington (State) Nature Conservancy explains, to protect a wetland preserve set aside to protect the habitat of a rare orchid, you need to be concerned about the hydrology of the entire watershed. Ecosystem management, then, requires at a minimum some coordinating mechanism applicable across a variety of proprietary rights-holders. Of course, in principle landowners could simply agree among themselves to coordinate their management efforts, but for all the familiar kinds of coordination problems—free riders, holdouts, the sheer informational and other costs associated with informing and organizing and maintaining communication among a larger number of parties—purely voluntary coordination among landowners is likely to be rare,⁶ at least in the absence of some externally imposed

⁶In addition, of course, there is the question of incentives, which I take up below. Since many of the benefits of ecological stewardship may be diffuse and externalized while the costs are likely to be concentrated and internalized to the landowner, some landowners may prefer not to be ecological stewards. As I shall argue below, the same is true for local governments and also, to

coordinating mechanism.

ii. Local governments. By their very nature, governments claim territorial jurisdiction that crosses the lines established by property ownership. But local units of government—cities and counties—are also almost invariably too small to manage ecosystems qua ecosystems. With respect to the regional ecosystem units we want to manage, their jurisdictional boundaries are underinclusive. Coordination is needed at a level higher than the local level of government. For essentially the same reasons that impede the formation of purely voluntary agreements among landowners—that is, the structure of incentives coupled with high transaction costs—such agreements are also unlikely to emerge among local governments. This is at least likely to be true where costs are concentrated and locally internalized, benefits diffuse and at least partially externalized, and there are large numbers of parties, raising the transaction costs to potentially prohibitively high levels.

iii. States. On the other hand, states may be both too big AND too small. Their territorial boundaries, which generally define the limits of their jurisdictional reach, are both overinclusive and underinclusive. California, for example, is very large and extremely diverse. It can be divided into distinct bioregions or large regional ecosystems, many of them contained entirely within California; thus we might say that even if a state like California is motivated to try to engage in ecosystem management, it must effectively subdivide itself into smaller scale units in order to manage even these very large ecosystems. But others of California's bioregions have a transboundary character (e.g., the Sierra, or the Klamath region in the north which crosses California's boundary with Oregon). Maryland, on the other hand, is for the most part dominated

some extent, states.

by the Chesapeake Bay, but the state of Maryland does not have jurisdiction over the entire Bay, which it shares with Virginia. And of course, the Bay's watershed—the source of much of the nutrient pollution that plagues the mainstem of the Bay—encompasses an even much larger multistate region, severely constraining Maryland's ability to manage the Bay without a high degree of interstate coordination.

Owing to the circumstance that states themselves are either underinclusive or overinclusive or both simultaneously, their boundaries are not particularly well matched to demands of ecosystem stewardship. Some of the costs of ecological stewardship will be concentrated within the state, though in transboundary cases at least some of those costs must be borne by extraterritorial parties whom the state has no jurisdiction to reach. And to the extent states are geographically overinclusive, costs (especially costs of regulatory compliance and the opportunity costs of foregoing or limiting development) may be borne by particular regions of the state rather than shared broadly the entire state population. Or, contrariwise, costs imposed across the entire breadth of the state's population through general taxation, while the benefits are perceived to be flowing to a particular region. In either case, then, ecosystem conservation at the state level may feed into the politics of regional and sectional rivalries in ways that may impair the state's capacity to act. Similarly, on the benefits side, even very large states like California may not fully internalize the diffuse benefits of ecosystem management,⁷ some of which flow to neighboring states, some of which flow to the public generally.

Finally, there is the question of capacity. For all the categories mentioned so

⁷I, for one, confess to be an avid and regular beneficiary of California's and Florida's spectacular ecological resources, a portion of which I pay for with the few meager tourist dollars I leave behind, and some of which I pay for through federal programs, but much of the cost is absorbed by Californians and Floridians.

far—individual landowners, local governments, and states—knowledge and money are likely to be critical limiting factors. States in general may be expected to have greater in-house expertise, greater capacity to acquire and process the relevant scientific and technical information, greater financial resources (should they choose to deploy them), and a more robust and well-rounded set of regulatory powers (again, subject to a political decision to deploy them) than either individual landowners or local governments, their capacities are highly variable. On the other hand, because of their very size, states may lack what is possessed in great abundance by more localized parties (landowners and municipalities), that is, the capacity to generate fine-grained, high resolution information at more localized scales, including, critically, information on the cost side of the equation, such as the opportunity costs of foregoing or constraining real estate development in a particular community or on a particular parcel. Thus, in a state like California, although the state may come equipped with relatively high quality information on the life-cycle of the California gnatcatcher and the stresses on its coastal sage scrub habitat, it will have less locally detailed information on, let us say, the costs and consequences of a rule barring any further development in the coastal sage scrub, than is held (or could be acquired) by the largest local landowners and the city and county governments.

For all these reasons the shift toward local/regional ecosystem management is not merely a question of neo-federalist devolution of authority to the states per se as the natural locus for managing ecosystems. Undoubtedly, the states will have a prominent role to play (as they do in each of the examples we've cited). But a high level of state autonomy may actually turn out to be antithetical to ecosystem management if it acts as a barrier to interstate coordination, or if an excessive quantum of authority becomes lodged at a tier of government that is neither particularly well-informed about regional ecosystems (either in purely technical and scientific terms, or with

regard to the costs and benefits of the available management measures), nor places a high priority on managing them, nor has the informational, technical, administrative, financial, or political resources at its disposal to do so effectively. This is not to say that we can expect that all states will do a poor job. Some, including each in its own way California, Florida and Maryland, have been exemplary. But there is a good deal more to effective ecosystem management than for the federal government simply to stand down from the leading role it has historically played in environmental stewardship, and devolve authority to the states, hoping that they will do the job.

iv. Federal government. Yet the federal government is almost certainly too big and too remote from these highly variable, locally situated, thick contexts that comprise ecosystems to assume sole or even principal responsibility for managing them. Except, of course, when it's too small, such as in cross-border situations (e.g., the Great Lakes, Rio Grande/Rio Bravo, Sonoran Desert, Gulf of Maine). The federal government may have a great deal of scientific and technical expertise at its disposal, and it certainly has the greatest concentrations of money, land, coercive power, and other strategic resources that could be brought to bear to help solve environmental problems. But the kind of thick locally contextualized knowledge, and locally context-dependent rule-making that we described as so necessary for effective ecosystem management, are hardly its forte. The challenge for the federal government is severalfold. First, although its capacity in knowledge and information, money, land (in many cases), and regulatory powers (which as we shall see turn out to be significant) are likely to be greater than those of any other party, they are insufficient for the task at hand. Even leaving aside for the moment the questions of money and land, the sheer information burden on the federal government, were it to endeavor to direct ecosystem management efforts in every relevant ecosystem across the nation, would be insurmountable. As the Soviet Union found out when it attempted the similarly ambitious

task of managing a complex modern industrial economy through central planning, no central state authority, however muscular, can elicit, absorb, process, and respond intelligently to that much information. Not even EPA. Not even EPA and Interior combined. (I'm being slightly facetious here).

