On the Economic Value of Ecosystem Services

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ABSTRACT

The productive services of nature, such as the ability of fertile soil to grow crops, receive low market prices not because markets fail but because many natural resources, such as good cropland, are abundant relative to effective demand. Even when one pays nothing for a service such as that the wind provides in pollinating crops, this is its 'correct' market price if the supply is adequate and free. The paper argues that ecological services are either too 'lumpy' to price in incremental units (for example, climatic systems), priced competitively, or too cheap to meter. The paper considers counter-examples and objections.

KEYWORDS

Ecosystems, valuation, economics

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INTRODUCTION

In an early and (especially for me) influential paper, Alan Holland and Jeremy Roxbee-Cox question the assumption found in economic theory that preference or its satisfaction has intrinsic value.[1] They refer to Pearce and co-authors who state, 'Values ... reflect people's preferences.'[2] Holland and Roxbee-Cox propose 'to replace the view that values reflect preferences with the view that preferences reflect values'. In that case, one must go behind a preference to the value it reflects to see if and why it should be considered significant from a social or policy point of view. To be sure, people should be free to try to satisfy their own preferences under rules and within institutions that secure and promote the same liberty for others. To be sure, society has an obligation to help with certain kinds of preferences, for example, basic needs (according to a theory of justice), security (according to any political theory), and merit goods (if it wishes). Holland in several important papers rejects the idea that it is an objective of social policy to seek to satisfy each and any preference ranked by willingness-to-pay and taken simply as it comes.[3]

Holland has advanced this position – with which I entirely agree – against those who believe in principle that the prices at which goods trade in efficient markets respond to preferences and therefore measure the value of those goods. These commentators contend that where markets fail to establish prices for environmental goods economists can and should attribute prices to them on the basis of the amounts people are willing to pay to satisfy their preferences. According to one prominent ecological economist, 'Moral arguments are not enough – we have to make nature a regular column in our spreadsheets and cost-benefit analyses, so that natural assets are properly valued in our decisions.'[4]

In this essay honouring Alan Holland, I shall argue that markets already assign efficient or competitive prices to goods ecological economists identify as 'natural capital' or as 'ecosystem services', even if these goods are 'too cheap to meter' and thus even if the price is often zero. I agree with Holland that moral, aesthetic, cultural and spiritual arguments are enough; they provide compelling reasons to preserve the magnificent aspects of the natural world. I question whether there is any ecosystem product or service which does not already receive a more or less objective market price – and thus which should be given a 'shadow' or imputed price in our spread sheets and in our cost-benefit analyses.

THE ECONOMIC VALUE OF NATURE

At the time Europeans began to colonise the New World, John Locke compared land values in Great Britain to land values in America.

> An acre of land that bears here twenty bushels of wheat, and another in America, which, with the same husbandry, would do the like, are, without doubt, of the

> same natural, intrinsic value. But yet the benefit mankind receives from one in a year is worth five pounds, and the other possibly not worth a penny…[5]

Many ecologically-minded economists today describe as 'ecosystem services' or as 'natural capital' what Locke called the 'natural, intrinsic value' of land. In 1997, a group of ecological economists estimated the economic value of ecosystem services and related natural capital at between $16 and $54 trillion per year.[6] Locke reasoned on the contrary that the labour accounts for nearly all the benefit land yields. 'Labour makes the far greatest part of the value of things we enjoy in this world: And the ground which produces the materials is scarce to be reckoned in, as any, or at most, but a very small part of it.'[7] Locke suggested that labour accounts for the economic value of agriculture, while what we call ecosystem services are 'possibly not worth a penny'.

Locke supported his conclusion in part by defending a labour theory of economic value. For Locke, labour functioned as an essential ingredient that turned otherwise useless materials into useful goods. He wrote, 'Land which is wholly left to Nature, that hath no improvement of Pasturage, Tillage, or Planting, is called, as indeed it is, *waste*; and we shall find the benefit of it amount to little more than nothing.'[8] Economists following Locke, including Ricardo and Marx, whether simply to explain economic activity or also to justify it, endorsed the idea that the amount of labour inherent in an object determines its economic value. Because Karl Marx saw economic value as an inherent or intrinsic quantity and located it in the contribution of labour, he like Locke concluded that natural materials obtain value only when mixed with labour. 'The purely natural material in which human labour is objectified … has no value.'[9]

It would be hard to find an economist today – especially an environmental economist – who endorses a labour theory of economic value either to explain why goods trade as they do or to provide a normative basis for economic valuation. Environmental and ecological economists today, however, generally accept the idea that economic value represents or refers to an intrinsic or inherent essence to which they attach normative significance. They may adopt one of two different conceptions of the normative factor that makes one good more valuable economically than another. Environmental economists in the tradition Holland criticises believe that the satisfaction of preference ranked by willingness to pay (WTP) is inherently or intrinsically valuable.[10] Ecological economists, in contrast, locate the source or nexus of value in the natural world, for example, in free energy, net primary productivity, 'emergy', 'exergy', or some other factor thought to limit production.

