If Ecological Risk Assessment is the Answer, What is the Question?

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If Ecological Risk Assessment is the Answer, What is the Question?[1]

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ABSTRACT

Ecological risk assessment has become a commonly used tool in policy analysis, but its use is controversial. Opinions are diverse; they range from enthusiastic support to caustic dismissal. Much of the controversy with using risk assessment in ecological policy analysis revolves around defining the initial policy question or problem to be assessed. In formulating the "question" in ecological risk assessment, the nature of the analytical technique forces analysts to make assumptions of values and priorities; these assumptions may not be the same as those of the public or their elected or appointed representatives. Specifically, much of the difficulty with applying *risk* assessment is that, by definition, risk is *adverse.* Deciding which ecological changes are adverse (undesired) and which are beneficial (desired) is likely to be the primary political debate. Ecological conditions and changes are classified by the values and priorities of the person or administrative body doing the classification; ecological condition or change in itself is neither good nor bad, beneficial nor adverse, healthy nor degraded. One method often used to determine which ecological conditions or changes are adverse is to apply the human "health" metaphor to ecosystems or ecological components. However, application of the concept of ecosystem health is fraught with value-based requirements

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which are difficult and probably impossible to attain. Formulating the question is, or at least should be, driven by societal values, preferences, and priorities, but this is difficult to do in a pluralistic society. Better ways to evaluate and measure public values, preferences, and priorities in framing ecological questions are needed to enhance the utility of ecological risk assessment.

Key Words: Ecological risk assessment; ecosystem health; ecological health; decision making; environmental protection; biological diversity

INTRODUCTION

The use of ecological risk assessment in public policy deliberations has become commonplace, but its use is contentious (Karr, 1995; Montague, 1995). Opinions on the legitimacy of use of ecological risk assessment in public policy analysis are diverse; they range from encouraging: " . . . scientifically credible evaluation of the ecological effects of human activities" (Suter, 1993a) to cautious: " . . . most quantitative ecological risk assessments are generally unvalidated and in many cases highly misleading" (Holdway, 1997) to suspicious: " . . . one more hurdle on the road to a permit" (Webster and Connett, 1990) to abhorrent: ". . . risk assessment is a sham . . ." (Merrell, 1995). Most opinions lie somewhere in the middle of various extremes and are represented by a disjointed array of opinions because debate over the proper role of ecological risk assessment defies simplistic categorization (*e.g.*, right vs. left, conservative vs. liberal, technocratic vs. democratic, or "green" vs. "balanced use"). Neither the controversy nor the tool is new, but the rancor has increased as ecological risk assessment has become established as the policy tool of choice in some organizations (Lipton *et al.*, 1993; Lackey, 1994, 1995; Regens, 1995; Power and Adams, 1997).

Appropriately or not, ecological risk assessment is widely used by governmental and nongovernmental organizations (Friant *et al.*, 1995; Patton, 1995; Molak, 1996). It is evident that many consider it to be a worthwhile tool to help answer at least some types of ecological policy questions. But, what kind of assessment questions are being asked, and are they the appropriate types of questions? Ecological risk assessment is being used routinely to produce answers, but are there other tools or approaches that would be more suitable for answering the questions? It is the issue of the appropriate use, or perhaps more accurately, the misuse, of ecological risk assessment that is my focus in this commentary.

Many of the criticisms of using risk assessment in ecological policy analysis revolve around defining the initial question to be answered. To be technically tractable, rigorous, and credible, the risk "question" is usually defined in fairly narrow, technical terms, often reducing the relevance of the result to the real policy issue. Even defined in "fairly narrow terms," the analysis may be technically complex and require sophisticated scientific information and analyses.

Most often the narrowing is done (or is claimed to be) by a policy mandate or management directive [*e.g.*, Comprehensive Environmental Response, Compensation, and Liability Act and the bureaucratic decisions on how it is interpreted and implemented (Lipton *et al.*, 1993; Friant *et al.*, 1995)]. The risk question then becomes relatively "simple" analytically [*e.g.*, one or a few chemicals are the stressor causing effects on a few biological components; the effects, if present, are "adverse" by definition (Regens, 1995; Calow and Forbes, 1997)].

Such simplification, of course, begs the question of whether this analysis leads to "good" or "useful" policy analysis, but it does give the analyst a benchmark to determine what is "desired" or "adverse" (Friant *et al.*, 1995). It also gives risk assessments an aura of scientific rigor and credibility even if the assumptions upon which the analysis is based limit the applicability of the results. The danger of misusing the results under these circumstances is real. Pagel and O'Brien (1996) conclude that ecological risk assessment " . . . acts as a blind, blunt, and unwieldy tool to facilitate and 'scientifically' rationalize incremental degradation of the integrity of landscapes and ecosystems."