v. Regional Pooling: The Emergence of Interjurisdictional Coordination through Hybrid Ecosystem Governance Institutions. In most cases, the “natural” locus for ecosystem management will be at some intermediate regional level, defined by the facts and circumstances of the individual case, i.e., in large measure by the characteristics of the ecosystem, including the sources of stressors on ecosystem health. And indeed, if we look at the Chesapeake Bay, NCCP, and South Florida cases, that is precisely what has emerged. In each case, lacking any pre-existing regional coordinating mechanism, it became necessary to invent one; and invented they were, on an ad hoc, case-by-case basis, as local exigencies demanded. Characteristically, these involve horizontal coordination among multiple “sister” governments (e.g., multiple states in the Chesapeake Bay case, multiple municipalities in some of the California NCCP cases), as well as (and simultaneously) vertical coordination across multiple tiers of government (local/state/federal, as in the Chesapeake, California, and South Florida). Moreover, and crucially, beyond *intergovernmental* coordination, the new ecosystem management institutions typically involve *interagency* coordination across functional mission and program lines. Thus we see wildlife management and fisheries officials working side-by-side with land managers, water supply managers, representatives from environmental protection agencies, and forestry and agriculture agency officials. Finally, and also crucially, the new ecosystem management institutions facilitate and actively seek to foster coordination among private as well as

governmental proprietary right holders, who often play a an active (and even leading) participatory role in the coordinating institutions.⁸ And of course, once the process is opened to non-governmental actors, fairness and balanced representation of the full array of affected interest demands that it also be open to environmentalists, conservation organizations, other affected industry groups, and all manner of civic associations and community organizations.

This characteristic—high levels of both intergovernmental and public/private cooperation—is probably the most readily apparent feature of the ecosystem governance regimes that have emerged to date. Indeed, it is tempting for some commentators to conclude that ecosystem management begins and ends with the need for complex interjurisdictional coordination and cooperation, and many would argue that this is precisely why ecosystem management is doomed to be a non-starter. We know from bitter experience that complex, non-hierarchical negotiations can quickly break down over the strategic behavior and rent-seeking of some participants. Because the kinds of institutions contemplated here must overcome deep interagency rivalries, incompatible agency missions, intergovernmental mistrust, private landowners' distrust of government's motives and vice versa, and all the usual coordination problems (free riders, holdouts, etc.) that plague any multiparty coordination effort, the massive cooperative effort contemplated under these arrangements might seem a singularly messy and unpromising way to go about accomplishing anything. Moreover, in the absence of any single, clearly identifiable, authoritative decision-maker, we might wonder where accountability is to come from. With no one in charge, who can hold the parties accountable to each other, and who can be held accountable to the public on whose behalf decisions are being made? And it is certainly is easy

⁸The precise mechanisms and forms of participation vary considerably, of course.

enough to point to some spectacular failures.

But I think that analysis is too facile. For one thing, it doesn't account for the successes, or make a serious effort to identify the possibility conditions for success, or to find distinguishing features that might account success in some cases and failure in others. The complex, hybrid governance structures that are now emerging where successful ecosystem management is occurring—the Chesapeake Bay, for example—are often truly remarkable, robust, vital institutions. They tend to be distinctly non-hierarchical; they tend to involve high levels of both vertical, horizontal, and functional coordination, across federal-state-local tiers of government, across multiple agencies within any single government (e.g., regulatory and natural resource/lands management agencies), across multiple governments at the same tier (e.g., states, municipalities), and all these simultaneously. Indeed, in some cases they incorporate coordination across multiple branches of government, as in the Chesapeake Bay Program where the Chesapeake Bay Commission, itself a coordinating mechanism for the legislatures of the three states, has been from the outset an active participant in the Chesapeake Executive Council, otherwise made up of state and federal executive branch officials. Not only do these hybrid institutions not fit comfortably into standard models of federalism, they also might not fit comfortably into standard models of separation-of-powers. Finally, and perhaps even more problematically (at least from a lawyer's perspective), by creating such a prominent and explicit role in the governance regime for non-governmental parties such as landowners, industry groups, environmental organizations, and civic and community associations, they begin to challenge traditional conceptions of the nature of governance itself, in which sharp distinctions are drawn between the “public” (governmental) and “private” (non-governmental) spheres. The bare fact that such unconventional and counterintuitive institutions exist at all—much less that some of them are persisting over time, and not only surviving

but apparently growing more robust and actually beginning to make progress toward solving difficult, complex problems where other approaches have failed—ought to at least pique our curiosity. My contention is that until we’ve given them more careful critical and analytical scrutiny and subjected the most interesting of both the successes and failures to careful comparative analysis, it’s too early to dismiss them on what purport to be theoretical grounds. Because if the conclusion of the theory is that reality is impossible (or at least highly improbable), it may be that our theory—and not reality—is underinformed.

A Brief Digression on Game Theory and Natural Resources

In that light—and with all due respect to many distinguished colleagues, some of them in this room—I want to propose a moratorium on the use of the Tragedy of the Commons and the Prisoner’s Dilemma to analyze the deep structure of environmental and natural resources management issues. (And here I’m being only half facetious). You all know what I’m talking about. The Prisoner’s Dilemma comes out of game theory; it’s a coordination game. Two prisoners are held in separate cells, and each is separately offered the same deal. If neither confesses, both go free; if both confess, both serve time; if one confesses and the other doesn’t, the defector gets a reduced sentence and the non-cooperator (from the authorities’ perspective) serves the maximum sentence. Upshot: both confess, because neither can risk being caught in the “sucker” position, refusing to confess and being ratted upon by the defector. And this result holds even though, had they been able to make and effectively enforce a conspiracy of silence, both would clearly have been better off.