Ecological economists might follow Nicholas Georgescu-Roegen in arguing that the essential value-giving limit on production has to do with the fund-flow of low-entropy resources;[11] they might agree with Paul Ehrlich and others that net primary productivity (the product of photosynthesis) constrains economic growth;[12] or they may refer to various limits imposed by 'natural capital'.[13] It makes no difference, however, whether you agree with Locke or Marx that

labour is the essential element, with welfare economists who equate 'benefit' with preference or WTP, or with ecological economists who develop concepts such as 'emergy' to define what is intrinsically economically valuable. What is important is not how these positions differ but what they have in common, that is, a commitment to the idea that economic value is a measurable quantity – whether physiological (labour), psychological (WTP) or material (low entropy resource flows).

I think on the contrary that nature has no economic value. The reason is not that nature does not benefit us in every way – of course it does – but that nothing has economic value. The phrase 'economic value' has no coherent reference. Economists from Locke to Marx thought the term referred to the input of labour, but it is hard to find anyone who propounds this view seriously today. Ecological economists use the term to refer to a construct, such as 'emergy', 'low entropy resource flows', or something of that sort I do not presume to understand. Welfare economists equate 'economic value' with WTP but no one has ever shown empirically a correlation between WTP and any conception of the good – e.g., 'welfare', 'benefit' or 'well-offness' – not trivially and vacuously defined in terms of it. No one has measured *use value*, *benefit* or *utility*, for example, to test whether or not it varies with embodied labour, embedded energy or willingness to pay. Economists simply use terms like 'utility' or 'benefit' as logical proxies, stand-ins or equivalents for whatever they think is the source of value. The term 'economic value' may be defined in whatever way one likes – some like to define it in terms of WTP, others in terms of energy flows, and still others in terms of labour – but it has no testable, defensible, non-circular normative meaning or content.

To repeat the mantra I have intoned earlier: having a preference gives the individual a reason or at least a motive to try to satisfy it. Everyone agrees he or she should be free to try to satisfy that preference under rules and within institutions that assure the same freedom to others. The existence of that preference or that WTP in itself, however, makes no legitimate or intelligible claim on society. As Holland has argued, we have to determine whether the preference or WTP reflects a value society has reason to satisfy or that individuals have reason to want. To be sure, the amount someone is willing to pay for something correlates with its 'utility' if 'utility' is measured in terms of the amount he or she is willing to pay for it. There is no way beyond this tautology get from WTP to value from a social point of view.

I agree, then, with the Austrian school of thought which believes that economists should focus on two concerns. The first is to explain the nuances of Smith's 'invisible hand', in other words, to explain '…how within a specific set of institutional arrangements the power of self-interest can spontaneously generate patterns of social order that simultaneously achieve individual autonomy, generalised prosperity, and social peace'.[14] Competitive price signals lead consumers to bargains and producers to opportunities; prices are crucial to

guide economic activity in the direction of prosperity. They are not of themselves measures of value. A commentator on Ludwig von Mises has written that for him 'use values' or economic benefits, being subjective, '…did not allow for the appropriate coordination of individuals' actions. Such a measure was only afforded by [competitive] money prices for goods and services.'[15]

The second task, as Friedrich Von Hayek wrote in *Scientism and the Study of Society* is 'for human reason rationally to comprehend its own limitations'. These limitations defeat '…the characteristic and ever-recurrent demand for the substitution of *in natura* calculation [of value] for the 'artificial' calculation in terms of price'.[16] Hayek's essay, which refutes current trends in both environmental and ecological economics in advance, argues that it is beyond our capacity to calculate value objectively, for example, in terms of units of labour, energy, WTP or whatever (O'Neill 2004). Libertarians throw cold water on utopian delusions such as the scientific measurement of 'value' by reminding us that the economic problem is co-ordination not valuation. The solution is to structure property rights to turn liberty into prosperity, not to put scientists in charge.

