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**Beyond Value Neutrality:
An Alternative to Monetary Monism in Ecological Economics**

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Abstract

Ecological Economics has developed as a "transdisciplinary science," but it has not taken significant steps toward a truly integrated process of evaluating anthropogenic ecological change. The emerging dominance within ecological economics of the movement to monetize "ecological services," when combined with the already well-entrenched dominance of contingent pricing as a means to evaluate impacts on amenities, has created a "monistic" approach to valuation studies. It is argued that this monistic approach to evaluating anthropogenic impacts is inconsistent with a sophisticated conception of ecology as a complex science that rests on shifting metaphors. An alternative, pluralistic and iterative approach to valuation of anthropogenic ecological change is proposed.

What do you get if you cross an economist and an ecologist? While genetic technology has (thankfully) not yet allowed for this experiment to be attempted at the level of the individual, over the last 20 years the field of ecological economics has emerged and grown as a result of just this type of cross-fertilization at the disciplinary level. As nurtured through ISEE conferences, other national ISEE meetings, in colleges and agencies, and in the writings in the journal, Ecological Economics, the field is the result of a sustained experiment in integrated ecological and economic understanding of environmental problems and the challenge of sustainable living. Is the post-disciplinary, trans-disciplinary chimera that stands before us a fulfillment of the vision that gave it birth? Or are we feeding a beast that does not serve the purpose for which it was designed? Perhaps it is time to evaluate the direction and standing of the field of ecological economics.

A report card, however informal, may be timely because, as I understand the current situation, the trans-disciplinary field of ecological economics faces an important choice, a crossroads that will determine its future shape as a discipline and will

determine--for me at least—whether the experiment has been a success. If one judges the field of ecological economics on the basis of our learning about the interactions of ecological and economic forces and the importance of their interpenetration, I believe great progress has been made. If, however, one were to ask whether the practitioners of ecological economics have evolved a new framework for evaluating ecological and economic impacts of anthropogenic change, I think the only honest answer is, "No; and progress, much less success, in developing that framework has been elusive."

Ecologists still think like ecologists and economists still think like economists. While practitioners in both fields have learned from the cross-fertilization, so far ecological economics has only succeeded in harnessing two complementary disciplines and created a forum for discussing policy in a context informed by both. This is no mean accomplishment, but it merely places the field at a cross-roads. Will the "field" of ecological economics go forward with two methodologies—a descriptive and hypothesis-testing method when uncertainty is faced—and economic value measurement methods—using direct and indirect methods to establish wtp for goods and services—as the method for *evaluating* those changes?

If the field does remain dualistic in this sense, it will be a result of confusion surrounding positivism's commitment to value neutrality in science. Ecologists, many of whom cling to value neutrality as if their science depends upon it, are anxious to shift responsibility regarding valuation to others; and once ecologists and economists began working closely together, the ecologists have simply ceded the ground to environmental economists, most of whom maintain the mainstream's fiction that economics, itself, can be "positive" and value neutral. One would look in vain among the writings of logical positivists of the Vienna Circle a more impassioned commitment to positivism than is expressed by Milton Friedman and other advocates of free markets. In the area of environmental valuation studies (the subfield that evaluates anthropogenic environmental change), the myth of positivism appears as the fiction that economists' valuation studies merely measure human behavior in the search for human welfare.

While space does not permit a full-out refutation of this myth, here,¹ I simply note that positivism and its commitments to value neutrality have lost all plausibility given our developing understanding of the complex role of assumptions and metaphors play in the development of all "models", whether models of human behavior or models of galaxies. In the present case, it is simply not plausible for environmental economists, operating on the implicit metaphor of earth as a welfare-producing machine, to use that hidden metaphor to narrow the ways one can legitimately value, or express one's values toward, nature, and then claim that their measures are "value free."