The Tragedy of the Commons, the name taken from Garrett Hardin’s famous 1965 article in

Science, is essentially just an N-person Prisoner's Dilemma. The argument is that each user of a common pool resource will have an individual, rational incentive to use more than a sustainable fractional share of the resource, because if she doesn't someone else will. Again, in the absence of coordination, we arrive at an outcome adverse to the long-term interests of all participants arising out of rational individual incentives.

But as Fritz Scharpf and others have point out, the Prisoner's Dilemma (and by extension the Tragedy of the Commons) is a badly overused metaphor. Not every natural resource management question has the character and incentive structure of a Prisoners' Dilemma, which is constructed out of a set of very strong assumptions. First, the Prisoner's Dilemma assumes that the incentive structure is symmetrical—although cooperation by all parties would produce an optimal outcome for all, the defection option is clearly superior to the “sucker” option in which the cooperator loses out at the hands of the defector. But incentives are not always symmetric among parties, or so clearly structured in the three-tiered fashion assumed by the Prisoner's Dilemma. To take a simple example, consider the New York City watershed. New York City gets its drinking water supply—actually, some 9 million people in the downstate region get their drinking water, administered by the City—from a rural and partially agricultural region in the upper Delaware and Catskills watersheds. Modest population growth and agricultural runoff in the region have produced a gradual deterioration in water quality, to the detriment of the 9 million water users who now face the imminent threat of needing to build a \$6 to \$10 billion water filtration system. Building the filtration system is one solution, though a costly one. Strict, and strictly enforced, state or federal non-point pollution regulation is an obvious alternative, but not an attractive one from the point of view of landowners in the watershed, or from the point of view of state and federal officials because it plays into New York State's traditionally fierce upstate-v.-city political

rivalries in a way that threatens both the state's and the federal government's political capacity to act. So an alternative solution is now moving forward—rather than build an expensive water filtration plant, the city will in effect coordinate and finance “voluntary” non-point pollution mitigation projects across the watershed, paying the full incremental costs of sewage collection and treatment systems, and nonpoint source management measures undertaken by farmers and landowners, as well as throwing in as a “sweetener” a regional economic development fund. At \$2 billion it's not cheap, but (assuming it works) it's much cheaper than the next likeliest alternative (filtration). The point is simply that sometimes cross-subsidies among parties are an option because the potential costs to one or more parties from non-cooperation outweigh the costs that will be incurred by other parties.⁹ There are still many difficult coordination problems, to be sure, including the problem of potentially extortionate demands on the part of parties whose cooperation may be necessary, as well as problems of trading off concentrated short-term costs against diffuse and longer-term benefits, and monitoring against defections. But the basic incentive structure is quite different in the New York City watershed case—which led to a cooperative outcome—than in the Prisoner's Dilemma. Perhaps only in rare cases will the difference be so clearcut. Few parties are as big as New York City, or face such enormous direct and concentrated costs of non-cooperation, or are so well positioned to spread the costs across a large base of water users so that the net cost to any individual will be small. Yet my point stands. We cannot

⁹This, of course, is a classic Coasean solution. The upstream polluter effectively holds an entitlement to pollute, but because the costs of pollution to the downstream party are greater than the costs of pollution abatement upstream, it is economically efficient to invest in pollution. So, says Coase, absent transaction costs the parties will bargain to the efficient outcome—in this case, the downstream party will pay the upstream party not to pollute. And although in the real-time New York City watershed version of the Coasean fable there are very large transaction costs to be overcome, the costs to the downstream party in this case are so great that it is willing to pay a stiff premium to overcome them.

simply assume that just because we are dealing with a natural resource management question, the very special incentive structure that defines the Prisoner's Dilemma or Tragedy of the Commons will necessarily apply.

Similarly, I would argue that with respect to many of the collaborative ecosystem governance projects that have emerged to date, the Prisoner's Dilemma incentive structure does not apply—or even if it does apply initially, can be erased or modified. Consider the southern California NCCP/HCP plans. There, the default position in the absence of a cooperative solution was strict enforcement of Sec. 9 of the Endangered Species Act, the “no take” provision, which would have effectively shut down development across a large swath of southern California, imposing enormous costs on local landowners, developers, local governments and, arguably, the citizenry in that region as a whole in the form of foregone economic opportunities, possibly housing shortages, and other economic pathologies. The incentive structure was very different from the Prisoner's Dilemma. Concededly, it was the self-conscious interposition of a federal regulatory requirement that altered the incentive structure; Bruce Babbitt personally made the decision to list the California gnatcatcher as “threatened”, a decision probably justified by the science and therefore defensible under the statutory standard, but a decision nonetheless made in full cognizance that it would have the effect of forcing southern California to develop a serious alternative to the status quo of more-or-less unrestrained development that was destroying the last remnants of the coastal sage scrub. But my point is precisely that sometimes that's all it takes. The default position—the consequences of non-cooperation—are sometimes unacceptably high, or can be made so by the strategic exercise of state or federal governmental authority. In the southern California case, some landowners were reported to have complained that the “voluntary” or “cooperative” process of negotiating a binding regional land use plan consistent with habitat

protection looked from their vantage point more like extortion. So be it. I would argue that one of the critical resources that state and federal (as well as local) governments bring to the table in the hybrid regional governance institutions that are emerging, is precisely this capacity to exercise a wide variety of regulatory and non-regulatory governmental powers strategically, to alter the incentive structure of erstwhile non-cooperators and make cooperators of them. As the farmer carrying the axe handle reportedly said of his mule, “Sometimes you just need to get their attention.”

Similarly for some parties to the Everglades restoration. The National Park Service acts, in effect, in the capacity of trustee, exercising the federal government’s proprietary rights over Everglades National Park and the Big Cypress Preserve for the benefit of the public generally. We can argue about the problems and pathologies inherent in that model; my own view is that it works tolerably well, though the statutory framework could be spruced up a bit, but that’s not the point nor this the place to make it. The crucial point here is that if the Park Service takes its role as trustee over these lands seriously, it was in serious jeopardy of breaching its fiduciary duty by allowing permissive waste of these priceless ecological assets, not by virtue of negligence in its own stewardship within the boundaries of the park, but as a result of externalities imposed by other parties, beyond its own power to control. Specifically, the Everglades were dying as a result of large-scale water diversions dating back to the 1940s, committed in the first instance by another arm of the federal government, the Army Corps of Engineers, on behalf of the State of Florida, its public water management authorities, and millions of water users and landowners, large and small, throughout south Florida. Also, and not unrelated, the Everglades were choking on nonpoint pollution, most of it generated by large sugar growers on land that had formerly been the north Everglades, along the south shore of Lake Okeechobee, until they were drained and

protected by the same levees and ditches that diverted north Everglades water to the urban centers along the coast, and the “excess” out to sea.. From the Park Service’s point of view at least, non-cooperation was simply not an option; the stakes were enormous, and the costs of non-cooperation unacceptably high. Incentives were not symmetrical from the beginning. In an administration politically committed at the highest levels to seeing the Park Service’s position at least substantially protected, the Corps’ incentives could also be, to put it delicately, influenced. And once again, the implicit or explicit threat of regulatory sanctions if the big landowners failed to cooperate may have altered their incentive structure as well. There is, of course, much more to the story in South Florida than I have related here, but the point once again is simply that it would be a mistake to write off cooperative solutions as impossible across the board, because not all resource management problems are Prisoner’s Dilemmas, and even where they begin that way, it may be possible to alter in incentive structure by changing the default position—the price that non-cooperators pay for their non-cooperation.¹⁰