PRICE IS LOW WHEN SUPPLY EXCEEDS DEMAND

In 1819, James Maitland, Lord Lauderdale, reasoned that any good that nature provides plentifully, no one has any reason to purchase. It cannot fetch a price in a competitive market, even where markets for it exist, and so it has no exchange value – that is, no one can get anything in exchange for it. The result is a paradox. The more freely and lavishly nature benefits us, the lower the price the 'marginal' unit of a natural product or service will fetch or, to say the same thing in other words, the less exchange value nature will possess.[17]

The principal condition for production, exchange and therefore economic value, Lauderdale argued, is scarcity. He defended two principles: (i) 'That things [with desirable qualities] are alone valuable in consequence of … existing in a certain degree of scarcity; (ii) That the degree of value which every commodity possesses, depends upon the proportion betwixt the quantity of it and the demand for it'. For Lauderdale, 'economic value' should be understood in terms of what Adam Smith called 'value in exchange' or what can be obtained in exchange for that good. Value thus defined can be located at the intersection of supply and demand for the incremental unit of that good, i.e., at its price in a competitive market. Economic theory suggests that competition drives consumer prices down to producer costs. Goods which cost the least to produce – no matter how beneficial they may be – will fetch the lowest prices, especially if supply vastly exceeds demand.

That the market price or 'value in exchange' of a good is negligible tells one nothing about its utility or its 'value in use'. Price has to do with the relation of supply and demand not with the benefit a good provides. Every breath you

take – each 'marginal' or 'incremental' unit – is exigent, life-giving and beneficial. That you breathed a lot yesterday does not make the air any less valuable today. As long as the air you breathe is abundant and free, its price is zero. As this and any number of other examples suggest, no equivalence holds between price paid and marginal benefit.

Advances in technology, by driving down the cost while increasing the quality of a good, lower its competitive market price while increasing the benefit of the next or incremental unit purchased. The consumer pays much less for his or her 'marginal' purchase but obtains the same or a greater benefit. Any phone call may soon be free – the Internet already allows this – and thus it will have no market price. The benefit of a call to 911, to your bookie, or to your broker remains he same. When the antibiotic Cipro lost its patent, generic equivalents appeared at a tenth of the price. The 'next' prescription may do you just as much good even if you pay ten times less. Those who are early to market because their need is greatest get the best deals; they benefit more but pay less than others. For example, if you offer me a $1 million honorarium to speak to your group a year from now, I will purchase my airline ticket now at a low price. The benefit of travel is immense, the price negligible. The person in the next seat, who may be travelling on far less urgent business, may have paid much more merely because he booked later. The price is higher, the 'marginal' benefit lower for exactly the same ticket.

If price paid corresponded to 'marginal' benefit, doctors should never recommend and the government never approve inexpensive drugs since they could not be effective. Only when the benefit one obtains from a good – the house one owns, for example – falls below the market price will one offer it for sale. That very few houses go on sale – even though real estate prices go up – suggests that consumption benefits are much greater than market prices for these goods. In other words, market price does not reflect 'consumer surplus'. When prices go up, so will WTP, because a lower price cannot be found in the market. This does not show that the price paid equals the expected benefit 'at the margin' or marginal WTP but only that price may be seen as a lower bound on valuation.[18]

FOUR EXAMPLES

I shall now describe four examples – water, timber, the pollination services of insects, and biodiversity – in which markets correctly or efficiently price natural capital and ecosystem services at often negligible prices. One could also easily add cropland (or the fertility of the soil) since the rent the farmer pays on land is included in the price of food, and this rent – as it did in Locke's time – amounts to little more than a penny or two on the dollar.[19]

Fresh Water

What has value – what is scarce relative to demand – is not water, which is superabundant, but either 1) residential real estate close to the sources of water or 2) the labour and technology needed to transport water to where it is consumed. Fresh water is a resource that nature provides through the hydrological cycle in vaster quantities than humanity can use. The sun evaporates water from the oceans, the wind moves the clouds to land, and the distilled water precipitates over the earth, but in some places more than in others. Overall, humanity uses about 2,100 km^3 of fresh water a year – one-fiftieth of the amount that precipitates over land. The runoff from rain that is accessible – rainwater that is collected behind dams or in lakes, rivers or aquifers near large human populations – equals slightly more than one-tenth of the total rainfall on land or 12,500 km^3 annually. This provides 10 times more water than the average European and three times as much as the average American consumes.[20]

For the residents of New York City, like those of many municipalities, abundant, pure, clean rain water falls like manna from Heaven; it has little 'exchange' value. City residents must pay, however, for expensive dams, reservoirs, pipes and tunnels, in other words, capital improvements, to gather and deliver the water from upstate sources, primarily the Catskills watershed. People who live in the watershed are required (and often subsidised) to build septic systems because nature will not treat their sewage for them. Since the 1920s, the City has chlorinated its water in part to kill fecal bacteria and other pathogens associated with the wastes produced by 350 vertebrate species that thrive the region. In the reservoirs, 'the background contamination from wildlife populations is apparent'.[21]