My point, then, is that assumptions built into the model, confusedly called "positive" by mainstream economists, and adopted more and more by ecological economists, cannot be "positive". When ecologists buy into the economic model for "valuing change," they limit the values we can find in nature to those that can be measured on the economists' model; and the economists' model simply embraces one of the many metaphors necessary to comprehend the complexities of environmental changes and their impacts on humans. What is interesting about the tendency of economists and ecologists to continue to think disciplinarily within ecological economics, is that they are both victims of the same confusion: both are befuddled by their hopeless clinging to the positivist ideal of value neutrality. Ecologists, worried that they will not be viewed as sufficiently "objective" and "scientific," refuse to consider the important role of value in the development and use of ecological models.² Economists, worried that they will violate their oath as value-neutral, "positive" social scientists, claim their measurement of welfare based on behavior based on preferences is "positive" science. Not by a long shot. Positivism in both economics and ecology have led to a dead end in attempts to characterize the impacts of environmental change. To limit such measurement to descriptions of welfare change cannot reflect the diversity and complexity of human interactions with, and evaluation of, the constantly changing, dynamic environment as conceived by ecologists.

¹ For an all-out argument against the positivist myth of a fact-value dichotomy, see Norton, (2005, especially Ch. 3 and Section 9.3).

² This is a point I have made before. See Norton, (1998).

The alternative is to seek a new approach to evaluating change, an approach that takes into account insights from both economics and ecology. For me the key question regarding the successful integration of ecological and economic science depends upon whether the new field creates a new and more satisfactory language and approach to evaluating changes that occur as a result of human activities. In this area, I think ecological economics has a long way to go. More urgently, as I read randomly in the field, I do not even see progress toward this goal.

Having already invoked the cliché of a field at a cross-roads, I might as well say that a "wrong turn" is being taken. If I correctly read the turn signals indicated by the mix of articles and books published in the discipline recently, the field is moving away from, not toward, a truly integrated conception of how we might meaningfully evaluate ecological and environmental change. In this paper, I argue that, in order to truly reform environmental policy according to ecological and economic principles, it will be necessary to develop a new, pluralistic, multi-scalar, and multi-criteria method of evaluating anthropogenic changes to natural and social systems.

Part I: The Choice: Monism or Pluralism

To explain the choice I think the field faces, I introduce a useful distinction—originally applied to ethical approaches to environmental policy analysis by the legal scholar, Christopher Stone—between "monistic" and "pluralistic" approaches to the evaluation of environmental outcomes. Monistic approaches to evaluation attempt to represent all environmental value in one framework of analysis—such as utilitarianism, cost-benefit analysis, or rights theory. Pluralistic theories, on the other hand, do not attempt to enforce a universal vocabulary upon the discourse of environmental value. The monistic approaches are thought by many to have an advantage in that, given their requirement that all values must be expressed in one vernacular, they can at least claim to be comparing comparables, and they can provide some hope of a definitive and decisive outcome in the form of a final accounting in a single system of analysis. Pluralistic theories, on the other hand, seem messy and confusing to interpret, leaving all kinds of open questions when our evaluative criteria point in different directions. I argue, however, that environmental problems are messy, often involving conflicts between

conflicting goods, and that embracing—and somehow learning to manage—a pluralistic and diverse evaluation process seems more likely to be useful than seeking algorithmic predictions of costs and benefits or by assigning rights to more and more elements of nature. Unlike monism, which starts by laying down a methodological requirement that limits the expression of values to a single vernacular, pluralism accepts the fact of pluralism—the fact that people express their values toward nature in many vernaculars, and then seeks a methodology that will make sense of the cacophony.

Using this distinction, I can state my current concern: I fear ecological economics is drifting—maybe even stampeding—in the direction of monism, both in conceptualization and in accounting, in evaluating environmental change. Unless I am mistaken, the trend in ecological economics is toward a single quantification of environmental values in terms of dollars of impact on human welfare. Use values are more and more counted in terms of dollars-worth of ecosystem services, while non-use values are explored mainly through various elicitation techniques, all designed to assign a dollar value to some element, aspect, or attribute of natural systems. Both types of values, however diverse, must be interpreted, on this monistic view as individual values, individual values that are aggregated in units of willingness-to-pay (wtp). While there remain differences and disagreements about the direct comparability of economists' estimates of market values at the margins with estimates of dollar values derived from "ecosystem services," the overall trend seems to be toward entering policy frays with a single sword: the aggregated dollar value of goods, services—welfare—derived by humans from nature.