Because formulation of the question to be asked requires a value-based decision, it is perhaps more properly part of the risk *management* process, not the risk *assessment* process. Risk assessors (and scientists) have a role but that role is limited to technical input as to what types of measurement and analysis are technically feasible. If stakeholder input is necessary, it is obtained at this step. Regardless of who formulates the question, all risk assessments require a number of simplifying assumptions and some policy and analytical choices.

QUESTIONS

Technocrats, scientists, and politicians can always define many risk "questions" in ways that can be "answered" technically, but which, if any, of these questions have any relevance to the public policy at issue? The metaphor often used is the risk assessor looking for his lost keys under the street lamp. Although the keys were most likely lost far from the street light, the risk assessor laments that he has little chance of finding the keys in the dark so why waste time looking there. Although this anecdote adds a little humor to the discussion, the message is painfully manifest: ecology is complex and our understanding is limited; therefore there is a strong, understandable tendency to define risk assessment problems in ways that can be evaluated scientifically, even though the risk question may be policy irrelevant (O'Brien, 1995; Lackey, 1996a).

Risk assessment, however, may have a role in answering or at least clarifying certain questions in ecological policy analysis (Fairbrother *et al.*, 1995). The practical challenge is to identify appropriate assessment questions that are policy relevant. The role of ecological risk assessment to date has been to address narrow, well defined technical questions, not to answer complex public policy questions. However, though widely touted as realistic, or at least promising, Pagel (1995) concluded that " . . . ecological risk assessments do

not address the complexities of the natural world, are humanistically arrogant, and disregard or do not consider alternatives which offer imagination and realistic attempts to reduce human impact to the land." His view is that ecological risk assessment, at least as commonly practiced, is routinely misused.

Perhaps the most commonly identified misuse by technocrats, scientists, and politicians in formulating the question in ecological risk assessment is to rely on their personal values and priorities rather than those of the public or elected representatives (Webster and Connett, 1990; Menzie, 1995). In philosophical terms this is illustrated by shifting the scientific "is" to the political "ought." In science there are no "oughts." Individual animals or plants may be easily classified as unhealthy (from the individual animal or plant's perspective), but animal populations, plant communities, and ecosystems are neither good nor bad, better nor worse, healthy nor sick unless a *value* criterion is applied. "Risk" has no definition in ecology unless someone defines what ecological condition or change is adverse (or healthy). For example, the introduction of wheat, horses, zebra mussels, dogs, or humans to North America is either good or bad, depending entirely on the value criteria applied.

In formulating a question, one runs immediately into the "risk" paradox. By definition, risk is *adverse,* a change or condition that is undesirable (Bartell *et al.*, 1992). Because ecological systems have no intrinsic "good," "bad," or "adverse," an ecological condition or change can be labeled "adverse" only by individuals, organizations, or societies making a value judgement. Therefore, the fact that a risk assessment has been completed means that *someone* made a value judgement of which ecological condition will be defined as *adverse* (USEPA, 1990). In practice who makes such choices? Most participants in the debate over the appropriateness of ecological risk assessment skillfully evade this issue — or raise it ever so tactfully, but it is an important criticism and it supports apprehensions that risk assessment can be easily manipulated to support any desired policy position. For example, in studying how risk assessment operates in practice, Pagel and O'Brien (1996) observe " . . . the use of this seemingly benign tool to undermine the development of 'good' public policy."

ASSUMPTIONS

Identifying which questions are appropriate for ecological risk assessment is predicated on accepting a fundamental assumption about the characteristics of ecological policy: *anthropocentrism* . . . The benefits from decisions affecting ecological systems are accruable to humans (Lackey, 1996b). Indeed, society may preserve wilderness that few humans actually visit, shield from extinction unsung species that have no economic or tangible value, and allocate scarce tax dollars to sustain habitats for species without market or apparent aesthetic appeal. All such efforts provide benefits to people; the benefits may be nonmarket, nonmonetary, or merely a way to "purchase" some indeterminate

future insurance, but the decisions benefit man. Ecosystems, species, or individual organisms may survive (benefit) or not based on man's decisions, but only as a byproduct of the primary decision. Society protects biodiversity because some people believe deleterious things may happen to current or future generations of people if we do not. We preserve wilderness areas because merely knowing that unaltered ecosystems exist has value (benefit) to some people. It will probably always be impossible to measure total benefits, even though some would argue that contingent valuation may be an effective tool — another tool, incidentally, that is based on an anthropocentric perspective.

From an anthropocentric perspective, risk assessments weigh ecological alternatives on the basis of their relative value to man . . . protecting owls vs. providing timber jobs; building highways to facilitate mobility vs. protecting watersheds to maintain salmon populations (Principe, 1995). It is important to remember that the assumption of anthropocentrism does not necessarily lead to risk questions that are skewed toward commodity or other tangible benefits.

Another world view is *ecocentrism.* The basic tenet is that all species are equal; humans are only one species and are no more important than others. We protect ecosystems because all animals and plants have a "right" to exist. Protecting indigenous biological diversity is important because it is morally right, not because biological diversity is or might be important to man.