According to suburban legend, New York City authorities determined that that 'preserving habitat in the watershed and letting the ecosystem do the work of cleansing the water'[22] was worth the price of buying up land and development rights 'to restore the functioning of the watershed ecosystems responsible for water purification'.[23] If any of this had actually happened, it could offer an example of a willing buyer (New York City) who purchased land or development rights and thus put a market price on an ecosystem service, namely, on the ability of natural habitat and biodiversity to disinfect and purify water. That the story represents a fiction or fabrication does not matter because it demonstrates the 'correct' academic theory.[24] As Thompson has written, 'One should have a healthy dose of scepticism regarding how often water companies, local governments and other entities will find it worthwhile to preserve watershed lands.'[25]

Fibre

The transition from hunting and gathering in the wild to plantation-based industry, expected to occur in fisheries over the next two decades, has largely taken place in forestry. According to a report in *Issues in Science and Technol-*

ogy, 'The United States today finds itself in a world of timber surpluses and increasing competition'. Industrial tree plantations are rapidly underpricing and out-producing wild forests. 'Particularly important has been the expanded use of intensively cultivated, short-rotation tree plantations in temperate and subtropical regions of the Southern Hemisphere. These 'fiber farms' have proved to be extraordinarily productive.'[26]

When farming declined the region east of the Mississippi reforested. In a fine article, nature writer Bill McKibben celebrates the resurrection of the Eastern forests to their pre-Columbian expanse. He quotes a Forest Service official who wrote that the forest of the East and South '…has come full circle. By the 1960s and 1970s, the pattern of forest, fields and pastures was similar to that prior to 1800, its appearance much like it must have been prior to the American Revolution.'[27] A survey of 50 nations in the boreal and temperate world found results similar to those of the eastern USA. In the 1990s, the forest biomass in every one of these countries increased.[28]

So much timberland now exists in the USA and so much inexpensive pulp and paper can be shipped in from South America – a 10 per cent tariff followed by stiff quotas has reduced the glut of lumber easily imported from Canada – big firms are selling off forest holdings to conservation groups, speculators, developers and individuals. In 2004, International Paper announced its decision to sell 5.1 million acres of timberland in the USA**,** an area larger than Massachusetts. In separate deals arranged by the Nature Conservancy and the Conservation Fund, the company sold a million acres for aesthetic preservation.

The demand for forests as objects of love and appreciation seems more robust than the demand for them as sources of timber. 'Based on market components', said David Liebetreu, International Paper's vice president for forest resources, 'our forestlands are worth a lot more to other people than they are to us'.[29] According to a newspaper account, urbanites 'are looking for play forests and country home sites'.[30] A forest appraiser involved in these land transfers opined, 'It used to be that timber production was the primary objective for someone buying timberland, but today, recreation and investment is their main motive'.[31]

The transition we are seeing from capture fishing to aquaculture and forestry to silviculture is unsurprising. Environmental economists such as John Krutilla had noted decades ago that advancing technology has 'compensated quite adequately for the depletion of the higher quality natural resource stocks'.[32] If an ecosystem service – such as the provision of wild turkeys – becomes scarce, advances in technology supply substitutes and drive prices down. A hundred million turkeys appear at very low prices on dining tables on Thanksgiving without anyone firing a shot. Krutilla observed that 'the traditional concerns of conservation economics – the husbanding of natural resource stocks for the use of future generations – may now be outmoded by advances in technology'.[33]

Biotechnology can even create better products at lower prices – wood, for example – than intact natural ecosystems. Transgenic trees offer the same ad-

vantages – fast growth, cold-hardiness, uniform and predictable quality, disease resistance, etc. – as transgenic fish. According to Roger Sedjo, 'High-yield plantation forestry has the potential to meet the world's industrial wood needs while simultaneously protecting existing natural forests and thereby conserving their environmental values.'[34]

Insects

In his famous 'Canticle of the Creatures', St. Francis of Assisis praises God for the work of 'Father Sun' and 'Sister Moon'. One might ask if praising God for the diurnal rotation of the Earth properly 'values' this gift to us. Why not put a 'price' on the work of the sun and the moon; why not compute our WTP for the force of gravity which keeps us all from floating off into space? In 'St. Louis Blues', Bessie Smith wailed, 'I hate to see the evening sun go down'. Maybe she did. We would all be willing to pay a lot, however, not to see it coming up.

One could not imagine a more fatuous, deluded and irrelevant pastime than to try to compute the losses that would occur if gravity dwindled in power, the moon no longer lit the night, or the sun refused to shine. Since none of these scarcities is in the cards, it is a waste of time to worry about them. I want to argue that this is generally true of the ecological services to which many environmentalists seek to attach economic values. It serves as little purpose to consider what losses would occur in the absence of the labour of insects, for example, as what losses would occur in the absence of the force of gravity, the sun, microbes, photosynthesis and so on and on.

