

# Rensselaer

## Working Papers in Economics

Department of Economics, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180-3590, USA. Tel: +1-518-276-6387; Fax: +1-518-276-2235; URL: <http://www.rpi.edu/dept/economics/>; E-Mail: [heimj@rpi.edu](mailto:heimj@rpi.edu)

### **The Parable of the Bees: Beyond Proximate Causes in Ecosystem Service Valuation**

John Gowdy  
*Rensselaer Polytechnic Institute*  
[gowdyj@rpi.edu](mailto:gowdyj@rpi.edu)  
[johngowdy@earthlink.net](mailto:johngowdy@earthlink.net)>

Lisi Krall  
*SUNY Cortland*  
[Lisi.Krall@cortland.edu](mailto:Lisi.Krall@cortland.edu).

Yunzhong Chen  
Duke University  
[yc121@duke.edu](mailto:yc121@duke.edu).

Number 1202

January 2012

## The Parable of the Bees: Beyond Proximate Causes in Ecosystem Service Valuation

John Gowdy\*, Lisi Krall\*\*, Yunzhong Chen\*\*\*

### Abstract

Many ecological and environmental economists take a microeconomic approach to environmental valuation and view the macroeconomy as one big firm whose primary task is to efficiently allocate scarce resources. In this framework, replacing freely provided ecosystem services with costly human-provided substitutes is by definition inefficient. Using the example of apple tree pollination in Maoxian County, China we argue that destroying and replacing the free gifts of nature can be an economic benefit. We do not argue that the positive economic benefits justifies eliminating natural processes. On the contrary, the Maoxian case illustrates the danger of allowing the logic of the market to drive conservation policy. The conflict between the market economy and the natural world must be recognized and addressed in a more substantial way. The bees of Maoxian County are a parable for the relationship between humans and the natural world and show clearly the danger of leaving the fate of nature to the whims of the markets even if prices are “correct.”

**Keywords:** Biodiversity, ecosystem services, environmental valuation, market failure, natural capital

\*Rittenhouse Professor of Humanities and Social Science and Professor of Economics Rensselaer Polytechnic Institute, Troy, New York, 12180 USA, [gowdyj@rpi.edu](mailto:gowdyj@rpi.edu). Gowdy’s research focus is environmental valuation, particularly climate change (Garrison Institute’s Climate Mind and Behavior project) and biodiversity loss (The Economics of Ecosystems and Biodiversity).

\*\*Professor of Economics, State University of New York at Cortland, Cortland, New York 13045 USA, [Lisi.Krall@cortland.edu](mailto:Lisi.Krall@cortland.edu). Krall’s research focus is institutional analyses of land policy history in the US, critiques of ‘natural capital’ and institutional explorations of no growth economics.

\*\*\* [Candidate](#) of Master of Environmental Management, Nicholas School of Environment, Duke University, Durham, North Carolina, 27701 USA , [yc121@duke.edu](mailto:yc121@duke.edu). Chen’s research focus is environmental policy and economics, particularly cap and trade and ecosystem services.

## **The Parable of the Bees: Beyond Proximate Causes in Ecosystem Service Valuation**

“A new ethics is what the world needs most. If our values are right, everything else—prices, production, distribution and even pollution—has to be right.”  
Nicholas Georgescu-Roegen<sup>1</sup>

### **I. Introduction: The Parable of the Bees**

It is a commonly held belief among ecological and environmental economists that placing market values on ecosystems and their services is a necessary and sufficient condition for insuring their preservation. Underlying this view is the standard microeconomic worldview that humans are rational allocators of scarce resources and that environmental services are being misused because their true value is not reflected in market prices. In a production function framework the loss of environmental services harms the economy by imposing additional input costs that were once free gifts of nature.<sup>2</sup> Yet a closer look suggests that this approach to conservation fails to address the fundamental conflict between markets and the natural world. The case of bees and their pollination services nicely illustrates the inadequacy of monetizing ecosystem services as a conservation strategy.

Most economists recognize that problems exist in the way the unregulated market economy allocates the use of the services the natural world provides. In spite of the general apathy toward the environment among economists<sup>3</sup> those specializing in environmental, resource, and ecological economics recognize the importance of a host of issues surrounding its use. Those who concentrate on ecosystem service tend to identify the problem as “market failure” and propose that the solution is to identify the valuable services of nature that have fallen through the market valuation cracks. The policy prescription is to determine the “correct” prices (social or shadow prices) so that these can be translated into market signals to rational agents who will initiate the process of efficient allocation.<sup>4</sup> In this vein the debates among those

economists and ecologists who concentrate on ecosystem services generally revolve around the appropriate economic valuation technique to use. The economic-environment conflict is seen as both theoretically tractable and practically resolvable within the confines of neoclassical theory and the market economy.