In Norton (2005, Section 4.1) I argue in detail that most environmental problems have the classic characteristics of "Wicked Problems," as defined by Rittel and Webber (1973). Discussants, that is, cannot agree on problem formulation because their conflicting interests cause them to characterize the problem differently. Trying to force all values at issue into a single, monistic framework leads to a politics of ideology and exclusion, as interest groups that define the problem differently struggle to gain control of the methodology that yields "one right answer". Issues of value formulation that should be discussed openly are hidden in bureaucratic decisions concerning "appropriate" discount rates, for example. Recognizing multiple values and multiple vernaculars,

encouraging open discussion of values—pluralism—can lead to negotiation and reformulation of problems as people develop new, sometimes more similar, "mental models" of problem situations.

Here—since the trend toward estimating shadow prices for non-use values has been with us longer and has been much discussed—I will concentrate on the recent success, and apparent future dominance—of the "ecosystem services" approach in the assignment of value to aspects of nature. The ecosystem services methodology assigns dollar values as measures of the economic contribution of certain aspects of nature to human welfare, conceived as units of goods and services available for consumers. The very success of this approach, however, worries me because this quantified approach is becoming so dominant in ecological economics that the field seems at this point to be adopting monism by default, without even canvassing for alternative approaches.

Let me be clear: I do not oppose making, publicizing, and discussing estimates of economic values delivered to humans; nor do I think this way of framing some research questions is incompatible with pluralism. What worries me is that the current enthusiasm for ecosystem service methods (used in tandem with contingent valuation methods) has locked the rhetoric of environmental evaluation in a very monistic, utilitarian, and economic vernacular that leaves little or no room for other social scientific methods, or for appeal to philosophical reasons or theological appeals. It also discourages a more profound re-examination of how one might create a rational process of policy evaluation that truly takes into account both economic and ecological impacts of our decisions.

I, as a philosopher, was attracted into the fringes of the discipline of ecological economics by the possibility of finding a community of scholars who were seeking a new way to conceptualize and count the impacts of economic and policy decisions on ecological systems and processes. But I hear less and less discussion of these deep issues as ecological economists have embraced quantitative analysis of non-market values and ecosystem services as the means to identify and count environmental values in virtually every circumstance and context. Even if one grants—I believe the jury is still out on this question—that placing dollar values on ecosystem services can be rhetorically effective, I still worry that the discipline of ecological economics is being swept by a tide of dollar-

valuations toward a monistic methodology of estimating and aggregating benefits in dollar terms only. If so, pluralism—what I think is the most promising avenue toward a new, integrated approach to evaluation—will never be given a chance. If that happens, ecological economics will remain two mutually interactive disciplines yoked together in a dualistic discourse: Ecologists will describe change; those economists engaged in valuation studies will evaluate change in their monistic, monetary vocabulary, and their discourse will never be suitable to truly integrate the diverse factors that must go into a comprehensive evaluation of the impacts of policy change.

In Part II, I provide a pointed analysis and criticism of the general strategy of monism, showing that such systems of analysis are unlikely to be able to comprehensively evaluate change in complex, dynamic ecological systems. If we seek an integrated and comprehensive system for evaluating environmental and ecological change, we must embrace and develop a pluralistic but integrated system of evaluation and policy. Such an integrated system of evaluation would of course involve economic indicators and considerations—but it would be pluralistic in the sense that it counts values other than units of human welfare measured in terms of aggregated wtp.