Everyone recognises the 'vital ecological services provided by insects'.[35] The important or relevant question is whether any of these services is scarce enough – whether the demand for it so exceeds the free supply – that it could conceivably generate a competitive market price. Consider, first, pollination, especially the pollination of crops, which 'is perhaps the best-known ecosystem service performed by insects'.[36] To associate an economic value with this service we could try to estimate the price which an incremental unit of it would fetch in a competitive market. To see how this could be done, consider the basic cereal crops, wheat, rice and maize or corn. These are all wind pollinated. If you take bellows to Kansas and offer to blow pollen around the fields, you will not be hired. There is no demand for additional wind. In this example, pollination has a zero price because there is so much of it anyone can have all he wants for nothing.

The same analysis applies to insect pollinators if they function as ubiquitously and freely as the wind. One could as meaningfully try to estimate what society would pay – or how much it would lose – if it had to find some substitute for insects (in insect-pollinated crops) as for wind (in wind-pollinated crops). In a study of the economic value of the ecological services provided by insects, John Losey and Mace Vaughan have written, 'We base our estimations of the

value of each service on projections of losses that would accrue if insects were not functioning at their current level.'[37] To show how price is relevant, however, one must demonstrate the prospect of scarcity, in other words, the prospect that someone might be interested in purchasing the next or incremental unit of the service.

A good way to determine whether agricultural production is ever limited by the human-caused decline of pollinators is to find out if bee-keepers are hired to employ their hives to provide pollination services nature once supplied. The prices bee keepers receive for the pollination services of their bees could be ascribed to the loss of a natural service if, indeed, native or natural pollinator populations had declined. It is extremely difficult to get data, however, that tells what rents may be paid to apiarists to make up for a lost ecosystem service rather than to provide a service nature never supplied.[38] The leading paper in the field notes that that even when the local decline of a pollinator has affected production (of blueberries in New Brunswick, for example), 'it did not affect the overall market price for blueberries because that was set elsewhere by broader, regional effects'. The essay observes bleakly that 'the economic impacts of pollinator declines have not been well recorded' and pleads for more data.[39]

Losey and Vaughan point out that dung beetles decompose (often by burying) the waste cattle produce on the range, 'resulting in significant economic value for the cattle industry'.[40] They estimate this 'economic value' as the losses the industry would incur in the absence of dung beetle activity. No one suggests, however, that dung beetles are becoming scarce. If you set up a stand on a highway in Texas advertising 'Dung Beetles for Sale', it is doubtful that anyone would stop but the police. You would do as well with your dung beetle business in Texas as with your bellows business in Kansas.

In fact, if you permit me to anthropomorphise, I would suggest that the cattle industry pays the beetle for its work. Indeed, the cattle industry has created dung beetle Heaven. Any rancher within the natural range of the beetle can acquire as many as he or she wants or can use by making a direct exchange with the beetle itself. The beetle works for dung. The farmer provides the dung; the beetle provides the decomposition. What's not to like – if you are a dung beetle? You can have a big family. It's the same with the pollinating insects who visit the flowers of fruits, nuts and vegetables to acquire the nectar or pollen or whatever it is they seek. They are paid for their work – and supported in vast numbers by the farmer's compensatory planting of crops. Indeed, one could argue that the farmer is just the pollinator's way of making another pollinator.

Ecological economists view the work of the insectival classes (along with that of nature's other servitors) as Marxist economists regard the work of the labouring classes. Both the insect worker and the human worker, on this general approach, produce the 'surplus' value captured by the agriculturalist or the capitalist respectively. What is a dollop of dung, a *nosh* of nectar or a worker's wage in comparison to the value these labourers add to the product of capital-

ism – the surplus value that accrues to the capitalist but is truly earned by the labouring masses (in this instance, of insects)? The sentimentally appealing but intellectually empty effort to ascribe economic value to nature's services may at bottom constitute little more than the labour theory of value *redivivus*. Marx had a recommendation: the workers of the world should unite to throw off their chains. What recommendation do ecological economists offer the labouring insectival classes?