Those who believe the problem is primarily one of market failure (incorrect prices) are themselves a diverse group ranging from neoclassical environmental economists<sup>5</sup>, ecological economists<sup>6</sup>, to conservation biologists<sup>7</sup>. This diverse group has major differences concerning the best valuation approach, the degree of substitutability between natural and human-manufactured capital, and the place of environmental ethics in environmental policy, but when it comes to the belief that pricing nature and its services will allow the market to allocate efficiently the three camps are quite similar.

The enthusiasm for environmental service valuation arises from the underlying belief that once the “true” value of the contribution of the natural world to human well-being is known then it will be protected. But is this always the case? A highly publicized example from China suggests otherwise. Due to overuse of pesticides and the overharvesting of honey the population of bee pollinators has dramatically diminished in Maoxian County, China. As a result apple trees grown there now have to be pollinated by hand. The picture of a young girl pollinating an apple blossom using chopsticks has become an iconic symbol of the economic costs incurred when the benefits of ecosystem services are lost<sup>8</sup>. Yet our research suggests that replacing ecosystem services with human labor is efficient from a microeconomic (production function) perspective. Furthermore, replacing bees with human labor has the added benefit of increasing aggregate economic activity. Human pollinators have positive macroeconomic effects in terms of

Keynesian multipliers, not to mention the social value of employment. Human pollinators can recycle income, bees cannot.

We argue below that not only is the market valuation approach flawed, economic valuation in general offers only a partial explanation of the on-going catastrophic loss of biodiversity and ecosystem services. In suggesting an alternative we rely on Tinbergen's<sup>9</sup> distinction between proximate and ultimate causes. "Wrong prices" may be a proximate cause of ecosystem service losses but the ultimate cause is an ever-increasing reliance on logic of the market economy—an institutional arrangement that fundamentally alters the relationship of humans to the natural world and to each other, reducing complex relationships to a question of rational allocation using relative prices. To protect nature we need to recognize the complex institutional landscape of creating exchange value. The proximate-ultimate distinction offers an opening for environmental ethicists to enter the policy debate on an equal footing with economists.<sup>10</sup>

## **II. Apple Pollination and the Redundancy of Nature**

A survey completed in 2005 of apple growers in Maoxian<sup>11</sup> found the following: (1) average land holdings are very small, about 0.2 hectares, (2) farmers maintain a small proportion of pollinator trees (5-7%), well below the estimated minimum requirement of 20% with wild pollinators, (3) apple farmers use pesticides extensively, spraying 10-15 times each season, killing not only bees but other natural pollinators, (4) due to the pressure of maintaining high yields farmers prefer hand pollination since they feel that humans can ensure that each flower is pollinated. The county government actively encouraged hand pollination through its extension service beginning in 1990. As news of the productivity increase through hand pollination spread

throughout the county, the practice quickly spread. By 1997 almost all of the estimated 2000 hectares of apple orchards in the area were hand pollinated.

In January 2011 one of the authors (Chen) visited Maoxian County and conducted in-depth interviews with the major apple growers in the region. These discussions confirmed the results of the earlier survey and provided additional information about the economics of using human labor rather than bees for pollination. Apple growers estimated that apple production is 30-40 percent greater with human pollination as compared to relying on bees. Aside from the obvious benefit of pollination versus non-pollination, many apples need cross pollination which requires unproductive “pollinizer varieties” that are not commercially desirable and they take up land which could be used for more productive trees. Human pollination by hand minimizes the number of pollinizer varieties needed and maximizes the number of productive commercially viable varieties. Furthermore, human pollinators can work in windy and rainy weather when bees have greater difficulty. Apple farmers prefer to use human beings because by doing so they are able to have a more productive orchard from the perspective of total apple production. If wage costs are low and the potential for productivity increases sufficiently high, then it makes economic sense to use people instead of bees.

In Maoxian county replacing ecosystem services with human labor appears to be economically efficient and it has the additional benefit of increasing local economic activity. Another benefit impossible to quantify arises from the social nature of apple pollination by hand. The orchards are in mountainous regions with differences in elevation and the flower phase of every orchard differs. The different flowering times enable neighbors to help each other pollinate. Thus the labor “payment” is usually not in monetary terms but rather in-kind labor and is not so much an economic loss as it is a social benefit in terms of establishing closer

community ties. If the replacement of ecosystem services by humans has an undeniable economic logic then a reevaluation of ecosystem service valuation as a strategy for preservation of ecosystems is warranted.