Part II: Economic Monism and Ecology: A Problem of Units of Analysis

In this Part, I will briefly summarize an argument that I have developed in much greater detail elsewhere (Norton, 2005, esp. Part II), to the effect that monistic economism is ill suited to evaluate ecological change. Ecological change is an interaction of forces of development, disturbance, competition and cooperation. Ecological change is systemic and change should be evaluated in terms of impacts on those forces. My argument, to put it most simply, is that the methodological requirements imposed by the decision to measure all impacts as dollar impacts on individual welfare is inappropriate for evaluating values that emerge in a many-scaled, dynamic ecosystem.

To me, the Achilles heel of monistic economism is the requirement that natural events and processes be represented as elements, or units--a commodity or service—in order to assign a value to it. These units of value, then, are aggregated to obtain before-and-after totals of social welfare associated with a project or policy, and the monistic

economist's story is one of counting units of stuff, stuff people are wtp for. Ecology, on the other hand, tells a story of overlapping processes, of systems embedded within systems, and of impacts across scales. Any attempt to "reduce" this complex, ecological story to one of wtp for chunks of nature—whether "commodities," or "services," or "amenities," is sure to miss the value of dynamic and creative aspect of natural systems.

Traditional environmental economists engaged in valuation studies, despite some interesting hand-waving, have not succeeded in developing a method that can capture what we would usually call ecologically valuable aspects of nature, such as system complexity, resilience, reductions in ecological risk, and the protection of basic ecosystem functions. While some economists may expect a breakthrough, a new method to measure the currently unmeasurable aspects of dynamic changes affecting "ecological values." This apparent inability of economists to offer welfare measures of ecological benefits begs the following question: Why are ecologists in ecological economics joining the stampede toward universal pricing of benefits? Why, if many sober economists have questions about whether their methods can capture these systemic values, would ecologists be complicit in making universal a valuation system that cannot account for "ecological" values?

I advocate an end to atomistic evaluation of environmental impacts; rather, I suggest we shift the unit of analysis to *development paths*. Development paths are ways our community/place can develop over time and into the future. Development paths can be thought of, alternatively, as *scenarios* that may unfold in the future if we make certain choices. Proposed policies can be understood as interventions to modify or stabilize systemic effects on community or place, and simulations can be used to explore how policy options might lead to varied scenarios. Goals can be set, not as abstract principles that demand maximization of a single value—welfare—but as descriptions of favored development paths. Proposed policies, and the development paths they are modeled to shape and encourage, can then be evaluated on multiple criteria, including economic criteria (such as job creation and comparative efficiency of different institutional means to achieve improvements on key criteria), but also including longer-term impacts on ecological systems. So, I am proposing an alternative approach to evaluation of environmental change which shifts the unit of evaluative analysis: development paths can

be evaluated according to impacts on multiple scales of time and space, and these development paths must protect a range of human values, recognizing the multiple ways humans value nature.

Where do these criteria come from? They should be worked out in the process of building models that are responsive to social problems. This process--what I call "adaptive management"--ideally includes public involvement as well as agency and managerial participation in an ongoing process that attempts to learn by doing. Individuals and groups will argue that certain features and processes are of value; further discussion will explore whether these features and processes can be associated with a measurable indicator. Rejecting the positivist model of describing environmental change and then aggregating the wtp of consumers for each and every commodity or service before and after an intervention would actually be very liberating for ecological economists. It would also bring the system they use to evaluate change more in line with the lessons of ecology. Discussion of environmental policy will be reformed as debate turns from how values will be expressed as measurable dollar quantities to proposals of varied economic and ecological indicators, proposals of management goals with respect to those indicators, and discussion of priorities among goals and indicators. I will return to this alternative approach to evaluating ecological change. Before developing the alternative a bit more in Part IV, in Part III I explore one line of recent ecological thought that has great promise for shifting the discussion away from sterile positivism to a richer view of how values, ecological models, and human values affect each other.

