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How should a parasite value its host?

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1. Introducing the question

Let's be clear on what is being discussed here. The valuation of nature represents the commodification of global life support. This is worrisomely serious business. For the first time in human history, it seems necessary to some to put a price on the biophysical structures and functions that make higher life possible on Earth. Until now, the essentials to life have been free.

The felt need among environmental economists to price 'the environment' implies a sense of impending scarcity.[1] Making sound decisions in a context of scarcity is what economics is all about. Price in this context is a tool—it is the means by which individuals and communities decide how to choose among mutually exclusive possibilities, how to exercise their preferences for the many competing things life has to offer.

Of course, assigning a price to something implies the ability to compress a great deal of information about that thing into a single indicator or metric. In theory, this compacted information should enable us to make 'better informed' decisions about the allocation of that thing among competing interests or about its disposition in the event that it may have to be 'traded off' in some economic development decision (Pearce, 1994; Vatn and Bromley, 1993).

There can be little question that the contributions of nature to human welfare are not presently well represented in markets and 'are therefore often given too little weight in policy decisions' (Costanza et al., 1997). Historically, there has been an "asymmetry of valuation" Pearce (1994). The economic playing field is biased against conserving the functions of nature because, without markets or prices, their contribution to the economy is not reflected in the either the individual or social choices made. Such classic market failure necessarily results in inefficient economic and policy decisions. Thus, the relevant question here is, can present efforts to evaluate ecosystems goods and services lead to more efficient and legitimate decisions about economic development?

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[1] To many ecologists, this particular form of scarcity indicates an increasingly dysfunctional relationship between the human enterprise and the ecosphere.

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2. The economy as parasite

Approaching this question first requires an understanding of the physical relationship between the economy and nature. Conventional environmental economics tends to see the economy and the environment as separate and rather independent systems. This is the economics of environmental 'externalities', of confidence in the capacity of technology to substitute for failing natural resources and of unfettered growth. The question of appropriate economic scale doesn't arise. By contrast, ecological economics sees the material economy as an inextricably integrated, completely contained and wholly dependent growing subsystem of a non-growing ecosphere. From this perspective, there are no externalities and we are more humble about prospects for substitution. Most important, there are real limits to material growth and the issue of optimal economic scale is a critical concern (Daly, 1996).

Ecological economics also recognizes the economy as a complex, far-from-equilibrium, self-organizing system subject to the second law of thermodynamics. This is a critical distinction given that the economy is embedded in the ecosphere. In particular, modern interpretations of the second law suggest that all self-producing systems, including the economy, can maintain or increase their internal order only by importing available energy/matter from their host environments and exporting degraded energy/matter back into them. That is, complex systems develop and grow "at the expense of increasing the disorder (entropy) at higher levels in the systems hierarchy" (Schneider and Kay, 1994).

By this interpretation, the economy is but one level in a nested hierarchy of systems in which the survival of each sub-system is dependent on the productivity of the system immediately above. For the economy, the superior system is the ecosphere. This relationship is no problem for either the economy or the ecosphere as long as material consumption and residuals production by the former does not significantly exceed resource production and waste assimilation by the latter. Unfortunately, both conditions are being violated today. Deforestation, fisheries collapse, falling water tables and biodiversity loss are examples of over-consumption while stratospheric ozone depletion, greenhouse gas accumulation, acid lakes and polluted air imply waste sinks are filled to overflowing. Little wonder that ecological economists see physical scale as a central issue. In effect, the economy has become parasitic on nature—its growth and vitality are increasingly purchased at the expense of the health of the ecosphere (see Peacock, 1995). The relevant question now becomes, how should a parasite value its host?

3. (In)validating valuation

As noted, if decisions using money prices are to be truly 'better informed', the prices should reflect all significant values contributing to the worth of the entities being considered. Pearce (1991) shows that in some circumstances even a crude "total economic value" approach has significant potential to change development decisions in nature's favor. He estimated a range of non-market values—e.g. carbon sink, biodiversity and existence values—accruing to the world at large from the Amazon rain-forest. In a perfect world, Brazil could reasonably claim several billion dollars per year, particularly from wealthy northerners, in compensation for market benefits foregone if Brazil chose not to 'develop' the forest.

In lauding the total economic value approach, Pearce (1991) argues that "it does not deny other rationales (e.g. ethical considerations) for conserving tropical forests… Yet it may be unnecessary to resort to such moral arguments. Economic arguments alone could well be sufficient to justify a dramatic reduction in deforestation".

But it is not a perfect world. As Pearce acknowledges, there are presently no mechanisms to tax northern free-riders for benefits received nor to transfer these benefits to Brazil (and given the uncertainties in both the economic calculus and global change—to say nothing of geopolitics—none can be anticipated any time soon). Meanwhile, Brazil receives only a small share of the non-market gains from preservation but reaps all the benefits of economic development. This leaves

the country with no 'rational' choice but to proceed with rain-forest development, a choice that may well be uneconomic in the global context.