The Maoxian case is not unique. A different but equally intriguing situation involving bees, market efficiency and agricultural technology has arisen in Fresno, California where oranges and almonds are produced. Almonds need bees to pollinate them and historically bee keepers have brought their bees to almond producing groves so their bees will have food and almonds will get pollinated. The bees also pollinate oranges and make orange blossom honey. Since the oranges bloom after the almonds, it is convenient for bee keepers to come and stay until both almonds and oranges are pollinated. But the problem is that citrus production technology in California is changing. Consumers want Clementines, a seedless citrus, which apparently self-pollinate and are now grown in the same areas as almonds and oranges. But if the bees spread the pollen from oranges blossoms to Clementine blossoms the latter end up with seeds which defeats the whole purpose of growing them<sup>12</sup>. Thus the pollination services of bees end up being an economic benefit to some and an economic liability to others.

We recognize the value of pointing out the contributions of nature to economic output. For example, the economic value of ecotourism alone is enormous.<sup>13</sup> Scholes and Biggs<sup>14</sup> found that nature-based tourism in southern Africa accounts for more revenue than farming, fishing and forestry combined. A UN funded study *The Economics of Ecosystems and Biodiversity* (TEEB) estimated that losses associated with the destruction of forests costs the world around \$2.5 trillion per year.<sup>15</sup> It is clear that preserving nature has quantifiable indirect economic benefits as well. A study by Markandya<sup>16</sup> et al. found that the precipitous decline in vultures in India has had substantial negative economic consequences including the increased costs of treating cattle

for diseases, increasing costs of combating rabies in dogs, and many other costs. Documenting and publicizing the straightforward economic benefits of nature conservation can be an effective way to preserve specific environmental features. Even so, placing economic values on nature can be extremely difficult and can quickly lead to dubious estimates of value. For example, Boyles et al.<sup>17</sup> estimated the decline in populations of white nosed bats in North America could lead to agricultural losses of more than \$3.7 billion per year. But the study ignores regional differences in crop production, land values, and bat distribution. Fisher and Naidoo<sup>18</sup>:

By ignoring this variation, the authors' approach to calculating the economic value of bat services is tantamount to calculating the nations' gross national product based on a county-wide extrapolation of steel production in Pittsburgh. Boyles et al.'s extrapolation results in the remarkable claim that the value of pest regulation by bats is roughly 50% of the total crop value in states such as Montana, Oklahoma, West Virginia, and Wyoming. Yet the predominant crop in the latter two states—hay—is a crop that *Helicoverpa zea* (the pest for which the original bat service values were calculated) does not affect.

It is understandable that those who wish to protect nature are eager to document the economic benefits of doing so. However, many of the attempts to monetize nature are so seriously flawed that they discredit the whole effort.

### **III. The Efficient Market Assumptions Underlying Ecosystem Service Valuation**

Many of the well-publicized attempts to value nature have been criticized for their faulty applications of standard methodology. Criticism of the underlying theoretical foundation of these studies has been less ambitious. So-called “state of the art” methods to quantify economic values are based on assumptions that are rarely critically assessed in the studies that use them.

Economic valuation models incorporate wildly unrealistic assumptions about the power and reality of our market economy and of human reason. Basing ecosystem valuation on discredited economic models gets us even further away from understanding the reality we need to change.<sup>19</sup> Numerous questionable assumptions of microeconomic analysis underlie the belief that the

market economy is capable of insuring the ‘ideal’ amount of ecosystem service provision. A few of these assumptions and the objections to them are:

1. *Features of the natural world can be correctly priced.* Some economists have argued it is impossible to meaningfully price irreplaceable natural resources for at least three reasons. First, future generations cannot bid on exhaustible and irreplaceable resources therefore their true market value can never be known.<sup>20</sup> Secondly, we cannot correct this incomplete market since we cannot possibly know the preferences of future generations.<sup>21</sup> There is a general, although by no means unanimous, feeling among economists that the well-being of future generations should be given equal weight to the well-being of those living in the present, that is, the rate of pure time preference should be near zero.<sup>22</sup> This implies that future generations should be allowed to bid on exhaustible and irreplaceable resources but they cannot because they are not yet present, and there is no way for the current generation to bid for them since their preferences are unknowable. Thirdly, ecosystems are so complex it is impossible to even describe them accurately much less reduce their value to a single number.<sup>23</sup> Norgaard<sup>24</sup> has pointed out that the use of the ecosystem service model has limited our understanding of complex ecosystems. Norgaard is critical of the influence of simplistic economic thinking on our understanding of rich and complex ecological relationships and complexity. He is concerned that:

[T]he implementation of the concept of ecosystem services has been on a project-by-project basis within existing national and global institutional structure.... Yet the driving motivation, from the initial use of the ecosystem metaphor to the implementation of PES [pricing ecosystem services] projects, has been to instigate significant institutional and consequent economic change in response to what are perceived to be very serious environmental problem generated by the economy we have.<sup>25</sup>

In his discussion of institutional change, however, Norgaard never questions the sanctity of the market economy, instead he advocates for understanding more fully how “markets and

institutions work together.”<sup>26</sup> This is an interesting delineation since the market economy is itself an institutional arrangement.