Part III: Post-Positivist Ecology

In a series of papers with several co-authors, Steward Pickett has explored the possibilities of using lessons of ecology to better understand the lived environment, including lessons they have drawn from their study of the Baltimore Long-Term Ecological Research site (LTER) (Pickett and Cadenasso, 2006; Pickett, et. al., 2004). Advocating the use of the ecosystem concept as a useful tool for communication among scientists and among scientists and the interested public, including stakeholders and government agencies (Pickett and Cadenasso, 2002, 5; Pickett, et. al., 2004), these authors identify several "frameworks" that have been useful in Baltimore, and they think

these may be useful in other contexts as well; These are: (i) "spatial patch dynamics...", (ii) the watershed as an integrative tool," and (iii) "the human ecosystem framework" (Pickett and Cadenasso, 2006, 114) these authors frame the question as one of choosing a model appropriate to one's purpose, arguing that "The richness of topics, complexity of model domains, and range of behaviors that models can exhibit suggest that ecosystem models can be used for diverse purposes" (Pickett and Cadenasso, 2002, 5; Pickett and Cadenasso, 2006; Kolasa and Pickett, 200x) This pragmatic, constructivist, and instrumentalist approach to models is linked by Pickett and co-authors with an explicit endorsement of the importance of metaphors associated with ecosystems, seeing them as having a creative and generative role in science; and as valuable in communicating ecological ideas to the public and policy makers in public discourse.

What is really fresh in this work is that it is based on a recognition that human purposes—goals, values, priorities—are integral to ecological model-building.³ Pickett and Cadenasso (2002, 6) say "This area of communication includes education, the media, policy making, and management. In such public uses, the precision and narrow focus of technical terms is eschewed in favor of richness of connotation and in support of societally important, if sometimes controversial, values. " Substantively, Pickett and Cadenasso also advocate the identification of ecological systems with spatially defined areas, and also advocate encouragement of recognition of systems as "places" with social meaning and endowed with "responsibility and empowerment" (Pickett and Cadenasso, 2002, 6). This work is so important because, drawing heavily on recent thought in the philosophy of science, Pickett and colleagues are creating an integrated dialogue about environmental policy and scientific research that is post-positivist and self-reflexive about the choices that are made in building models and framing environmental problems.

I believe ecological economists should respond to this opportunity to re-think the relationship between the models we use to describe natural processes and the models we use to evaluate changes in their processes. Pickett and the others just cited in the last footnote are advocating no less than an inversion of our usual thinking about science,

³ I do not mean to suggest this group of authors are alone in making this dramatic move, nor in their application of ecological insights to policy discussions. See, especially, Clark, (2002) and Peter Taylor (2005)

values, and policy. The old positivist model advocated first gathering descriptive information and data, and then predicting impacts of actions, followed by a microeconomic estimate of the dollars-worth of impacts on the welfare of consumers. In Norton (2005), I call this "the Serial View of Science and Policy," and criticize it in more detail there.

Pickett and colleagues argue that, at its deepest level the ecosystem concept rests on metaphors, and these metaphors connect our values and emotions with our choices of models. In order to be applied to real-world situations, the ecosystem concept demands experimentation with new analogies and interpretations, and this level of "experiment is deep enough to connect to our values, fears, and aspirations. They do not propose that we first describe changing systems and then evaluate the changes according to a single computation of the effects on human welfare. Instead, they embrace an open-ended search for many partial, but complementary, models that tell stories from multiple points of view, recognizing that this search will be guided by our diverse values and purposes. Taylor (2005, 226-227) refers to such an approach to research as "reflexive" ("applying one's method to one's own work") and as involving "practical reflexivity" ... "that takes into account the range of practical conditions that enable researchers to build and gain support for their *representations*." ⁴

Rather than leave the work of Pickett and colleagues at this rather abstract level, I cite the development of Aldo Leopold's views on science, management, and evaluation. Leopold, the great American Forester-Philosopher, constructed a plausible, but complex conceptual model for understanding evaluation ecologically. Leopold's changing views