Biodiversity

What about the economic value of biodiversity? Biodiversity represents nature's greatest largess or excess since species appear nearly as numerous as the stars except that 'scientists have a better understanding of how many stars there are in the galaxy than how many species there are on Earth'.[41] The 'next' or 'incremental' thousand species taken at random would not fetch a market price because another thousand are immediately available, and another thousand after that. No one has suggested an economic application, moreover, for any of the thousand species in the USA listed as threatened.[42] To defend the 'marginal' value of biodiversity on economic grounds is to trade convincing spiritual, aesthetic and ethical arguments for bogus, pretextual and disingenuous economic ones.[43] As David Ehrenfeld has written,

> We do not know how many [plant] species are needed to keep the planet green and healthy, but it seems very unlikely to be anywhere near the more than quarter of a million we have now. Even a mighty dominant like the American chestnut, extending over half a continent, all but disappeared without bringing the eastern deciduous forest down with it. And if we turn to the invertebrates, the source of nearly all biological diversity, what biologist is willing to find a value – conventional or ecological – for all 600,000-plus species of beetles?[44]

The disappearance in the wild even of agriculturally useful species appears to have no effect on production. The last wild *aurochs*, the progenitor of dairy and beef cattle, went extinct in Poland in 1742, yet no one believes the beef industry is threatened. The genetic material of crop species is contained in tens of thousands of landraces and cultivars in use – rice is an example – and does not depend on the persistence of wild ancestral types. Genetic engineering can introduce DNA from virtually any species into virtually any other – which allows for the unlimited creation of biodiversity.

A neighbour of mine has collected about 4,000 different species of insects on his two-acre property in Silver Spring, Maryland. These include 500 kinds of Lepidoptera (mostly moths) – half the number another entomologist found at his residence.[45] When you factor in plants and animals the amount of 'backyard biodiversity' in suburbs is astounding and far greater than you can imagine.[46] Biodiversity generates no price 'at the margin' because nature provides far more

of it than anyone could possibly administer. If one kind of moth flies off, you can easily attract hundreds of others.

The price of a building lot in suburban Maryland, where I live, is a function of its proximity to good schools and to Washington, DC. The thousands of kinds of insects, weeds, microbes, etc. that nature lavishes on the typical suburban lot do not increase its price. No one wants to invest to see if any of these creatures contains a cancer-curing drug, although a raccoon in my attic did test positive for rabies.[47] No one thinks that property values are a function of biodiversity; no one could suppose that a scarcity of critters looms that might create a competitive advantage for housing lots that are more generously endowed with deer, opossums, muskrats, raccoons, birds or beavers. (A neighbour who has a swimming pool plays unwilling summer host to a beaver who at night jumps off the diving board into the pool, swims around, and jumps again.) An astronomical variety of biodiversity is thrown in with every acre zoned for residential use. Buy an acre or two, and an immense amount of biodiversity is yours for nothing.

OBJECTIONS

To suggest that ecosystem services possess only a negligible 'exchange value' or market price is to invite at least the following four objections. First, one may earnestly assert that ecosystems '…act to purify air and water, regulate the climate and recycle nutrients and wastes. Without these and many other ecosystem goods and services, life as we know it would not be possible.'[48] The team that pegged nature's services at tens of trillions wrote, 'The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system.'[49] Bromides such as these, however edifying, tell us nothing about competitive price or exchange value, which is a measure of scarcity not dependency.

I understand, of course, that when economic development changes a landscape, for example, when a university such as Stanford takes the place of a savannah, some of the ecosystem services the landscape once provided will be lost. No one would suggest, however, that in view of the diminished ecosystem services, the landscape be restored and the offending university removed. What is needed are examples of an ecosystem service which is worth more in market terms than the privately-built housing, schools, hospitals, farms, etc. because of which that service diminished or declined.

For example, one could speculate that downstream towns vulnerable to flooding – New Orleans is an example – could conceivably pay farmers upstream to let their lands flood during the rainy season (thus delaying or foregoing planting their crop) to approximate the ecosystem service – in this instance, retaining water – the forests, fields or wetlands once supplied. This sort of brokering might be worthwhile to attempt at least as an experiment. Researchers have found

instances in which towns have purchased land in flood plains to mitigate flooding,[50] although on inspection, these examples may be dubious, in part because of huge financial incentives from the federal government and in part because flooding occurred anyway that might have been prevented by infrastructure such as levees. The literature cites examples, but when one follows the footnotes, one often finds much less there than one might hope.[51]

Consider a second objection to my argument. The Nature Conservancy and other groups raise and spend enormous amounts to acquire and retire for aesthetic and ethical reasons 'the last great places', as the Conservancy calls them. The appreciation of the spiritual, moral and aesthetic aspects of nature – an obligation to protect undeveloped places – is exactly the kind of commitment environmentalists share and should act upon. It would be a mistake to say that natural areas have value because people are willing to pay to preserve them – as if WTP were the locus or source of value. Rather, people contribute to organisations like the Conservancy because they recognise the beauty and glory inherent in nature and a duty to protect the aesthetic, moral, historical and religious value of particular places. This kind of value, which is associated with merit goods, unlike mere preference or WTP, makes a legitimate claim on social recognition. This illustrates the appropriate relation Alan Holland correctly draws between public values and private preferences.

