

Butterflies Aren't Free

Nature is the ultimate service economy. Putting a price tag on 'ecosystems' may help save them.

BY SHARON BEGLEY

PAT HEITKAM'S LINE OF WORK WAS virtually nonexistent a couple of generations ago, but for the 20 years that the Orland, Calif., beekeeper has been in business demand has gone nowhere but up. The calls from almond growers start in November. Their trees will start flowering in early February, and they need Heitkam to set his hives throughout their orchards so his honeybees can pollinate their trees. No pollination, no almonds. Until the 1940s or so, nature provided this service, free of charge. "But with pest control and other agricultural chemicals, there are fewer and fewer [natural] pollinators," says Heitkam. Not that he's complaining: his 2,500 hives rent for \$40 to \$50 per colony in almond orchards, and American farmers now spend close to \$100 million a year on pollination.

Any mother who feels that her services are taken for granted knows how to make her brood recognize their value: start charging them market rates for laundry, cooking, cleaning and taxi services. Now Mother Nature is doing something similar. Many "ecosystem services," such as natural pollination, have been so degraded by pollution and development that they are no longer performing the jobs they once did. Until now there has been what biologist Gretchen Daily of Stanford University calls a "near total lack of public appreciation of [society's] dependence on natural ecosystems." But that is starting to change. According to a study in the current issue of the journal *Nature*, led by ecological economist Robert Costanza of the University of Maryland, the dollar value of the world's ecosystem services averages \$33 trillion per year. Output of human-made goods and services, a sort of planetwide GNP: \$18 trillion.

Although "economics" and "ecology" share a common root ("eco-" comes from the Greek word for "house"), scholars in the two fields have traditionally had little to say to each other. But that is changing now that scientists are figuring out exactly how ecosystems support the world's economies, says Daily, editor of a new book, "Nature's Services" (392 pages. Island Press. \$24.95). For instance, swamps and other wetlands filter water and control floods. Vegetation holds soil in place and prevents mudslides like the fatal ones in Washington and Ore-

gon last winter. Bacteria and algae grab nitrogen out of the air and convert it into fertilizer. Soil microbes take the carbon, nitrogen and other nutrients out of, say, a dead parrot in the Amazon and return them to the food chain; absent such "nutrient cycles," life would run out of raw materials. Microbes also turn rock into soil.

What are those services worth? In one sense, says Maryland's Costanza, an infi-

ens calamitous climate change. Value: \$600 per acre. New York City gets drinking water from upstate, where soil purifies rainfall and runoff. The price of building a purification plant to do that: \$5 billion.

Some environmentalists cringe at the thought of putting a dollar value on nature; they believe it should be protected on moral grounds. But reckoning nature's services in money may turn into a powerful argument for their cause. The new approach "gives you at least a rough dollar value of what you would lose if you went ahead with, say, developing a coastal zone," says ecologist Stuart Pimm of the University of Tennessee. New York City managed to avoid building the \$5 billion purification plant by buying up land in the watershed and restricting development and fertilizer and pesticide use. "If you want cost-benefit analysis, bring it on!" says Pimm.



Worth more as an air filter than as firewood: Stanford's Daily in arboreal mode

nite amount, since the world's economies "would grind to a halt without [them]." But "infinite" is not a useful number. One way to assign value is to figure out what it would cost to substitute technological fixes for what nature does. Substituting chemical fertilizer for natural nitrogen fixation, for instance, would cost at least \$33 billion a year. Growing crops without soil by substituting the hydroponic systems beloved of urban gardeners would cost \$2 million per acre in the United States. Grasslands sequester carbon, which, in the form of carbon dioxide, warms the planet and threat-

That may be overly optimistic. As Stanford biologist Paul Ehrlich points out, estimates of the future value of an ecosystem tend to be low: a forest that used to be valued just for holding soil and cleaning air and water looks much more precious when one of its trees is found to contain an anti-cancer compound. Also, as the supply of ecosystem services declines, their value rises: it's not as bad to lose 1 acre of wetland when you have 1,000 more as to lose 1 when only 10 remain. The value of nature, the epitome of a service economy, will only grow. ■