⁴ I have, with my own set of colleagues, developed what we call a "two-phased process" of policy formation and evaluation. The phases, while intermixed in time, are characterized by the different frame given the questions addressed and the purposes driving choices. In the **Reflective Phase** goals are discussed and strategies are formed. In adaptive management, the reflective phase is very important because it is in this phase that one evaluates outcomes of prior actions—and prepares new experiments to reduce uncertainty (Norton, 2005). In the **Action Phase** actions are undertaken based on agreed-upon goals according to agreed-upon strategies. Again, in a system of management that is functioning adaptively, actions will be taken both to address perceived problems, but also to reduce uncertainty and learn from doing (Norton, et. al., 1998; Norton and Steinemann, 2001; Norton, 2005).

on wolf management represents an act of self-reflexive modeling and it illustrates how a rich understanding of reflexive model-building can change both perception and sense of responsibility simultaneously and inseparably. By using Leopold's transformation as a historical case that can be evaluated with hindsight, we can begin to see how metaphors, model building, management and science can all be brought together in something we would today call, "adaptive management". What I think has not been adequately recognized—and so I emphasized it in Norton (2005)—is the interpenetration of Leopold's choices in modeling and monitoring with his speculation about values. Far from shying away from values in managing and in building scientific models, Leopold often used fundamental metaphors for understanding ecological phenomena—and human responsibilities regarding those phenomena.

As one spectacular example, I refer to Leopold's famous simile, "thinking like a mountain," which was the title of a brief essay that criticized his earlier wolf eradication programs; that essay was published in Leopold's 1949 classic, A Sand County Almanac and Essays Here and There. Leopold built upon a conceptual base created in the earlier essay, "Marshland Elegy," where he sketched out three separate "scales" of time, a micro-scale of human perception of time (which Leopold illustrated by writing impatiently of waiting for the cranes to arrive at the crane marsh), ecological time (the scale on which the cranes had established a viable habitat within a marsh system evolving out of the ice ages), and geological, deep time (during which the mountains, lakes and marshes were gouged and re-shaped by geological processes). Leopold left his reader with the idea that human beings cannot understand their affairs realistically, unless they see them as embedded within a larger geological and evolutionary story. These processes, he said, which were expressed in the longstanding migration of the cranes, make the cranes "the symbol of our untamable past, of that sweep of millennia which underlies and conditions the daily affairs of birds and men" (Leopold, 1949, p. 97).

Leopold continues this theme of multiple time scales in the subsequent essay, "Thinking Like a Mountain," opening his thoughts with the observation that "only the mountain has lived long enough to listen objectively to the howl of the wolf" (Leopold, 1949, p. 129). While the essay focuses initially on the death of an old she-wolf, Leopold makes it clear that her death was a metaphor for the extinction of the wolves from the

Southwest Territories: the simile illustrates Leopold's recognition that systems formed over decades and centuries, if violently altered, will suffer long-term, ecological impacts—loss of vegetative cover, erosion, loss of topsoil-- as well as desired, immediate impacts such as an expanded deer herd. When Leopold lamented not "thinking like a mountain," he was criticizing himself for not having considered the impacts of his actions on multiple scales of time and as affecting systems of larger spatial scale.

Learning to think like a mountain is learning to think pluralistically: it is not to stop thinking economically, but it is to start thinking in terms of long-term ecological impacts *in addition to economic analysis*. It is to adopt a more complex model of nature, and to learn to evaluate impacts on multiple scales. When Leopold figured out that his predator eradication program—a great success in the short run--had led to over-population of deer and a destruction of the vegetative cover, he was forced to shift his "mental model" from an economic calculation of economic impacts of improved deer hunting to a more complex, ecologically informed model of the situation. What is interesting and important is that he *simultaneously* and inseparably accepted responsibility to submit future policy proposals to another layer of analysis—an analysis of the violence and the likelihood of significant impacts on ecological systems that are usually slower-changing.⁵