2. *Other (non-ecosystem) prices are correct.* This assumption is necessary since market choices depend on relative prices. If other prices are “wrong” because of market failures, out-of-equilibrium conditions, or government subsidies (to the agriculture sector for example), then relative prices may not reflect “true” values even if ecosystem services are “correctly” priced. The Theory of the Second Best<sup>27</sup> tells us that in a general equilibrium framework correcting one market failure and leaving the others alone may actually move us further away from Pareto efficiency, the notion that well functioning markets allow us to reach a point where no one can be made better off without making someone else worse off.

3. *Consumers are self-regarding and narrowly rational.* The ecosystem valuation approach must accept all the axioms of consumer choice to come to the conclusion that if ecosystem service prices are correct consumers will choose the socially optimal amount of these services. Social welfare is maximized by rational individuals expressing unfettered market choices. A large body of evidence suggests that people do not make economic decisions according to the economic definition of rationality.<sup>28</sup> A growing body of evidence on the “social brain” suggests that the model of *Homo economicus* strips away much of what makes us human.<sup>29</sup> The social nature of decision making calls into question the sanctity of individual-based market outcomes as an indicator of optimal social welfare.

4. *The value of ecosystem services in the future must be discounted.* The standard economic model is essentially a financial investment model describing the rational investment strategy of an individual acting at a point in time (the immediate present). From the point of view of an individual something is worth less in the future than it is now. The value of ecosystem services

must be discounted. Otherwise, since they last indefinitely, their value would approach infinity. The economic model values future states of the environment using a so-called social discount rate. But the discount rate is merely the individual discount rate adjusted for external effects.<sup>30</sup> The social good is merely the sum of the well-being of self-regarding individuals. Valuation decisions are stripped of their social context.

5. *Scarcity is the reason ecosystems and their services are now in jeopardy.* Scarcity and market failure are the explanations of how we come to be in our particular circumstances. Market failure is offered as the explanation for why scarcity does not register in market prices. Daily<sup>31</sup> claims that “For most of humankind’s experience on Earth, ecosystem capital was available in sufficient abundance, and human activities were sufficiently limited, that it was reasonable to think of ecosystems services as free. Yet today, Nature everywhere is under siege.” No one would argue against the notion that nature is under siege but the real explanation lies not in the relative scarcity of ‘natural capital’ but in our inability to fully comprehend the logic and dynamic of our economic system and how it has led us to this particular historical moment. In a similar vein Robert Costanza was asked in a Wall Street Journal commentary: “if ecosystems are worth more intact, why the heck are they being razed and paved? And surely it can’t be true that leaving America the way Europeans found it would make it worth more today than with its highways, railroads, factories and cities.”<sup>32</sup> Costanza acknowledged that these past conversions benefitted society as a whole but claimed that we have now come to the point where the marginal value of nature, because there is so little of it left, is much higher. Again relative scarcity is offered as the explanation. But scarcity only tells us that things have shifted but doesn’t give us any information about “why?” and “how?” and these are precisely what we need to understand.

The above criticisms of the standard economic model are well known and it is tedious to have to keep repeating them. But the discredited assumptions of welfare economics refuse to die a natural death and as long as they continue to dominate our discourse they must be confronted.<sup>33</sup> More importantly, we must move to construct an alternative way of understanding our predicament.

#### **IV. Beyond Free Market Utopia: Recognizing both Proximate and Ultimate Causes of Environmental Destruction**

The distinction between ultimate and proximate causation stresses the need for two separate and complementary explanations for all products of genetic and cultural evolution. Ultimate causation explains why a given trait exists, compared to many other traits that could exist, based largely on the winnowing action of selection. Proximate causation explains how the trait exists in a mechanistic sense. For example, ecosystems are being degraded and biodiversity is being lost because their prices are too low (proximate cause) but more importantly because of the way industrial capitalism evolved in terms of production techniques dependent on fossil fuels, the concentration of economic and political power, population growth, and the culture of consumption (ultimate causation). It is especially important to recognize the many-to-one relationship between proximate and ultimate causation, whereby many functionally equivalent solutions can evolve in response to a given environmental challenge.<sup>34</sup> Failing to distinguish between the institutional configuration of an economy and its specific manifestations can result in the inability to understand the driving forces behind ecosystem loss.