The second strong assumption made by the Prisoner’s Dilemma is that parties have no opportunity to coordinate their strategies, or to enforce effective sanctions against defectors. But as Elinor Ostrom and others have shown, frequently in the real world there are opportunities for both coordination, monitoring against defections, and enforcement of sanctions against defectors (e.g., in small, relatively closed communities, such as coastal artisanal fisheries, but not in large,

¹⁰Notice that this is very different from saying these problems can be solved through regulatory command. My own view is that it will frequently, perhaps usually, be difficult or impossible to craft a sufficiently precise, effective, flexible, and dynamic rule to expect the rule to solve the problem. Indeed, it is precisely because regulatory rules are typically so heavy-handed and clumsy that parties subject to them will often make strenuous efforts to avoid them—including cooperating in situations where cooperation might otherwise have appeared unattractive. Under this arrangement, the rule applies only as a default position, only if the preferred, cooperative solution fails.

open-access arrangements, such as high seas fisheries). And more sophisticated game theorists like Robert Axelrod have shown through computer simulations that, even given the strong assumptions of the Prisoner's Dilemma, stable cooperation can and does emerge over time in "repeat-play" games, where players develop strategies such as "tit for tat," rewarding the opponent's defection in kind but also rewarding the opponent's cooperation in kind, so that opposing players learn over the medium and long run that cooperation produces a superior run of outcomes overall. Given that many natural resource management situations involve, or can be structured to involve, repeat plays (as well as monitoring regimes that improve all parties' capacity to detect defections), it should not be surprising that even when incentives are structured in the classic Prisoner's Dilemma arrangement, cooperation should sometimes emerge as a stable solution.

Game theory aside, I should like to return to my central point. Not only are the new hybrid ecosystem governance institutions pitched at a regional scale appropriate to the resource to be protected, but they provide extraordinary opportunities for pooling a rich and diverse array of resources that no individual participant in the collaborative arrangement, acting alone, could possibly hope to muster. While the expertise of the state and federal governments, for example, are fractioned among a variety of specialized departments and agencies, the hybrid institutions pool that expertise under a single institutional umbrella, where it frequently finds expression in the form of frequent face-to-face interactions and regular (perhaps daily) interdepartmental working relationships. This in itself is not to be underestimated. The U.S. EPA collectively, as an institution, knows a great deal, and can find out a good deal more. (Here I'm not being facetious). But when what the EPA knows is combined with what the National Park Service and the Fish and

Wildlife Service and NMFS and the Corps and whatever other arms of the federal government know or can learn about, let's say, the Chesapeake Bay or the Everglades, the collective capacity in expertise and information is very large indeed, and perhaps again greater than the sum of its parts, insofar as the parts can and do learn from each other in the pooled effort. And when this combined federal expertise and information are then further combined with the expertise and information in the hands of a variety of state agencies; and again with local governments; and again with private landowners; and again with environmental and conservation organizations, many with high-resolution local knowledge of critical ecological resources; and again with independent scientists who may be expert in (or induced to re-focus their more generalized scientific expertise toward) local ecosystems, the pool of expertise and information grows richer and deeper as each succeeding level is added. Indeed, systems for assembling, organizing, managing, storing, and disseminating all this richly flowing information have become a central preoccupation of some of the more robust of these institutions (I am thinking here principally of the Chesapeake, but we can find similar examples elsewhere). Not to say that simply assembling what we already know will give us all we need to know to manage ecosystems intelligently; far from it. But the regional collaborative pooling approach is very likely the most effective shortcut to assembling in one basket all or virtually all the baseline information we might want, and making it available to the full array of parties who might make beneficial use of it.¹¹ For management purposes, the

¹¹This works to the benefit not only of government agencies, but also of private parties. One reason that the section 10(a) Habitat Conservation Plan/incidental take permit provision was so rarely used prior to 1994 was that most private parties simply couldn't afford to do the scientific studies necessary to assemble a defensible habitat conservation plan for species occurring on their land. Regional multi-party HCPs, on the other hand, may involve multiple species, but they also bring in multiple players, including some with deep pockets, to fund regional studies and monitoring systems that benefit all participants.

challenge will be not only to put into place the systems to manage that information, but simultaneously to put into place the systems to build on that knowledge base systematically, continuously, and over the long haul, filling in the many gaps, continuing to produce top-quality science (especially “situated science” of the kinds most useful to regional management efforts), and establishing monitoring regimes that provide rich, continuously updated data on measurable indicators of ecosystem’s actual functioning and indirectly facilitate better-informed evaluation of the success or failure of management measures.

The same goes, I would argue, for other critical resources, including money, land, and regulatory authority; in each case multiparty collaborative pooling provides a richer set of resources that can be brought to bear on the problem than would be available to any of them (including the biggest and richest, the federal government) acting alone. For money and land the point is perhaps obvious. In many mission- or program-specific government offices and agencies, money for investigation and analysis is chronically in short supply; and to a much greater degree than is commonly recognized, financial constraints are a critical limitation on their ability to manage the environment. But collaborative ecosystem governance creates regional pools of information and regional pools of both funds and expertise to carry out the information-production function collectively. Consequently, the combined financial and territorial resources available to federal, state, and local agencies acting in concert are greater than any of them could muster alone. Redundancy of effort can be reduced; efforts of various parties can be aligned to work in tandem rather than at cross purposes or tangentially; the high fixed costs of environmental monitoring, scientific research, and analytical work can be spread over a larger number of institutional and

individual parties; and the collective pool of money and expertise can be allocated to the highest-priority elements of the shared enterprise. Add non-governmental resources, and the pool grows even larger and deeper.