This old example, I think, illustrates the richness of Pickett's use of the ecosystem concept to which he attributes a very flexible, technical definition applicable at many scales and in many contexts, but relies heavily upon metaphor and modeling to bring the technical definition to bear upon the particular cases. The fleshing out of an ecosystem model on the ground is part of understanding what is going on, and it involves highly metaphorical thinking. In Leopold's case, the new metaphor allowed him to balance short-term economic thinking against long-term ecological thinking. The metaphor of "mountain-thinking," (and "watershed thinking", and "wetland-thinking.") is, first of all, a

⁵ In this paper, I concentrate on redirecting evaluative discourse, and have not said nearly enough about the importance of developing institutions that are capable of addressing future challenges. See Bromley (2006) as providing a complement to my argument by proposing that environmental economists, once they give up their pricing emphasis, adopt the role of institutional analysts in the tradition of Veblen, Common, and the "old institutionalists." Also see Norton (2005) for an extended discussion of this and related issues.

re-orientation of thought—a shift in both scale and in "problem formulation", but it is also an act of accepting responsibility for all the future effects of our choices that are foreseeable in the present. Leopold's guiding metaphor tells us to see the effects of our action in a larger ecological scale.

For Pickett, however, Leopold's model choice, driven by his over-arching ecological metaphor of the "mountain," is both an act of scientific insight and an embrace of responsibility. The metaphorical dimension that expresses itself in the choice of a guiding metaphor is then activated, applied by the specification of a "domain and a variety of features". This middle dimension is described as embodying "the specifications needed to address the many and real or hypothetical situations that the [technical] definition might apply to" (Pickett and Cadenasso, 2002, p.1).

Leopold's metaphorical leap into a multi-scalar, pluralistic system shaped the models he used both to understand and to evaluate future proposals for game management. The metaphorical shift opened up new possibilities in the construction of models, and new opportunities to evaluate policy proposals on multiple temporal scales and according to multiple criteria. Leopold's pluralistic approach, which I have designated as a first try at specifying a multi-scalar, adaptive approach to management (without the label, "adaptive management" itself), seems to me to be the most promising approach to the evaluation of ecological change available.

Part IV: Ecologically Sensitive Evaluation: A Sketch

As was noted in passing, above, p. 3, most environmental/ecological "problems" emerge as "messes," as what Rittel and Webber called "wicked problems": they do not emerge as well-defined problems that are formulated similarly by different participants in the discussion. There will, on the contrary, be varied complaints and varied explanations of what the problem is, often associated with varied value positions and perspectives of the participants. Positivist science, in these early stages of problem formulation, is irrelevant. One cannot test hypotheses—indeed one cannot even know what hypotheses to test—if participants in the discourse differ radically about the nature of the problem at hand. The positivists, by assuming realism plus reductionism for their models, bypass the "messes" that are key to beginning an ongoing, iterative, public dialogue. But it is in this

messy dialogue about goals and aspirations that metaphors and similes allow the reconstruction of a problem by virtue of reconstructing the models used to characterize that problem. What is useful at this stage is a discussion of values, goals, and aspirations, interspersed with attempts to achieve short-term and intermediate goals that can be agreed-upon. Once goals are clarified by being exposed to multiple, pluralistic value systems, it may become possible to form some useful managerial hypotheses—such as the hypothesis: Addressing non-point-source pollution is essential if we are to address our local water quality problems.

I am suggesting that we abandon the artificial mindscape of positivism. That mindscape encouraged the serial treatment of science, the completion of an account of the key variables constituting a problem before values and human purposes can be consulted and brought to bear upon problem formulation. It has also imposed upon us, relying on the unrealistic and artificial distinction between descriptive and prescriptive discourse, the dualistic discourse that still separates ecologists and economists. The dualistic, serial view of science and policy is a hopeless model because we cannot know what science is relevant, what data to collect, until we know what is important. As long as problem formulation remains unresolved—as it typically does in unproductive management processes, it is impossible to know what data is relevant. Discussion deteriorates into turf wars among disciplines, all urging their particular data and analysis as definitive. In place of the serial view, I suggest we make the process of evaluation—and the process of problem re-formulation—endogenous to adaptive management, and that we adopt an experimental approach to understanding and evaluating changes in social values entailed by human impacts on natural systems. This experimental approach—experimenting with different metaphors and "models" to characterize a problem—exemplifies Pickett's third "aspect" of model-building. This third aspect must embody a reflexive, self-critical and other-critical process of choosing appropriate models for communicating about, and working to solve, environmental problems.