The literature concerning valuation reveals both a lack of concern about whether valuation is a satisfactory approach to conserving ecosystems and whether formidable if not insurmountable problems exist concerning the practical problems of valuation. In all the

controversies there is a sense that once the particular problem of valuation is resolved (incorrect prices) the economic institutions we now have in place will prove reliable in providing an efficient amount of conservation. For example, Gretchen Daily claims that “major innovations to our economic and social institutions are needed” to capture the value of ecosystems and their services and “incorporate it into day-to-day decision making.” Daily continues “The main challenge in the pursuit of this goal is that most ecosystem services are currently treated as “public goods,” which if provided for one are provided for all, no matter who pays.”<sup>35</sup> This is a decidedly “market failure” approach—wrong choices are made because the market prices are incorrect. The general principles delineated by Daily et al.<sup>36</sup> in the valuation of ecosystem services are: 1) public policy should be limited to non-revolutionary changes in the status quo (correcting for market failure), 2) values should be derived from aggregating individual preferences, and 3) these preferences should be revealed by observing actual behavior if possible. Robert Costanza also recognizes natural capital as an asset that needs a “correct” price attached to it. Costanza et al.<sup>37</sup> argue that the value of ecosystem services is best measured by the costs of replacement leading Paul Portney to argue “Equating nature with its replacement value is seductive, but from an economist’s perspective, a non sequitur. Something’s economic benefit is determined by how much people are willing to pay for it.”<sup>38</sup> Despite the debates about appropriate measures of value the solution to the goal of ecosystem service valuation is to capture the true prices of ecosystem services and incorporate them into day-to-day decision making. This is clearly viewed as the corrective measure.

While we are sympathetic to using the price mechanism to discourage the over-exploitation of nature, we claim that the ecosystem service approach deals only with proximate causes—it does not go far enough to get at the heart of the matter. The loss of ecosystems and

their services is not a problem that can be best understood or resolved in the context of market failure and finding the “correct” value of nature. The domain of institutional change must be entertained in a more dramatic way if we are to conserve the natural world through the great bubble of human economic activity embodied in the global economy. Ecosystem service valuation is extremely limited as an approach to conservation and it reduces ecological complexity in a way that impairs our ability to understand ecosystems. Ecosystem complexity is reduced to an accounting of the service they render to the human economy and as the case of the bees indicate-----sometimes human substitution for these services is the best economic option. Moreover we are never led toward fundamental questions of economic organization with this framework. In an economic system built around the logic of profit and growth and the ongoing problem of stagnation (both secular and cyclical) resolvable only with more growth this seems extremely problematic. Valuation may in some limited and localized cases help to preserve ecosystems and their services but this approach to ecosystem preservation is no substitute for a critical look at our economic arrangements. In order to understand the loss of ecosystems we must recognize the need to disengage from the imperialistic language of neoclassical economics and its ideological thrust and recognize that being “politic” is not necessarily the best approach to our momentous problem.

The purpose of economic activity throughout history is to reproduce the material existence of society but how this is done varies quite dramatically over time and space. It is more enlightening to think about economic activity as a gradual process of domestication and simplification of ecosystems, a process that alters and remakes the human/nature relationship and then to concentrate more fully on the specific ways in which this process is unique and particularly pernicious under our economic arrangements. The economic methodology for

valuing ecosystem services has no way to account for these differences in economic organization or for the more specific problems with our economic organization other than market failure and scarcity. Natural capital and ecosystem services are not historically specific rather they are categories of analysis that have no sense of history nor the institutional embellishment necessary to understand the difference between Native Americans harvesting oysters and clams for subsistence, and commercial fishing for profit.

The economies of the hunter/gatherer, feudal society and mature capitalism are very different. What seems to be universal about economic activity is that it always and everywhere involves human intentionality interjected into the human/nature relationship. The extent and purpose of that intentionality changes over time as does the way it is organized and its purpose. Sahlins<sup>39</sup> discussion of uneconomic man comes to mind---his wants are few and his resources are plenty because the technologies and the organization of his economy are very different than they are under global capitalism. It is a very different economic matter to manipulate the natural environment to feed and clothe a small band of people who want to limit their possessions to remain mobile than it is to produce, for profit, goods and services. That is, in an environment where accumulation is a necessity for economic survival, where economic expansion is constantly interrupted with periods of stagnation which themselves can only be resolved with growth and where the source of energy has been a robust endowment of fossil fuel whose waste products have accumulated in the atmosphere to an extent that a sixth great mass extinction is in motion. The point here is that economic activity is always about human intentionality *but the purpose and extent of that intentionality can and does change over time* and our analyses should capture this fact.

It is not clear that the loss of bees in Maoxian Province constitutes a loss in marginal value high enough to preserve bees. In fact, the replacement of bees with human labor is worth it in both micro- and macroeconomic terms when viewed from the narrow perspective of ecosystem services. One is inclined to quip---yes but there is an overabundance of labor in China shifting the relative value of scarce inputs from bees to humans. While this is true we should keep in mind that unemployment seems to be a chronic problem of advanced capitalism. Whether or not human existence is made better off without bees is another question entirely. And what the long term and integrated effectives of the loss of bees are on ecosystem integrity is also another question that may have little to do with our material reproduction narrowly construed.