As for regulatory authority, the regional ecosystem governance institutions conceived as combined pools of resources have the combined capacity to exercise (or at least influence the exercise of) a diverse array of regulatory powers—state and local land use authority; a wide range of state licensing, permitting, rulemaking, and enforcement authorities; the powers available to federal agencies under the federal environmental (and other) statutes. The regional institution, then, if it acts as a single coordinated entity, can pick and choose among all these authorities, to find and apply those regulatory powers that in its judgment will be most effective under the circumstances, matching up best with needs at hand. So, for example, the Fish and Wildlife Service can invoke the Endangered Species Act, or the EPA can invoke the Clean Water Act, or both, as circumstances warrant., to trigger the incentives for non-cooperators to reconsider the wisdom of non-cooperation. And when protection of the California coastal sage scrub can best be effectuated through a combination of highly protected core preserves and land use restrictions in a surrounding buffer zone, private landowners, conservation groups, and federal and state governments can donate or purchase land for the reserve, and local governments can agree to do their share by volunteering the use of their land use regulatory powers to translate the buffer zone plan into legally enforceable zoning requirements. There is often a high degree of discretionary latitude in the hands of the agency to set regulatory and enforcement priorities, and to interpret existing rules and apply them to a given set of facts. Of course, there will be many other pressures weighing against such selective and targeted priority-setting, including legitimate competing agency-wide priorities, external political pressures, and concerns about setting or violating

precedents or longstanding agency policies, as well as basic rule-of-law principles that counsel even-handedness in the making and enforcement of regulatory rules. Nonetheless, if we view the collaborative regional institution as an entity that operates by pooling the many capacities of its diverse participants, it appears that this institutional form has some distinct advantages as the locus for our efforts to manage ecosystems—advantages that cannot be matched by any of its obvious rivals.

Finally, a word about nested scales. We've briefly discussed the notion of nested scales of management efforts, as exemplified by the Chesapeake Bay basinwide/tributary division of authority. It is also useful, however, to think of the regional collaborative institutions themselves as pooling nested scales of perspectives, expertise, information, and interests under a single institutional roof, in a potentially valuable and powerful way. Thus for example the scale of interests and expertise of individual landowners is distinctly local in character—they are concerned first and foremost with their own individual parcels, and that is what they are most knowledgeable about. Indeed, they will likely know more about their own land—or at least, certain aspects of it, such as the costs of foregoing development—than any other party. What they know, and the interests they are trying to protect (primarily economic for most private landowners, though certainly not all, considering for example The Nature Conservancy), are certainly relevant to management decisions. Yet their information and their interests are not the only ones relevant to the decision, and should not be in a position to trump all others. One level up, local governments will often have relatively local and parochial concerns—impacts on the local tax base, jobs, economic development, but also locally beneficial environmental amenities—and this information and these interests, too, are relevant to the decision. In general, as we go up the scale, interests will tend to become broader, but the information will also become in a sense broader and more

general, not necessarily of lower quality, but of wider scope and lower resolution. By pooling participation at all these scales, the regional collaborative institution is also pooling information at various scales and degrees of resolution; it is, in fact, pooling the information that is presumptively most relevant to the scale of the interest to which it corresponds. Thus, local landowners (for example in the Southern California NCCP/HCP case) bring to the table detailed knowledge of their land and how it might be alternatively developed under various scenarios, and some sense of what the economic costs and consequences would be to them; but as they are the ones most directly affected on the cost side of the equation as a result of whatever management measure is ultimately chosen, the information they bring is directly relevant to an informed decision. Indeed, it is very like better, and higher-resolution, information than a regulator sitting in Washington or Sacramento, or for that matter in San Diego, could ever muster. But at the same time the Interior Department and various state agencies bring a broader perspective on the benefits flowing to the public generally from endangered species protection and protection of the California gnatcatcher in particular, as well as specialized biological expertise. Thus information about both the broad, diffuse benefits and concentrated, localized costs, as well as the relevant science, is pooled around a single table. Other parties make similar contributions. This notion of collaborative governance as a mechanism for pooling all the relevant information from nested scales of perspectives and interests is, of course, a highly idealized construct, and in practice the discussion may not always be as high-minded, nor the information as high-quality or free-flowing, nor the behavior of parties as non-strategic, as I imagine it here. But to the extent the collaborative regime creates an institutional framework within which pooling of information corresponding to these nested scales of interests and information can occur, it represents another distinct advantage of the collaborative regional governance model.

V. Dynamism: Experimentalism and “Adaptive Management”

As we have already discussed, ecosystem governance requires the adoption of flexible and provisional policy measures that can be adjusted in light of changing conditions and new learning. This “rolling rule” regime tends to place a heavy emphasis on **systematic monitoring** of ecosystem conditions and stressors, seeking to inform policymaking with real-time (or close to real-time) data and to generate continuous information feedback loops so that the actual consequences of each successive round of policy adjustments can be measured. If necessary, those measures can then be modified in light of measured results which may or may not correspond to the predictive calculations upon which the decision was originally based.

A related management tool is the setting of **specific, quantified biological and environmental objectives**, as measured by carefully selected (although also necessarily provisional) biological and physical “indicators” of (or measurable proxies for) ecosystem health. Further emphasis is placed on **scientific and technical collaboration** among agencies and tiers of government, as well as among academics and other independent researchers, aimed at generating a continuous stream of high-quality, policy-relevant, locally situated ecosystem science that at each successive stage refines and challenges the scientific hypotheses, theories, and assumptions upon which previous rounds of policy-making had been based. In this process—where the baseline expectation becomes the continuous advance of science and the continuous flow of monitoring data—the monitored indicators may themselves come under challenge and need to be revised in light of subsequent learning.

Finally, and in tandem with all these developments, the last decade has witnessed widespread adoption of an “**adaptive management**” approach, explicitly embracing self-

conscious experimentation in the design of policy measures. Under this approach, policy measures are understood as necessarily provisional and ever subject to modification in light of scientific advances and the results of rigorous monitoring. The net result of all these developments is the generation of a complex web of continuous information feedback loops, continuous reassessment of specific policy measures and the scientific and other assumptions upon which they are based, and ongoing readjustment and revision of policies in light of new learning. Rather than “codify[ing] existing knowledge in rules that are hard to change,” the new ecosystem governance institutions seek to “foster an open-ended process of knowledge creation”¹² on the theory that although we can’t ever know enough at any given moment to decide what’s right or best, we also cannot afford to defer decision-making until “all the information is in” for the simple and inescapable reason that all the information will never be in.