So, making evaluation a sub-process of ongoing adaptive management processes, should make us—philosophers, economists, and ecologists alike—aware of the choices we make when we "model" deterioration or recovery of ecological systems. The choices we make in scaling models, in locating boundaries—both spatio-temporal and

conceptual, and in describing the mechanisms and processes driving a problem--must be carried out at the metaphorical level as described by Pickett and colleagues. At this deep level, the metaphors we choose and the models we build re-conceptualize "messes" as emergent problems capable of encouraging learning through doing. This learning can only take place, however, if goals and values are open for public debate in an ongoing discourse that encourages rich metaphors and diverse values.

In place of the methodological debates about how to force all values into a single measure, this approach offers a public discourse focused on choosing appropriate "indicators" of sustainability. Choices of indicators reflect the choosers' values in the indirect sense that choosing to monitor some ecological process is evidence that that process is of interest to the choosers, or at least that it is associated with some other factor of interest to them. So, discussion of environmental values can be absorbed into a community-level process of choosing some small set of indicators which, if followed and stabilized, would protect most of the community's values. At this point, the name-calling across the anthropocentric-nonanthropocentric divide can be replaced with constructive discussion of what processes, given our shared and varied values we draw from nature, to monitor as indicators. Values people have remain important in the process, but their values feed into an ongoing process of discussion, debate, and management experiments. Crucial to these experiments is reflexive model-building directed at characterizing and communicating the nature of perceived threats to social values. Embedding the search for models and guiding metaphors in public discourse encourages problem-based model-building—a process that in turn encourages "social learning" at the deepest, metaphorical, level (See Figure 1).

This new approach does not decide, before doing research, what kind of values will be found. Rather, we advocate elicitations following the important methodological breakthroughs of Kempton, et. al. (1995), who begin the characterization of people's environmental values with open-ended interviews. In this way they can maintain the richness and diversity—and look for the similarities—among varied respondents' answers.

Also, the context of evaluation is shifted. Evaluation will no longer be monistic: proposed policies will be evaluated according to multiple criteria applicable at multiple

spatial scales—impacts on a list of indicators that is currently hypothesized to reflect, at least roughly, the cross section of the values of participants who helped to choose them. As various problem models are introduced into the public discourse, as various metaphors are tried out, there is the possibility of reconciling problem formulation through the adoption of common models characterizing the problem. In successful cases, these exercises in community model-building can lead to the kind of social learning that can "re-model" complex and wicked problems and improve communication by disentangling messes into addressable problems. In this process, public policies and actions will be hypothesized to affect various valued and monitored processes. Proposed actions can then be compared according to their likely effects on the list of monitored processes. And these comparisons, if taken together, can function as a multi-criteria evaluation of possible actions.

Key to all these connections and learning about them is the creative choice of appropriate metaphors, and the development of effective and transparent models for seeing the likely effects of possible choices that will determine development paths—and what gets protected—as we move into the future. As these models operationalize chosen metaphorical representations, attention then shifts back to evaluating the effects of proposed actions and policies on those monitored processes (indicators). Adaptive management and social learning, on this approach, are given the chance to address problems iteratively, embodying plural values in multiple criteria, and by focusing attention on important choices that will constitute the future.

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Figure 1: Metaphor and Iteration: We need metaphors and "models" to understand any complex process; Metaphors and "stories" of a place, such as Leopold's Thinking Like a Mountain, re-orient science, creating models more appropriate to our values; in turn, this leads to more useful science (adaptive management) and, most importantly, to acceptance of responsibility for long-term impacts. This progression, in turn, encourages yet more meaningful science and adaptive management.