The natural capital approach to conservation is based on a financial investment model making “optimal” preservation of the natural world an outcome of economic self interest. Daily<sup>40</sup> makes this explicit: “Conservation can’t succeed by charity alone. It has a fighting chance, however, with well-designed appeals to self-interest.” For Daily, conservation has its best chance if a price is attached to ecosystem capital and then markets are created to allocate. Garrett Hardin<sup>41</sup> made the same point in his rejection of appeal to conscience as an effective policy for population control. Hardin strongly condemned appeals to the common good: “But what is the meaning of the word ‘conscience? When we use the word responsibility in the absence of substantial sanctions, are we not trying to browbeat a free man in a commons into acting against his own self interest?”

Ecosystem service valuation assumes that ecosystem services are valuable; that when bees disappear there is a cost that was not anticipated because it was never accounted for in the first place. But what happens when it makes economic sense to replace these services by humans

anyway? There are many instances in which human labor, intentionally applied, can substitute for services provided by nature. And certainly, in the case where we want to rationalize production, human intentionality might be the best option. The valuation of ecosystem services will never provide us with a clear picture of how to reconcile our economy with the ecological limits of the planet. In fact, one could just as easily make the argument that in a mature market economy, plagued by unemployment and overproduction, a new service economy can be created by replacing ecosystem services by labor intensive, human intentionality wherever possible.

#### **V. The Alternative to Market Valuation: Saving the Bees by Recapturing the Commons**

What is it about our way of living and associated ways of thinking that puts so little value on the future of the planet? We argue above that a major reason is the narrow logic of the global market economy which values nature solely on its contribution to the discounted present value of economic activity. Following the logic of the market, the dominant economic model views the natural world from the financial investment perspective of an individual at a point in time. But the magnitude, suddenness, and long-term consequences of the current human abuse of the natural world calls for a radical new approach to economic organization, one based on a “deeper sense of time.”<sup>42</sup> Such an approach would move beyond attempts to “correctly price” nature based on imputed market values and would instead rely on a more critical perspective on economic organization, a concern for future generations and an assessment of the right place of humans in the nonhuman world.

This advice is of course “old hat” to environmental ethicists and the question remains “how do we do this?” How do we go beyond our preoccupation with “proximate solutions” (in this case tinkering with markets) to ultimate solutions (changing the institutions that govern our relationship to the natural world)? We might begin by acknowledging that humans lived

sustainably as hunter-gatherers within the confines of local ecosystems for 95 per cent of our existence as a species. This is not a call to return to the past but rather an attempt to explore in a more full-bodied way what it means to live as humans in a ecologically and economically balanced way. In the past our well-being as a species depended directly on the sustainable use of local ecosystems. For a variety of reasons, including tapping into the stock of the earth's stored carbon energy, we broke out of the confines of local ecosystems and convinced ourselves that we were somehow unconstrained by the evolutionary context—the web of life—that shaped us. We now find ourselves once again coming up against biophysical limitations, this time imposed by the entire finite planet.<sup>43</sup> We also come up against the prospect of leaving a dramatically diminished planet once we navigate our way through our present bubble.

Over the past few decades reasoned public discourse and participatory democracy has been taken over by the let-the-market decide mentality. Bromley<sup>44</sup> describes this dynamic:

Suddenly, it seems that public policy is not what we thought it was. Democracy as public participation and reasoned discourse is somehow suspect—not to be trusted. It seems that the public's business cannot be properly conducted unless it adheres to the precepts of individualistic models of “rational choice” applied to collective action.

The neoliberal public policy prescription is to set markets in motion and then let efficiency in allocation determine the socially optimal outcome. It is based both on an unrealistic notion of human behavior and an unrealistic notion of what the market economy is all about. In terms of the valuation of nature, this prescription requires only that prices be “correct” and that property rights are fully specified. Moreover, it moves “democracy” from “one person, one vote” to “one dollar, one vote”. And as this happens social stability and environmental sustainability are eroded in the name of efficiency, individualism, and the belief that the market economy somehow channels individual choice into social welfare and is therefore sacred.