Risk assessment can be abhorrent to those holding an ecocentric view. For some who hold this view, the mere discussion of ranking risks to ecosystems would be similar to Sophie's choice, deciding which humans should live. The debate is often value or morally based; thus "rational" (in a philosophic sense) argument can play little or no role. For those individuals who hold an ecocentric world view, or those who lean in this direction, risk assessment has not been well received. From an ecocentric perspective, risk assessment is a form of ecological triage.

Perhaps there is another path around the polarized debate over the use of ecological risk assessment. One possible approach is to use the human health metaphor.

ECOLOGICAL HEALTH

The concept of ecological "health," patterned after human "health," is widely advocated, but is not currently a well developed concept in spite of a vast literature on the subject. There is little consensus among scientists and policy analysts on definitions, and the limitations and implicit assumptions are not understood by most politicians and most of the public. The fundamental problem is not lack of technical information, but lack of agreement on what constitutes the desired or preferred ecological condition. For example, is a pristine condition defined as the benchmark, or preferred condition, of ecological health? If such an assumption is followed, then does human alteration make an ecosystem less healthy? Does it follow that the degree of

perturbation is inversely related to ecological health? Whereas humans are conceived, follow a predictable gestation period, live through well defined life stages, always followed by death, ecosystems follow no such path. There are many similar difficulties with the concept of ecological health that can only be overcome by making a number of arbitrary, value-based assumptions. Some ecologists (Suter, 1993b) have concluded that " . . . it is a mistake for environmental scientists to treat this metaphor as reality."

The "is-ought" separation applies in concepts of health as it does in risk assessment. For example, the use of the term "degradation" to describe a certain ecological change is human value-driven; the term "alteration" is a statement of fact, an "is" statement.

Defining problems to make them technically tractable is also a danger, as it is in risk assessment (Lackey, 1996a). For example, the "degree" of healthiness may also be driven by what is quantifiable, rather than what is important from a policy perspective. As Calow and Forbes (1997) conclude: " . . . the ecosystem health paradigm requires that ecology and ecologists play a dominant role in not only carrying out risk assessments but in defining the criteria by which risks are evaluated."

Perhaps policy-relevant problems in ecology generally are too complex for easy scientific experimentation or analysis (Woodhouse, 1995) and we should accept the old rule in policy analysis that "if something can be measured, it is probably irrelevant to policy making." If problems are simplified to the point of making them scientifically tractable, then the result may lack policy relevance. Expert scientific and technical opinion must be used. Computer-generated maps and computer-assisted models may be elegant, but for really important decisions the political process demands expert opinion.

Selecting the desired or preferred ecological (healthy) state is, or at least should be, driven by societal values and priorities; this is difficult, if not impossible, to do in a pluralistic society (Wilson and Crouch, 1987). Better ways to evaluate and measure public preferences and priorities in framing ecological issues need to be developed. Public opinion polls always show that the public is very supportive of the "environment," as it is with "peace," "freedom," and "economic opportunity." The public is similarly supportive of preserving biological diversity, ecosystem management, and sustainable natural resource management. Unfortunately this type of "preference" information is of limited use in helping frame or make difficult environmental decisions. The public is not a monolith; it encompasses many divergent views, and individuals vary greatly in the intensity of their opinions (Woodhouse, 1995). Individuals may argue forcefully for the "industrial economic paradigm" or for the "natural economic paradigm," but practical political options are not framed in this context.

Some analysts contend that most current public decision-making involves professionals controlling the process with public input requested as desired (Schrecker, 1991). Professionals may operate either within the formal "government" bureaucracy, or influence the process via positions with nongovernmental organizations. Skeptics of such domination of decision making by

professionals argue that ecological policy issues like biological diversity and sustainability are too important to be left completely in the hands of technocrats.

CONCLUSIONS

There does not appear to be any decrease in the use of risk assessment for ecological policy problems; in fact, its use is probably increasing. But neither does there appear to be any lessening of the controversy over its use; in fact, the critics appear to be increasing. Where does that leave us? Let me conclude with three observations:

First, I don't see any near-term developments that will make the application of ecological risk assessment dramatically less controversial. Opinions will continue to range from highly supportive to highly negative, complicated to a large degree by serious differences over multiple definitions for the same words. People who conduct risk assessments, or provide information to those who do, should appreciate the value-based nature of the technique.

Second, debates over formulating the questions in ecological risk assessment will continue because they raise critical, policy-relevant differences. How the question is formulated in ecological risk assessment largely defines the result. More and more people are beginning to recognize this, focusing the important policy debate around the first step in risk assessment: defining the question to be asked.

And finally, to the extent that risk assessment forces policy debate and disagreement over fundamental differences rather than superficial ones, it will be useful in decision making. Otherwise, it is just the latest in a long procession of analytical tools, each of which has a role, albeit limited, in policy analysis.

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