This flexible and dynamic approach stands in sharp contrast to first 30 years of large-scale environmental effort. Until recently, the preferred approach to environmental problem-solving has been **fragmentary and reductionist**, the opposite of holistic. The reductionist approach seeks to isolate, analyze, and control individual pieces of the system, hoping thereby to generate improvements in the system in itself.

The standard approach has also been **categorical**. The assumption is that if nutrients from sewage disposal plants are a problem, we can prescribe uniform effluent limitations for nutrients from sewage disposal plants, divorced from context of the particular ecosystem and particular background conditions within which those releases occur. Similarly, if a toxic pollutant, call it “ethyl methyl bethyl,” is a problem, then the solution is to prescribe categorical rules limiting the

¹²Levy, Keohane & Haas at 410-11

permissible levels “ethyl methyl bethyl” emissions, and so on.

The prevailing approach has also relied heavily on **top-down prescription** on the assumption that a regulator (whether at federal or state level—this is not a federalism problem per se) will know enough to be able to identify and isolate the most important problems, and gather sufficient information about them to prescribe effective solutions

Finally, the canonical approach has emphasized **fixed** rules. It assumes, in general, that there are definitive “right” and “wrong” answers to every question, and that the challenge for the regulator is to study the problem until she decides she has enough information to prescribe a fixed rule

But if what I have said so far is right, this search for fixed, categorical, centrally prescribed, reductionist rules is likely to prove futile in the context of managing ecosystems. And more study simply won’t do it: the approach itself is wrong-headed.¹³

The pervasiveness of uncertainty, unpredictability, and surprise also suggest a more humble approach to ecosystem management. We can’t really “manage” ecosystems in the sense of controlling them. But we can constrain or influence (and in that sense “manage”) human behavior in ways that will affect the whole ecosystem, though we won’t ever be entirely certain just what

¹³Incidentally, although this critique is inspired by the predominant “command-and-control” model of environmental regulation, much of what I say here applies with equal force to certain familiar forms of market-oriented regulatory substitutes, such as cap-and-trade schemes. The approach Congress and EPA took toward acid rain control, leading to the much-vaunted 1990 Clean Air Act Amendments authorizing permit trading for SO₂ emissions, was still at its core a highly reductionist and top-down prescriptive approach. The goal was to fix an optimal cap on SO₂ emissions, isolated through reductionist science as the leading cause of acid deposition, across broad categories (electric utilities) of sources without regard to localized context. Although the permit trading approach does allow for more flexibility in implementation than conventional command regulation, it nonetheless relies on fixed and categorical rules aimed at isolated pollutants and imposed by top-down fiat, and consequently suffers many of the same deficiencies.

the effects of our management efforts will be. This, too has led ecosystem managers to emphasize “adaptive management.” Rules are self-consciously provisional and experimental, subject to revision (often, in practice, within a pre-specified range), not only because we recognize that new science and changing conditions as revealed in monitoring data may change the perceived “needs” of the ecosystem, but also because we recognize that human behavior is also subject at best imperfect prediction and control, so that policy measures may need to be adjusted over time to adjust to revealed deficiencies in the management measures previously selected.

The currency of exchange under all these arrangements is information, and particularly information generated through continuous feedback loops of experiment-monitoring-learning-and adjustment. If environmental management is chronically information-starved (as I have argued), then collaborative governance mechanisms, provide at least a partial solution. They begin as (relatively speaking) information-rich arrangements, pooling information from a variety of parties with a variety of perspectives and bodies of locally held knowledge. But recognizing their own limitations, they quickly establish themselves as richly information-generative institutions, committing themselves to generating a continuously deepening and broadening pool of more and better information—more sophisticated monitoring, deeper and richer and more complete science, and a continuously expanding base of experiential learning. They thus create the necessary informational infrastructure to support the “rolling rule” in practice.

The Challenge for Law and Legal Theory

To date, the legal academy has paid surprisingly little attention to the kinds of developments I’ve surveyed here, even though, in my judgment, any fair-minded observer would

have to conclude that collaborative ecosystem management is the most pronounced trend in environmental law and policy over the last decade or more. As a result, we don't even have the vocabulary, much less the analytical toolkit, that we need to understand the peculiar challenges and opportunities posed by these developments. This is not to say that there's been no writing on it. But much of what's written in the law journals tends to be superficially dismissive, concluding that collaborative ecosystem management is either:

- a) impossible in principle; or
- b) even if theoretically possible, impractical in all but the most narrowly constrained circumstances, or
- c) even if practical, unwise because it's likely to lead to "suboptimal" outcomes; or
- d) in any event, even if possible, practicable, and desirable, probably illegal.

I think there may be a deeper motivation behind all this. Lawyers like rules. We like enforceable rules. We want our rules to be optimal, and we want our rules to be timeless. And we prefer the institutions that make and enforce them to be tidy and to fit neatly into the boxes on Mr. Madison's flow chart, with clear divisions of authority between rule-maker and ruled, between the rule-making, rule-enforcing, and rule-interpreting and -applying powers, and between federal, state and local (well, at any rate, between federal and state) tiers of government.

Collaborative ecosystem management, by contrast, involves messy, elaborate, cumbersome, and apparently *sui generis* institutions, in which lines of authority and divisions of responsibility are often neither formal nor transparent; institutional boundaries are fluid and permeable, and identities are submerged in hybrid public-private, national-and-local forms.¹⁴

¹⁴Indeed, in some cases the "institutions" may exist more as "virtual institutions" than as clearly demarcated institutional entities in their own right. Within the Chesapeake Bay Program,

Rules are provisional and, for that matter, often not enforceable through the familiar formal enforcement mechanisms. This may sound singularly unpromising, especially to lawyers and legal scholars accustomed to policing relatively sharply-defined lines of authority. It is hard to see where accountability comes from when the lines of authority become blurred, because no single party can be identified as THE authoritative decision-maker. All this violates our deep-seated sense of order, and it may even appear incompatible with “the rule of law as a law of rules,” to borrow Justice Scalia’s felicitous (if shortsighted) phrase.

My message to lawyers and legal scholars is this: let’s get over it. Something is happening here, something very big, and something quite unconventional by the standards of the now familiar past. We didn’t invent it, and perhaps as a group we don’t yet understand it very well, and therefore we are understandably uncomfortable with it. But before we go off trying to shout it down as impossible, or unwise, or unlawful, let’s at least try to understand it. And just maybe, if we do, we will find that we can play a constructive role in it.