Environmental valuation must capture the fact that human society is more than a collection of isolated individuals acting only in their narrowly defined self-interest. The market economy is no more the 'natural order' of society than another institutional arrangement. In contrast to the economic model, recent evidence from such diverse fields as anthropology, behavioural science, psychology, and neuroscience has established that humans are unique among mammals as to their degree of sociality.<sup>45</sup> This means there are clearly multitude ways of structuring society. We have only to look at the example of the Kalahari Bushmen and their relationship to bees to know this is so. Laurens van der Post<sup>46</sup> tells us of the Bushmen "He loved honey with a passion that we, with a sweet-shop on every corner, cannot hope to understand....the taste of honey to the Bushman was like the light of the fire to his eye, and the warmth of its ruby flame in the black night of Africa." Yet this desire for honey did not move the Bushman to domesticate and dominate the bee, rather it heightened his sense of observation and embeddedness so that the Bushman could follow a bee line to find out where a hive resided long after other individuals could no longer discern the flying bees in the distance. The Bushman temporarily subdued the bees in order to steal some of their honey. They valued the honey because it was wonderful and yes, scarce. Yet nowhere in this mix was there ever any question that Bushman would become bees.

We are taught by the example of the Bushmen that in a different place and time and under different conditions the relationship between people and the natural world was decidedly different. In the case of the Bushmen their keen sense of observation coupled with humility and imagination honed them to their surroundings and allowed them to reproduce a rich life in a place most of us would find uninhabitable. In our image of what is to come we should not forget their example.

Market valuation is an exercise for people who have lost all sense of ecological embeddedness. This is us the global economic human of the 21<sup>st</sup> century. Yet with a deep sense of time and an appreciation for the ability of humans to socially construct themselves it is not impossible to imagine other ways of relating to the natural world. To do so means we have to let go of the language that imperializes our discourse and we have to understand our economic system for what it is and for the disastrous ecological balance that has ensued in its wake. This might point us in the direction of a more effective environmental policy design and it is an answer to libertarian-leaning environmentalists who subscribe to a narrow view of “choice.”<sup>47</sup>

## Footnotes

1. Nicholas Georgescu-Roegen, 2010
2. Ed Barbier, “Valuing Ecosystem Services as Productive Inputs,” *Economic Policy*, January (2007): 177-229; Gretchen Daily et al., “The Nature of Value and the Value of Nature,” *Science* 289 (2000): 395-396; Geoffrey Heal, *Nature and the Marketplace* (Washington, DC: Island Press, 2000).
3. Partha Dasgupta, “Nature in Economics,” *Environmental and Resource Economics* 39 (2008): 1-7.
4. Partha Dasgupta and Geoffrey. Heal, *Economic Theory and Exhaustible Resources* (Cambridge: Cambridge University Press, 1979); Heal, *Nature and the Marketplace*.
5. Barbier, “Valuing Ecosystem Services,”; Partha Dasgupta and Karl Gören-Mäler, “Net National Product, Wealth and Social Well-Being,” *Environment and Development Economics* 5 (2000): 69-93.
6. Mick Common and Sigrid Stagl, *Ecological Economics: An Introduction* (Cambridge: Cambridge University Press, 2005; Robert Costanza et al., “The Value of the World’s Ecosystem Services and Natural Resources,” *Nature* 387 (1997): 253-260; Herman Daly and John Cobb Jr., *For the Common Good. Redirecting the Economy Toward Community, the Environment, and a Sustainable Future* (Boston: Beacon Press, 1994).
7. Daily et al., “The Nature of Value,”; Stuart Pimm, “The Value of Everything,” *Nature* 387 (1997): 231-232.
8. Freya Matthews, “Planetary Collapse Disorder: The Honey Bee as Portent of the Limits of the Ethical,” *Environmental Ethics* 32 (2010): 353-367 argues that “The disappearance of honeybees is a portent not merely of physical demise, nor merely of ethical catastrophe, but something more ultimate: the unraveling of the larger context of meaning itself, the context in which ethics and even extinction can matter.”
9. Niko Tinbergen, “On Aims and Methods in Ethology,” *Zeitschrift für Tierpsychologie* 20 (1963): 410–433.
10. Robert Frodeman, “The Policy Turn in Environmental Ethics,” *Environmental Ethics* 28 (2006): 3-20.
11. Uma Partap, and Tej Partap, “Pollination of Apples in China,” *Bees for Development Journal* (September 2, 2005).
12. Tracie Cone, “Tangerine Growers Tell Beekeepers to Buzz Off,” Associated Press, November 1, 2009. At [http://www.seattlepi.com/national/395428\\_tangerines10.html](http://www.seattlepi.com/national/395428_tangerines10.html)

