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Paradise lost has high cost
 Experts say land often worth more to economy if left undeveloped

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Continued disruption of the natural environment for human use is a bad economic deal, researchers say.

Converting wild ecosystems into developed areas costs the equivalent of about \$250 billion each year, an international group of scientists and economists has calculated. The team, led by British economist Andrew Balmford of the University of Cambridge, studied the difference between the economic values of intact ecosystems and their developed counterparts.

The balance sheet - their version of it, anyway - is in: It's 100-to-1 in favor of conservation, the researchers wrote in the Aug. 9 issue of the journal Science.

A growing number of scientists and economists are starting to think of the world's ecosystems as capital assets. But a spirited debate has emerged over how to best measure their value, and what to do with the numbers once they've been determined. Not everyone agrees that the economic worth of the world's ecosystems can be inferred from case studies or that it ought to be boiled down to a few numbers.

But the new study was designed for that very purpose. The team scrutinized five disrupted areas - tropical forests in Malaysia and Cameroon, a mangrove swamp in Thailand, a Canadian marsh, and a coral reef in the Philippines. In each case, the loss of natural benefits such as storm protection, sustainable hunting and tourism carries a big economic cost.

Yet people continue to pillage natural areas throughout the world. There are some basic reasons, the authors said. For one thing, government subsidies and tax incentives often encourage development. And of course, such development often provides short-term economic gains for investors. What's more, developers are often unaware of the benefits lost when land or water is adapted for human use.

The practices that stem from these motivations are not sustainable for long, says Robert Costanza, an ecological economist from the University of Maryland who participated in the study. "It's like blowing a hole in your own spaceship," he says.

In fact, an ecosystem is worth considerably more when it is left whole rather than developed or converted for human use, Dr. Costanza and his colleagues reported. The mangrove swamp, for example, was worth 72 percent more when left to naturally supply fish, timber and storm protection than after conversion to a shrimp farm, they say. And the Canadian freshwater marsh was 58 percent more valuable when intact than when farmed.

When managed well, ecosystems provide vital goods - like timber, new medicines and seafood.

And the services a healthy environment provides are vast, the researchers say. Forests prevent soil erosion and absorb heat-trapping carbon dioxide emitted by factories and cars. Forests also purify drinking supplies by naturally filtering water through roots and soil. Wetlands absorb floodwaters, protecting homes and farms near rivers. Coral reefs are nurseries for young fish and help protect shores.

A global network of nature reserves would provide \$400 trillion worth of goods and services, Dr. Costanza says. "The value of ecosystem services should become incorporated into the market as a matter of routine," he says.

Entrenched views

The growing field of ecological economics aims to do just that.

But finding a starting point for a partnership between conservation and capitalism has proved tricky. The tendency to pit nature's intrinsic value against the economic interests served by developing it, Dr. Costanza says, is embedded in the minds of many ecologists and economists.

Trying to counter this mind-set, Dr. Costanza led a 1997 study that estimated the market



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value of nature's services to be greater than the sum of the world's gross national products. Some critics said the estimate was too high. Others said it was too low: Michael Toman, of Resources for the Future, said the authors' multitrillion dollar appraisal was a "serious underestimate of infinity."

Many critiques of the original study were valid, Dr. Costanza concedes. But a rough estimate is better than no estimate, he says. And those who are offended at the idea of putting a price on nature, he says, "have buried their heads in the sand." Wild areas already carry a price tag, but are consistently undervalued.

True, but the methods used in the new assessment are dangerously misleading, says Kerry Smith, director of the Center for Environmental and Resource Economics Policy at North Carolina State University.

"A lot rests on the kinds of assumptions that you have to make to recover these estimates," Dr. Smith says. Dr. Costanza and his collaborators "drew estimates from a variety of different sources that make different assumptions."

Dr. Smith and Dr. Costanza share the same goal: responsible conservation. But, Dr. Smith believes, sweeping estimates of nature's worth take valuations of particular ecosystem services, made in specific parts of the world, out of context. Such a method assumes that a given ecosystem - such as a wetland or prairie - will fill the same needs and have the same economic value anywhere.

It's like assuming the value of a home would be the same no matter where it sits, he says.

And any commodity becomes more valuable as it becomes rare, he says, and so the value of one hectare of mangrove forest along a coastline in a dangerously degraded area ought to be valued more than the same area of mangrove forest in an area where the forests are plentiful.

Balance is key

The real danger of trying to put a price tag on the global environment, Dr. Smith says, is that it undermines the importance of making individual decisions about whether to develop an area. And making blanket judgments about the value of setting aside natural areas suggests that it might never make sense to develop, he says.

"It's about managing the resources and having a portfolio of assets, some that are developed and some that are in a preserved state," says Dr. Smith.

But "the problem is, there is no CEO of the planet," says Paul Sutton, of the University of Denver, one author of the 1997 report. "The individual self-interest supersedes the collective self-interest." Some governments, Dr. Sutton says, are beginning to step in.

The Costa Rican government, for example, pays private landowners to maintain natural areas. In a remarkable turnaround, Costa Rica has reduced its rate of deforestation from one of the world's highest to one of the world's lowest in less than two decades.

The Kyoto Protocol, the draft international treaty designed to combat global warming, allows the buying and selling of carbon credits. And such trades have already been taking place for years, aided by brokers in New York and London. Signed in 1997, the protocol requires participating nations to reduce their carbon dioxide emissions an average of 5 percent by 2012.

Last week, the government of Brazil announced the creation of the largest rain forest national park in the world - the Tumucumaque Mountains National Park, which covers nearly 10 million acres of pristine forest. In a similar venture earlier this year, the Cambodian government created a million-acre land preserve in the Cardamom Mountains, an area of land originally slated for logging. The international nonprofit organization Conservation International helped fund both projects. Agreements such as this and debt-for-nature swaps, in which developing countries are forgiven their debt in exchange for setting aside protected land, are important but all too rare, says Dr. Costanza.

The World Summit on Sustainable Development is now under way in Johannesburg, South Africa. Dr. Costanza - and many of his critics - say participants should heed the economic value of goods and services provided by intact ecosystems.

Without doing so, and by overusing economic justifications for the development of natural areas, "we're basically hiding costs, inflating profits and making the whole economy look better than it is," Dr. Costanza says. "That's going to get us into trouble, because it's bad accounting. If you do that as a company, you go to jail. If you do it as a country, nothing happens to you."

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