With respect to recent developments in the management of natural resources—and especially with respect to management of resources as complex and elusive as ecosystems—legal theory has lagged well behind the real world, real time developments of law in action. Law, in turn, arguably has lagged behind changes in official policy, so that the (nominal) written rules are

for example, leading players include officials from a wide variety of federal and state agencies whose official job titles and duties are those defined by reference to their home agencies, but who also simultaneously wear a semi-official Chesapeake Bay Program hat. Their efforts on behalf of the CBP may define much or even all of the real content of their work, and inspire a collective allegiance to an overarching set of goals, objectives and strategies that together may constitute as significant a constraint on the exercise of discretionary duties as any rule or policy of their home agencies.

often left as the legal tail wagging behind the policy dog.¹⁵ For its part, officially articulated policy has probably lagged behind the actual practice of ecosystem management in particular cases, as innovative, determined, and hard-pressed managers in the field furiously invent new approaches faster than the official policy organs can assimilate and rationalize them. And practice, finally, has itself lagged behind both ecological science and the emerging cross-disciplinary science of complexity in grasping the need for flexible and “adaptive” management techniques and the unique strengths of collaborative institutional designs.¹⁶ Lawyers and legal academics thus increasingly risk becoming irrelevant to the most interesting, important, and dynamic developments in environmental policy today.

Yet (though it may reflect only a measure of professional conceit) I would insist that law and legal theory ought not to be irrelevant, are not irrelevant, and can instead play a valuable, even essential role in the newly emerging order. There is a place for law, for example, in defining and policing procedural regularity, so as to reduce opportunities for interest-group capture, enhance opportunities for genuine democratic participation, and reduce the incidence of abuse and

¹⁵An example is habitat conservation planning under the Endangered Species Act. The section 10(a) “incidental take” permitting process, originally envisioned to authorize only relatively narrow partial waivers to the section 9 “no take” rule for listed wildlife species, has now been stretched to accommodate a stated policy of encouraging ambitious, proactive, multi-species, ecosystem-oriented conservation planning that aims to protect not only listed species by also other, non-listed species sharing their threatened habitats. While this policy reformulation is defensible, indeed laudable, on scientific and other grounds, it is arguably well beyond what was imagined by the authors of section 10(a), and by most accounts the statutory text itself now needs an overhaul to bring it into line with the actual policy.

¹⁶See generally the electronic journal Conservation Ecology, available at: <http://www.consecol.org/Journal/>. Edited by ecologist C.S. “Buzz” Holling, who coined the “adaptive management” concept more than two decades ago, the journal is a leading forum for peer reviewed interdisciplinary work advancing the theory of ecosystem conservation and restoration and, more broadly, the management and sustainable use of natural resources.

manipulation of fluid and largely unstructured processes by cynical agency officials or self-interested rent-seekers of any stripe. Lawyers also bring to the table considerable expertise in questions of regulatory design and the architecture of successful institutions and processes. Careful and thoughtful attention to the structures and processes of accountability is necessary if collaborative ecosystem management is to become a durable and productive part of the institutional landscape—something more than a disparate series of slapped-together, ad hoc arrangements, and more than the fashionable buzzwords into which it could easily degenerate.

I have argued that experimental prototypes of collaborative ecosystem governance have begin to emerge for some very good reasons—including the need for locally tailored and context-specific rules, the need to build institutional learning capacities at local and regional scales appropriate to the ecosystems to be managed, the need for flexibility and adaptability in response to dynamic conditions and the dynamic trajectory of our knowledge, the need for collaboration arising from the nested scales of interests implicated in managing ecosystems, and the need to re-legitimize rulemaking process to get local buy-in. Yet remains much to be done to build on those foundational experiments, and here, too, lawyers and legal theory can play a critical role.

Our understanding of the operating mechanisms, the opportunities and limitations of collaborative ecosystem governance are far from complete. What follows are just a few of the difficult conceptual problems that remain to be worked out.

- **Institutional design and the theory of governance.** As I previously suggested, these collaborative regional institutions appear to fit poorly into the conventional structures of federalism, and perhaps even separation-of-powers. What do we make of that? Do we need to redesign the new institutions to force a better fit with the background arrangements and understandings, or should we instead seek to revamp and reinterpret the background

arrangements to accommodate the new realities? Equally troubling, the new hybrid institutions appear sometimes to blur the familiar sharp boundaries that separate “the state” on the one hand, and the institutions of civil society on the other.¹⁷ Thus there appears to be a two-fold “decentering” of the state: first a shift from central to decentralized (though not necessarily state-level) decision-making, and simultaneously a new permeability of “public” decision-making to direct participation by non-state actors. This demands, I think, a very basic rethinking of familiar assumptions about how government—and governance—ought to work.

- **“Representativeness” v. direct participation, and the nature of the problem-solving process.** The new institutions are sometimes described as “stakeholder” processes. I think this characterization is conceptually thin and under-informative, if not downright misleading. The “stakeholder” label doesn’t capture the full flavor of deep collaboration

¹⁷Most famously, Jefferson talked about a “wall of separation” between state and church. But Jefferson wrote at a time when the modern notion of the nation-state was just crystalizing. In that historical context, the church-state separation arguably can be seen as part of a broader and more general trend to create a “wall of separation” between state and civil society. So, for example, at the same time the church was being stripped of any official role in the affairs of state, the sovereignty of the state was being extricated from the personal identity of the sovereign; official duties were separated from hereditary titles and prerogatives, and indeed in the most important cases tenure in office would now be granted only for fixed terms in contemplation that the office would rotate among a series of meritorious citizens; status (apart from slavery) was in general demoted in matters of state and citizenship, in favor of an undifferentiated formal equality of opportunity to participate. Is this vision of a detached state apart from the organs of civil society now beginning to erode, as hybrid public-private institutions come to play an increasingly prominent role in making what would otherwise be properly regarded as “public” decisions? It is perhaps tempting to regard this development as something akin to European corporatism, but there are crucial differences. European corporatism (like some elements of the New Deal in this country) revolves around the brokering of high-level deals among generally well-established interest group representatives, who stand as proxy for large segments of society whose interests are thought to be more-or-less fixed and more-or-less well understood by their representatives. In the new regional public-private collaborations, by contrast, participation is more direct than representational, the interests often less fixed, and the solutions more local.

and genuine openness to learning and ongoing redefinition of self-interest that defines many of the most successful ecosystem management projects. It invites governmental policy-makers, in particular, to imagine that so long as they cobble together a process that includes some venue for participation, however limited and informal, by some number of more-or-less diverse parties who may be loosely characterized as “stakeholders,” they will have touched all the bases and can proceed from there to do as much they please under the protective cover of the “stakeholder” process. And this sort of abuse, in turn, will call into question the credibility of all other efforts proceeding under a similar label.