13. A. Balmford, A., J. Beresford, J. Green, R. Naidoo, M. Walpole, A. Manica. "A Global Perspective on Trends in Nature-Based Tourism," *PLoS Biology* 7 (2009): e1000144. Doi:101371/journal.pbio.1000144
14. R. Scholes, R. and R. Biggs, *Ecosystem Services in Southern Africa: A Regional Perspective* (Pretoria: Council for Scientific and Industrial Research, 2004).
15. Pushpam Kumar, (editor) *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations* (London: Earthscan, 2010).
16. A. Markandya, T. Taylor, A. Longo, M. Murty, S. Murty, K. Dhavala, "Counting the Cost of Vulture Decline—An Appraisal of the Human Health and Other Benefits of Vultures in India," *Ecological Economics* 67 (2008): 194-204.
17. J. Boyles, P. Cryan, G. McCracken, T. Kunz, "Economic Importance of Bats in Agriculture," *Science* 332, (2011): 41-42.
18. Brendan Fisher and Robin Naidoo, "Concerns about Extrapolating Right off the Bat," *Science* 333, (2011): 287.
19. Jack Knetsch, "Gains, Losses, and the US-EPA *Economic Analyses Guidelines: A Hazardous Product?*" *Environmental & Resource Economics* 32 (2005): 91-112; Clive Spash, "Deliberative Monetary Valuation and the Evidence for a New Value Theory." *Land Economics* 84 (2008): 469-488.
20. Nicholas Georgescu-Roegen, "Energy and Economic Myths," Reprinted in *Energy and Economic Myths* (San Francisco: Pergamon Press 1976: 3-36).
21. Arild Vatn and Daniel Bromley, "Choices without Prices without Apologies," *Journal of Environmental Economics and Management* 26 (1994): 129-48.
22. Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, UK, Cambridge University Press, 2007).
23. David Ehrenfield, "Why put a Value on Biodiversity? In *Biodiversity*, E.O. Wilson (ed), (Washington, DC: National Academy Press, 1988); Vernon Rull, "The Candid Approach," *EMBO Reports* 11 (2010): 14-17.
24. Richard Norgaard, "Ecosystem Services: From Eye-Opening Metaphor to Complexity Blinder," *Ecological Economics* 69 (2010): 1219-1227.
25. Ibid.
26. Ibid., p. 1225.

27. Robert Lipsey and Kevin Lancaster, "The General Theory of Second Best," *Review of Economic Studies* 24 (1956): 11-32.
28. John Gowdy, "Behavioral Economics and Climate Change Policy," *Journal of Economic Behavior and Organization* 68 (2008): 632-644; John Gowdy, "Terms and Concepts in Ecological Economics," *Wildlife Society Bulletin* 28 (2000): 26-33.
29. U. Frith and C. Frith, "The Social Brain: Allowing Humans to Boldly go where no other Species has Been," *Philosophical Transactions of the Royal Society B* 365 (2010): 165-175.
30. Lisi Krall, L. and John Gowdy, "An Institutional and Evolutionary Critique of Natural Capital " In *Toward an Integrated Paradigm in Heterodox Economics – Alternative Approaches to the Current Eco-Social Crises*. Rolf Steppacher and Julien-François Gerber (editors) (London: Palgrave-Macmillan, forthcoming).
31. Daily, et al., "The Nature of Value".
32. S. Begley, "Furry Math? Market has Failed to Capture True Value of Nature," *Wall Street Journal*, New York, N.Y., Aug 9, 2000.
33. See John Quiggin, *Zombie Economics* (Princeton, NJ: Princeton University Press, 2010).
34. David Sloan Wilson and John Gowdy, "The Relevance of Evolutionary Science for Economic Theory and Policy," "White paper for NSF SBE Program Initiative "Framing Research for 2020 and Beyond", 2010, Available at <http://evolution-institute.org/files/NSF-EvoEco-White-Paper.pdf>
35. Gretchen Daily, *The New Economy of Nature: The Quest to Make Conservation Profitable* (Publisher 2002).
36. Daily et al., p. 356.
37. Costanza et al.
38. Begley.
39. Marshall Sahlins, "The Original Affluent Society," In John Gowdy (editor), *Limited Wants, Unlimited Means: A Reader on Hunter-Gatherer Economics and the Environment* (Washington DC: Island Press, 1998).
40. Daily, *The New Economy of Nature*, p. 12.
41. Garret Hardin, "The Tragedy of the Commons," *Science* 162 (1968): 1243-48.
42. S. Wing, "We Need a Deeper Sense of Time," *Science* 333 (2011): 825.

43. Niles Eldredge, *Dominion* (Berkeley: University of California Press, 2005).
44. Daniel Bromley, "Environmental Regulations and the Problem of Sustainability: Moving Beyond 'Market Failure'." *Ecological Economics* 63 (2007), 677.
45. B. Chapais, "The Deep Social Structure of Humankind," *Science* 331 (2011): 1276-1277, Bruce Wexler, *Brain and Culture* (Cambridge, MA: MIT Press, 2006).
46. Laurens van der Post, *The Lost World of the Kalahari* (New York: William Morrow and Company, (1958) 1966).
47. Bryan Norton, "Review of Mark Sagoff, *Price, Principle and the Market*," *Environmental Ethics* 27 (2005): 319-322.