

# The value of everything

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**Economists and ecologists have joined forces to estimate the annual value of the services that Earth's ecosystems provide. Most services lie outside the market and are hard to calculate, yet minimum estimates equal or exceed global gross national product.**

Economists' self-effacing definition of their craft is that it is one that knows the price of everything and the value of nothing. In that lies a crucial distinction.

Market prices are the easier objects of study, recorded abundantly in units (currencies) with known, if varying, calibrations. Values are more slippery, being likely to vary widely from person to person and from generation to generation. Prices, moreover, reflect incremental (or 'marginal') costs. Diamonds trade for a higher price than does fresh water. Yet the value of all fresh water is infinite: we could not survive without it. For ecologists, prices are woefully incomplete measures of nature's value that poorly prefigure the consequences of humanity's exponential growth. For economists, the challenge is how to assess an ecosystem's non-market values

and predict their future trends. The words 'economics' and 'ecology' share a common root, yet for many years their practitioners had little to do with each other.

A turning point may have been C. W. Clark's 1973 demonstration that the most profitable strategy for harvesting whales is to convert all of them quickly into money in the bank<sup>1</sup>. Even the most stingy savings account produces interest income faster than whales reproduce themselves. Using the mutually intelligible medium of mathematical models, Clark's economics explained ecological history. Maximizing profits demanded that the slow-moving, inshore-feeding species were first hunted to extinction, before whalers tackled species whose capture required more advanced technology. The appropriately named right whales did go

first, the 'wrong' whales following at ever shorter intervals. Generally, only species that grow faster than money in the bank should be harvested sustainably.

But if whales are more than just meat, how are we to estimate these other values? Trees in tropical forests grow slowly too: must economics doom them to extinction in the next century, like some whales in the last? On page 253 of this issue<sup>2</sup>, a team of ecologists and economists, sponsored by the newly established National Center for Ecological Analysis and Synthesis in Santa Barbara, California, address such questions. Costanza *et al.*<sup>2</sup> take the flippancy definition of economics to heart, estimating the annual value of all the world's ecosystems — essentially, the value of everything.

Take whales as an example. Whalers once set out from Lahaina and Nantucket on year-long trips armed with harpoons. Better-paid descendants set out on day-trips, escorting passengers armed with cameras. The cultural value of whales far exceeds that derived from their meat or oil, even if one only counts the price paid for boat tickets. Whales also have ecological roles that maintain species abundances of other marine species, including commercially valuable fisheries. These values, too, could be very large, and easy to estimate in theory, if not in practice.

Estimating other values is more contentious. Many people would consider Baker and Palumbi's observation<sup>3</sup> of the presence in Japan's sashimi trade of meat from the long-protected humpback whale to be a violation not only of international laws, but of religious principles, or to be evidence of unacceptable cruelty. Economists incorporate these views by asking how much the public would pay to protect whales. (A real example of such calculations involved asking how much the public felt deprived when the oil from the *Exxon Valdez* gummed up Alaska's scenically spectacular shoreline.)

Herein lies a vigorous debate, for others deem such calculations irrelevant — a feeble, last gasp of economists to fix their inability to assess real values. But would anyone accept child labour just because willingness-to-pay estimates for its abolition were smaller than the money saved by paying children less than adults? Aren't there overarching moral issues in placing monetary values on a sustainable environment for future generations? Costanza *et al.* point out that moral arguments make the discussions more difficult, but go on to say that they have no choice but to try to take them into account. In practice, we do indeed make financial trade-offs involving moral dilemmas, and the authors recommend that we proceed with both moral arguments and economic assessments.

Ecologists must grapple with exceedingly complex ecological interactions. Clear-cut a forest and the price of adjacent homes will

## Estimating the cultural value of the oceans

Costanza and colleagues' summary table, Table 2 (page 256), is both fascinating and frustrating: Some numbers are small, others are huge. For none of them is there an indication of how they are obtained. How could there be in a journal with strict space limits? *Nature's* Web site <http://www.nature.com> provides a solution that until recently would have been impossible: it displays the six-page spreadsheet and accompanying 18 pages of footnotes to document the calculations.

For example, how do the authors obtain a value of \$76 per hectare for the cultural value of the world's open oceans? Multiplied

across the planet's oceans this is a huge number — roughly \$2.8 trillion. The tangible economic evidence of valuing the sea is how much more we will pay for coastal real estate than for comparable properties inland. (The calculation for the cultural value of coastal waters themselves is separate, and takes into account such factors as the scientific value of estuaries.)

For California, the difference between coastal and inland real estate is \$10 million per hectare, for Alabama, only \$500,000. Costanza *et al.* estimate the length of the coastlines of wealthy and less developed nations to be 194,435 km and 284,795 km, respectively, and assume coastal

properties extend 0.5 km inland. They further assume that wealthy nations value their coasts 100 times as much as poorer ones, making the latter's contribution relatively tiny.

The total values come to \$5–105 trillion, using the Alabama and California estimates, respectively. Amortized over 20 years, this yields the average value of \$2.8 trillion, or \$76 for each of the oceans' 36.3 billion hectares. All that is before we've added the money spent on tall ships (and yachts), the sextants to sight the stars to steer them by, and all the other paraphernalia needed to mess about in boats. **S. L. P.**