Alternatively, it may seem to imply that what is called for here simply naked deal-making among the right set of local parties, whose interests are taken to be more-or-less exogenous. But in my judgment, collaborative governance is not merely about putting a diverse group of “stakeholders” with exogenous preferences into a room and having them sit around a table and bargain until they reach a “win-win”, Pareto-superior solution. This conception—in addition to being highly unrealistic insofar as it assumes that a Pareto-superior solution will be available for every problem¹⁸—ignores the unique contributions made by the information-generating, information- and other resource-pooling, deliberative, and pragmatic problem-solving functions that these institutions, at their best, appear to perform. But whatever the label, I think we have not yet seriously begun to sort out just what kinds and levels of participation, by what group of actors (especially among non-governmental parties), may be necessary, and what is the effect of participation on both the

¹⁸I would argue, however, that if and when a Pareto-superior solution is available, the collaborative process that I have described here seems a much more likely candidate to find it than conventional forms of top-down, prescriptive rulemaking.

participant and the larger enterprise. Do we mean to fall back on an older model of interest-group representation, in which one or a few parties stand in as proxies for others similarly situated? If so, how are the appropriate groups and their “representatives” to be selected, and how do we ensure the quality and fairness of the representation that occurs? Or do we instead mean to encourage direct participation by the principals themselves, not through some representational medium but on their own behalf? What mechanisms are necessary to encourage and accommodate this? What are the pitfalls? What kinds of participation actually occur? Who really participates, how deep and lasting is their participation, how valuable is it (to them and to the overall process), and how much opportunity do real citizens have to participate in meaningful ways in real decisions that matter? If this, as some colleagues and I have argued elsewhere, a genuine vehicle for democratic renewal, or are we only kidding ourselves?

- **The nature of collaboration and “consensus” processes.** If local rule-making is no longer hierarchical but collaborative, what decision rule should govern the process? These are often described as stakeholder “consensus” processes, but what do we mean by that? Do we really envision a formal or “hard” consensus, in which every participant effectively holds a veto over every decision? Or do we envision some form of “soft” consensus in which no party holds an absolute veto but some level of agreement substantially beyond a majority vote is necessary? Or are these, in fact, “mixed” processes in which power is distributed somewhat unequally (if not along strictly hierarchical lines), with some senior parties (e.g., major government agencies charged with responsibility for administering and enforcing background legal standards) effectively holding something close to a veto, while other junior parties hold a weaker hand, including the power to

inform, cajole, persuade, and if necessary make a public stink over their objections, but little more. Which decision rules are most likely to lead to real solutions? Are there some rules (or non-rule approaches) that can help to overcome the many natural impediments to achieving consensus? For example, if persistent obstructionism can lead to expulsion or diminished status and influence over the longer term, would that tend to counteract the tendency toward self-interested strategic bargaining that otherwise might disrupt the process? Or would it invite strategic maneuvering to isolate and expel parties with opposing interests? When and where can the background default rules be adjusted to induce continued cooperation, without inviting government agencies to succumb to the temptation to abuse these trump cards so as to micro-manage the process or to browbeat other parties to submit to the agencies' preferred outcomes?

- **What about transaction costs?** Although I suggested earlier that the transaction cost argument is often overplayed, nonetheless transaction costs are not a trivial problem. Arguably, collaborative mechanisms have worked best in extreme situations, where one or more parties felt they had their backs to the wall. For example, in San Diego and Orange Counties developers and landowners agreed to play ball only when it appeared that they otherwise might face a virtual shutdown of development opportunities. Just how much are these and similarly harsh default rules responsible for driving collaborative processes toward successful resolutions? Perhaps, as suggested earlier, similar default rules can be invoked in other cases, but if so, what are they? How, more generally, do we take precautions against interest group capture, logrolling, and similar exercises in zero-sum (or negative-sum) redistributive rent-seeking or other pathologies that may follow from the exercise of strategic, self-interested behavior within a nominally collaborative structure?

- **Formation of group identities and allegiances.** The collaborative ecosystem governance model I have sketched out here appears to require aligning a set of diverse institutions and individuals, with varied missions, interests, and operational constraints, into a pattern of cooperative or collaborative behavior that allows them jointly to define and take steps to achieve a common objective that would be beyond the reach of any of them operating individually. But I have also hinted that the process is, in part, about forging new regional identities, and new sets of preferences and interests, organized around the idea of the ecosystem, a shared mission to protect and restore its health (whatever that may mean in principle, and whatever it may require in practice), and a consequent redefinition of personal and institutional identities, missions, goals, and priorities, embracing this larger shared regional goal and sense of mission. That's not to say there's a complete submergence of old identities and missions into the new. We see, at present, a kind of dualism of official identities, a lot of people "wearing two hats." Officials and staff in various Maryland or Virginia state agencies, along with regional EPA and Fish and Wildlife Service and NMFS officials become, simultaneously, officials and staff to an amorphous but durable 'Chesapeake Bay Program' that, although it has its own formal institutional arrangements to be sure, extends far beyond and beneath the surface of the formal institutional structures that it creates. The semi-visible dual governance regime includes less formal networks of interpersonal and interagency relationships, and rich patterns of coordinated activity that cross and re-cross formal institutional lines. To what extent does this result in a genuine transformation of personal and institutional identities and allegiances? To what extent is such a transformation necessary as a base condition for ecosystem governance?

- **Possibility conditions.** More generally, what background rules and conditions are necessary, or sufficient, or for that matter even minimally helpful, for the success of these kinds of enterprises?
- **Transition paths, systemic learning, and second-order coordination.** At the macroinstitutional scale: how do we move from a series of discrete and more-or-less sui generis local experiments, to a larger and more robust system or coordinated web of collaborative ecosystem governance institutions (assuming for purposes of argument that it is wise to do so), without losing the local, participatory, and experimental character that appears to be so critical to their success? Central monitoring of local experiments, systematic efforts to learn from and replicate the most successful models (and to learn from the errors of the failures), and larger structures and mechanisms of accountability to the public at large are generally not well developed at this stage. What would those second-order institutional arrangements look like? And how do we get there from here?

That's my research agenda for the next few years, or at least until something better comes along. I want to invite you to make it yours, as well.

