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Ecosystems – which range in size from whole biomes to small ponds – are capital assets. They maintain a genetic library, preserve and regenerate soil, fix nitrogen and carbon, recycle nutrients, control floods, filter pollutants, assimilate waste, pollinate crops, operate the hydrological cycle, and maintain the gaseous composition of the atmosphere. Their degradation is like the depreciation of roads, buildings, and machinery – but with two big differences. Firstly, the damage is frequently irreversible: at best the systems take a long time to recover. And, secondly, ecological processes are overwhelmingly non-linear, meaning that an ecosystem can collapse abruptly, without much prior warning. Imagine what would happen to a city's inhabitants if the infrastructure connecting it to the outside world were to break down without notice. Vanishing water holes, deteriorating grazing fields, barren slopes, and wasting mangroves are spatially confined instances of such breakdowns.

Ignoring the ecological basis of the Millennium Development Goals, therefore, would be a move of conscientious stupidity

So, one prominent message of the Millennium Ecosystem Assessment is that the services ecosystems offer humanity are not just luxuries – like landscapes of aesthetic beauty – but economic necessities. Another is that declines in these services are felt mostly by the world's poorest, most of whom rely on them directly for their livelihoods. Thus, when wetlands, inland and coastal fisheries, woodlands, forests, ponds and lakes, and grazing fields are damaged – owing, say, to agricultural encroachment, nitrogen overload, urban extensions, the construction of large dams, organisational failure at the village level, or resource usurpation by government – it is the traditional dwellers who suffer. They often have no alternative source of livelihood, and migration is usually not an option. By contrast, rich eco-tourists or importers of primary products have alternatives – there is always something else, often somewhere else. So the question of whether there are substitutes for natural capital is not just one of technology and consumer preferences; the poor suffer from a lack of substitution possibilities in ways that the rich do not. Ignoring the ecological basis of the Millennium Development Goals, therefore, would be a move of conscientious stupidity.

I believe, however, that even if the degradation of ecosystems were taken seriously, it would remain on the back burner. As with climate change, powerful voices would claim that the decline in ecosystem services is not today's problem, but one for the future. They would say that because big losses would occur only then, the costs of doing something now to stem the decline are too large in comparison.

Economic disruptions

How does that argument work? It works by a practice economists and accountants have made popular, of discounting future costs and benefits at a positive rate. To see what discounting means, suppose commercial banks are offering you an annual interest rate of 5%. A thousand dollars deposited with them now would grow to a thousand and fifty dollars next year. So, a promise of a thousand and fifty dollars next year would be equivalent to a ▶

Discounting **Ecosystem Losses**

PARTHA DASGUPTA explains why economists and environmentalists should unite in insisting that the declines in biodiversity and ecosystem services must be tackled immediately

Of all global environmental problems, the ones relating to a decline in biodiversity and ecosystem services are the most neglected. International discussions on climate change, for example, may remain tense, but the issues are at least on the table. But these two related declines remain on the back burner thanks to the widespread belief that ecosystem losses are someone else's problem. The urban citizen in the West can at least imagine climate change for the worse, but the role played by ecosystems in our lives is elusive. How many people know or care about micro-organisms in the soil and water, or the nitrogen overload in today's environment? Acknowledging that millions and millions of natural processes enable humanity not only to live, but to run modern economies, would require that we study the findings of ecologists – and, more generally, of environmental scientists. But how many of us are prepared to do that?

thousand dollars now: you would use a 5 % discount rate to make that future thousand and fifty dollars equal to a thousand dollars today. Economists use this line of reasoning to justify the use of a positive discount rate for comparing future benefits with current costs. Reducing ecosystem declines (just as reducing global carbon emissions) would involve large costs now, but the benefits from averting possible economic disruptions would be enjoyed only in the somewhat distant future. Prominent economic models of climate change, for example, show that the costs are greater than the sum of the discounted benefits. Doing something now, they imply, would be to throw money away on a comparatively bad project – and that self-same argument could be used for ecosystem protection.

Investment decisions

Environmental scientists, however, frequently ask why the global community should discount future costs and benefits at all when making collective investment decisions. Why not simply subtract the sum of all costs from the sum of all benefits?

There are two reasons why a society could wish to value present and future costs and benefits differently. First, a future benefit would be of less value than that same benefit today, if society is impatient to enjoy the benefit now. So, impatience is one reason for discounting future costs and benefits at a positive rate. Secondly, if people expect to grow richer over time, their collective need for further increases in consumption would be less in the future than it is today, other things being the same. Rising consumption levels therefore provide a second justification for discounting future costs and benefits at a positive rate. (I am neglecting uncertainty in future consumption, which would merely reinforce the argument developed below.)

Future benefits

Philosophers argue that societal impatience is ethically indefensible, because it favours policies that discriminate against future generations merely on the grounds that they are not here now. Once we accept their argument, we are left with only the second reason for discounting future costs

and benefits. But if rising consumptions provide a society with a reason for discounting future benefits at a positive rate, declining consumptions would provide that same society with a reason for discounting future benefits at a negative rate. Empirical evidence from societal and personal choices suggests that the rate a society ought to use for discounting future benefits is something like three times the %age rate of change of average consumption. (This means that if per capita consumption is expected to grow at 2 % per year, society ought to discount future benefits at 6 % per year. On the other hand, if per capita consumption is expected to decline at 2 % per year, future benefits ought to be discounted at minus 6 % per year. Notice, though, that applying a negative discount rate amplifies costs and benefits in the distant future when viewed from the present - they are not attenuated, as they would be if positive rates were used instead to discount them. (If declining consumptions appear to be an unfamiliar phenomenon, recall that sub-Saharan Africa has experienced them for over three decades.)

Declining economy

Admittedly, private investors would, in all likelihood, be using a positive rate to discount their personal future earnings even in a declining economy. They would do so because the interest rate offered by commercial banks on deposits would most likely remain positive. But there is no contradiction here: in the presence of economic distortions, we should expect a

wedge between the rates private investors use to discount their own future earnings and the rates the world community ought to use to discount collective costs and benefits in the future.

Ecosystem degradation

Consider now those scientific experts who are persuaded that if nothing substantial is done today to curb biodiversity losses and ecosystem degradation (or, for that matter, emissions of greenhouse gases), there is a non-negligible chance that world output of goods and services, suitably weighted across regions and income groups, will decline. To them neglecting biodiversity and ecosystems in proposals for attaining the Millennium Development Goals would appear intuitively wrong. And they would be right. Biodiversity loss, ecosystem degradation, and climate change, taken together, are an example of a global "tragedy of the commons", meaning that the rates that should be used for evaluating the collective costs and benefits of stemming the tide do not bear any obvious relationship to market rates of interest. If declining economic output is a serious possibility in the future, the discount rates that should be used should be negative. There is no necessary conflict between environmental scientists' intuitions and economists' reasoning ■

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