This is a textbook example of the so-called common property—public good problem. It implies that regardless of the value of nature's services, we may be propelled to the brink of ecological and social chaos "not so much by the evil acts of selfish people as by the everyday acts of ordinary people whose behavior is dominated, usually unconsciously, by the remorseless self-destructive logic of the commons" (Ophuls and Boyan, 1992).[2]

Those who would commodify nature face many other problems. Two of the most important relate to properties of ecosystems themselves. Many of the valuable flows functions associated with natural capital stocks are difficult to quantify and price. More critical, however, are those ecosystems elements whose precise contribution "is not known—indeed, is probably unknowable—until (they cease) to function" (Vatn and Bromley, 1993). Because of this 'functional transparency', hypothetical values for natural capital inevitably suffer from "a non-trivial loss of information" and are therefore dangerously misleading. In these circumstances, "so-called 'contingent valuing'… somewhat paradoxically, may contribute minimally—if at all—to the revelation of values" (Vatn and Bromley, 1993).

The marginal pricing of nature's services may also be invalidated by erratic systems behavior. Catastrophe theory predicts that key variables of any ecosystem under stress will be characterized by unpredictable discontinuities, particularly lag and threshold effects. Human impacts on ecosystems only "slowly accumulate to trigger sudden changes (which directly affect) the health of people, the productivity of renewable resources and the vitality of societies" (Holling, 1994). In these circumstances the marginal value of critical ecosystems services may suddenly break toward infinity, without warning and with little possibility of an orderly recovery (Rees, 1995). Thus, even as the economy expands with little apparent friction, there is a finite possibility that we could actually be "on the verge of extinction, blissfully unaware that a mathematical fiction in the space of the possible is about to become reality. And the really nasty feature is that may take only the tiniest of changes to trigger the switch" (Cohen and Stewart, 1994).

4. A risk-averse strategy

It seems that the best efforts at assigning monetary value to nature may fail absolutely to produce safe measures of ecological scarcity. This in turn makes it impossible rigorously to determine how much natural capital to preserve. How, then, should we parasites value our host? Since adequate stocks of critical natural capital are necessary to maintain the life-support functions of the ecosphere, the risks associated with their depletion are unacceptable and there may be no possibility for technological substitution, simply "*conserving what there is* could be a sound risk-averse strategy" (Pearce et al., 1990, [emphasis added]). This is exemplary advice to a species that is depleting its resource base, confronting the possibility of erratic global change and yet remains dedicated to further material growth.[3]

Fortunately, 'conserving what there is' does not necessarily mean totally abandoning the efficiency of economic incentives. These can be incorporated into a 'zero net impact' approach to development. Project proponents would be required to regenerate, at some other location, a stock of natural capital equivalent to that used or destroyed in

[2] The 'common-property' (or better, the 'common pool') dimension in this example comes from the use of the atmosphere as a CO^2 waste dump by all. Also, while Brazil owns much of the world's rain forest, it provides many life support services required by everyone. This property of natural capital blurs the usual distinction between common and private property.

[3] 'Conserving what there is' implicitly recognizes that humans have already exceeded the long-term carrying capacity of Earth. Accordingly, the marginal benefits of *any* further throughput growth may be less than the marginal costs associated with lost ecosystem services. (Further population growth implies that we may actually have to enhance existing natural capital stocks to maintain a constant stock of wealth *per capita*.) (Rees, 1995).

project implementation. The value of the sacrificed assets would be accounted for in the form of natural capital replacement costs. To the extent that these added costs affect project design, scale, operation and demand they would contribute to more ecologically sustainable and economically efficient development. In theory, Environment Canada has had such a 'no net loss' policy respecting development in marsh and other wetland habitats since the mid 1980s.

To be sure, some biophysical services are neither technically nor economically substitutable. Consider the Gulf Stream. This thermal 'conveyer belt' from the South Atlantic releases heat over the North Atlantic and Europe "at the rate of a trillion kilowatts (10^{15} W), an amount equivalent to 100 times the world's energy consumption" (Rahmstorf, 1997). Evidence is now emerging that global warming could possibly disrupt this flow, "(plunging) most of Europe into a big chill (5°C cooler) lasting 100s of years…" with disastrous consequences both there and beyond (Rahmstorf, 1997). Humans have no hope of replacing this free heating service. In short, at the present critical stage of world development, we must regard many of nature's services as we would an expensive yacht. If we have to ask the price, we probably can't afford it.

5. Epilogue

The accelerating erosion of ecosystem services is a major problem in light of human dependence on the ecosphere and the general scarcity of Earth-like planets. A parasite that destroys its host and has nowhere else to go will be culled by natural selection. Unfortunately, for all its theoretical attractiveness, ascribing money values to nature's services is only a partial solution to the present dilemma and, if relied on exclusively, may actually be counterproductive.

The message for humans is to learn to live in harmony with nature—well-adapted parasites go virtually unnoticed by their hosts. To the extent that the partial pricing of life-support services is a means to this end, so much the better.

However, true harmony will require a sea change in prevailing human values. At the least, effective solutions to the sustainability crisis reside in a solid sense of ecologically enlightened self-interest. Some even argue for adoption of a more purely ecocentric ethic. Certainly our humanity has been diminished by the loss of humility and any sense of awe before the sheer wonder of nature. These would be restored, in part, by the extension of moral rights to nature's creations. To inversely paraphrase Pearce (1991), this ethics-based approach does not deny arguments to conserve nature based on monetary valuation. However, with a more balanced system of values, it may not be necessary to resort to crude economic analyses. Indeed, the question of how to commodify the living world would never come up.

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