A third objection is obvious. Nothing has been said here about minerals, such as diamonds and gold, which are obviously scarce relative to demand, and thus have value in exchange. The argument here would not apply to diamonds and other minerals but to services associated with the functioning of today's ecosystems, such as pollination. It would not apply to petroleum since it is not supplied by living ecosystems.

Fourth, one might point to the problem of climate change and to the importance of protecting planetary systems. I would reply that the biospheric system which regulates the global climate represents an example of what economists sometime call a 'lumpy' good, that is, a good that cannot be provided incrementally, divided in pieces, or sold in units. Either we protect (or 'buy') the whole system or forego it; there is no way to trade in marginal amounts. Accordingly, political will and legal institutions – not more competitive prices or more efficient markets – are required to limit 'greenhouse' gases that threaten to destabilise the planetary climate. At this vast scale, force exercised by legitimate authority is simply mandatory; market prices based on voluntary exchange are beside the point. There is no meaningful way to enter the stability of the global climate in our spreadsheets and cost-benefit analyses by 'pricing' units of the global climate incrementally or at the margin.[52]

Fifth, one may object that the argument presented here extends only to exchange value, competitive market price, or the intersection of supply and demand. No way of conceiving 'economic value' other than in terms of competitive market price, however, allows one to compare ecosystem services with

ordinary consumer goods. A group of ecological economists has rightly written that the test '…of whether an ecosystem service will facilitate conservation is not whether academics can valuate it, but whether someone – or some organization – is able and willing to do what is necessary to secure it'.[53]

The products or services associated with living ecosystems – arable land, fish, trees, drinking water and the like – do trade in markets and thus do receive competitive prices. The productive services of nature, such as the ability of fertile soil to grow crops, receive low market prices not because markets fail or because a resource such as fertile soil is a 'public good' but because the resource, in this example good cropland, is quite abundant relative to effective demand. This is the case generally. Even when one takes a service for granted – the wind that pollinates cereal crops, for example – one may pay the full market price for it, even if it is zero, because the supply is adequate and free. The value or benefit, of course, may be vast or even infinite.

The attempt by economists to 'value' by 'pricing' ecosystem services only creates confusion because price does not correlate with value, benefit or utility. By 'putting a price on it' we abandon the rhetoric of reverence; we regard nature as a resource to exploit rather than a heritage and an endowment to maintain. This is the most self-defeating path environmentalists can take.

Everyone agrees, of course, with platitudes about how plentifully and freely nature sustains us, comforts us and inspires us. We recognise that the preservation of the beauty, complexity and integrity of the natural world represents an aesthetic opportunity, a spiritual duty, and a moral obligation. Alan Holland is correct in his critique of the attempt to reckon the 'value' of environmental goods in pounds or pence. The prices at which goods trade hands may reflect their scarcity relative to demand or their cost to produce but not their 'value' in any sense – neither the 'marginal' benefit they provide nor the intrinsic worth they possess nor the reasons they are important. That is why the best things in life are and ought to be free.

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An earlier paper, Sagoff (2005), which defends the same core argument in a more historical context, considers at length the examples of cropland and fisheries. In writing this essay, I am grateful to Clive Spash for comments.

NOTES

[1] Holland and Roxbee Cox (1992).

[2] Pearce, Markandya and Barbier (1989).

[3] See especially Holland (2002).

[4] Gretchen Daily, quoted at the web page of The Natural Capital Project at Stanford University. http://www.naturalcapitalproject.org/about.html

[5] Locke (1690).

[6] Costanza et al. (1987), pp. 253–360.

[7] Locke, V, 42.

[8] Ibid.

[9] Marx (1858 [1993]), p. 366.

[10] For a statement that 'preferences do contain their own normative content', see Zerbe, Bauman and Finkle (2006), pp. 14–16.

[11] Georgescu-Roegen (1971). See also Daly (1992).

[12] Vitousek et al. (1986), pp. 368–373.

[13] See, for example, Prugh (1995).

[14] Boettke, Coyne and Leeson (2006)

[15] Uebel (2005), p. 313.

[16] Von Hayek (1944).

[17] See Daly (1998), pp. 21–23, citing Lord Lauderdale, 'An Inquiry into the Nature and Origin of Public Wealth and into the Means and Causes of its Increase', 2nd edn. Constable, Edinburgh, 1819. Available on line: http://www.thoemmes.com/economics/wealth5.htm.

