Published online 8 October 1998 | Nature | doi:10.1038/news981008-3

News

The worth of the Earth

Laura Garwin

How much is the environment worth? Or, to put it another way, how much would be have to pay for services that the environment currently gives us for free - services such as the purification of air and water, the mitigation of floods and drought, pollination, pest control, and the generation of fertile soils?

Such questions are inspiring collaborative research between economists and ecologists into such environmental issues such as biodiversity conservation, climate change, and the management of forests, fisheries, and fossil fuels.

Until recently, economists and ecologists, even when collaborating, have tended to continue working from within their own disciplines, but with an unwritten hierarchy between the two: those known as 'environmental and resource' economists have tended to frame the problem, with ecologists providing the basic data.

This hierarchy, however, is now being challenged by two schools from of a newer discipline known as "ecological economics'. Broadly speaking, ecological economists no longer accept kngroup of researchers, most of whom define themselves as ecological economists, believeecology as a subdiscipline of environmental and resource economics. And they want trained ecologists playing a greater role in setting - and not just achieving - conservation research goals.

Both schools are also united by a conviction that placing a financial value on environmental services is one way of focussing attention on the importance of environmental protection.

But that is where the similarities end. While one school wants to work within the parameters of neoclassical economics, the second refuses to do so, and wants ecological economics to be seen as an entirely new discipline in which economists and ecologists work as equal partners along with all other 'stakeholders' in solving environmental problems.

This controversy came to the fore with an attempt to put a price on the world's" "ecosystem services and natural capital", published in last year (Nature **387** , 253-260; 1997) ecologist Robert Costanza of the University of Maryland, and 12 co-authors. This paper caused an immediate outcry, pointing up the different attitudes and methods of ecologists and economists.see

The idea of valuing ecosystem services was not new to the paper. Earlier in the year, the Stanford ecologist Gretchen Daily had published an edited volume, Nature's Services, containing contributions that aimed to "identify and characterize components of ecosystem value". But Costanza et al. did something that has been described as both "heroic" and "foolhardy": they tried to estimate the total value of all of the world's ecosystem services, put together. The answer was US$33 trillion per year - a figure that exceeds the sum of the world's gross national products.

Although it was widely covered by newspapers and magazines, and the $33 trillion a year total the authors came up withfigure has been quoted in public speeches by government officials, many economists have characterized the paper as not just wrong but misleading. But Costanza and his colleagues have been resolute in defending the importance of their contribution. And as the dust settles, it seems that most interested observers believe their paper, whatever the rights and wrongs, can still serve a useful purpose, by identifying drawing attention to an important issue.

At first glance, what Costanza and colleagues set out to do seems straightforward, namely to rectify the fact that "because ecosystem services are not fully 'captured' in commercial markets or adequately quantified, they are often given too little weight in policy decisions".

The paper describes the figure of $33 trillion per year as "a minimum estimate" for the "current economic value" of 17 ecosystem services (ranging from atmospheric gas regulation to the provision of "cultural value") summed over 16 types of ecosystem or 'biomes' (ranging from the open ocean to urban centres).

Mainstream economists were quick to protest. In a special issue of the journal Ecological Economics (**25** , 1-72; 1998) devoted to the paper, Michael Toman of Resources for the Future characterized the $33 trillion figure as "a serious underestimate of infinity". A group of British economists wrote that the biome-scale calculations "risk ridicule from both scientists and economists", and called the figure "not supportable".

The economists seemed to be complainingcomplained that Costanza and colleagues didn't properly understand what they were doing. "If you use an economist's definition of valuation, you have to understand what it can be used for and what it can't," says Nancy Bockstael of the University of Maryland. What it can't be used for, say critics, is to place a total value on everything. For neoclassical economists, value can be measured only in the context of a specific exchange. In this view, it is nonsensical to ask what is "the value" of the world's ecosystem services; the economist would ask, "value to whom?"

A related requirement is that one can evaluate only small - or 'marginal' - changes from current conditions. Real-world decisions are incremental: one may have to decide what it's worth to give up a hectare of beach, but we are never asked to give up all of the beaches in

the world.

Costanza and colleagues, the critics complained, strayed out of context and well away from the margin. The paper took published valuations of particular ecosystem services, made in specific parts of the world, and converted these to "per hectare" values for a particular biome. For example, the paper used values placed on soil formation in Colorado as the basis of such a calculation for all the world's grasslands. But this assumes that all hectares of grassland are equivalent - not only in their ability to form soil, but in the value of this service to local populations.

The critics also pointed out that, because the value of a commodity increases as it becomes more scarcer, one cannot simply multiply the present value of a hectare of biome (even if there were a uniform value per hectare) by the number of hectares to get the total value. The last hectare to disappear will be much more valuable than the first.

In response, Costanza and colleagues argue that what they have done is no different from classical GNP accounting, in which "the total value of marketed products" is computed by multiplying the current price for each product by the number of units traded in a year [see R. Costanza et al. Ecological Economics **25** , 67-72; 1998]. But the critics remain unpersuaded.

Costanza himself treats the detailed criticisms with some impatience, describing himself as a "big picture" person. "This is an order of magnitude study, a first cut," he says. "Probably most economists would have guessed 1 per cent of GNP or less [for the value of ecosystem services]. They're in the wrong order of magnitude. Therefore this issue requires a lot more attention."

One of Costanza's economist co-authors, Stephen Farber, of the Graduate School of Public and International Affairs at the University of Pittsburgh, is more ready to admit that many of his fellow economists' criticisms are on target. "I don't place a lot of credibility on the $33 trillion figure," he says. "But if we were to try to satisfy [our critics in neoclassical economics], doomsday would be past before we got any useful knowledge out there."

This seems to be the nub of the difference between Costanza and his colleagues on the one hand, and their critics on the other. The authors realize that what they did was imperfect in many ways, but feel strongly that their number is better than no number at all.

Ironically, "the number" has come back to haunt one of the economist co-authors. Ralph d'Arge, an emeritus professor from the University of Wyoming, says that he has had "calls from federal agencies asking how they can use this number to implement policy. The answer is they can't. The per-hectare numbers are averages - they're unlikely to be a good measure of a local loss." d'Arge nevertheless stands by the paper's methods, saying, "We followed all the rules [of neoclassical economics]."

While vocal critics such as Bockstael view the paper as potentially damaging to their profession, other economists are prepared to take a more philosophical view of the paper's contribution. Although Costanza is not a trained economist, he sees his status as an outsider as an asset, not a liability. He started his undergraduate training as an engineer, then switched to architecture and urban planning. He says that this training taught him how to synthesize: "Most scientists get very little or no training in synthesis," he says. "They get all their training in analysis, taking things apart." But Costanza's synthetic skills are not appreciated by his critics, his ability to capture public attention is widely admired - even by some economists. Trudy Cameron, an environmental economist at UCLA, characterizes the Costanza paper as "a recklessly heroic attempt to do something that's futile". But then she goes on to say that the paper has been "very useful - it has stirred things up a lot." Toman, one of the harshest critics of the paper's methods, echoes this view, saying that "it can best be read as a political document". Farber agrees that the main contribution of the paper may have been less in the precise numbers it arrived at than in raising awareness of the issues that it highlights. "This is the first attempt to see what information is out there. We thought we would provoke, and thought that provocation would be good." Indeed the paper's most lasting contribution may be as a recruiting document. "Because of the paper, we're seeing young graduate students becoming attached to this issue," says Farber. "Even if people tear the article apart, that's okay if it provokes interest in large-scale problems."