[18] I am aware of the catechism that 'marginal benefit equals price'. No one has ever measured marginal benefit, however, to see if it equals price. Virtually all examples (e.g., relating to antibiotics, phone calls, houses, and songs) suggest that marginal benefit does not equal price. Economists explain away counter-examples (e.g., by claiming that the demand for antibiotics is 'inelastic', that houses are 'lumpy' or that songs downloaded are 'public goods'). Thus economists invent ad hoc explanations for inconvenient phenomena. The only way to establish the relationship between *marginal benefit* or *marginal WTP* and *competitive market price* is to define and measure the normative terms (*benefit, value*) independently of observed prices to see if in fact there is an empirical correlation. This has not been done because it cannot be done.

[19] USDA, *Amber Waves*, February 2004; on line at: http://www.ers.usda.gov/amberwaves/february04/indicators/behinddata.htm

[20] Lomberg (1998), p. 150.

[21] NRC (2000), pp. 160, 161, 197. Increases in fecal coliform bacteria, when observed in the principal reservoir, 'coincided both spatially and temporally' with increases in waterfowl populations.

[22] Jackson et al. (2001), pp. 1027–1045.

[23] Chichilnisky and Heal (1998), pp. 629–630.

[24] Sagoff (2002), pp. 16–21.

[25] Thompson (2000), p. 301.

[26] Franklin and Johnson (2004).

[27] McKibben (1995), quoting Douglas MacCleery, of the U.S. Forest Service.

[28] UN-ECE/FAO (2000). 'Data from reporting countries show an average increase in area of about 1.95 million ha per year.' See also Moffat (1998).

[29] Barringer (2006); see also Bond (2006).

[30] Ibid.

[31] Billy Humphries Jr., chairman of Macon-based Forest Resource Consultants, quoted in Bond, p.16.

[32] Krutilla (1967), p. 777.

[33] Ibid., p. 778.

[34] Sedjo 2004, p. 4. See also Victor and Ausubel (2000); Sedjo and Botkin (1997).

[35] Losey and Vaughan (2006), p. 311.

[36] Ibid. p. 315.

[37] Ibid. p 311.

[38] See Morse and Calderone (2000). Honeybee populations have declined because of infection by a mite. It is unclear, however, whether honeybees could be counted as natural pollinators in the U.S. since they are introduced species. I have no idea whether the mite is native or not. It is very easy for ecological economists to theorise and speculate about prices paid to bee-keepers for pollinating services. It is more difficult to get the data – to phone up bee-keepers or study the actual market – and then to show the relevant decline of a natural pollinator, so this actual research is rarely if ever done.

[39] Kevan and Phillips (2001), p. 8.

[40] Losey and Vaughan, p. 312.

[41] World Resources Institute (1992) p. 1. Perhaps 1.4 of what might be 100 million species have been identified. Because globalisation spreads species, the species richness of most places is increasing vastly (e.g., doubling on large oceanic islands) with species hybridisation and radiation evolving new varieties. Because of globalisation and resulting hybridisation, new species may be evolving faster than we can identify them. Genetic engineering, which can recombine genetic material from nearly any species, has the capacity to produce an infinite number of new creatures, but we have plenty as it is.

[42] Fish and Wildlife Service http://ecos.fws.gov/tess_public/Boxscore.do

[43] These pretextual economic arguments often backfire. No pharmaceutical firm believes it can find profitable medicines by assaying organisms in rainforests; companies develop '… drugs based on molecules that scientists can create for themselves in the laboratory, using new combinatorial chemistry techniques' Macilwain (1998). Unfortunately, environmentalists have believed their own stories – 'sucked their own exhaust' – with the unintended consequence that officials in developing countries now guard their forests from ecologists. See Tinker (2002) and Russo (2003) (quoting Arturo Gómez-Pompa, a professor of botany at the University of California, Riverside).

[44] Ehrenfeld (1988).

[45] Dawson (2004) and Sagoff (2003).

[46] Shaw (2004).

[47] After the bankruptcy of Shaman Pharmaceuticals – a firm that did attempt to assay biodiversity for medicines – it is hard to find a biologist who takes bioprospecting seriously enough as an economic proposition to invest money in it. Occasionally, a firm (such as Merck) will look in toxic wastes sites and other degraded environments for micro-organisms with antibiotic and other qualities.

[48] Krieger (2001).

[49] Costanza et al. (1987), p. 253.

[50] See, for example, Salzman, Thompson and Daily (2001).

[51] See Martin (2006).

[52] After capping total emissions, government may create a market in pollution allowances. This does not represent free and willing exchange but a way to make centralised command-and-control regulation more cost-effective.

[53] Chan et al. (2007), p. 62.

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